DEVELOPMENT OF
TECHNICAL EDUCATION IN PAKISTAN:
A CRITICAL STUDY OF OBJECTIVES AND ACHIEVEMENTS

by

Mir Mohammad Ali

DEPARTMENT OF EDUCATION
UNIVERSITY OF KARACHI
1990
DEVELOPMENT OF TECHNICAL EDUCATION IN PAKISTAN:
A critical study of objectives and achievements

By
Mir Mohammad Ali

A Thesis submitted to the University of Karachi for the
Doctor of Philosophy
Department of Education

Research conducted under the supervision of
Dr. S A H Rizvi
Thesis Adviser
DEVELOPMENT OF TECHNICAL EDUCATION IN PAKISTAN
A CRITICAL STUDY OF OBJECTIVES AND ACHIEVEMENTS

A THESIS FOR DOCTOR OF PHILOSOPHY
APPROVED FOR THE DEPARTMENT OF EDUCATION,
UNIVERSITY OF KARACHI.

by
IN THE NAME OF ALLAH THE BENEFICENT AND MERCIFUL

TO

The pursuit of Knowledge enjoined in the Quran
"Say: O Lord increase my Knowledge"
and honoured by Prophet Mohammad (S A W A S).
"I am the city of Knowledge and Ali its gate"
ACKNOWLEDGEMENT

I am thankful to many people and organisations who assisted in this study. I thank Prof. Mrs. Birjees Khan, former Principal Government College of Education, Karachi for her assistance in my enrollment with the University of Karachi to undertake this study. My special thanks to Dr. S. A. H. Rizvi who rendered valuable guidance in conducting the study. I have very much benefited from his experience and grasp on the techniques of research. I am thankful to Dr. Ismail Saad, Director Special Education and Chairman, Department of Education, Karachi University, for his suggestion to include a comparative study of systems of technical education.

I owe special thanks to Dr. Donald K. Mitchell, Manager, Division of International Teaching and Development, Hawthorn Institute of Education, Australia, for permission to use the data from the Report of Technical and Vocational Education of Pakistan to which I had also contributed as Specialist in Technician Education. I record my thanks to the sources referred in the study.

My daughter Asghari Ummul Banin also deserves due appreciation for her suggestions during the drafting of the study. I am thankful to my wife Kaneez Zainab who relieved me of all domestic preoccupations so that I could exclusively concentrate on this study.

Without the personal interest and assistance of Engr. Syed Ahmed Ali of Computer Systems & Services, Karachi, this manuscript could not have taken the print form in a short time. I am specially thankful to Mr. Mohammad Altaf Mala for his cooperation and patience to accommodate in the software changes as warranted. Mr. Ghaffar Siddiqui also deserves due mention for his coordinating efforts. And, of course many thanks to Meherjri Dastur of Victoria Printing Works for his services in the final getup of this document.
ABSTRACT

DEVELOPMENT OF TECHNICAL EDUCATION IN PAKISTAN

A CRITICAL STUDY OF OBJECTIVES AND ACHIEVEMENTS

MIR MOHAMMAD ALI

Technician education as a specific programme for the training of supervisory personnel in the industrial manpower team has received attention of the successive governments in Pakistan. This study investigates the development of technician education during 1947 to 1988. Education as an open organisation system was adopted as the theoretical framework for the study. The investigation is organised into components of inputs, implementation processes and output related issues of the system. The final recommendations also are patterned on the systems sequence.

The system of public education introduced by the British rulers in India in 1800 had passed through different stages of development when it was inherited by Pakistan in 1947. Chapter II traces the gradual integration of vocational studies in schools in pre-Pakistan era with a reference to the Sargent's Report of 1944 which also provided a basic framework for policy formulation of technical education in Pakistan. The flow of events emerging from the recommendations of Technical Education Committee 1950 included major thrusts under the report of Commission on National Education 1959, Education Policy 1972-80, National Education Policy 1978 and National Education Conference 1989. Discussing the educational policies
implemented during 1947-88 Chapter III identifies them to carry formative, developmental, innovative, consolidating and quality improvement thrusts. The developmental initiatives resulted in raising the number of institutions to 50, annual intake to 9000 and enrollment to 31000 by 1988. This was achieved by maintaining a constant share of 9-10% for technical education in the funds for educational development during the five year plans. The study however indicates an imbalance in the system resulted by the over supply of engineers in relation to technicians and craftsmen.

Discussing the implementation processes chapter IV emphasises the need to improve the quality of inputs of the students, upgradation of teacher's competencies and provision of teaching learning material and supplies. The supply of teachers which registered 20-50% shortfall was expected to be augmented through inservice teacher training programmes to be undertaken by the National Technical Teachers' Training College, Islamabad which started functioning in 1988. In the matter of curriculum, besides its limited revision and updating the initiatives included innovations in the design and delivery system as modular approaches and evening diploma courses. About the managemnt of the system which presented varying management styles in different provinces the need for greater institutional autonomy and decentralisation of administration was evident.

Tracer studies involving polytechnic teachers, passouts and employers were conducted to supplement the existing information for determining the external efficiency of the system and the relevance of the output to the employment needs. The results of these studies as discussed in Chapter V indicate that 40% students could complete the programme in the prescribed period of three years, 56%
passout could secure employment within 6 months of graduation and the training provided better social benefits. The passouts demonstrated capability to operate their own business also. The industry was however not satisfied with the level of attainment of practical skills though the study refers to their indifference to the programme also. The Chapter ends with a review of development pattern of technician education which registered an average 62% efficiency of utilization of development funds, 10 times increase in the number of institutions, and 25 times increase in the enrollment. The planning indicated a forward look as programmes gradually became more sophisticated to meet the industrial demands. But the study indicates the needs for further specialization to match the needs of high tech era.

The dimensions of the study were enlarged by the inclusion of a comparative view of technical education systems in Pakistan, Bangladesh and India, all emanating from a common origin and developed under similar socio economic constraints. Comparing various aspects of the three systems Chapter VI concludes that they competed favourably with each other sharing common concerns in the lack of cooperation between technician institutions and industry, insufficient data for micro level manpower planning and management training.

Chapter VII concludes the paper with a summary of findings and recommendations which include adoption of better criteria for students selection, staff development, enhancement of budget for the institutes, provision of equipment and grants to private institutions to improve the inputs to the system. The efficiency of implementation processes is to be enhanced through introduction of cost effective modes of training, installation of management information system and establishment of technical education
authority. The demand led aspects of the system call for a full scale evaluation of system. creation of manpower cells, enforcing measures for industrial training of students and passouts, establishment of professional body for the registration of technicians, technologists and craftsmen and restructuring of the system to provide linkages and mobility. The determination of relationship in investment in technical and vocational educational programmes and corresponding growth in the national economy has emerged as a problem from this study warranting further investigation.
# TABLE OF CONTENTS

**ACKNOWLEDGMENT**

**ABSTRACT**

**LIST OF TABLES**

**LIST OF FIGURES**

**CHAPTER**

1. THE PROBLEM AND DEFINITION OF TERMS
   - Background 1
   - Statement of Problem 7
   - Purpose of Study 7
   - Limitations of Study 8
   - Sources of Data 8
   - Method of Study 9
   - Theoretical Framework of Study 10
   - Definition of Terms 11
   - Assumptions of the Study 14
   - Abbreviations 15

2. EDUCATION IN PRE-PAKISTAN ERA
   - Vocational Training : Historic Perspective 18
   - Summary 21
Chapter

3. EDUCATIONAL POLICIES AND PLANS

Formative Stage : 1947-58 23
Educational Policies 24
Report of Technical Education Committee 30
Educational Development 31
Achievements 33
Expansion Stage : 1958-71 35
Educational Initiatives 36
Educational Development 42
Achievements 44
Educational Administration 46
Experimentation Stage : 1971-77 47
Educational Initiatives 48
Educational Development 52
Achievements 56
Quality Improvement Stage : 1977-88 58
Educational Initiatives 59
Educational Development 63
Technician Training for Women 65
Higher Education of Technicians 67
Achievements 69
Summary 71

4. IMPLEMENTATION PROCESSES

The Quality of Input 77
Faculty 82
Chapter

| National Technical Teachers Training College | 90 |
| Financial Resources | 94 |
| Curriculum Design and Development | 99 |
| Revision of Curriculum | 104 |
| Curriculum Updating | 106 |
| New Fields of Training | 109 |
| Innovative Approaches in Curriculum | 111 |
| Curriculum Development Roles | 114 |
| Teaching Learning Strategies | 115 |
| Textbooks and Learning Material | 119 |
| Student Evaluation Process | 124 |
| Role of Boards | 126 |
| Managerial Processes | 128 |
| System Evaluation | 134 |
| Developmental Processes | 136 |
| Institute Industry Interaction | 137 |
| Future Development | 137 |
| Summary | 139 |

5. OUTPUT OF TECHNICIAN EDUCATION SYSTEM

| Demand Related Studies | 141 |
| Tracer Studies | 144 |
| Quality of Output | 145 |
| Cost Benefits | 153 |
| Development Pattern of Technician Education | 157 |
| Summary | 155 |
Chapter

6. COMPARISON OF CONTEMPORARY TECHNICIAN EDUCATION SYSTEMS

Rationale for Comparison 166
System of Education 167
Development of Technician Education 169
Course Structure 169
Administration 170
Quality Improvement Thrusts 171
Innovative Approaches 172
Problems and Issues 173
Summary 175

7. SUMMARY CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings 179
Conclusions 193
Recommendations 195

Measures to Improve the Inputs to the System 196

Measures to Improve the Implementation Processes of the System 197

Measures to Improve Demand Led Aspects of the System 199

Problem for Further Study 201

BIBLIOGRAPHY 202

APPENDIX

A. Report of the Scientific Research and Technical Education Committee 213

B. Extracts from the Report of Technical Education Committee 221
Appendix

C. Scheme of Studies, Technical School Certificate 225

D. Diploma of Associate Engineer Curriculum - 1960 227

E. Curricula and Scheme of Courses - 1970 232

F. D.A.E Revised Scheme - 1982 237

G. Data of Respondents to Tracer Studies 243

H. Respondents to Establishment Survey 245

I. Polytechnic Institutes and Colleges of Technology : Programmes, Intake Capacity and Enrollment : 1987 - 88 247

J. Questionnaire for Establishment Survey (Q-1) 249

K. Questionnaire for Survey of Passouts (Q-2) 252

L. Questionnaire for Survey of Self Employed Passouts (Q-3) 256

M. Questionnaire on Programme Assessment (Q-4) 260

N. Organisation Chart : Federal Ministry of Education 266

O. Organisation Chart : Technical Education Punjab 267

P. Organisation Chart : Technical Education Sindh 268

Q. Organisation Chart : Technical Education Balochistan 269

R. Organisation Chart : Technical Education NWFP 270

CURRICULUM VITAE 271
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Development of Polytechnic Institutes</td>
<td>5</td>
</tr>
<tr>
<td>2. Stages of Educational Development in Pakistan</td>
<td>25</td>
</tr>
<tr>
<td>3. Technical Education: Physical Targets and Achievement – First and Second Five Year Plan</td>
<td>44</td>
</tr>
<tr>
<td>4. Development of Polytechnics: Second and Third Five Year Plans</td>
<td>45</td>
</tr>
<tr>
<td>5. Government Polytechnic Institutes and Colleges of Technology: Annual Intake Capacity and Enrollment by Technology, 1987/88</td>
<td>73</td>
</tr>
<tr>
<td>8. Polytechnics: Enrollment and Teachers</td>
<td>84</td>
</tr>
<tr>
<td>9. Polytechnics Institutes: Sanctioned and Filled Posts</td>
<td>85</td>
</tr>
<tr>
<td>10. Qualifications, Training and Experience: Polytechnic Teachers</td>
<td>87</td>
</tr>
<tr>
<td>11. Rating on Staff Development Needs</td>
<td>89</td>
</tr>
<tr>
<td>12. Distribution of Budget in Polytechnic Institutes</td>
<td>96</td>
</tr>
<tr>
<td>15. Recurring Budget For Technical Education: Institutions and Directorate</td>
<td>131</td>
</tr>
<tr>
<td>16. Data of Passouts (1985-87)</td>
<td>145</td>
</tr>
</tbody>
</table>
Table

17. Time Taken for Completion of Course 146
18. Deficient Aspects of Training 148
19. Earnings of Technicians 151
20. Fee Schedule of Polytechnic / College of Technology : 1987/88 154
21. Social Cost of Training 155
23. Progressive Development of New Courses in Polytechnic Institutes 162
LIST OF FIGURES

Figure

1. The Engineering Team ............................. 4
2. Integrated System of Technical Vocational and Engineering Education
3. Technician Institution as an Open Input-Output System .... 12
4. Input-Process-Output Model for Technician Education System ........ 76
5. Knowledge Skill Mix: Technical Manpower ........ 100
8. Technical Education: Resources Allocation and Utilisation ........ 161
9. Structure of Technician Education, Bangladesh - India - Pakistan ........ 168
CHAPTER ONE

THE PROBLEM AND DEFINITION OF TERMS

Background

A country's stage of development is often judged by the quality of life prevalent there. There are numerous indicators of economic development. To mention, some of them are: total wealth, infant mortality rate, percentage literacy, enrollment at various levels of education, extent of reliance on foreign imports, capacity to export, quality of heavy industry and adequacy of medical facilities. It is the endeavour of every developing country to become developed on the basis of these criteria. In a Report on Intra Regional Training following two immediate objectives of economic development of emerging nations were identified:

1. To reap the benefits of their independence by translating it into human happiness through scientific progress.

2. To defend their independence by means of power to be generated through their efforts with the help of science and technology.

Science and technology have contributed enormously to achieve any nation's goal for development. Science and technology are closely linked since technology refers to the utilisation of scientific progress. Scientific development itself is governed by the number and quality of appropriately trained technical manpower available for national development activities.

Major problems facing the developing countries are population explosion, lack of basic necessities of life, housing, medical care, mass scale illiteracy, low productivity and poor standards of living. Economic growth ultimately depends on human resource development. The most obvious way of developing human resources is through education, both formal and non-formal. In the context of increase of production capacity it is also necessary to create conditions which increase the working capacity of the people. This requires provision of better health services, improved public health facilities and better nutrition for an increased span of life.

The development of human resources for attainment of scientific and technical superiority among the nations has become the key factors of economic growth. The harnessing of resources of the earth, the cutting short of distance through better means of communication and transport and freedom from the scourge of disease and lately the access to space science are now the immediate aspirations and objectives of the developing societies.

The development and well being of the people of a country as referred above is closely linked with the quality and size of educational facilities available within the country. Education is a cultural force as the spirit of education and intellectual discipline, inculcated through education, builds up an enlightened attitude that is a valuable asset for any nation. No plan of economic development and no dream of economic growth can become a reality unless there is a good foundation for education
which is the basis of all such development. For the developing countries it is, therefore, extremely important to pool and harness the available resources to provide meaningful education to the maximum number of persons.

The human factor has been considered to be the most important element of the economic growth. Economic growth makes it possible for a nation to put more investment in education which again contributes to rapid economic development under given conditions. Thus education is both the cause and effect of economic development. The developing countries therefore need to build up a sound system of education, specially scientific and technical education. Rapid changes in physical, social and economic conditions demand concentration of efforts in this important area of education. With the explosion of knowledge it becomes necessary to keep the system of technical education updated according to the changing situation and needs of the country.

The term "technical education" is flexible in its meaning and has a wide range of application. In general it refers to education and training programmes aimed to develop technical manpower which includes skilled and semi-skilled workers, supervisory personnel, technicians, technologists, engineers and research workers in the application of science and technology. They combined form the components of an "engineering team".

Although technicians are not identified and defined uniformly in all the countries, there is a general understanding that technicians constitute middle level manpower occupying positions in industry between engineers / technologist and skilled workers. They hold positions such as supervisors, foremen, technical assistants, technical instructors etc. In some countries the technician is closer to the engineers as 'engineering aide' and the skilled worker may be performing repetitive operations. However in a developing economy the technician may have to exercise
supervisory functions and also a good deal of manipulative skills on shop floor. It is the proportion of knowledge and skill in a given mix which distinguishes between the engineer, technician and the skilled worker. Fig. 1 attempts to identify the position of engineer, technician and skilled workers in the manpower team and also their functions. Fig. 2 further attempts to trace the mobility and linkages between various programmes in technical education and corresponding technical manpower in Pakistan.

![Diagram](image-url)

Pakistan's experience in development of technical manpower is reflected through various steps taken to develop an infrastructure of technical education required for the needs of an emerging free nation. Technical education as an integral part of overall education system has also underwent remarkable changes both in size and quality. The magnitude of quantitative change can be imagined from the
fact that at the time of partition there were no separate institutions for the training of supervisory personnel. The two engineering colleges which existed in Karachi and Lahore were also training supervisory staff. Over a period of about forty years since the establishment of the first polytechnic institute in Pakistan multifold expansion has taken place giving rise to a number of institutions and increase in their enrollment, as evident from Table - 1.

**Table - 1 : Development of Polytechnic Institutes**

<table>
<thead>
<tr>
<th>Item</th>
<th>First : Second : Third : No : Fifth : Sixth</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Inst.</td>
<td>4 : 10 : 14 : 28 : 31 : 40</td>
</tr>
<tr>
<td>Annual Intake</td>
<td>NA : 2100 : 3500 : 5271 : 6950 : 7425</td>
</tr>
<tr>
<td>Enrollment</td>
<td>727 : 5846 : 7800 : 13100 : 17320 : 20950</td>
</tr>
<tr>
<td>Annual output</td>
<td>432 : 2100 : 2500 : 3550 : 3970 : 4956</td>
</tr>
</tbody>
</table>

* Targets

(Source : Sixth Five Year Plan, Planning Commission, Government of Pakistan, 1983).

By 1988 the number of institutes in public and private sector had grown to 50 with the enrollment reaching 31000. Against the three traditional fields of civil, electrical and mechanical technology in which training was imparted in 1947 the number of programmes increased to 25 technological disciplines by 1988.
Fig 2: INTEGRATED SYSTEM OF TECHNICAL VOCATIONAL AND ENGINEERING EDUCATION

INDEX
O - EXAMINATION
△ - SELECTION TEST
G - RE-ENTRY TO EDUCATION
* - PROPOSED

SPECIALIZATION

HIGHER STAGE II

HIGHER STAGE I

SECONDARY STAGE

ELEMENTARY STAGE

PRIMARY STAGE

STAGE AGE GRADES
EDUCATIONAL STRUCTURE

WORK EXPERIENCE AND STUDY

MANPOWER PYRAMID

Statement of Problem

To bring about the quantitative changes in technical education infrastructure as referred above sizable resources had been allocated from time to time. Various measures were also taken to improve the quality of the system. But no systematic study was conducted to relate the developmental inputs with the resulting outputs both in quality and quantity. The responsiveness of the system in terms of its internal and external efficiency also remained undetermined. This situation provided the focal point of the study to document the history of technical education of Pakistan as a developmental activity. In particular the study was aimed to critically examine the objectives of development of technical education in Pakistan and to discuss issues related to their achievement.

Purpose of Study

The general objective of the study as stated was to ascertain the relationship in the objectives of development of technical education as set in educational policies and economic development plans and their actual realisation. More specifically it addressed to the following aspects:

1. Quantitative development of technician education
2. Qualitative aspects of technician education
3. Relationship of technician education with the manpower needs
4. Measures for further improvement of technician education

The study was expected to provide information about problems and issues facing technician education system and programmes. The result of the study would be useful to the policy makers in the Government to provide a basis for future planning. The administrators might find the results
revealing in their sphere of operation. The technical teachers would also find the study as useful material for their professional preparation as teacher.

Finally, the industry including the Chambers of Commerce etc. who are the end users of the product of technical institutes would also find the study helpful in bridging the gaps between the institutional training and industry's expectations.

Limitations of Study

This study was limited to development of "technician education" programmes which is a specific programme offered in polytechnics and similar institutions. It was specifically addressed to study teaching learning processes and related issues for the training of a type of technical manpower know as technician, as defined earlier.

The analytical and field study part of the study was limited to selected subjects (industrial organisations and passouts of polytechnics) in Sindh and Punjab only.

Despite the fact that till 1971 both wings of Pakistan remained united the data for the study was restricted to the western wing only so as to maintain a logical basis for continuity in comparisons.

Further the time sequence of the events was limited to the period from 1947 to 1988 i.e. upto the sixth five year plan with more emphasis on developments in the recent past.

Sources of Data

An attempt was made to document the data available in literature related to technical education which included the following sources:

1. Government Reports.
2. Five Year Development Plans.
3. Education Policies.
4. Studies of specific Task Forces and Study Groups.
5. Proceeding of conferences, workshops and seminars.
7. Studies by individuals on contemporary developments specially the monographs of Colombo Plan Staff College for Technician Education and Unesco reports.

For nearly 35 years in government service the writer had participated in the planning, implementation and evaluation of technical education programmes in Pakistan. This had helped to recall the missing bits in the documented data of this study.

In addition to the sources as described above the study also included a comparative analysis of the technician education system in Pakistan, Bangladesh and India. The choice of the specific countries in the sub-continent was aimed to provide a more valid basis of comparison between the systems which had branched out from the same origin and operated under similar socio economic constraints.

Method of Study

In addition to the information which was available in the sources referred above primary data was also generated through administering questionnaires to the following population:

1. Passouts of polytechnics.
2. Teachers of polytechnic institutes.
3. Administrators of Polytechnics and
4. Employers of polytechnic graduates.

The above data was aimed to supplement the available information with on-the-spot validation to enhance the dimensional effects of this historical research.
The sample for the data included selected polytechnic institutes in all the four provinces of Pakistan. A quota sampling was adopted to ensure due representation on geographical basis as well as on the basis of sizes of institutes in terms of enrollment and programmes offered. The data was obtained by on-the-spot visits of the enumerators and also through mail survey.

Theoretical Framework of Study

The Systems Approach

In conducting this study an attempt was made to adopt the 'Systems Approach' which presumes that technical education has all the attributes of an open organisation system consisting of inputs, processes and outputs operating in a contextual environment of supra system and also comprising its own sub-systems. At the input interface it reacts with the educational system of secondary, higher secondary and university education. It operates within an environment which serves as a context to determine the needs, priorities, aspiration of the society as outlined in the Government policies and planning documents.

INPUT: The input to the system consists students, staff, physical facilities, financial resources, curricula and operating policies.

PROCESS: The processes of the system which help to convert these inputs into measurable as well as intangible outputs include teaching learning processes, student evaluation process, staff development and training processes and managerial processes.
OUTPUT: The system has the output in the form of students but with value added in terms of knowledge, skills and attitudes to perform as trained technicians to contribute in the economic development of the society. Other outputs may include information service in the form of research and advice, extension of physical facilities to the industry, exchange of teachers and experts between the institutes and the industry. The extent of such interaction depends on the degree of openness that exists in the system. At the outer boundary the system interacts with the techno-socio-economic forces and establishes its corporate image. Based on the above approach the information from various sources of the study was delineated and organised into input, process and output as distinct but interlinked components of the system of technician education² (Fig - 3).

Definition of Terms

Technical Education: It is a comprehensive term referring to those aspects of educational processes involving, in addition to general education, the study of technologies and related sciences and acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. According to the Recommendations of General Conference of UNESCO,³ technical (and vocational) education is further understood to be:

a. an integral part of general education.
b. a means of preparing for occupational field.
c. an aspect of continuing education.


Fig. 3  TECHNICIAN INSTITUTION AS AN OPEN INPUT-OUTPUT SYSTEM

Adapted from "Organisation and Management", William A Shrode and Dan Voich Jr., Richard D Irwin Inc. USA.
Technician: The main focus of this study is the 'technician' who plays a dominant and strategic role in the planning process, in the transfer and application of scientific and technical knowledge to production process, in the development of innovations and research, in the practical training of workers in specialised skills and technical know-how. The Commonwealth Conference on Education and Training of Technicians has also defined him as a person lying in the broad spectrum of occupations between the craftsman and the professional engineer. Within this spectrum there may be wide differences both in the subject and degree of expertise. But whatever their specific functions they can be classified as technician.

Skilled worker: (craftsman; tradesman): A person who by practical application performs duties, predominantly, of repetitive nature in manufacturing, maintenance, installation and service industries.

Engineer: The term engineer applies to persons working in occupations for which the need of education in appropriate science in university or equivalent institution of higher education is recognised and covers level of activities as research, development, organisation, planning and production.

Technologist: Person undergoing education and training similar to engineer but with more practical orientation for production work and shop floor activities.


7. Ibid.
Modular Training: A system in which training programme contents is divided into independent units or modules of learning.

On the Job Training: Training provided at the place of work rather than in a training centre or other special training situation.

Internal Efficiency: The evaluation of training process measured by level of enrollments, dropout rates, graduation rates, teacher student ratio, recurrent and capital cost per graduate.

External Efficiency: Comparison of cost and outcomes of training which also takes into account the impact and relevance of training on the productivity of the organisation who employs the trained person.

Assumptions of the Study

The following assumptions were made in this study:

1. The history of technical education of Pakistan can be documented.
2. Some developmental pattern can be identified that would establish the direction in which technical education is moving.

10. Ibid., p. 40.
3. Deficiencies in technical education can be located for correction.

**Abbreviations**

ADB Asian Development Bank
BTE Board of Technical Education
CPSC Colombo Plan Staff College (Singapore/Manila)
DAE Diploma of Associate Engineer
DTE Director of Technical Education
FYP Five Year Plan
GCT Government Colleges of Technology
GOP Government of Pakistan
GPI Government Polytechnic Institutes
GPP Government of Pakistan Press
HIE Hawthorn Institute of Education (Victoria, Australia)
ILO International Labour Office (Geneva)
MOE Ministry of Education (Government of Pakistan)
NTB National Training Board (Pakistan)
NTTTC National Technical Teachers' Training College (Islamabad)
PTB Provincial Training Board
PCPP Printing Corporation of Pakistan Press
TTW Teachers Training Wings
CHAPTER TWO

EDUCATION IN PRE-PAKISTAN ERA

The education system of Pakistan was a legacy of the system of education introduced by the Britishers during their colonial rule of this part of the world which was once known as the British India. The educational development in India under the British rule reflected the echoes of social political and technical changes in England during the corresponding periods. A knowledge of the system helped to understand the system which Pakistan inherited in 1947. The historians of education movement of British India have documented the development of public education in India in some distinct phases, each phase relating to some specific characteristic in terms of decisions or events which have affected the destiny of education in that era. Nurullah & Naik¹ have classified the period beginning from the 18th century AD when the Britishers consolidated their rule until the partition of the sub-continent into six chronological phases:

1. 18th century - 1813; 2. 1817 - 1854;
3. 1854 - 1900; 4. 1901 - 1921
5. 1921 - 1929; 6. 1929 - 1947

The phases and some of the main events were as under:

Phase-1. 18th Century - 1813.
East India Company accepted the responsibility to spend money for the education of the Indians.

Phase-2. 1813-1854.
Struggle between the Macaulian school of thought and local intellectuals on the objectives of education.
Wood's Dispatch on education allowing the propagation of western knowledge and sciences with some encouragement to study oriental learnings at college level.

Phase-3. 1854-1900.
Quick jobs for students trained through the western system resulting in gradual annihilation of local schooling system.
Adoption of English as medium of instruction in all aided institutions of higher education.
Setting up of Indian Education Commission - 1882.

Phase-4. 1901-1921.
Promulgation of Indian Universities Act 1904.

Phase-5. 1921-1929.
Authorisation to provinces to reorganise education departments.
Struggle between demand for quality versus expansion resulting in 1929 Hartog Committee Report.2

Introduction of adult literacy scheme and vocational education programmes.
Sargent's Report to upgrade educational development.

Aziz has divided the above phases into seven stages, by further dividing the Phase 3 into two periods i.e. 1854-1882 and 1882 to 1904.

The above, as it could be understood, is not an exhaustive account of the development which took place during the periods referred. It only indicated the march of events and trends which had far reaching effects in years to follow.

Vocational Training: Historic Perspective

Occupational bias in the British Indian education system was first referred in the Wood's Dispatch in 1854, as means to improve the production capacity of a sizable segment of population through occupational education. The Hunter Commission of 1882 recommended two distinct streams at high school stage one for preparing for university education and the other for practical occupations. The Calcutta University Commission suggested the establishment of 'intermediate colleges' to prepare students for university and also practical occupations. The Hartog Committee 1929 recommended diversified courses in schools to include industrial and commercial fields. The Sapru Committee 1934 recommended the commencement of vocational


studies after 11 years of schooling. In 1938 the Central Advisory Board of Education accepted the proposal of Zakir Hussain Committee to make education work or craft oriented. This was called the Wardha Scheme of Basic National Education. The Sargent's Report of 1944 while accepting the Basic Education Scheme advocated the introduction of both academic and technical streams to provide an all round education.

In this perspective it was highly encouraging to see that the importance of human resources for achieving technical self-sufficiency was also perceived by the pioneers of Pakistan movement. As early as 1904, Allama Iqbal expressing his views on the subject as stated in the Makhzan:

"The battle for existence which is waging amongst the nations of the world today and whose results will certainly prove disastrous for some people is a battle which does not need armed soldiers. The real soldiers in this struggle are those artisans and technician who are quietly working in the factories of their country. In this era if you want to judge the real strength of a country you should not just examine its guns and rifles. Go into factories and weigh for yourself how far that nation is dependent upon others and to what extent it is able to meet all its needs by its own efforts. I consider industry and technology the most important need of the nation. In the present circumstances economic freedom must be achieved before political freedom and in this respect the Muslims of the sub-continent lag far behind the other nationalities. Their basic requirement is not literature or philosophy, but technical education which will make them free and independent. They must devote all their energies to this particular aspect of education".


Of particular relevance to this study was the part of the Report of Central Advisory Board of Education on Post War Educational Development in India, 1944 which was generally known as "Sargent's Report" referred earlier. This report contained detail measures relating to technical education. As seen later in the study the Sargent's Report had far reaching implications in the formulation of technical education plans in the newly born state of Pakistan.

The main purpose of the post war educational plan in the Sargent's Report was to raise the educational development of (undivided) India in forty years to the level attained in England. The recommendations covered a wide range of topics from the primary to university education, employment exchanges, public libraries and a 20 years target to banish illiteracy.

Some of the provisions of the Sargent's Report as relevant to this study were as under:

1. Establishment of technical high schools with greater mobility between technical and academic schools.
2. Curricula contents of technical schools to have specific urban and rural bias.
3. According due recognition to the educational and training requirements of the following categories of manpower:
   - Senior Executives and Research Workers.
   - Junior Executives, Foreman and Assistants.
   - Skilled Workers.
   - Semi skilled and Unskilled Workers.

The provisions had thus covered all categories of modern industrial manpower. But before the recommendations of the report could be implemented the Government became heavily involved in the political upheaval which ultimately led to the partition of India and emergence of Pakistan as
an independent state. Though after independence each country
governed its own policy and course of action to shape its
educational system the impact of this report was very much
obvious in the initial policy formulation in Pakistan. This
has been discussed in detail in the subsequent sections of
this study.

Summary

Pakistan inherited the system of public education which
had developed in the British ruled India from the 18th
century. The system which was adjusted to the social,
political and industrial changes in Britain had to undergo
changes in the special socio-economic conditions prevailing
in the sub-continent during the British rule. From the
fundamental concept of identifying the responsibility of
educating its subject and determining the type of education
and its role, the system expanded to include the ingredients
of technical and vocational education for the changing needs
of post war reconstruction in 1945. From 1854 onwards
various committees on education reforms considered the
inclusion of vocational bias in the education system.
Development of education in Pakistan in later years, 1947
and onwards, was influenced by the system built in the
pre-Pakistan era.
CHAPTER THREE

EDUCATIONAL POLICIES AND PLANS

Like all developing countries, in Pakistan also, the inputs to the educational system were determined on the basis of Government's policies about education and the corresponding economic development plans. These policies and plans were framed by the respective Governments in keeping with their political aims and manifesto of the ruling party. Unfortunately, for Pakistan, its short history was checkered by rapidly changing political events which had their impacts on the socio-economic-political environment of the country. The political events that occurred at different periods resulted in the emergence of various educational policies and initiatives so as to prepare the youth to keep abreast with the needs of the time and ensure their personal enrichment.¹ Under the influence of these changes educational system also underwent adjustment and reviews so as to bring it in line with the objectives of the changes.

The development of technician education in Pakistan was therefore examined in this study against the background of the chain of events that occurred since 1947. The situation offered many options for a historical documentation of the changing pattern of system of education in Pakistan. For the

purpose of this study the time sequence could be divided into four stages as under, keeping in view the focus of educational policies during the phase and corresponding economic development plans. The four stages were:

- Formative Stage : 1947 to 1958
- Expansion Stage : 1958 to 1971
- Experimentation Stage : 1971 to 1977
- Quality Improvement Stage : 1977 to 1988

The educational policies provided the necessary guidelines for undertaking development initiatives. Subsequent inputs to the education system were foreseen in the national development plans for the corresponding periods. The linkages in the educational policies and corresponding development plans have been shown in Table - 2. Following is a detailed discussion on each stage as mentioned above.

**Formative Stage : 1947 to 1958**

After the turmoil of partition in 1947 the tempo of development was gradually building up when the first Prime Minister was assassinated in 1951. The dissolution of Constituent Assembly in 1954 created a political vacuum and administrative uncertainty. The question of parity between East and West Wing of the country was resolved by the unification of the provinces of Punjab, Sindh, NWFP and Balochistan in 1955 into a single province of West Pakistan known as One Unit. The first constitution was passed in 1956. The political manoeuvring which prevailed during 1957-58 resulted in destabilising the political fibre of the country and frequent changes in the central and provincial Governments. In October 1958 the country was placed under the Martial Law. These events described above had their repercussions in the educational policies and development plans which were formulated and implemented in this period.
Educational Policies

Immediately after independence the Government faced staggering problems in the field of education. The education system which the country inherited was based to serve the objectives of a century of British colonial rule. It was quite inadequate and incompatible in the changed situation. Technical education occupied a very insignificant place in the system as it was aimed to provide a limited number of people to maintain the public utility services in the traditional fields of civil, electrical and mechanical engineering. The facilities of two engineering colleges—one at Karachi and the other at Lahore—were the main source of training of the engineers and technicians. A limited number of technicians were also trained for specific purpose in public organisations such as railways, telephone and telegraph and public works department. Beyond this the concept of manpower training was not well defined. The problem and the magnitude of the task faced by the Government of the new state could be visualised from the fact that for a total population of 32 million (for the part which now constitutes Pakistan) there were only 8413 primary schools, 2190 middle schools, 408 high schools, 4 colleges, and 2 universities.2

The problem was further aggravated by shortage of manpower due to the emigration to India of a large number of teachers and technically trained persons. Though the influx of refugees from India also brought trained persons, it, however, required time for their recovery from the upheavals of partition and personal sufferings before they could participate in the economic activities in the new environment. There was an urgent need to save the system.

---


24
from a complete collapse. Further, the emergence of Pakistan as a nation committed to Islamic ideals also necessitated to spell out in clear cut and precise terms the educational goals at the national level to give proper orientation to the system at the formative stage of the new state.

**TABLE - 2 : STAGES OF EDUCATIONAL DEVELOPMENT IN PAKISTAN**

<table>
<thead>
<tr>
<th>STAGE</th>
<th>EDUCATIONAL INITIATIVES</th>
<th>DEVELOPMENT PLANS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Formative Stage</td>
<td>Pakistan Educational Conference, 1947</td>
<td>Six Year Development Plan 1951 - 57</td>
</tr>
<tr>
<td></td>
<td>Survey of Technical Education, Ford Foundation 55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Development of First Polytechnic Curricula 1954 - 57</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manpower and Education Commission, 1966</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proposals for New Education Policy, 1970</td>
<td></td>
</tr>
<tr>
<td></td>
<td>New Education Policy, 1970</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Revision of Polytechnics Curricula, 1976</td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Education Policy, 1978</td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Education Policy and Implementation Plan, 1978</td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Education Conference, 1986</td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Education Policy, 1982 - 1986</td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Education Policy and Implementation Plan, 1986 - 1993</td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Education Conference, 1993</td>
<td></td>
</tr>
</tbody>
</table>

25
Pakistan Educational Conference 1947

In this challenging scenario the Government convened the Pakistan Educational Conference from 27 November to 1 December 1947, at Karachi, with a view to assist the Education Division of the Ministry of Interior in determining the future educational policy and programmes. The agenda of the Conference interalia included “To consider the desirability of establishing a Council of Technical Education in order to survey the field of Technical Education in Pakistan and to make suggestions for its improvement.”

Quaid-i-Azam’s Message: The guide lines for the socio-moral and scientific basis of education were clearly given by the Quaid-i-Azam in his message to the Conference which stated:

“...There is no doubt that the future of our state will and must greatly depend on the type of education we give to our children and the way in which we bring them up as future citizens of Pakistan. Education does not mean academic education only. There is immediate and urgent need for giving scientific and technical education to our people in order to build up our future economic life and to see that our people take to science, commerce, trade and particularly well planned industries. We should not forget that we have to compete with the world which is moving very fast in this direction.”

------------

3. Interior, Information, Broadcasting and Education occupied the status of a Division in the Ministry of Interior.


5. Ibid., p. 5.
Address of Chairman: The Chairman of the Conference, Mr. Fazlur Rehman, Minister for Interior, Information, Broadcasting and Education, delivering the inaugural address covered a wide range of problems and issues and emphasised the need of reorientating the entire educational policy to correspond closely with the needs of time and to reflect the ideals for which Pakistan as an Islamic State stood.

Fazlur Rehman further stated that the existing system as originally conceived by Macaulay was intended to serve a narrow, and utilitarian purpose with artificial improvisation and lack of realism. Speaking about the Sargent’s Report, referred in earlier Chapter of this study, he considered it as the first concerted attempt to provide an efficient system of education. But in his view it failed to embody the ideals which were embodied in the creation of Pakistan. On the aspects of higher education he emphasised the need to prevent aimless drift of all and sundry to high schools and colleges and colossal wastage in the absence of any selective principles. In an age dominated by science with its ever increasing tempo of technological development the high priority to be given to training of technical personnel was emphasised in these words:

"...it is therefore a matter of supreme concern to us that we should lose no time in strengthening and enlarging the scope of the few technician institutions that remain with us and in establishing, if necessary, as many as may be required by our own needs".

------------------------
6. Ibid., p. 5.
7. Ibid., p. 6.
8. Ibid., p. 8.
10. Ibid., p. 10.
Fazlur Rehman also informed the conference about the Scientific Manpower Committee which was being set up to assess the requirements of technical and scientific manpower. The Conference which lasted for five days took a number of decisions based on the reports of various committees. The report of Sub Committee for Scientific Research and Technical Education is placed at Appendix-A.

Council of Technical Education

One of the major recommendations of the conference was the establishment of a Council of Technical Education for Pakistan which was to consist of members representing Ministries of Industries, Education, Communication, Agriculture, Elected representatives, Provincial representatives, Representatives of Association of Industries and Commerce, Representatives of Universities and Representatives of Labour. Thus all the parties and organisations who had a direct interest as end users of the product of technical education were fairly represented on the Council. The proposed Council was given the following terms of reference:

1. To advise the Government of Pakistan on matters relating to the advancement of Technical Education at all stages.

2. To survey the existing facilities for technical education in Pakistan, especially in the higher stages and suggest ways and means of making up the deficiencies in as short a time as possible resulting from the partition of India.

----------

11. Ibid., p. 48.
3. To prepare a comprehensive scheme for the re-organisation and development of on modern lines of technical education in all its aspects suited to the economic needs of the country and the peculiar genius of the people of Pakistan.

4. To draw up a five years scheme for the training of scholars at home and abroad in technical subjects and suggest ways and means of implementing that scheme.

Advisory Board of Education

The Government also appointed a high level Advisory Board of Education for Pakistan with the Minister of Education as its Chairman. A similar Board had existed in the undivided India. The newly appointed Board held a series of meetings to consider the progress of actions taken on the decisions of Pakistan Educational Conference and consider such matters as were referred to it for advice. A study of the proceedings of the meetings revealed the farsight and imaginations of the members who were trying to grapple with the numerous problems. Many innovative ideas on educational development in Pakistan which appeared in later periods had their origins in these deliberations.

The proceedings of the meetings of Advisory Board of Education which were held during 1948 to 1950 indicated that the progress of development of technical education was regularly reported to the Advisory Board also.\(^2\) In a meeting of the Council of Technical Education held at

Karachi on 11 June 1948, it was decided to appoint a Committee to formulate a comprehensive scheme for the development of technical education. The Technical Education Committee submitted its interim report to the Council of Technical Education which recommended to establish three polytechnic institutes to offer diploma level education to be gradually raised to degree level. The Council of Technical Education recommended for the creation of separate Directorate of Technical Education in each province to work under the Minister of Education of the province. The Minister would be assisted by an Advisory Council.

Report of Technical Education Committee

Comprehensive Development Plan.

The Technical Education Committee appointed by the Council of Technical Education submitted its report to the Council of Technical Education in its 3rd meeting held at Karachi on 26 & 27 September 1950. The report of the Technical Education Committee provided a comprehensive plan to develop technical education which included the following aspects.

1. A sound foundation for technical education.

13. Ibid., Second Meeting, Peshawar, 7 - 9 February, 1949, p. 27.


15. Ibid., Forth Meeting, Lahore, 29 Nov. - 1st Dec. 1950, p. 28.

2. Technical bias during the secondary stage of education.
3. Facilities to pursue a technical course on completion of secondary stage with a strong practical bias.
4. Technical degree courses.
5. Training of technicians, semi-skilled workers, and entrepreneurs for small scale industries.
6. Opportunities for part time courses.

From the above it is clear that a balanced system of technical, vocational and engineering education was envisaged right from the beginning. The Report of the Committee for the first time recognised polytechnics as the best type of institutions for the training of technicians and recommended the establishment of three such institutions within next five years (up to 1955). The institutions were to be located one in Karachi, and one in each of the province of West and East Pakistan. The report also dealt in detail about the training of skilled and semi skilled workers. Extracts of the Report may be seen at Appendix-B.

This report served as a blueprint for all future development of technical and vocational education in Pakistan. The system of training of engineering technicians was, therefore, to be streamlined through the establishment of polytechnics, monotechnics and specialised technical institutions.

Educational Development

The period under review (1947-1958) saw two developmental efforts in the form of (i) Six Year Educational Development Plan (1951-57) and (ii) First Five Year Plan (1955-60).
Six Year Development Plan (1951-57)

For the first time an attempt towards long range planning was made in the form of a Six Year Development Plan. The chief aim in this effort was the translation in terms of money, material and people of the educational task envisioned by various bodies on education. This plan was prepared in isolation and was not related to an overall plan for social and economic development of the country based on economic analysis of resources. Consequently it could not serve as a concrete plan of action and had to be scrapped. It nevertheless proved a useful guideline to the relative needs of various levels and phases of education.17

First Five Year Plan (1955-60)

The First Five Year Plan (1955-60) was the first ever effort of integrated planning in the newly established country. In the section of technical education and training the plan envisaged the establishment of polytechnics and monotechnics. The plan expected an annual output of 650 graduate engineers and 950 engineering technicians, by the end of the plan period for the whole undivided Pakistan. In the First Five Year Plan a total of 27.8 million rupees was allocated for technical education. This included expenditure on engineering education also. The plan also recommended the establishment of Directorates of technical education in each province.18


Achievements

One polytechnic was established at Karachi in 1953 which started enrolling students in 1955. The training was planned in the field of Auto and Diesel, Civil, Electrical, Electronics, Mechanical, and Power Technology. Another polytechnic was established in 1958 at Rawalpindi. A new approach in technician training was experimented through the establishment of a Swedish Pakistan Institute of Technology at Landhi, Karachi. The polytechnics at Karachi and Rawalpindi were patterned after the American system of technician training aimed to produce "engineering technicia"ns which lay more emphasis on supervisory skills. In contrast the Swedish system produced "industrial technicians" with more emphasis on practical skills. In the Rawalpindi polytechnic training in narrow specialisation in the field of drawing and drafting, foundry and pattern making, machine shop and welding technologies was also introduced to meet the needs of rapidly expanding heavy engineering complexes.

The technician training programmes offered in the engineering colleges were gradually discontinued. A Bureau of Technical Education was established which gave a new dimension and separate entity to this type of education.

Besides the establishment of two new polytechnics (Karachi and Rawalpindi) and a Swedish Pakistan Institute of Technology (at Landhi) the training of technicians also continued in the form of licentiated courses in civil, electrical and mechanical engineering in the already established technical institutes at Lahore, Sialkot, Peshawar, Khairpur and Hyderabad, which were functioning under the Industries Department of West Pakistan. A School of Engineering at Rasul under the Buildings and Roads Department of West Pakistan was exclusively training supervisory staff for civil engineering works.
During the First Five Year Plan the actual expenditure on technical education was 22.0 million rupees against a total allocation of 27.8 million. This represented 6% of the total expenditure in the education sector during this period.19

An appraisal of the achievement during this formative stage lead to the conclusion that while high priority was given to establishment of polytechnic institutes and engineering colleges which were attracting the elite, the training of skilled workers did not receive proper attention. To sustain a reasonable degree of industrial activity there had to be a definite ratio between the number of engineers, technicians and skilled workers. It should be a pyramid type distribution with a large number of skilled and semi-skilled workers forming the base of the technical manpower. In the absence of integrated planning the situation resulted in a higher supply of technicians as compared to skilled workers which perpetuated in the years to follow. The unfavourable social attitude towards manual work and lower categories of technical profession was also responsible for the situation. Absence of reliable source of labour and manpower statistics and overlapping of responsibility of training of skilled workers between different agencies were also among other contributing factors for this situation.

By the end of this first phase the annual enrolment capacity for the training of technicians, reached to 722, with an annual output of 432 diploma holders.20 Considering the time lag in the take-off for the educational schemes and unforeseen preoccupation of the Government in the internal


as well as external problems these achievements by no means were considered little. The formulation of a reasonable infrastructure was achieved.

Expansion Stage : 1958-1971

This period started with the Martial Law in the country. Under a new constitution the presidential form of government was introduced. An indirect system of public representation was introduced in the form of basic democracy which was more suited to the needs of local governing bodies. The country had to fight a war against India in 1965. By 1968 the opposition against President Ayub Khan gained momentum in the form of a full scale political agitation. In 1969 President Ayub relinquished power to Gen. Yahya Khan and the country was placed under (second) martial law within ten years. Under a Legal Framework Order the One Unit administration of West Pakistan was also dissolved and old provinces of Punjab, Sindh, NWFP and Balochistan were revived.

After the general elections in 1970, differences cropped up between the leaders of East and West Pakistan on the issue of sharing of power to govern the country. This resulted in an organised movement in East Pakistan against the Federal Government and war with India in 1971. Ultimately it ended in the separation of East wing from Pakistan which emerged as independent state of Bangladesh. The geographical boundaries of the country shrunk to the area which was once the Province of West Pakistan. Inspite of the difficulties and turmoil in the last quarter of this phase, the control on the administration for about a decade helped the government to implement its policies and plans to a reasonable degree of attainment.
Educational Initiatives

National Education Commission

On assumption of power in 1958 the martial law government took a number of measures to provide policy directives in many important sectors such as education, science, and technology and agriculture. A Commission on National Education (generally known as Sharif Commission after its chairman) was set up in 1958 which submitted its Report in 1959, in which the Commission recognised education as an investment in national growth and as an economic asset. The Commission made a number of recommendations to improve the overall system of education in Pakistan. The Commission played a more significant role in further identifying the needs for technical and vocational education. In Pakistan for the first time, the Commission drew the attention of planners for the need of a proper ratio between engineers, technicians and craftsmen.

Emphasising the need for a balanced system of manpower the Commission stated.\textsuperscript{22}

"...It is extremely important that production of engineers should be accompanied by a corresponding production of intermediary stage of supervisors and technicians... We shall aim at a ratio of about ten technicians to one engineer... In the USA, Britain and USSR a ratio of one to five is considered desirable... Arrangements should be made for the production of 7000 technicians of various type every year."

The Commission also recommended the need for training of various categories of technical teachers. The Commission estimated that during the next five years (till 1965) about 900 teachers of polytechnics and technical institutes must


\textsuperscript{22} Ibid., p. 155.
have been trained. To meet the situation the Commission recommended the establishment of teachers training wings in some polytechnics. In view of the shortage of technical teachers which the Commission observed very strongly in its Report, the Commission recommended to stagger the training programme of teachers to be completed in several years. Other important recommendations of the Commission included the following measures.\(^\text{23}\)

1. The curricula should be diversified at various stages of education to train different categories of manpower.

2. A network of vocational schools should be established with the aim to train students who have manual skills and aptitude for craft work.

3. All polytechnic and technical institutes should offer evening and part time courses as a regular feature of their programme.

4. Industry should provide systematic training for the operators.

5. Industry should bear substantial portion of the cost of establishing technical institutes.

6. Technical institutions should be placed under the control of Directorate of Technical Education in Education Department.

7. A Council of Technical Education should be established with branches in each province.

8. Boards of Technical Examinations should be set up by appropriate administrative authorities.

9. The position regarding salary scales of technical teachers should be reviewed carefully to attract suitably qualified personnel to this important field.

\[^{23}\text{Ibid., p. 161.}\]
The Report of the Commission reflected the efforts put in by its members in producing a very comprehensive document which contained the ingredients of rational and mature thinking.

Many of the institutional arrangements for teaching, learning and managerial processes in education in general as well as technical education which existed in Pakistan owe their origins to the ideas put forth in this Report. In subsequent phases also various aspects of education were studied but this Report stood unique in its approach and thoroughness.

**Commission on Student Problems and Welfare**

Another significant initiative in this phase was the appointment of a Commission on Student Problems and Welfare. The Commission in its Report recommended for the improvement of facilities in the educational institutions. The Commission also took note of the shortage of teaching staff in polytechnics.

About the discipline in polytechnics the Commission stated,

"...That the discipline in these polytechnics and technical institutions, it is conceded on all hands, is much better than in institutions of general learning. Since the students of polytechnics and technical institutes have definite prospects of suitable employment on successful completing their courses they have the sense of vocation and seriousness of purpose so conducive to proper study and discipline."

---


25. Ibid., p. 121.
This was an important observation of the Commission to examine the causes of indiscipline and law and order situation in the polytechnics and suggested the need for proper linkage between training and employment.

Manpower Commission

The Government had also set up a Manpower Commission (Mr. G. Moeenuddin as Chairman). The Commission started preliminary studies in 1968. However due to change of events and political turmoil towards the close of this phase the Commission (probably under the advice of the new regime as no formal cancellation of the Commission was made public) abandoned its task without finalising its report. Abdul Ghafoor considered that the Commission could have made a valuable contribution towards the integration of the educational system with the national economy by way of adjusting educational output to job availability.26

Manual of Standard
for Polytechnics

An important and lasting contribution to technician education planning was a "Manual of Standards for Polytechnic Institutes"27 which was developed by Technical Education Standardisation Committee appointed by the Education Commission Reforms Implementation Unit of the Ministry of Education. The purpose of this document was to guide the Education Departments of the provinces and other public and private groups in establishing educational


institutions for diploma level technicians. The manual included curricula and course description, staff requirements and qualifications, training logistics, laboratory and workshop equipment specifications, standard quantities of supplies and equipment, layout of equipment, sizes of workshops, model class schedules and administrative and operating policies to facilitate efficient operation and supervision of institutes.

Implementation Units referred above were set up in different sectors of educational activities. These were manned by mostly full time heads of Units. This greatly helped in timely implementation of the recommendations of Commission on National Education.

National Education Seminar

In 1968 the Government announced the intentions to initiate actions on the formulation of the Fourth Five Year Plan for the period 1970-75. To obtain the views of the educationists and leaders of public opinion on future development plans the Government planned to organise a National Education Seminar. The preparation for the seminar were completed but due to political agitation which started in the country the seminar could not be held. This was an innovative approach in as much as educational planning in Pakistan was considered and if implemented could have very much contributed in evolving plans for sound educational development.

New Education Policy

By 1969 the political situation took a turn for the worse resulting in the (second) martial law in the country. The students' dissatisfaction with the system of education was also a dominant factor in this agitation. The new regime therefore considered to attach high priority to educational
problems and made every possible effort to meet the needs of students, among other issues. Based on the field studies conducted by different groups and interviews of students, teachers, administrators and public opinion leaders, in July 1969, the Government announced "Proposals for a New Educational Policy" with intentions to finalise it by September 1969 after receiving public comments. (This policy was also known as Nur Khan's Policy after Air Marshall Nur Khan who was in charge of educational portfolio in the martial law government). The proposals were reviewed in the light of large public response and over 15000 pages of comments received by the Ministry of Education. In the meantime the Government announced the dissolution of One Unit in West Pakistan reviving the old provinces. The proposals were further revised to meet the changed circumstances. The New Education Policy was announced in March 1970. (By this time Air Marshall Nur Khan was replaced by Mr. Shamsul Huq as Education Minister).

The New Education Policy\textsuperscript{28} emphasised the need for proper control over private educational institutes by prescribing rules and regulation.

In the matters of educational administration the general tempo of the Policy was in favour of decentralisation through formation of District Education Authorities for schools and Zonal Authorities for colleges. The Policy also recommended the setting up of governing bodies for each of the institutions from secondary schools and upward.\textsuperscript{29} In the case of technical education it recommended diversification of secondary education with a separate stream for technical education at various levels.


\textsuperscript{29} \textit{New Education Policy} : op. cit., p. 21.
Other recommendations included organisational arrangement for curriculum development and practical training programmes in industries.\textsuperscript{30}

The recommendations of the Policy could not go beyond the enunciation stage as no concrete action could be taken due to the engagement of the Government to settle the political turmoil, war with India in 1971 and aftermath of separation of East Pakistan. The Policy thus became an academic exercise and a matter of record and reference for future.

\textbf{Educational Development}

The regime under President Ayub Khan lasted over a decade. Opinion may differ on the results of this long concentration of power. But a long span of political control vested in a single person and without any effective political opposition facilitated the Government to concentrate on its social and economic policies and pursue programmes for their realisation in a consistent manner. In case of education this situation resulted in building up a sizable infrastructure under the cover of the Second and Third Five Year Plans.

\textbf{Second Five Year Plan}

The size of Education and Training sector of the Second Five Year Plan was based on the provisions and recommendations of the Commission on National Education referred earlier. The financial outlay for technical

\textsuperscript{30} Ibid.
education under Second Five Year Plan was 79 million rupees. Main targets of the plan in technical education included the following measures: 31

- Strengthening of Directorate of Technical Education
- Introduction of new technologies.
- Upgrading of existing technical institutes to polytechnic level.

**Third Five Year Plan**

The basic objectives of the Third Five Year Plan (1965-70), was to provide an educational system which would facilitate the transition of the society into an era of science and technology. The Plan envisaged to raise the intake into polytechnics from 4000 in 1965 to 14000 in 1970. For this purpose an allocation of 81.7 million rupees was made in the Plan. In the field of technical education following targets were included:

1. Establishment of 13 new polytechnics and one monotechnic.

2. Expansion of 8 polytechnics and one monotechnic.

3. Introduction of new technologies such as gas, paper, instrumentation, hotel management, printing.

4. Increase of output of technicians to bring it to 12000 during the plan period.

5. Introduction of technical teachers training programme.

---

Achievements

Most of the targets of Second Five Year Plan were either achieved in full or exceeded. The financial performance was over 95%. In the case of technical education the performance was 100% or more as seen from Table - 3 below:

Table - 3 : Technical Education Physical Targets and Achievement: First and Second Five Year Plan.

<table>
<thead>
<tr>
<th>Item</th>
<th>1959-60</th>
<th>Estimated Plan</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base Year</td>
<td>Achievement</td>
<td>Target</td>
</tr>
<tr>
<td>New Institutes</td>
<td>2</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Annual Intake</td>
<td>912</td>
<td>2200</td>
<td>2000</td>
</tr>
<tr>
<td>Annual Output</td>
<td>432</td>
<td>1275</td>
<td>1000</td>
</tr>
</tbody>
</table>


One of the reasons of this high rate of performance could be attributed to the strict vigilance under the martial law regime.

The Third Five Year Plan aimed at accelerating the development pace of technical education and improving the quality of education. If the tempo of development that continued during the Second Five Year Plan could be maintained, it was possible to achieve the break through. However due to war with India in 1965 the priority of education had to be put to a lower level than stipulated in

the Plan. During the first four years until the recovery from the aftermaths of war only 50% of the Plan allocations were earmarked. Actual utilisation of funds was even less. This prevented timely completion of most of the projects. At the diploma level the target of admissions and enrollment were attained to the extent of only 57% and 67% respectively.

Table - 4: Development of Polytechnic During Second and Third Five Year Plans

<table>
<thead>
<tr>
<th>Item</th>
<th>Second Five Year Plan</th>
<th>Third Five Year Plan</th>
<th>Increase</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation (Rs. Mil.)</td>
<td>61.7</td>
<td>258.7</td>
<td>330.0</td>
<td></td>
</tr>
<tr>
<td>Expenditure (Rs. Mil.)</td>
<td>78.0</td>
<td>97.0</td>
<td>26.0</td>
<td></td>
</tr>
<tr>
<td>No. of Institute</td>
<td>9 (IF)*</td>
<td>14 (IF)*</td>
<td>66.6</td>
<td></td>
</tr>
<tr>
<td>Annual Intake</td>
<td>2100</td>
<td>3500</td>
<td>60.0</td>
<td></td>
</tr>
<tr>
<td>Enrollment</td>
<td>5120</td>
<td>7700</td>
<td>50.4</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>2100</td>
<td>2500</td>
<td>20.0</td>
<td></td>
</tr>
</tbody>
</table>

* Women Polytechnic


The expansion of technical education facilities as indicated above was achieved by upgrading the technical institutes at Lahore, Sialkot, Bahawalpur, Peshawar, Khairpur, Hyderabad and School of Engineering Rasul and by establishment of new polytechnics at Leiah, Multan, D.I.Khan and Swedish Pak Institute, at Gujrat. The First Polytechnic for Women was also established at Lahore.
Educational Administration

The expansion of technical education necessitated to streamline the administrative setup also. At the provincial head quarters at Lahore the Education Department was strengthened by the creation of a post of Adviser Technical Education with the status of Joint Secretary. The Bureau of Technical Examinations which was responsible to conduct the examinations of erstwhile technical institutes was replaced by the West Pakistan Board of Technical Education which was set up under an Ordinance of the Government in 1964. The academic control of the Board was extended to all the technical, vocational and commercial educational institutes functioning in West Pakistan. The transfer of administrative control of all technical institutes from the Industries to Education Department was a significant development during this phase.

As the expansion took place two Directorates of Technical Education were also established in 1964, one at Karachi to cover the civil administrative divisions which later formed the provinces of Sindh and Balochistan and the other at Lahore for the areas of Punjab and NWFP.

Later on in this phase, when in 1970, the old provinces were revived due to dissolution of One Unit the functions of the Directorates were adjusted in the respective provinces. While Punjab started with a functioning Directorate and Board of Technical Education, Sindh had only the Directorate, but NWFP and Balochistan had none. In 1970 immediately on the formation of Sindh province a Board of Technical Education was created through an Ordinance. In NWFP a Directorate of Technical Education was created in 1970 while the technical institutes remained affiliated with the Punjab Board of Technical Education until 1974 when a separate Board of Technical Education was setup. The smaller number of technical, vocational and commercial institutes in Balochistan did not justify for separate arrangements for
administration and academic supervision as in Punjab or Sindh. They continued to be administered through College Education Directorate and remained affiliated with local Board of Intermediate and Secondary Education, Quetta.

Assessing the performance of technical education sector during this phase (1959-71) as a whole it was justified to conclude that it was a significant period of expansion and consolidation of technical education. Many of the institutional arrangements which were created during this phase still continued to serve as a model and main source of supply of technical manpower.

Experimentation Stage: 1971 - 1977

The third phase of educational development started with the revival of parliamentary government with Pakistan Peoples Party assuming political control in Pakistan, formerly West Pakistan. Started in an atmosphere of shattered confidence the government was faced with the gigantic task of political rehabilitation to overcome the shock as well as economic consequences of the partition of Pakistan. The problems of nearly 95000 prisoners of war in the Indian custody and the occupation of large areas of Pakistan captured by the Indian forces during the 1971 War were also other concerns of the government. The framing of a new constitution was also due owing to the changed geographical and political situation, return to parliamentary form from the presidential form and the revival of old provinces. The Fourth Five Year Plan for 1970-75 which was prepared on the basis of unified Pakistan required drastic revision in the changed circumstances. In fact the government was without any valid document relevant to the realities of the existing situation to undertake planning programmes in immediate future.
With the initial difficult start due to the situation as described above the Pakistan Peoples Party managed to remain in power until 1977 when elections were held. Trouble started on the results of election as the opposition parties believed that the elections were rigged. Inspite of prolonged parleys dispute between the government and the opposition could not be resolved and the country was plunged into serious internal conflict which was gradually drifting toward civil war. The situation called for the intervention of the armed forces to restore normalcy. There was split opinion whether the forces intervened on their own or on the invitation of the opposition political parties. Consequently on 5 July 1977 armed forces took over the control of the civil administration in the country with a complete ban on political activities.

The third stage of educational development in Pakistan thus dealt with the performance of an elected representative government which remained in power for five years with martial law and political turmoil on both the ends.

**Educational Initiatives**

**Education Policy 1972-80**

The Pakistan Peoples Party was a comparatively new political party which was entrusted the responsibility to govern the country due to rapid political developments at the close of 1971. The Party was committed to undertake a socio-economic programme based on its manifesto and political aspirations. Several policy declarations were announced within a few days of its assumption of power. The Education Policy 1972-80 was announced on 15 March 1972. The policy proposed a programme of educational reforms to be achieved during the period up to 1980.
This Policy proposed some radical changes and departure from the existing system and practices in education. The content as well as methods of practical realisation of the proposed objectives very much differed from its for-runners. Announcing the Policy the President stated: 33

"By its very nature an education policy cannot be final or static. Constant reflection, experimentation and reform in the thought and practice of education is an important requirement... In the past whenever any educational reforms were concerned, they were treated as highly sacrosanct and were imposed with as much rigidity as if they were the last writ of human wisdom... The fate of all previous education reforms were sealed by their unwarranted inflexibility. The policy which I am presenting to you today will remain under continuous review and evaluation and shall go on developing further and further in the light of experience gained in its implementation..."

On the content of the Policy he (the President) further said: 34

"...We have to democratise education and usher in an era of universal literacy... We have to compete in the race for higher science and technology in a world which is moving very fast towards material perfection... We have to ensure that there is a massive shift from aimless general education to a more meaningful agrotechnical education. It is essential that a boy who drops out after class VIII should carry with him enough skills to return to his local or ancestral vocation as a better farmer or craftsman that a boy who leaves the school after matric is ready to be absorbed in our socio-economic framework as a good middle class technician or worker. Education must be closely related to employment opportunities..."


34. Ibid., p. 2.
The Education Policy 1972-80 aimed at the following broad objectives:

1. Building up national cohesion
2. Eradicating illiteracy
3. Equalising access to education
4. Designing curricula relating to national needs
5. Providing massive shift towards agrotechnical education
6. Integration of general and technical education
7. Nationalisation of privately managed institutes
8. Introduction of distance learning through open university

TECHNICAL EDUCATION

The provisions of the Policy relating to technical education included:

1. Workshops will be provided progressively in all middle schools so that pupils may engage in activities such as weaving, book binding, metalwork, blacksmithy etc.
2. There will be massive shift from aimless general education to a more purposeful agrotechnical education.
3. By 1980 one third of the total enrollment will be in each of the three main streams, Arts, Science and Technical / Occupational skills.
4. By 1980 the enrollment in technical subjects will increase from 5% to 33% and in Science from 23% to 33%.

36. Ibid., pp. 9, 10.
5. The integration of general and technical education will equip secondary and college students for gainful employment including self employment in industry, agriculture, business, home economics and education.

6. Facilities in a large number of vocational studies will be developed.

7. Technical and occupational education streams similar to those at high and intermediate stages will be introduced at the degree level as well as in major vocational fields.

**POLYTECHNIC EDUCATION**

The Policy recommended following specific provisions for the Polytechnic (Technician) level of education:

1. Polytechnics will be converted to technical colleges.

2. Students will be encouraged to undergo two years of industrial training / experience after completing the three year diploma course.

3. For diploma holders a one year additional course leading to the degree of B-Tech. will be provided.

4. Appropriate legislation will be introduced requiring industry in the private sector to provide training facilities to the students of technical colleges.

5. Technical colleges will also provide programmes covering areas of technology at certificates, diploma and degrees such as Matric (Industrial), Matric (Agriculture), F. Sc. (Industrial), B.Sc. (Education), etc.

---

37. Ibid., p. 17.
6. Technical colleges will be assisted to develop new areas of technology including, inter-alia, the following:
Electronics and instruments, paramedical, printing and graphics, gas, petroleum, leather, marine.

7. Some of the technical colleges / institutes will be assisted to offer programmes leading to Master of Technology.

Educational Development

Innovation and Experimentation

The innovation and experimental characteristics of policy formulation during this phase was inherent in the measures taken such as mass scale vocationalisation of secondary education, introduction of agrotechnical courses, upgradation of technician training programmes to degree and post graduate level, nationalisation of private institutions and introduction of distance learning system through open university.

B-Tech. Courses in Polytechnics

Although this study was restricted to the development of technician level education a major development which was very closely linked to technician education system and merited consideration was the introduction of degree level programmes in polytechnics. This step provided an upward mobility in the technician training programmes as well as helped to raise the social status of the products of these programmes. The long standing demand of polytechnic students for provision of higher education was though recognised by the Commission on Student Problems and Welfare³⁸ no

concrete action was so far taken to give it a practical shape. Those associated with the planning and development of technical education in Pakistan had been advocating the necessity of a programme which should be comparable in level to engineering degree but in its content it should aim to maintain the special feature of technician training programme. Instead of merging into traditional engineering stream the programme should aim to provide further specialisation in the disciplines in which the diploma holders were originally trained. The programme was therefore termed as Bachelor of Technology to be distinguished with traditional Bachelor of Engineering offered in the engineering colleges and universities.\textsuperscript{39} The Education Policy 1972-80 recommended to institute B.Tech. degree courses for the polytechnic diploma holders.\textsuperscript{40} Keeping in view the requirement of affiliation, duration and status of degree level programmes, a two stage programme was designed and implemented in some of the polytechnics which were converted to college of technology. The first stage of the programme was a B.Tech. (Pass) course of two years duration followed by the second stage of B.Tech. (Honours) of two years. The B.Tech. (Hons) was approved by the Ministry of Education as equivalent to a degree in engineering.\textsuperscript{41}

Revision of Polytechnic Curriculum

The Education Policy 1972-80 provided guidelines for the reforms and development of education. To attain the objectives of the Policy large scale revision and development of curricula at all levels of education was


\textsuperscript{40} Education Policy 1972-80, op. cit., p. 17.

under taken. The existing curricula of polytechnic institutes also needed re-orientation to bring it in line with the objectives of the education policy.

The needs of the country and the state of arts in science and technological education had changed since the framing of the first curriculum of polytechnics in Pakistan in 1954. But the same curriculum was still in force with minor adjustment. To assess the suitability of the curriculum in matching the employment needs a Manpower Survey was conducted. Based on the findings of the survey the curricula were revised with an increased proportion of practical contents aiming to produce industrial technician.42

Vocationalisation of Secondary Education

The Policy had advocated a massive shift to agrotechnical studies through integration of general and technical education at elementary and secondary levels. This was in line with the global trend to vocationalise secondary education. The practice of teaching of practical arts in schools in Pakistan dated back to early fifties when under assistance from the Colombo Plan technical high schools were established. These were in addition to the normal schools.43 But the agrotechnical studies proposed in the Education Policy 1972-80 were distinct in two respects. First the programme was made compulsory part of the scheme of studies to ensure participation by every student. Secondly, the courses aimed at developing skills for gainful employment.


To achieve the objectives, subjects of wood works, metalwork, applied electricity, agriculture and home economics were introduced in VI-VIII classes. A trade course was included as vocational component in class IX & X.

Introduction of Matric Technical Courses

Another innovative measure proposed in the Education Policy 1972-80 was the introduction of Matric Industrial course. This was intended to expand the base of vocational training. Every educational system should have recognised exist points and bridgepoints. At exist points students may enter into the labour force with some meaningful level of qualification, at bridge point students may move from one stage of system to another. It was observed that the conventional programme of craft training of one or two years introduced in the vocational institutes under the Education Department were not attracting students especially in the rural areas due to the total absence of upward mobility coupled with the unemployment of trained workers. The curricula of vocational institutes was therefore redesigned as Matric Technical Courses to provide a sound general education alongwith craft training in a selected trade. This was intended to expand the base of vocational training.

The Matric Technical course which was a two year programme after class VIII was distinct from the vocational component of agrotechnical course offered as part of general high school programme. It was offered in vocational Institutes and technical high schools and more oriented to specific trade requirements. Eventually it became a feeder programme for entry to polytechnic institute which further

helped in popularising the programme in the rural areas. The programme started in Sindh in 1973 and later on it was adopted by other provinces. A sample of the programme is given in Appendix C.

Achievements

Development Perspectives

The Fourth Five Year Plan (1970-75) which was prepared on the basis of resources and development of a unified Pakistan had to be scrapped as stated earlier. For the period from 1972-77 there was no comprehensive plan document. Instead all development programmes were executed on the basis of Annual Development Plans prepared for each financial year. This period was therefore termed as "No Plan Period" in the records pertaining to planning and development activities for this period.

Towards the later part of this phase Government prepared Development Perspectives for 1975-80. Hitherto education was assigned low priority in the matter of resource allocation. For the first time the development strategy in education aimed to reverse the process of pre-empting the resources for education due to more pressing demand in other sectors. It was proposed to increase the per capita expenditure on education from Rs. 23 to 63, which in turn was expected to raise the educational expenditure from 1.6 to 3.2% of GNP. In the field of technical education the Development Perspectives were less specific and proposed only for the integration of technical education with general

education to the maximum extent possible (agrotechnical course) and opening of new technical colleges in the areas where polytechnics did not exist.46

During this period 6 new polytechnics were opened and 7 polytechnics were upgraded to Colleges of Technology to offer B.Tech., courses in addition to diploma courses. The enrollment in polytechnics was raised from 12000 in 1974-75 to 13100 in 1977-78. The annual intake and output had reached to 5271 and 3550 respectively by the end of the "No Plan Period".47

The actual expenditure on technical education during 1972-77 was 222.7 million rupees.48 The Development Perspectives,49 however, had estimated an outlay of five hundred million rupees for technical education, to raise the enrollment to 20000 by 1979-80. Thus the actual enrollment indicated a shortfall of 33% when compared with the estimates of Development Perspectives. Other significant attainments during this period included the setting up of a Technical Education Board in the NWFP. Action was also initiated to draft a legislation requiring the industries to provide training to the polytechnic diploma holders.50 The nationalisation of private institutions, however, slowed down the pace of development of education due to the

-------------


49. Development Perspectives, op. cit., p. 351.

stoppage of support from the private sector and also diversion of a sizable portion of public funds to foot the bill of nationalised institutions. With their transfer to the Government control there were also signs of laxity and attitudinal changes in the staff of the nationalised institutes.

The pace of development of agrotechnical studies was also slow due to paucity of resources which were needed for a massive shift as proposed in the Education Policy. By 1978 these courses were introduced in 3000 schools in classes VI-VIII and in only 100 schools at classes IX & X. The total enrollment in these courses was about 2.8 lacs (0.28 mil.) which was only 15% of the enrollment at the secondary level.\(^5\)\(^1\)

To conclude, the overall achievement in this phase must be judged in the context of only five years performance between two martial laws. The various measures undertaken during this phase have laid down the foundation of a wide range of innovations which were intended to develop a new scenario of technical education in the future.

**Quality Improvement Stage : 1977-1988**

The fourth and final phase of educational development in Pakistan, for the purpose of this study, covered the period from 1977 to 1988. This period started with the imposition of martial law in 1977, as referred earlier. The Presidential form of government at federal level and military governors in the provinces ruled the country through the cabinets composed of military and civil personnel. The Parliament and provincial assemblies were replaced by a nominated body named 'Majlise Shooara'. The situation continued until 1985 when elections were held to constitute parliament and provincial assemblies on non-party

\(^{51}\) Fifth Five Year Plan, op. cit., p. 15.
basis as the political parties were still not functioning. On the basis of elections a civilian Prime Minister was inducted into office. Similarly, Chief Ministers were also appointed in the provinces. The President with the dual authority of Chief Martial Law Administrator and Military Governors in the Provinces continued till the end of 1985 when martial law was lifted. Eventually the political parties were revived and the non party assemblies turned into traditional assemblies with political affiliations.

The return to democracy was however short lived as in May 1988 the President dismissed the Federal Cabinet, as well as dissolved the National and Provincial assemblies. The general elections for the assemblies which were announced for November 1988, were held on party basis. In December 1988 with the revival of assemblies the country again returned to democracy with elected Prime Minister and Chief Ministers to head the Federal and Provincial governments respectively.

**Educational Initiatives**

Except for the initial one year this stage in general covered the period under two five year plans i.e. Fifth Five Year Plan (1978-83) and Sixth Five Year Plan (1983-88).

Without any formidable political opposition the administration under a strong Federal Government was able to pursue its policies for over a period of eleven years. This helped the government to adopt a consistent and continuous approach while framing development plans.

One of the common element in political parties who had united against the previous regime before the martial law, was their stand in favour of shift towards Islamisation in all walks of life. This prompted the martial law regime to adopt it as a corner stone of its policy directives in all spheres of activities including education which served as a more potential field to demonstrate its intentions.
In keeping up with the traditions of the past when each successive new government in Pakistan picked up education as its first area of concern, the martial law regime also convened a National Education Conference from 3 - 5 October 1977. Besides the ideological reorientation through steps in the direction of Islamisation of education, measures for improvement of quality of education were the main objectives of the educational development during this period. Therefore inaugurating the Conference the Chief Martial Law Administrator said:

"In Pakistan the importance of education is two fold - ideological and pragmatic. There are a number of injunctions and sayings in the Holy Quran wherein knowledge and its lifelong acquisition has been made incumbent on Muslims... In the long Muslim rule from the 11th to 18th century political power was an obvious by product of system of education. The main objective of this Conference is to revive the consciousness of the linkage between freedom and education... Our curriculum must ensure that our children are brought up and educated as good Pakistanis and good Muslims... There is a requirement of encouraging private individuals, private parties, private institutions to come forward and either get hold of some of the private (Nationalised) institutions and run themselves or even raise new private educational institutes... I want this (conference) to be an original exercise in framing an educational policy that is indigenous to Pakistan..."

As a result of 3 days deliberations the conference proposed as under:

- To develop in accordance with the Quran and Sunnah the character and conduct expected of a Muslim.
- To create an awareness of the Pakistan national as a part of universal Muslim Ummah.


53. Ibid., p. 13.
Consistent with the value system of Islam, to develop scientific attitude and skill, to liberate the creative and innovative energies of the people and to build their capability to effectively manage social, material and productive forces, to link science and technological training with production and to plan scientific endeavour in the overall context of national construction.

**National Education Policy**

The recommendations of the National Education Conference were processed in the Ministry of Education and on the basis of suggestions and consultation with various groups the National Education Policy was announced in October 1978. The policy inter-alia proposed following measures:

1. Islamic principles of life and commitment to ideology of Pakistan as national aim of education.
2. Provision of one thousand village workshop schools, to popularise vocational training in rural areas.
3. Four tier system of education of primary, secondary, college and university to be replaced by a three tier system of elementary, secondary and university education, (on 8,4,4, model).
4. Technical and vocational education to be made production oriented.
5. Establishment of a National Technical Teacher Training College.

---

6. Boards of education to be organized as research oriented body.

7. Professional educational institutions to arrange on-the-job training for the graduates.

In the case of technical and vocational education the policy included following recommendations:

"...Inspite of several efforts in the past the technical and vocational education is still not job oriented. Moreover there are hardly any arrangements for identifying the needs and providing training to 80% of rural population to make them more productive... It has been decided to introduce production oriented curriculum related to market requirements in technical / vocational institutes... Small production units will be established in polytechnics... Evening programme will be introduced in technical vocational institutes... Separate vocational schools for the dropouts of the school system will be established... Equipment will be standardised... A mechanism for standardizing, testing and certification of technical / vocational skill will be introduced... Practical on-the-Job training of diploma and B.Tech. students will be made compulsory by (enacting) suitable legislation... Close liaison will be established between industry and institutes... A teacher training college for the training of teachers of technical / vocational institutes will be established..."

In the case of agrotechnical studies the policy proposed the evaluation of the scheme to make it more purposeful.

The above provision of the National Education Policy in the sector of technical education indicated no substantial deviations from the measures that were in progress under the cover of the previous policy which was introduced few year back. It favoured the continuation of the programmes already under implementation with more emphasis on the improvement of internal and external efficiency of the system through various measures as described above. This approach helped in the consolidation of the on going programmes.

-----------
55. Ibid., p. 10.
Educational Development

The Ministry of Education prepared a detailed implementation programme to give effect to the national Education Policy. This was a useful document which identified the policy statement, rationale, programmes, anticipated problems and resource allocation. It helped various implementation agencies to perform their role effectively. The implementation programme took note of the following situation in technical education:

1. Need to incorporate new trends in technical education.
2. Under utilisation of facilities.
3. Non-availability of right type of teachers.
4. Absence of pre-service teacher training arrangements.
5. Unattractive service conditions of technical teachers.
6. Absence of testing and certification of persons trained through informal system.

The following specific programmes were proposed for the consolidation of technical education programmes:

1. Appointment of Advisory committees for technical institutes.
2. Restructuring Boards and Directorates of Technical Education.
3. Production units to be attached in few selected institutes.
4. Evening training programmes to be started.
5. Training to be organized on modular system.
6. Preparation of standardised list of equipment.

57. Ibid., p. 40.
7. Boards of technical education to determine the various levels of the trade certificate.

8. Legislation for providing training for engineering and technical graduates to be enacted.

9. College for pre-service and in-service training for technical teachers and staff development programmes to be established.

10. The proposed Technical Teacher Training College to also undertake the preparation and translation of technical books.

Fifth Five Year Plan

The number of polytechnics at the beginning of the Fifth Five Year Plan (1978-83) was 25 including 7 Colleges of Technology which were offering B.Tech. degree courses in addition to 3 year diploma courses. The total enrollment of these institutions reached 13727 with annual intake of 5271 and output of 3550 respectively. The Plan also indicated lack of correspondence between training programmes and job requirements. Describing the strategy during the Fifth Five Year Plan it was aimed to improve utilisation of technically trained manpower through relating the training programmes with job requirements. It was envisaged that during Fifth Five Year Plan the enrollment in polytechnics / colleges of technology would increase from 13727 to 18930. Other provision included to raise the annual intake to 6400 and output to 4925. For this purpose the consolidation of existing polytechnics and establishment of new institutions was proposed. To achieve these measures the financial


59. Ibid., p. 3.

60. Memon Abdul Aziz, op. cit., p. 44.
outlay of 766.8 million rupees was proposed during 1978-83 for technical education. This was about 8% of the development outlay for education.61

Sixth Five Year Plan:

By the beginning of Sixth Five Year Plan (1983-88) there were 18 polytechnics, 5 monotechnics and 7 colleges of technology which also offered technician diploma courses. The enrollment capacity was 18000 in diploma courses and 1700 in B.Tech. Course. About half of these institutions were provided the required facility under an Asian Development Bank aided Project62 of US $ 21 millions. The Plan envisaged the establishment of 9 new polytechnics (6 for man and 3 for women) and also 15 monotechnics in smaller and less developed areas.63

The Plan also emphasised the need to undertake the preparation of books for the polytechnic as the absence of books was considered a major cause of poor quality of polytechnic education.64

Technician Training for Women

The development of facilities for the training of women in the technician profession had been slow. The main cause had been finding a choice of suitable field of training keeping in view the various social and cultural barriers and problems of adjustment of woman in a male dominated industrial environment. As a beginning a polytechnic

---

61. Fifth Five Year Plan, op. cit., p. 54.
63. The Sixth Five Year Plan, op. cit., p. 319.
64. Ibid., p. 36.
institute for women was first established in 1967 in Lahore. It was designed to offer courses in commercial photography, dressmaking and dress designing, and certificate and diploma level courses in commerce. Later a Diploma level programme in electronics was also included. The intake capacity in 1988 was 150 students.

In 1981 with the financial assistance of Women's Division of Government of Pakistan a polytechnic was setup at Karachi. This institute was located in a rented premises comprising the top four floors of Super Market in Liaquatabad. The initial programme included OAE courses in architecture, electronics and garment making. Later in 1986 a programme of Secretarial technology was also added. The annual intake capacity in the four courses was 200 students. In 1982 another institute was established at Sukkur with an intake capacity of 50 students in garment making course. In 1982 the government of NWFP also established a polytechnic for women. The intake capacity was 150 students in electronics, architecture, garment making and courses in commerce also. The Federal Ministry of Education also started a polytechnic for women at Islamabad in 1984. It was located in the rented premises. Courses in electronics and architecture and commerce were offered with intake capacity of 40 students. Separate building for this institute was under construction under an Asian Development Bank financed loan project.

The most recent addition of polytechnics for women were three in Punjab (at Multan, Bahawalpur and Faisalabad) with intake capacity of 200 and one in Hyderabad which was in the process of development. The setup of 8 polytechnics for women had developed an annual intake capacity of 700 students (in 1988). The absence of polytechnic for women in private sector was very evident.

In the above scenario of polytechnics for women in Punjab and NWFP it was observed that in all these institutions besides industrial courses commerce was also
included. It was not only a cost effective approach but more related to the job opportunities for the female in the urban areas with opportunities in banking and commerce sectors. This merited due consideration in future development also.

Higher Education of Technicians

A related issue pertaining to the technicians was the aspect of their higher education. In 1955 when technician training programme was introduced it was considered to be a terminal course. However, under economic, professional and social urges the passouts felt the need for upward mobility. By early nineteen sixties the diploma holders organised themselves as a distinct group to struggle for introduction of degree level B.Tech. programme as a separate stream of higher education for the diploma holders. In 1966 the Commission on Student Problems and Welfare took note of this situation and recommended to 'institute a regular post diploma two year degree course in Technology'. The need for a separate stream for the higher education of polytechnic diploma holders was also endorsed by the central Council of the Institution of Engineers Pakistan in its 115 meeting (held on 17 May 1970) which resolved that Polytechnic students should not, of course, be denied higher education. They might follow course of higher studies in the type of disciplines that was originally created for them but not engineering that required highly rigorous preparatory attainment. Chandrakant and other persons associated with the planning and development of technician education also considered that under the impact of scientific advances the engineering field had exploded and the tasks of an engineer were becoming more and more complicated. The engineer was being called upon to carry his field of work farther and farther away from the realm of application and operation in

which modern engineering started years ago. We must make use of technician for those tasks that were formerly in the realm of engineers. To achieve the necessary results an educational programme was required that was comparable in quality and general level with the university engineering programme but differed from its emphasis being on practical applications of established scientific principles rather than the development of new design concepts.66

Based on the above concepts B.Tech. Degree programmes in Pass and Honours courses each consisting of two years were designed which were approved by the Federal Ministry of Education in 1973 for implementation by the respective provincial governments. Selected polytechnic institutes were upgraded as Colleges of Technology to offer B.Tech. Degree courses alongside the DAE programmes.

As a subsequent development the equivalence granted to this programme declaring it at par with engineering degree was withdrawn by the Pakistan Engineering Council on various grounds such as the insufficient duration of training, want of properly qualified teachers to teach the prescribed courses and lack of facilities. It was however surprising that inspite of its disputable status of recognition the programme continued to be affiliated with the respective Universities of Engineering and Technology and also the examinations were being conducted by the said universities. Despite the issues of recognition pending between the concerned parties the B.Tech. programme had the distinct potential to further build upon the training imparted to the technicians to develop a category of manpower as "technologist" for the roles described above.

The progress of development of the B.Tech. programme had been slow probably due to the problems stated above. According to to the report of Study Group for Seventh Five

66. L.S. Chandrakant, "Methodological Approaches For Planning and Designing of Technician Education System" mimeograph, (Singapore: Colombo Plan Staff College, 1978).
Year Plan the output of B.Tech. Honours programme during (1986-1988) was only 521. The combined enrollment in the Pass and Honours course as reported by the concerned Directorates of Technical Education was 325 in Punjab (1986-87); Sindh 1846 (1987-88) and NWFP 45 (1986-87).67

The long term solution of the status of B.Tech programme required the strengthening of faculty and physical resources of the institutions and also improvement of entry behaviour of the students through industrial training prior to admission to the programme. On the administration side the setting up of a 'Council of Technology' on the pattern of Engineers Registration Board (ERB) in UK may be considered. The emerging indicators of sophistication in the industrial and engineering practices and the need to sustain the benefits of scientific advancement called for increased services of technologists in supporting roles.

Achievements

The discussion of women polytechnic and higher education of technicians brings the closure of this chapter on development as a whole. By the end of the Sixth Five Year Plan (1988) which was also the end of the fourth stage under this study there were 30 Polytechnics and 9 Colleges of Technology including 8 Polytechnics for women. The annual intake capacity of the institutions was 9000.68 However, on the basis of data collected during the study (from the Directorates of Technical Education) the actual number of polytechnics and colleges of technology in the government


sector was 42 by 1989. Besides there were 8 institutes functioning under the private and semi-government organisation with about 3000 enrollment.

The details were as under:

- Polytechnics / Monotechnics for boys: 24
- Polytechnics for Women: 8
- Colleges of Technology: 10
  (including Polytechnic Sections)

The annual intake for diploma level courses was 8300 for boys and 700 for girls. The estimated annual out put of diploma holder was 7700. Details are given in Tables 5 & 6. The estimated enrollment in private polytechnics and technical institutes was 3000. Training was offered in as many as 25 different technologies.

The National Technical Teachers Training College which was established in Islamabad was commissioned in 1988 with skeleton staff and nucleus of facilities. (It started its first long course in 1989).

The Sixth Five Year Plan had estimated the annual intake of polytechnics at 5950 where as the actual at the beginning of the Seventh Five Year Plan stood at 9000 as above. This 40% rise over the estimated intake was due to the sudden introduction of second / evening shifts in diploma courses in almost all the polytechnics under the provision of the Prime Minister's Five Point Programme which was aimed mainly to expand the educational base and provide job opportunities to the youth.

Besides strengthening the physical facilities and developing the infrastructure of training institutions a number of quality improvement initiatives including training courses and workshops, staff development initiatives,

development of teaching and learning resources and institutional management were also under-taken. These have been discussed in detail in a later part of this study.

Summary

During the period of 40 years from 1947 to 1988 Pakistan had undergone several political changes. The educational system was also put to adjustments to suit the objectives of successive governments. Four distinct trends could be visible in the changing scenario of education which could be identified as Formative during 1947-58, Developmental during 1958-71, Innovations an Experimentation during 1974-77 and Quality Improvement during 1977-88. The development during each of the above stage depended on the educational initiatives in the shape of educational policies and directives and economic development plans which were formulated to translate the policies into programmes. This study included the initiatives emerging from the Pakistan Educational Conference 1947 and subsequent developments up to the National Education conference 1989. The developmental aspects covered the First to the Sixth Five Year Plan, including the "No plan period" of 1970-78.

The recommendations of the Technical Education Committee, 1950 formed the corner stone of development of technical education of Pakistan. During the Formative stage three polytechnic institutes were established. Against a total allocation of 27.8 million rupees actual expenditure of 22.0 million was incurred.

During the period from 1959-1971 rapid expansion of facilities took place probably under strict vigilance under martial law regime and the presidential form of government. The closing period of this stage was marked with the break up of the Eastern wing of the country and revival of former four provinces in West Pakistan which led to the establishment of provincial Directorates and Boards of
technical education. Major input during this phase was the Report of Commission on National Education which provided a basis of large scale reforms in the education system. Seven new polytechnics were established with a record achievement of targets of Second Five Year Plan as 100%. Due to initial setback on account of war in 1965 the achievement for the Third Five Year Plan was only 60%.

The third stage extending from 1971-77 saw a number of innovations and experimentation which included the Education Policy 1972-80, innovations of agrotechnical studies, matric technical courses, degree level courses for polytechnic students and introduction of distance learning system in Pakistan. The achievements included setting up of 6 new polytechnics and upgrading of 7 into Colleges of Technology increasing the overall annual intake capacity to 5200. The expenditure on technical education during this stage was 222.7 million rupees.

The development in the fourth stage, 1977-88 was based on the recommendations of the National Education Policy 1978 wherein the focus was on consolidation and improvement of quality. Under two successive plan period the total number of polytechnics reached to 50 including 8 in the private sector, with course offerings in 25 disciplines. The annual intake capacity reached to 9000, with a total enrollment of 31000 students in 1988. A National Technical Teachers Training College also started functioning as a major developmental initiative for the future planning and improvement of quality of technical education programmes.
TABLE 5: GOVERNMENT POLYTECHNICS / COLLEGES OF TECHNOLOGY
ANNUAL INTAKE CAPACITY AND ENROLLMENT BY TECHNOLOGY 1987-88.

<table>
<thead>
<tr>
<th>TECHNOLOGY</th>
<th>PUNJAB</th>
<th>SINDH</th>
<th>NWFP</th>
<th>E' STAN</th>
<th>FG' CAP</th>
<th>TOTAL</th>
<th>PUNJAB</th>
<th>SINDH</th>
<th>NWFP</th>
<th>E' STAN</th>
<th>FG' CAP</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Civil</td>
<td>7340</td>
<td>520</td>
<td>210</td>
<td>50</td>
<td>2209</td>
<td>6115</td>
<td>1912</td>
<td>730</td>
<td>181</td>
<td>7078</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Electrical</td>
<td>995</td>
<td>850</td>
<td>250</td>
<td>50</td>
<td>2175</td>
<td>2411</td>
<td>2233</td>
<td>743</td>
<td>159</td>
<td>5616</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Mechanical</td>
<td>955</td>
<td>800</td>
<td>250</td>
<td>50</td>
<td>2175</td>
<td>2532</td>
<td>1782</td>
<td>678</td>
<td>133</td>
<td>5120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Architecture</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>20</td>
<td>170</td>
<td>137</td>
<td>113</td>
<td>18</td>
<td>25</td>
<td>293</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Auto &amp; Diesel</td>
<td>120</td>
<td>200</td>
<td>50</td>
<td>20</td>
<td>470</td>
<td>361</td>
<td>552</td>
<td>150</td>
<td>1090</td>
<td>1063</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Argo &amp; Farm</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td>150</td>
<td>302</td>
<td></td>
<td></td>
<td>302</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Chemical</td>
<td>300</td>
<td>150</td>
<td>50</td>
<td>20</td>
<td>500</td>
<td>653</td>
<td>990</td>
<td>145</td>
<td>1090</td>
<td>1035</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Electronic</td>
<td>390</td>
<td>400</td>
<td>50</td>
<td>20</td>
<td>860</td>
<td>1020</td>
<td>878</td>
<td>181</td>
<td>2104</td>
<td>2104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Refriger &amp; AC</td>
<td>75</td>
<td>220</td>
<td></td>
<td></td>
<td>275</td>
<td>155</td>
<td>387</td>
<td></td>
<td>656</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Clothing</td>
<td>210</td>
<td>20</td>
<td>50</td>
<td></td>
<td>340</td>
<td>257</td>
<td>205</td>
<td>77</td>
<td>619</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Garment &amp; Dress Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Instrumentation</td>
<td>170</td>
<td></td>
<td></td>
<td></td>
<td>170</td>
<td>404</td>
<td></td>
<td></td>
<td>404</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Textile</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
<td>150</td>
<td>226</td>
<td>220</td>
<td></td>
<td>443</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Spinning/Weaving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Welding &amp; Ship Metal</td>
<td>20</td>
<td>36</td>
<td></td>
<td></td>
<td>50</td>
<td>46</td>
<td>93</td>
<td></td>
<td>139</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Foundry</td>
<td>40</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Pattern Making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Woodworking</td>
<td>50</td>
<td>50</td>
<td>154</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Watch &amp; Instruments</td>
<td>25</td>
<td>25</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Printing &amp; Graphic Arts</td>
<td>100</td>
<td>226</td>
<td></td>
<td></td>
<td>100</td>
<td>226</td>
<td></td>
<td></td>
<td>226</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Power</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>205</td>
<td></td>
<td></td>
<td>205</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Secretarial</td>
<td>50</td>
<td>50</td>
<td>94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Directorates of Technical Education

Note: * Including second Shift/Evening Diploma Programme
** Post Diploma Course
<table>
<thead>
<tr>
<th>TECHNOLOGY</th>
<th>PUNJAB</th>
<th>SINDH</th>
<th>NWFP</th>
<th>B'STAN</th>
<th>FED. CAP</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Civil</td>
<td>501</td>
<td>382</td>
<td>135</td>
<td>60</td>
<td>-</td>
<td>1088</td>
</tr>
<tr>
<td>2. Electrical</td>
<td>298</td>
<td>445</td>
<td>148</td>
<td>47</td>
<td>-</td>
<td>939</td>
</tr>
<tr>
<td>3. Mechanical</td>
<td>343</td>
<td>352</td>
<td>63</td>
<td>24</td>
<td>-</td>
<td>785</td>
</tr>
<tr>
<td>4. Architecture</td>
<td>29</td>
<td>32</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>61</td>
</tr>
<tr>
<td>5. Auto &amp; Diesel</td>
<td>53</td>
<td>72</td>
<td>34</td>
<td>-</td>
<td>-</td>
<td>159</td>
</tr>
<tr>
<td>6. Auto &amp; Farm</td>
<td>32</td>
<td>39</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>71</td>
</tr>
<tr>
<td>7. Chemical</td>
<td>109</td>
<td>65</td>
<td>13</td>
<td>-</td>
<td>-</td>
<td>187</td>
</tr>
<tr>
<td>8. Electronic &amp; TV</td>
<td>181</td>
<td>194</td>
<td>52</td>
<td>-</td>
<td>0</td>
<td>433</td>
</tr>
<tr>
<td>9. Refrig. &amp; AC</td>
<td>29</td>
<td>59</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>88</td>
</tr>
<tr>
<td>10. Clothing/Garment</td>
<td>73</td>
<td>70</td>
<td>18</td>
<td>-</td>
<td>-</td>
<td>161</td>
</tr>
<tr>
<td>/Dress Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Instrumentation</td>
<td>36</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>36</td>
</tr>
<tr>
<td>12. Textile/Spinning</td>
<td>35</td>
<td>38</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>73</td>
</tr>
<tr>
<td>/Weaving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Welding &amp;</td>
<td>10</td>
<td>22</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>32</td>
</tr>
<tr>
<td>Sheet Metal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Biomedical</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15. Civil Drafting</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>16. Foundry &amp;</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Pattern Making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Wood Working</td>
<td>-</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>18. Watch &amp;</td>
<td>-</td>
<td>13</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>13</td>
</tr>
<tr>
<td>Instruments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Printing &amp;</td>
<td>37</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>37</td>
</tr>
<tr>
<td>Graphic Arts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Power</td>
<td>-</td>
<td>45</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>45</td>
</tr>
<tr>
<td>21. Glass &amp; Ceramics</td>
<td>-</td>
<td>45</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>45</td>
</tr>
<tr>
<td>22. Secretarial</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Boards of Technical Education
CHAPTER FOUR

IMPLEMENTATION PROCESSES

The systems approach to technician education as an open organizational system was referred in Chapter I. In Chapter III the educational policies and development plans were discussed which served as an interface to this system of education. These policies and plans were instrumental to provide guidelines and resources for the development of institutional infrastructure in the form of polytechnic institutes and Colleges of technology, administrative setup in the form of Boards and Directorates of Technical Education, Departments of Education and Ministry of Education at the provincial and federal levels respectively.

The main input to the system was the students who entered the institute and later on came out as trained technicians or dropped out for various reasons. The extent of training objectives achieved by the students reflected the internal efficiency of implementation process that operated in the system which, besides the students, consisted of faculty, material resources and administrators. It was also influenced by the external management style exercised by the Ministry and Department of Education, Directorates and the Board of Technical Education. The implementation process of the system was further governed by the operation of the sub-system of curriculum, teaching learning process, managerial processes, faculty and staff
development processes which exerted direct influence on the overall transformation which takes place in the system. Fig. 4 gives the conceptual model of the input-process-output for the technician training system.

**Fig. 4**: INPUT-PROCESS-OUTPUT MODEL
FOR TECHNICIAN EDUCATION SYSTEM.
With the above elucidation the study attempted to trace out the trend of the implementation processes in the technician training system during the period covered by this study. Since no systematic assessment was ever carried out in the technician education system from its inception about three decades ago, very little documentary evidences were available to judge the trends in the various aspects of internal processes of technician institutes in Pakistan. This situation was equally applicable to other sectors of education also. Some tracer studies were carried out by the writer as part of Study of Technical and Vocational Education in Pakistan conducted during 1989 by the Hawthorn Institute of Education, Melbourne, Australia, under an ADB aided project.¹ The data from the study was also referred with the permission of Hawthron Institute of Education.

The Quality of Input

Students: Enrollment

The input of students to the polytechnics and Colleges of technology were the passouts of Secondary School Certificate (SSC) examination in science group. Students passing Intermediate Science (I.Sc.) with pre-engineering subjects were also admitted against 10% seats reserved for such students.

The pace of expansion had recorded a growth of 500% in the enrollment of students during last 25 years. With the enrollment of 5800 during 1960-65, the enrollment in 1988 was 31000. During the same period the annual intake capacity increased from 2100 to 9000.²


² Sixth Five Year Plan, op. cit., p. 483.
As a result of expansion of secondary education facilities the number of students passing matriculation had also increased from year to year. The mounting pressure for admission to institutes of tertiary levels also included polytechnics. This situation stemmed out from the fact that people considered this type of education preferable over the aimless general education.

Table 7. attempts to provide a relationship between the annual intake of polytechnics and the corresponding output of the matriculates during the various plan periods.

<table>
<thead>
<tr>
<th>TABLE 7 : INTAKE OF POLYTECHNICS AS RELATED TO OUTPUT FROM SECONDARY SCHOOLS (1960 - 1988)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SECOND PLAN</strong></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td><strong>Enrollment</strong></td>
</tr>
<tr>
<td>Class IX/X (Male Group)</td>
</tr>
<tr>
<td>Class X (50%)</td>
</tr>
<tr>
<td>Output Matriculation (60%)</td>
</tr>
<tr>
<td>Polytechnic Intake</td>
</tr>
<tr>
<td>Intake as % of Matric Output</td>
</tr>
</tbody>
</table>

It was observed that the annual intake during all the plan periods registered a constant ratio of about 4% of the output of the matriculates (Male Group) in the corresponding (previous) plan period. In the absence of any other comparable yardstick this appeared to be valid criteria to establish the relationship of intake to polytechnics with the output of general education system. This ratio could be doubled if the base of matriculation was further reduced to represent the output of science group only which was generally about half of the total output. In another study this ratio was reported to vary between 5.6% - 7% for the period from 1975-79.3

Admission Procedure:

In the initial stage of the polytechnic established at Karachi the admission was based on an entry test. Students passing Matriculation examinations were required to appear in a test consisting of English, mathematics, Science and General Knowledge of matric level. This system was discontinued in 1962 when all the polytechnics were brought under the administrative control of West Pakistan Education Department. Instead of an admission test students were admitted on the basis of aggregate marks obtained in the matriculation examination. But to ensure a reasonable entry background to pursue technical courses, such students who failed in any of the subjects of English, Mathematics, Physics or Chemistry were not eligible for admission. This was an example of how administrative changes affect the teaching learning processes. A well tried system was done away with for administrative exigencies. Later in 1980 with the introduction of Matric Technical courses in vocational

institutes (in Sindh) and the adoption of letter grading system (instead of divisions) for the matriculation examination by all the Boards of Secondary Education the admission policy was further amended. Overall preference was given to students qualifying Technical matric or those from the Industrial arts group. The minimum qualifying grade was kept at D, i.e. students with E grade or aggregate marks of less than 40% were not eligible for admission. This policy was still in force, at the time of the study.4

Vocational Guidance

During the study no evidence could be found to judge the adequacy of vocational guidance and counselling to student seeking admission to professional training institutions. It was however observed that the Directorates of Manpower and Training under the Provincial Departments of Manpower and Labour had set up "vocational guidance cells". The assigned duties included job sampling, conducting orientation programmes in schools, job studies, development of career guidance booklets, selection tests for industrial training and training of school teachers in providing guidance services.5 But these efforts could not yield proper results as the available information and services could not reach the target population due to lack of coordination/appreciation by the user department and also for paucity of funds.

---


The need for vocational guidance and some selection criterion to assess students capabilities was also emphasised by the Commission on National Education, which stated:

"The possibilities of education of any are limited by his aptitude and interest. The choice of course of study by students is too often dictated by unrealistic ambitions of parents or other irrelevant consideration rather than by students' own endowment, capabilities and interests... The Commission is firmly of the opinion that appropriate tests should be administered and proper counselling provided to our students at each of these critical stages in their educational careers i.e. class VIII, X and XII".

A study group in Sindh had also made the following recommendations:

"The admission policy in technical institutes should be made more realistic. The admission system should be based on due weightage on public examination results and admission / aptitude test".

Mis-match between the students abilities and the demands of the programme resulted in the dropouts causing wastage of costly facilities that are provided in equipping the institutes.

In a study of first year dropouts for polytechnics in East Pakistan in 1968 the average dropout was estimated to about 50%.


On the procedure of admission the HIE-ADB Study Report referred earlier in this chapter also stated eight out of fourteen responding institutions have expressed dissatisfaction with the present admission criteria and made following suggestions:

i. admission should be made on the basis of admission / aptitude test.

ii. only such students who have secured 60% marks in mathematics and science be admitted.

iii. admission on reserved quota to be done away with.

iv. only fresh matriculates be admitted.

There appeared, therefore, an imperative need to introduce some valid and more realistic system of students selection for admission to the polytechnic institutes.

Faculty

The ultimate quality of the delivery system of any curriculum depends on the qualifications of teachers. On the basis of their specific teaching functions the polytechnic teachers were broadly classified into three categories; (a) those who taught technical theory courses, (b) those who taught practical courses in the workshops and laboratories and (c) those who taught related subjects of mathematics, science and humanities which were included in the polytechnic curriculum. Bases on this classification of functions the source of their supply also differed. Teachers of technical theory courses were in general engineering degree holders or with equivalent qualifications such as the membership of Institutions of Engineers. For teaching practical courses the prescribed qualifications were diploma

from a polytechnic or a trade certificate from technical training centres with industrial experience. A post graduate degree in the respective subject was required for the teachers of related subjects.

The staffing pattern of polytechnics consisted of Head of Department, Senior Instructor, Instructor and Junior instructor who shared the teaching load among themselves. Besides there were support staff such as Shop Assistant and Shop Attendants to assist in arranging the facilities for workshop and laboratory instruction. For each technology with single section enrollment of 30 students in each of the 3 years the distribution of teachers was generally, one Head of Department, one Senior Instructor, three instructors and three junior instructors. The above norm gave a student teacher ratio of 12:1. But due to social demand for admission the number of seats per technology were increased up to 50 students without increase in the staff resulting in a high ratio of students to teachers. This ratio for some institutions during the period from 1978-82 was determined to be an average of 24:1, with some individual institutes having as high as 38:1.  

Supply of Teachers

Table - 8 indicates the enrollment and the availability of teachers in the polytechnic institutes at various intervals during last 15 years.


TABLE 8: POLYTECHNICS: ENROLLMENT AND TEACHERS: 1976-89

<table>
<thead>
<tr>
<th>YEAR</th>
<th>POLYTECHNICS</th>
<th>ENROLLMENT</th>
<th>TEACHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975-77</td>
<td>22</td>
<td>9938</td>
<td>624</td>
</tr>
<tr>
<td>1980-81</td>
<td>22</td>
<td>13992</td>
<td>841</td>
</tr>
<tr>
<td>1984-85</td>
<td>26</td>
<td>19615</td>
<td>1216</td>
</tr>
<tr>
<td>1988-89</td>
<td>37</td>
<td>26137</td>
<td>1511</td>
</tr>
</tbody>
</table>

2. NIE-ACB Study Report, 1989, Ch. 16.

The above table indicates a sharp rise in enrollment during the last 4 years. While the enrollment registered an increase of 43.5% (from 19615 to 28137) the corresponding increase in the faculty was only 24.2%, (from 1216 to 1511). Reason for this sharp rise in the student enrollment could be attributed to the fact that in late nineteen eighties under the Prime Minister's (Mr. Junejo) Five Point Programme a second shift was started in all the polytechnics. The introduction of second shift being a temporary phase additional staff was not recruited by the provincial governments. The existing staff was also engaged to undertake the additional load on hourly remuneration basis. As a result of this policy the student teacher ratio increased from 16 to 19:1, (a net rise of 19%).

Table 9 gives the details of 1511 posts which were filled in 1988 in the 37 government polytechnics institutes in four provinces.
The proportion of vacant posts varied between provinces. Balochistan appeared to face difficulties because of its relatively small base of supply of potential teachers with technical and engineering background. Till late eighties there was no engineering college functioning in Balochistan. The incidence of vacancies between Punjab and Sindh appeared to be similar, nearly 30%. NWFP with only 20% vacant posts appeared to be in a comparatively better position. The possible reason could be attributed to the narrow base of industrialisation, especially in the interior, which should compel the qualified engineers and technician to take up position in training institutions in NWFP.

The overall position of supply of teachers seen in the context of increase in the enrollment due to mounting social demand must be a matter of concern to all the institutes. Suitable measures needed to be taken to resolve the situation.
Qualification of Teachers

The problem of technical teachers, their recruitment and training, was a complicated one because of gaps in the system. It was not merely an issue of numbers where the deficit ran up to 20 - 50% of the total teaching force, but more so of quality. The shortage forced the administrators to assign teaching duties to lesser qualified junior instructors resulting in poor academic standards.

Almost all the previous policies and plans have acknowledged the crucial need for training of teachers. The Commission on National Education had recommended for establishment of training courses for technical teachers12:

"At the present time we have no institutions which impart training in the methods and instructional techniques to teachers giving technical instructions... The three polytechnics should establish training courses for technical instructors (one year course)."

The Sub-Committee on Standardisation of Polytechnic Education also considered the issue13:

"It is essential that all staff members have training in the philosophy and teaching methods of technical education. The Diploma in Technical Teacher Education requires the completion of 36 credits. In one full academic year or four eight week summer sessions".

The data of qualifications of a cross section of 247 teachers of polytechnics as given in Table-10, further supports the situation explained in the above observations.

## TABLE 10: QUALIFICATIONS, TRAINING AND EXPERIENCE: POLYTECHNIC - TEACHERS

<table>
<thead>
<tr>
<th>ACADEMIC QUALIFICATION</th>
<th>TRAINING (MONTHS)</th>
<th>INDUSTRIAL EXPERIENCE (YEARS)</th>
<th>UPGRADING COURSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.Sc., MA, M.Sc.</td>
<td>1-3</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>ENG, M.E., B.Tech.</td>
<td>1-3</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

| 23 | 15 | 62 | 46 | 26 | 15 | 25 | 55 | 45 | 13 | 25 |

*All figures in percentage*

(Source: NIE-ADB Report, Ch. 16)

The above situation indicated a high degree of dependence on the lesser qualified teachers. The situation was further complicated that only 28% teachers were having pedagogical training of 6 months or more. In view of the typical nature of training imparted in the polytechnics the teachers were required to have adequate background of industrial practices. But only 45% were reported to have industrial exposure varying from one to four years.

**Staff Development**

Immediately after the establishment of the first two polytechnics the Government established two teachers training wings at Karachi and Dhaka polytechnic. (A third wing was also established in Rawalpindi Polytechnic). The TT wing at Rawalpindi had since been shifted to GCT Lahore due to abolition of the GCT Rawalpindi. The TT Wing of GCT Karachi had also been shifted to another Polytechnic Institute. After the dissolution of One Unit a TT wing was also established at GCT Peshawar and Hyderabad. The purpose of these wings was to provide inservice training to industrial arts teachers. For this purpose courses of certificate and diploma in teacher education were designed. These included pedagogical contents and subject updating.
An Appraisal Mission of Asian Development Bank in 1979 had reported the performance of Teacher Training Wing in these words:14

"This scheme has not proved successful. The polytechnics did not recruit master teacher trainers but relied on their staff to conduct the programes. The programes offered were therefore of a poor quality, and because resources were dispersed, no one polytechnic had the resources needed to offer a proper teacher training programe. Furthermore, because the scheme was limited to providing training programes for polytechnic teachers the need of vocational schools and technical high schools were neglected".

Views on Staff Development Needs

The staff development needs for polytechnic teachers were also indicated in a survey which was conducted as a part of the Study on Improvement of Standard of Higher Education in Sindh, referred earlier.

Based on the information in Table 11 the following three areas were considered as priority areas for staff development in polytechnics and colleges of technology:

1. Updating Knowledge of subject
2. Training in methods of teaching
3. Pre-service training of teachers

All the above areas had a direct relation to teacher's effectiveness in performing his task.

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>PRINCIPAL</th>
<th>TEACHER</th>
<th>STUDENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MI I II</td>
<td>MI I II</td>
<td>MI I II</td>
</tr>
</tbody>
</table>

1. Inservice training of teachers in

   a. Methods of teaching
      4 1 - 30 4 1 131 39 15

   b. Updating knowledge
      5 - - 30 6 - 150 20 7

   c. Techniques of testing
      3 2 - 17 16 1 98 76 14

   d. Research and planning
      3 2 1 10 19 1 98 64 18

   e. Educational administration
      2 2 1 12 20 3 103 63 17

2. Pre-service training as pre-requisite for appointment

   1 2 2 11 17 1 118 45 1

3. Pre-service training after appointment but before induction to teaching

   3 2 - 18 14 2 121 45 15

* MI : Most Important; I : Important; LI : Least Important

No further improvement in the situation could be visible even after a lapse of about nine years which was described in Sector Study on Education by the Asian Development Bank as under:\textsuperscript{15}:

"The Polytechnics suffer from an acute shortage of qualified trained teachers. The efficiency of these units (teacher training wings in polytechnics) is doubtful. The outputs are few partly due to limited operational resources, lack of teacher trainers, poor organisational arrangements and the lack of availability of teacher trainers to ensure the continuity of training activities. Even the present technical teachers need professional upgrading".

National Technical Teachers Training College

The training and staff development process in technical education remained totally a provincial concern until 1978 when the National Educational Conference took note of the situation. The need for a full fledged training institution for technical teachers was recognised in the National Education Policy 1978.\textsuperscript{16} A development scheme for the establishment of a National Technical Teachers Training College was approved in 1981. The project inter-alia envisaged following objectives.

1. To train about 700 pre-service teachers for polytechnics, vocational and commercial institutes and polytrade and agrotechnical course.
2. To conduct in-service training and staff development activities.
3. To do research for ascertaining the right type of technologies in the light of global trends.

\textsuperscript{15} "Asian Development Bank Pakistan : Sector Study on Education", op. cit., p. 66.

\textsuperscript{16} National Education Policy, 1978, op. cit., p. 11.
The Asian Development Bank agreed to provide soft loan for this college under loan agreement No. 419-Pak (SF). Some preliminary work had started when in 1982 it was decided to revise the scope of the scheme to provide more focus on inservice training, staff development, research and information system for technical education. The proposed institute aimed to provide educational services including development of teaching learning resources, instructional material and preparation of textbooks. It was also intended to act as a technical arm of the Federal Ministry of Education to maintain liaison with industry and provide data on employment trends, training needs of industry and assisting the federal and provincial governments in developing policy options.

The Revised Scheme was estimated to cost, Rs. 80.72 million as development expenditure and a recurring expenses component of Rs. 9.40 million per year when operating at full capacity.\(^ {17} \)

The major facilities of the College had since been completed and it had started functioning in 1988 - 89. The establishment of this College though a belated achievement had added a new dimension to the development of technician education in Pakistan. Given proper leadership, status and recognition the College promised potentials to contribute to technician education and specifically it staff development aspects. Some of the immediate areas of concern which the College was required to pay attention were arrangement for induction of new teachers for which there existed no system, development of proper linkages with the existing teacher training wings in the polytechnics and upgradation of knowledge and skills of teachers in keeping with the demands of technological changes.

Along with the traditional institution based pattern of teachers training conducted through the Teachers Training wings in the polytechnics a large number of senior teachers and administrators were exposed to short term courses and workshops organised by agencies like Colombo Plan Staff College, Singapore/Manila, Asian Development Bank and UNESCO. In addition in-country courses were also conducted to increase the scope of participation by the local teacher. As of 1984 about five such courses were conducted in Pakistan by the Colombo Plan Staff College for technician Education. As many as 150 teachers from Punjab, NWFP and Balochistan were also trained abroad during 1985 – 87 under the ADB loan 419 – Pak. (SF), referred earlier.

So far there had not been any institutional arrangement for pre-services training of persons who would like to choose technical teaching as a profession. The chronic shortage of teachers in technical institution led the government to consider pre-service technical teacher education programme as a potential mode for the preparation of teachers of polytechnic and technical institutes. The Seventh Five Year Plan had recommended to introduce pre-service B.Ed(Tech.) courses in the NTTTC. For Pakistan this was an innovative step though similar arrangements were already in existence in some of the regional countries such as Iran, Thailand, Malaysia, South Korea and Indonesia. A three years programme for students completing Intermediate Science appeared to be a reasonable length of time to

---


acquire the B. Ed. (Tech.) degree consisting of technical subject matter in a specific field along with pedagogical training.

Through another innovative arrangement the Directorate of Technical Education Sindh had arranged for the training of over 500 teachers during 1984-88. All the teachers were exposed to a two months induction programme consisting of training in the major areas of methods of teaching, development of T-L resources and student evaluation which were considered as minimum requirements for effective teaching. The Board of Technical Education in Sindh conducted the qualifying examination for this programme. In the context of constraints to organize long term courses for various reasons this appeared to be a suitable alternative in the situation that was existing.

Teacher's preparation should be first on the list of priorities if technical education is to be expanded properly. In a study by the UNESCO the preparation of these teachers, however was reported to pose a challenge in most of the developing countries. Teacher education must not be considered ended when initial qualification was achieved. This should be seen as simply the first in a career which should include further education through a well planned staff development process.20

Teacher is the most important element behind the implementation process who can engineer maximum use of resources through his creative ability. Resources are no doubt necessary but human competencies and skills are equally important to operate optimally. "While other resources are subject to decay deterioration and

obsolescence on a time scale it is possible to increase the potential and contribution of human resources as time flies by".21

Financial Resources

Education cannot be had cheaply and good programmes in technical education are expensive. Technical education entails higher cost as compared to general education. Besides high development outlay needed to provide costly equipment for workshops and laboratories it has a high component of recurring expenditure also.

The pay and salaries of suitably qualified teaching staff who happens to be in high demand by the industries is also comparatively higher as of teachers of general education. The cost of expensive raw material to teach workshop and laboratory courses is other component of training expenses. The salary structure of teaching staff is linked with the general recruitment policy of the government.

It was observed that the salaries and working conditions for technical teachers, though not very attractive, were at par with their counterparts in other government departments. The government was however facing difficulties to compete with the pay structure and other benefits offered by the industries to technically qualified persons. As a result technical teaching was not the first choice for many of the engineering and technically qualified persons.22


Another area of concern however lied in the provision of funds for raw material and other teaching contingencies. With a major emphasis on the development of manipulative skills it was essential to provide adequate funds to keep students engaged in workshops. The Commission on Student Problems and Welfare while commenting upon the need to provide adequate funds also reiterated that so long the students were kept busy in workshops and laboratories there were few disciplinary problems.\textsuperscript{23}

A typical sampling of budget provisions for four institutions conducted by the writer in an early study in 1980 is given in Table 12. It shows that about 10.5 paisas were provided as raw material expenses per student per class hour.\textsuperscript{24}

In another study\textsuperscript{25} the average distribution ratio of recurring expenditure in 12 institutes in Punjab during 1978 - 82 was reported as under:\textsuperscript{23}

\begin{center}
\begin{tabular}{|c|c|c|c|c|}
\hline
DISTRIBUTION OF RATIO OF RECURRING EXPENSES & Teaching Staff & Administrative Staff & Equipment & Library & Other \\
\hline
100 & 82\% & 45\% & 31 & 35\% \\
\hline
\end{tabular}
\end{center}

(\% as percentage of teaching staff)

\textsuperscript{23} Report of Commission on Student Problems and Welfare, op.cit., p. 121.


\textsuperscript{25} Quality of Input and Output of Technical and Engineering Institutions in Pakistan, op. cit., p. 26.
### TABLE 12: DISTRIBUTION OF BUDGET IN POLYTECHNIC INSTITUTES

<table>
<thead>
<tr>
<th>INSTITUTE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Enrollment</td>
<td>1500</td>
<td>500</td>
<td>350</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>2. No. of Technologies</td>
<td>12</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>3. Salaries of Administrative Staff</td>
<td>Rs. 673000</td>
<td>Rs. 1763000</td>
<td>Rs. 128000</td>
<td>Rs. 127000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% 22.8</td>
<td>19.6</td>
<td>22.2</td>
<td>22.4</td>
<td>21.3</td>
</tr>
<tr>
<td>4. Salaries of Teaching Staff</td>
<td>Rs. 150000</td>
<td>Rs. 560000</td>
<td>Rs. 350000</td>
<td>Rs. 648000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% 58.8</td>
<td>55.0</td>
<td>56.3</td>
<td>58.3</td>
<td>61.5</td>
</tr>
<tr>
<td>5. Training</td>
<td>Rs. 150000</td>
<td>Rs. 173000</td>
<td>Rs. 21000</td>
<td>Rs. 102000</td>
<td></td>
</tr>
<tr>
<td>Contingencies</td>
<td>% 2.1</td>
<td>7.2</td>
<td>4.6</td>
<td>9.6</td>
<td>6.8</td>
</tr>
<tr>
<td>6. Other</td>
<td>Rs. 233000</td>
<td>Rs. 110000</td>
<td>Rs. 20000</td>
<td>Rs. 120500</td>
<td></td>
</tr>
<tr>
<td>Contingencies</td>
<td>% 11.2</td>
<td>17.2</td>
<td>4.2</td>
<td>11.1</td>
<td>10.4</td>
</tr>
<tr>
<td>7. Total Budget</td>
<td>Rs. 2049000</td>
<td>Rs. 1300000</td>
<td>Rs. 578000</td>
<td>Rs. 114000</td>
<td></td>
</tr>
<tr>
<td>8. Cost/Student/Year</td>
<td>1908</td>
<td>2008</td>
<td>1852</td>
<td>2475</td>
<td></td>
</tr>
<tr>
<td>9. Cost/Student/hours</td>
<td>Rs. 2.26</td>
<td>Rs. 2.32</td>
<td>Rs. 1.97</td>
<td>Rs. 2.68</td>
<td>Rs. 2.24</td>
</tr>
</tbody>
</table>

(Items 8 & 9 on calculation basis)

1. Expenditure of raw material (included in the training contingencies)
   - Rs. 100000
   - Rs. 80000
   - Rs. 20000
   - Rs. 50000

2. Expenditure/student/year (on enrollment basis)
   - Rs. 67.00
   - Rs. 87.00
   - 111.00
   - Average Rs. 84.0

3. Expenditure/student/hour (10.52 Pasias)
   - Average Rs. 0.487

*Note: In one academic year there were 2 semesters, each of 18 weeks duration. During each week the practical work was conducted for 18 class hours.*
Table 13 gives the allocation of total funds for 18 polytechnics institutes and colleges of technology. The allocation of funds for the purchase of stores for the year 1987 - 88 are also shown therein. A look on Table-13 also indicates that for almost 40% institutions that were included in the sample the allocation of funds for raw material fell very much below the average. All the Institution with lower allocation were located in Sindh and NWFP, with the exception of Nowshera which was conducting vocational training courses also. In Sindh the Pak. Swedish Institute received the highest allocation of Rs. 132 per student which was almost double when compared with other institutions in the province. In Punjab the allocation of funds for raw material was higher compared to other provinces with Swedish Pak. Institute at Gujrat receiving the highest, reflecting almost three times of the provincial average.

A comparison of Table 12 and Table 13 indicates that the average allocation of funds for raw material which worked out to Rs. 84 per year per student in 1980 was raised to Rs. 132 per student in 1987 - 88 indicating an increase of 52%. But during the same period the total budgets of institutions with comparable enrollment were also increased by almost 5 times registering a general inflationary tendency. But it was noted that the proportion of training contingencies to total budget itself actually reduced from 6.8% in 1980 to 2.7% in 1987 -88. This indicated that the
increase in the funds for training material was a result of
general escalation in the price index and not a planned
increase to meet the actual requirements of training. This
was a matter of concern that the funds for training material
were not matching the actual training needs.

**TABLE 13**

**GOVERNMENT POLYTECHNICS/COLLEGES**

**OF TECHNOLOGY RECURRENT BUDGETS**

**AND COSTS PER STUDENT 1987-88.**

<table>
<thead>
<tr>
<th>INSTITUTE</th>
<th>TOTAL ENROLLMENT</th>
<th>TOTAL BUDGET</th>
<th>COST OF STORES</th>
<th>TOTAL COST/STORES</th>
<th>STUDENTS COST/STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. GCT Hyderabad</td>
<td>1970</td>
<td>6,973,000</td>
<td>70,000</td>
<td>3,530</td>
<td>36</td>
</tr>
<tr>
<td>2. GCT Lahore</td>
<td>1800</td>
<td>12,000,250</td>
<td>301,000</td>
<td>6,116</td>
<td>167</td>
</tr>
<tr>
<td>3. GCT Multan</td>
<td>1732</td>
<td>7,031,720</td>
<td>268,000</td>
<td>4,321</td>
<td>148</td>
</tr>
<tr>
<td>4. GCT Karachi</td>
<td>1685</td>
<td>8,494,800</td>
<td>120,000</td>
<td>5,800</td>
<td>74</td>
</tr>
<tr>
<td>5. GCT Sahiwal</td>
<td>1534</td>
<td>4,557,199</td>
<td>250,000</td>
<td>3,380</td>
<td>195</td>
</tr>
<tr>
<td>6. Cifee II Inst.</td>
<td>1250</td>
<td>2,127,400</td>
<td>30,000</td>
<td>1,701</td>
<td>24</td>
</tr>
<tr>
<td>7. GPI Islamkot</td>
<td>1181</td>
<td>5,125,950</td>
<td>215,000</td>
<td>4,340</td>
<td>182</td>
</tr>
<tr>
<td>8. GCT Khairpur</td>
<td>1178</td>
<td>4,480,880</td>
<td>70,000</td>
<td>2,803</td>
<td>59</td>
</tr>
<tr>
<td>9. GPI Sargodha</td>
<td>1053</td>
<td>4,600,440</td>
<td>215,000</td>
<td>4,368</td>
<td>204</td>
</tr>
<tr>
<td>10. GCT Peshawar</td>
<td>918</td>
<td>7,574,670</td>
<td>120,000</td>
<td>6,239</td>
<td>131</td>
</tr>
<tr>
<td>11. GPT Layyah</td>
<td>745</td>
<td>3,103,150</td>
<td>129,000</td>
<td>4,165</td>
<td>173</td>
</tr>
<tr>
<td>12. Habib CI, M'Sheh</td>
<td>603</td>
<td>2,288,270</td>
<td>35,000</td>
<td>3,196</td>
<td>58</td>
</tr>
<tr>
<td>13. PTIT Landhi</td>
<td>527</td>
<td>4,258,050</td>
<td>70,000</td>
<td>8,079</td>
<td>132</td>
</tr>
<tr>
<td>14. SPIT Gujrat</td>
<td>500</td>
<td>5,140,030</td>
<td>301,000</td>
<td>10,280</td>
<td>602</td>
</tr>
<tr>
<td>15. GPI Nawshera</td>
<td>497</td>
<td>2,626,060</td>
<td>99,700</td>
<td>5,284</td>
<td>200</td>
</tr>
<tr>
<td>16. GPI Jacobabad</td>
<td>442</td>
<td>1,518,540</td>
<td>30,000</td>
<td>3,145</td>
<td>68</td>
</tr>
<tr>
<td>17. GPI Quetta</td>
<td>438</td>
<td>2,566,112</td>
<td>66,000</td>
<td>5,063</td>
<td>136</td>
</tr>
<tr>
<td>18. GPI J. I. Khan</td>
<td>438</td>
<td>2,208,300</td>
<td>42,000</td>
<td>5,041</td>
<td>132</td>
</tr>
</tbody>
</table>

| TOTAL | 18,198 | 80,541,442 | 2,415,700 | 4,865 | 132 |

(Average) (Average)


The higher proportion of budget allocated to the
Pakistan - Swedish Institute of Technology both in Punjab
and Sindh was an example of proper return on proper
investment. Generally the passouts of these institutes have
reported better employment prospects compared to their
colleagues who have passed from the polytechnics. The training programme in these institutions aimed to produce industrial technicians. The revised curriculum in the polytechnics also aimed to produce industrial technician (details discussed later in this Chapter) but there had not been proper increase in the budgetary allocation to meet the objectives of the revised curriculum. It was therefore necessary that the allocation for raw materials should be increased to improve the standards of training.

Curriculum Design and Development

The curriculum is the focal point of any training programme. All the inputs to the system and the processes are geared to achieve the aim of curriculum which in turn serves as a vehicle for the required output.

In the engineering team the technician forms a link between skilled worker and engineer/technologist. In the South East Asian Sub-continent (Pakistan, Bangladesh, India, Sri Lanka) where initial schooling system is of 10 years duration, the programme for the training of technicians spread over three years. In countries with 12 years schooling system the programme generally takes 2 years making a total of 14 years.

Requirements of Knowledge and Skill

In designing the curricula for technical manpower due consideration has to be given to the requirements of knowledge and skills needed to develop desired competencies. Knowledge refers to intellectual preparation for the understanding of basic principles and skills develop ability to perform manual and repetitive work.
Fig. 5 gives a "knowledge - skill mix" pattern for the training of different categories of technical manpower.

**FIG. 5: KNOWLEDGE SKILL MIX**

It indicates that from craftsman towards engineer the contents of theory increases with corresponding decrease in the practical work. Also within a particular group of workers there are variations between the quantum of theory and practice depending upon the stage of industrialisation and economic development of the country. In general technician training curricula are designed to provide a proportion of 40% and 60% between the theory and practical work respectively. Programmes which aim to train industrial technicians (as compared to engineering technician) have a higher content of practical instruction.

By nature of his occupation a technician is expected to possess the following abilities:

a. High degree of applied mathematical ability.

b. Skill in analysis and diagnosis of technical problems.
c. Understanding of craft process.
d. Skill in dealing with people, (supervising and managerial ability).
e. Skill in oral and written communication.
f. Extensive background in a particular technology.

To provide for the above abilities the curriculum for the training of technicians generally includes following cluster of courses:

- Basic Science and Mathematics 25%
- Technical Specialities 45% (study of technology)
- Allied Technical Skills 20% (Drawing, Material Sciences)
- Managerial, Humanities, Social Study 10%

The above allocation of time for various groups is tentative and may vary according to the specific need of a particular field of specialisation.

In Pakistan the history of curriculum development for technician training dated back to 1954 - 55. With the decision of the Government to establish a polytechnic institute as recommended by the Council of Technical Education (referred earlier) there was no model available to adopt. Under a grant by the then Foreign Operations Administration (FOA), later US-AID, a team of Pakistani educators was deputed to the USA to study the functioning of polytechnics programs and develop the curriculum. The writer was also a member of the said team. Through an interactive exercise between the faculty of the then Oklahoma Agricultural and Mechanical College, Stillwater, USA, (later Oklahoma State University) the first curriculum for polytechnics in Pakistan was developed in Civil, Electrical, Electronics, Mechanical and Power Technology.
First Curriculum for Polytechnic Institutes

The curriculum was based on an entry qualification of matriculation (with 10 years schooling). The duration of training was three years. It was however envisaged that in future when sufficient number of students qualifying from the technical high schools, which had also started in the same period, were available, the duration of the course could be reduced to two years. The first year was therefore considered to be preparatory and common to all technologies. The original curriculum document know as 'Black Book' in polytechnic circles (because of its black folder) was however not traceable. However, the earliest version of a polytechnic curriculum which was available for public reference was given in the Manual of Standards for Polytechnics, referred earlier. The first curriculum was introduced in 1955 when the first batch of trainees was enrolled in Karachi Polytechnic (and also in Dhaka Polytechnic). The first batch under this curriculum graduated in 1958. It was unlikely that in the short period the curriculum would have undergone any change. It was safe to presume that the curriculum as available in the above referred Manual of Standards was the same as originally compiled.

The polytechnic curriculum document in the format available could not stand the rigid definition of curriculum document which besides the syllabus should also contain information on teaching learning strategies etc. But compared to other similar documents in the country, it had the distinct feature of listing in details all the topics of theory and practical instructions for each of the period provided in the curriculum / scheme of studies. This helped the teachers to determine the parameters of subject treatment.
Curriculum Development Process

The curriculum development process generally consists of the following sequential steps:

1. Survey of Job analysis, activity analysis
2. Forecasting technological development
3. Identification of Objectives
4. Validation of topic level
5. Formulation of Objectives
6. Selection of contents -- Design of evaluation system
7. Development of Resources:
   Material resources -- Human resources

Borrowed Models of Curriculum

Seen in the above context in the entire exercise of curriculum development for polytechnics many of the sequentially steps were not followed. The curriculum developers generally made use of base material available in the borrowed models and programmes and made adjustments according to their experience and perceptions which happened to be a subjective approach. This was in many cases the basic reasons for lack of relevance between the curriculum contents and the actual needs of the employment market. Many new institutions were set up incorporating training programmes in the emerging fields. But unfortunately there was no evidence of any systematic effort ever undertaken to develop the curriculum on the basis of activity analysis.

---------------------
Revision of Curriculum

The curriculum of polytechnics which was developed in 1954-55 underwent some adjustment when during 1964-70 all the polytechnics in the then West Pakistan were placed under the academic control of the West Pakistan Board of Technical Education.

After the announcement of the Education Policy 1972-80 a revision of the polytechnic curriculum was also considered necessary. Except for the minor modifications referred above the curricula were in use for nearly 20 years. During this period there was no evidence of any feedback from the industry.

Manpower Survey

The Sindh Board of Technical Education who was entrusted the task to revise the curriculum in 1974 decided to determine its adequacy in meeting the needs of the industry before making any change in the curriculum on ad hoc basis. With the assistance of the Manpower Division, Government of Pakistan, a survey was conducted to determine the weaknesses of the curriculum by obtaining the opinion of the employers and passouts of the polytechnic institutes. The survey covered about 500 diploma holders representing a 10% sample of the passouts during 1967-71 from 20 polytechnics selected at national level. In all 397 establishments located at 34 small, medium and big cities were selected. The responding rates to the questionnaires for passouts and establishments were 60.7% and 67.0% respectively.27

The survey brought out some striking points as under:\(^2^8\)

1. Industry requires industrial technician / supervisors with proficiency in trade skills rather than engineering technician.

2. The polytechnics should function as training centres and not as educational institutions.

3. As training centres the number of their product should be related to employment market.

4. A system of periodic evaluation of the institutions should be undertaken.

5. Closest possible cooperation and coordination should be established with industry.

Based on the findings of the survey the curricula was revised by the Sindh Board of Technical Education through the assistance of a number of teachers and subject specialists representing technical education at national level. Describing the rationale of revision the Report on Revised Curriculum\(^2^9\) stated:

"In the early period of establishment of these (polytechnic) institutions the product of these institutes were absorbed in local market without difficulty. The then existing vacuum at the supervisory level manpower was perhaps an important factor. With the passage of time the situation gradually changed. The criticism about the diploma holders, (poor) competence to perform practical work cannot be ignored. With the growing unemployment at the supervisory level, it is essential that the products of these institutions should have enough skills to be able to accept responsibilities at skilled workers level with prospects of eventual movement to supervisory positions. To achieve this purpose the curriculum should be so designed that it may serve the immediate need of training of skilled workers in a broader field of specialisation and also an


ultimate aim to produce technician. The above aspects were given due consideration while designing the Curricula.

The main feature of the revised curricula was to provide a built in continuity in the courses against fragmentation which existed and introduction of specialisation from the first year through comprehensive workshop courses.

The evaluation of the polytechnic curricula and its subsequent revision as referred above had its own limitation in view of the requirement of laid down procedures and models of programme evaluation in current practice. In Pakistan, however, this was a first systematic attempt to correlate the contents of the curricula based on some feedback from the users of the product of training institutions. As yet, with the passage of almost 15 years since the above survey was conducted this happened to be the only evaluative exercise in the field of technician education in Pakistan.

**Curriculum Updating**

The curricula which were revised in 1976 could not be implemented by the Ministry of Education until 1980. In the meantime, with the change in the government the National Education Policy was announced in 1979. Another exercise to update the curricula was under taken in 1980 to bring it in line with the aims and aspirations of the new Policy. This was achieved through a National Workshop sponsored by the Federal Ministry of Education. The participants of the workshop endorsed the need for constant review of the curriculum to develop people with appropriate balance in knowledge, skills and attitudes and to fulfill the aspirations of the society in line with the ideology and interest. In addition the curricula was also expected to
meet the demands of job market, provide for horizontal movement and cater to changing pattern of industrial workers team.30

The striking feature of the updated curriculum was the inclusion of Islamiyat as a compulsory subject for all levels of training, which was the corner stone of the education policy. The updated curriculum was introduced in the session 1981-82 in Sindh, followed by the Punjab in 1984, an NWFP and Balochistan in 1985 and 1986 respectively.

Comparison of Curricula

Since the inception of technician training scheme in Pakistan thirty five years ago three distinct curricula were available which pertained to the years 1960, 1970 and 1980. These are placed at Appendices D, E, F. A comparative analysis of allocation of contact hours is given in Table 14 for Civil, Electrical and Mechanical Technology. These three technologies were offered in all the four provinces of Pakistan, and accounted for about 60-70% enrollment of all polytechnics, (Ref. Table 5). It was observed that while marginal deviations were found between the 1960 and 1970 curricula, the revision of curricula in 1980 had introduced substantial changes in the time allocation. The proportion of time allocation to technical speciality courses had increased in all the cases in the updated curriculum. There was a corresponding decrease in the time allocation for the allied technical course. This appeared to be in line with the findings of the Manpower Survey to enrich the contents of specialised courses. There was reduction in the time

allocated to mathematics and Science in the updated curriculum ranging from 1-5%. This reduction though apparently of small magnitude was likely to have some negative implication in view of general criticism about the poor quality of teaching of these subjects at secondary education level. The increase in the managerial and humanities component was due to the addition of Islamiyat in all the semesters.

<table>
<thead>
<tr>
<th></th>
<th>Related</th>
<th>Mathematics and Sciences</th>
<th>Technical</th>
<th>Specialty</th>
<th>Courses</th>
<th>Allied</th>
<th>Technical</th>
<th>Courses</th>
<th>Managerial &amp; Humanities</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950(a)</td>
<td>11%</td>
<td>16</td>
<td>16</td>
<td>57</td>
<td>50</td>
<td>47</td>
<td>16</td>
<td>31</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>1970(b)</td>
<td>9%</td>
<td>12</td>
<td>14</td>
<td>54</td>
<td>52</td>
<td>45</td>
<td>17</td>
<td>29</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>1980(c)</td>
<td>10%</td>
<td>9</td>
<td>11</td>
<td>73</td>
<td>72</td>
<td>58</td>
<td>5</td>
<td>5</td>
<td>11</td>
<td>21</td>
</tr>
</tbody>
</table>

(a) Original Curriculum  
(b) Modified by M.P. Board of Technical Education  
(c) Updated by National Workshop  
(d) Figures indicate contact hour time allocation as percentage of total time for the technology.

Note: Analysis based on curricula in Appendices D, E, F.
New Fields of Training

A reference to Table 5 indicates that in 1988 technician training was offered in 22 specialised fields. The training programmes could be grouped as under:

a. Programmes which were offered in all four provinces & also in more than one institute, except in Balochistan.

b. Programmes offered in more than one institute including double shifts.

c. Programmes of specialised nature offered in selected institutes.

Civil, Electrical, and Mechanical; Intake 60%

Architecture, Auto-farm

Chemical, Electronics, TV, Refriff, & AC, Clothing, Instruments, Textile, Welding, Bio-Medical:

Intake 35%.

Foundary, Pattern Making, Woodwork, Power, Glass & Ceramics, Watch making, Printing.

Intake 5%.

It is recognised that in a developing country training programmes in traditional fields are required to provide essential manpower for development of physical facilities and infrastructure, housing, communication and electrification. This expansion is an integral part of any developmental programme. This therefore justified the multiplication of programmes in technologies under group (a) referred above. There was however need to increase the training facilities in programmes under group (b) which had the potentials to develop small business by nature of the work which in many cases involved repairs and maintenance and also did not require high initial investment.
However, the most important area which needed attention was about the future expansion in the high technology field. These included electronics, micro-processor, microwave engineering, computer applications, oil, gas, petrochemicals, metallurgy, industrial design etc. The situation was also referred to the National Education Conference as under:\n
"...The type of training required by a skilled worker from the trade school and polytechnic needs a different type of orientation. The country is also slowly entering into high technology field. These technologies are knowledge intensive and at the same time require high sophistication in machines. For instance even for a trade school graduate familiarity with computer, electronics and biology based technologies appears inescapable. Improvement in this area calls for a complete reshuffle of course, scheme of studies and equipment..."

In the light of these observations it was appropriate that in each of the mother technology some scope should be provided for specialisation on elective basis, as suggested below:

<table>
<thead>
<tr>
<th>Civil Technology</th>
<th>Public health engineering, Civil drafting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Technology</td>
<td>Power generation and Transmission, Maintenance of Instruments</td>
</tr>
<tr>
<td>Mechanical Technology</td>
<td>Industrial engineering, Production engineering, Machinery maintenance</td>
</tr>
<tr>
<td>Electronics</td>
<td>Digital electronics, Communication</td>
</tr>
<tr>
<td>Textiles Technology</td>
<td>Man made fibres</td>
</tr>
</tbody>
</table>

-----------

Innovative Approaches in Technician Curriculum

Evening Diploma Programme

The system of a second shift in schools and colleges was not uncommon. To meet the increased demand for admission, classes were scheduled in the evening. During nineteen sixties second shift programmes were also introduced in polytechnics. These classes were scheduled as staggered shift starting around midday and running up to evening. But a large number of workers who wanted to avail these facilities could not do so as it clashed with their working hours. In 1981 the Directorate of Technical Education in Sindh adopted a new and workable strategy to offer evening diploma courses by extending the duration of 3 years course to 4 years and reducing the daily working hours. This helped the trainees to join the course in the late afternoon. All the courses of 6 semesters were arranged to form a programme of 8 semester duration. Since the coverage of the content was same both the programmes were considered at par. 32

These programmes were increasing in their popularity and more institutions had adopted these course. In terms of continuing education these programmes have fulfilled an important recommendation of the UNESCO which states:

"The development and expansion of technical and vocational education as continuing education both within and outside the formal education system and within the framework of lifelong education should be a priority objective of all educational strategies and broad provision should be made for allowing every one, whatever the educational qualifications achieved prior to employment, to

continue both their professional and general education".  

Diploma on Modular Basis

Another innovative approach of Modules of Employable Skills in the curriculum structuring was undertaken during the National Workshop on Updating of Polytechnic curriculum held in 1980. The Modules of Employable Skills (known as MES) has proven its global application in the training of skilled workers. The participants of the above workshop considered the possibility of adopting the MES approach for the training of technicians also. The three years programme was restructured to form 12-14 self contained modules which could be completed in 4-5 years. The completion of each module was expected to develop salable skills in some specific area of employment and also it was a step towards the attainment of technician diploma. This scheme was in fact an integration of skill training with technician training and deserved to be given a fair trial.

Distance Learning System, Open University Programmes

A large number of applicants for admission to Diploma of Associate Engineer Programmes in various fields offered by Polytechnics and Colleges of Technology, are not able to get admission due to lack of facilities to accommodate more than a specified number of students in each programme. To overcome this difficulty and to increase technical manpower in the country technician education programmes through the use of distance learning system were started.


In 1985 the Allama Iqbal Open University designed a programme of Diploma of Associate Engineer in the fields of Electrical, Electronics, Automobile and Refrigeration and Air-Conditioning through the distant learning approach which was the mandate for the University. Courses equal to 12 full credits had been proposed for the completion of a Diploma programme. The programme consisted of core courses including mathematics, science, business management, accounting and Islamiyat which was compulsory for all students. Students could choose suitable courses from the elective lists to complete the diploma requirement.

Donor Led Models

It was observed that a number of international agencies were associated in building up technician training programmes in Pakistan. The first polytechnic was setup with the assistance of the Ford Foundation of USA. The curriculum framed was based on the American concept of technician with more emphasis on supervisory and managerial skills. Later on with the assistance of Swedish agencies institutes were setup at Landhi and Gujrat. The training programme was designed to produce industrial technicians with more emphasis on practical work. A third category of institutions was developed through Swiss assistance with a high degree of focus on narrow specialisation in fields such as watch making, precision instrumentation and die designing. These donor led models of curriculum no doubt had their usefulness in meeting specific training requirement. But they had also developed a disparate situation in which the employers being already shy to hire trained personnel found themselves struggling to draw comparison between the outputs of various programmes. The situation demanded the establishment of a minimum norm of technician training programme and adoption of a uniform format to report the course attainments.
Curriculum Development Roles

The Federal Government had statutory powers to develop and prescribe curricula and textbooks. The provincial Boards of Technical Education under their Acts also had the prerogative to develop the curricula. Neither the Ministry of Education nor the Boards had a full-time staff to undertake this activity. The work was carried out through adhoc committees for which members were appointed by the provinces. The outcome is a curriculum which represented a national compromise. But the major constraint of such curriculum was its inflexibility to adjust itself to micro level implementation and its incapability to meet the local employment needs. The disparity in physical facilities coupled with the varying competence of the teachers made the attainment of the objectives of a national curriculum difficult, if not doubtful. The remedy lied in the reversal of the roles between the federal and provincial agencies in the matter of curriculum development. The Federal Government might prescribe the general parameters and standards of achievement to ensure a broad based uniformity in the levels of training but the institutions in consultation with the local Boards of Technical Education would be able to make appropriate adjustments according to specific employment needs. It is neither possible nor desirable to develop a curriculum which satisfies the needs of each individual employers. According to Ghafoor interface with industry was considered to be a major problem area in technical education policy formulation in Pakistan. Given the flexibility as suggested it should be possible for the Board/institute to develop a "demand based curriculum" to satisfy the needs of a cluster of industries through provisions of options in the scheme of studies.

35. Abdul Ghafoor: "Background Study on Technician Education Policy Formulation", mimeograph (Islamabad: Academy of Educational Planning and Management, 1987).
Teaching Learning Strategies

Effective learning is best accomplished by planned and thoughtful use of learning media and methods. The essence of learning lies in the effective student teacher interaction for which communication is an important factor.

Technician education in Pakistan was still passing through developmental stage. In many cases the teacher’s only resource was either his own class notes or textbooks. Often these textbooks were meant for the engineering level students. While new ways and means were being looked into majority of teachers depended on “chalk and talk” method of teaching. Teachers in technician education had little access to different types of learning resources which are generally classified into two main groups, as under:

a. Planning Resources

Those needed by teachers to plan instructional activity and include curriculum, course objectives, topic analysis sheets, lesson plans, teachers’ guides, teaching aids of print and non-print type.

b. Learning Resources

Those needed by students to supplement instruction by the teachers and include textbooks, reference books, class notes, laboratory and workshop manuals, students workbooks and guides.
A study at national level was undertaken by Sultan to assess the prevailing state of use of instructional resources and teaching methods in technician education system in Pakistan. The study covered 86 teachers belonging to 14 polytechnics and Colleges of Technology in all four provinces.

Some of the salient findings of the study were as under:

Use of Teaching Aids
a. Chalk and black board: used by 80% teachers as sole aid, 20% used it very often alongwith use of charts and models
b. Overhead projector: never used by 90% teachers
c. Films and slides: never used by 75%
d. Models: used by 30% very often alongwith chalk board, 50% used occasionally and 20% had never used

Method of Communication
- 20% teachers used dictation only
- 15% teachers used lecturing only with students preparing their own notes
- 30% teachers distributed printed information sheets
- 15% teachers used both distribution of printed notes and lecturing
- 15% teachers dictated as well as distributed printed sheets
- 5% teachers claimed to use combination of all methods

Besides the provision of necessary physical facilities the survey had suggested a massive and continuous staff development programme to create a conducive environment and awareness among the teachers. Discussing the problems faced in the production and utilisation of learning resources and material the survey had further identified the following main causes:

1. Continuance of traditional examination system 50% *
2. No incentive for teachers to develop resource material 65% *
3. Lack of training 75%
4. Lack of printing facilities 90%
5. Lack of support facilities 60%
6. Reluctance for over involvement 60%

(*) Figures represent the percentage of responding teachers

This survey was the only evidence of any systematic probe in the teaching learning strategies which were in practice in technician training institutions in Pakistan. The situation called for taking suitable measures to organise educational services and provision of suitable software for teaching which had been neglected. As a beginning step consideration may be given to establish learning resource centre (LRC) in selected institutions which may be further expanded at regional levels for effective coordination. Through suitable arrangements the available resources may be pooled and shared between various institutes to avoid duplication of efforts and wastage of time and scarce financial resources.
Workshop and Laboratory Instruction

The laboratories and workshops are significant working areas of the technical institutions. Here the students spend considerable portion of their training time to acquire the necessary competencies of a technician. There is growing awareness among the educators to improve the quality of laboratory and workshop instructions. Laboratory and workshop instructions aim to develop among the students the capability to apply theory, techniques of experimentation, skills in sampling data for generalisation, and learn procedures in reporting and judgement.\(^{37}\)

There was a trend towards shifting from the traditional teacher centered teaching to student centered learning. Students learn better when they were actively involved in the learning process and that the process retained their interest. The oft repeated laboratory method of verification of established laws and rules was gradually giving room to structured inquiry, guided experimentation and project methods which helped the students to cultivate a sense of inquiry and experimentation. The situation in technician training institutions in Pakistan also called for the adoption of such approach.

The nature of laboratory and workshop teaching had remained rather static in the technician training institutions in Pakistan. Some of the drawbacks observed through the scrutiny of the curriculum documents are summarised as under:

1. Laboratory and workshop work was not integrated with other courses (interdisciplinary and interlaboratory barriers).
2. There were no well defined objectives of laboratory work resulting in random and disjointed exercises.

3. Laboratory experiences lacked relevance to the technician’s jobs.

4. Experiments were stereotyped having very little learning outcomes.

5. Evaluation of laboratory work received low priority in the scheme of studies.

The role of practical training as a fertile ground to cultivate thinking process assigns laboratory teaching an important function in a curriculum. The time spent in the laboratory and workshop in technician training institutes could be used more effectively than it was actually if careful planning was applied to the design of laboratory and workshop instruction. The process would include: (1) determining of the role of laboratory and workshop instruction in technician curriculum, (2) defining objectives of laboratory and workshop instructions, (3) designing suitable learning experiences, (4) evolving a system of objective evaluation of laboratory work, and (5) preparation of a detail guidelines for the conduct of laboratory and workshop instruction.\(^3\&\)

**Textbooks and Learning Material**

Among the problem areas identified by the Senior Administrators of technician education in the Colombo Plan countries "production of teaching learning resources" was assigned a high priority area occupying the fourth position.\(^3\&\) In another study of various problems and issues of technical education in Colombo Plan Regional Countries,

\[\text{---}\]


conducted by Yoshio⁴⁰, Pakistan was reported to have identified "instructional material" as the area of highest concern, followed by Papua New guinea, Bangladesh, Malaysia and India.

Describing the situation Pearce⁴¹ states:

"The importance and role of print material as least expensive way of imparting instruction is now almost universally accepted. Inspite of the explosion of educational aids, audio and video equipment for learning the demand for print resources has been steady in most of lesser developed countries. According to a World Bank study, the availability of textbooks in considered to be the most constant factor in academic achievement of the students."

Speaking at the World Congress on Book, 1982, Abul Hasan⁴² described that the Asia and Pacific region was said to be badly in need of technical books which further asserted the global nature of this problem.

A limiting factor in publishing of text books in technical subjects in Pakistan was the extremely low number of students enrollment in different technologies which made the printing and marketing uneconomical. Reference to Table 5 will indicate that even the most common technologies, Civil, Electrical and Mechanical had enrollments ranging between 5000-7000, which was considered a small size for publishing books. A very small number of

---


books were available but they were suffering from the following drawbacks:

1. Books of foreign origin were high priced.
2. The content presentation in foreign books was not suitable to the comprehension levels of students and some times to teachers also.
3. Often a single subject material was not available in one book.

To meet the situation as described above some initiatives were under taken.

a. A project for the development of books for polytechnics was initiated in late sixties through collaboration between the East and West Pakistan Boards of Technical Education. The project had made some headway and some books were also developed when it had to be abandoned due to the break up of the Eastern wing.

b. The Sindh Board of Technical Education through the financial assistance of Sindh Textbook Board had developed students manuals in 25 courses. The exercise did not proceed beyond the manuscript stage. No further dissemination could take place due to lack of finances and support services for this purpose within the Board.43

The problems of book development for technical education remained unattended for a long time when the Planning Commission of Pakistan took cognizance of the

situation while framing the Sixth Five Year Plan. The Plan noted as follows:

"The language of imported books for polytechnic students poses a serious problem of comprehension by students and no books have so far been produced within the country. Perhaps one of the major causes of poor quality is the absence of suitable books."

The Planning Commission urged that Ministry of Education in consultation with the University Grants Commission and provincial governments to develop a plan to generate sufficient interest and provide incentives for the writing of books. In pursuance of the above observations the Ministry of Education initiated a project of development of students manuals suited to the contents of Revised Curricula in the Polytechnics which was introduced in 1982. As many as 60 manuals were developed by 1987.

In 1984 during a Workshop organised by the collaboration of UNESCO and National Technical Teachers Training College, Islamabad, the possibility of producing manuals as a team effort were explored. It was a successful experiment when at the end of three weeks workshop four manuals were produced which were ready for microtesting. This strategy was further continued in subsequent workshops organised by Federal and Provincial agencies, the Boards and Directorates of Technical Education. The funds available in the Ministry of Education Project referred above were helpful in preparing the multiple copies of the manuals which were made available to institutions in limited numbers at the cost price.

44. Sixth Five Year Plan, op. cit., p. 316.

The strategy adopted in all the above efforts was focused on "compilation" and "utilisation" of existing material than developing original textural material. The urgency of the situation as well as lack of competence in the teachers in creative writing were the hindering factors. Although much of the work of manual production was "cut and paste" activity, it had however filled the existing vacuum and helped to meet the situation. The next step was to validate the material available and its subsequent revision.

Textbook Board for Technical Education

The strategy described above was only on ad hoc arrangement. Because of lack of follow up and coordination in many cases the development of manuals had not reached the dissemination stage. The establishment of a full-fledged textbook board for the development of technical books had been considered as the ultimate and effective solution of the problem. The shortage of textbooks for technical education required gigantic efforts. The initiatives undertaken by individuals, Boards and Directorates of Technical Education and Ministry of Education no doubt deserved due mention. But in view of the magnitude of the task it needed to be handled by a full time agency with appropriate resources, manpower and infrastructure. The Working Group on Technical Education also recommended that a National Textbook Board for Technical Education should be established under the Ministry of Education which should develop, print and distribute textbooks for polytechnics, commercial institutes and vocational institutes.

As an interim arrangements rental libraries and books banks be established in all the polytechnic institutes.

Student Evaluation Process

The teaching learning media, methods, textbooks and instructional resources provided a means to achieve the predetermined goals of education. The students evaluation is a process to measure the achievement of these goals. Much of the teaching learning process had become examination oriented because of its over-riding influence in the educational process in Pakistan. In the social setup prevailing in the country public examination was assigned a prestige value. Polytechnic institutes, however, were first to introduce a total system of internal evaluation in 1955. In the early days when the number of institutions was small and many teachers were also trained in pedagogical concepts and practices it was possible to continue the system of internal assessment with reasonable reliability. With the rapidly growing number of institutions which were functioning with a faculty of varying background of training and educational experiences it was felt necessary to introduce some measures of uniform standards of evaluation. For this purpose in pursuance of the recommendations of Commission on National Education, referred earlier, a Board of Technical Education was set up in West Pakistan in 1964.

According to then prevailing concept of the functions of the examining Board, the conduct of examination was considered as the sole responsibility of the Board. Subsequently the role had expanded to include research and quality improvement aspects also. The West Pakistan Board of Technical Education conducted the first examination of polytechnic institutes in 1965, for the final year students of sixth semester classes only. The internal evaluation conducted by the institutes for the previous five semesters were also included in the final assessment of students performance. The semester system called for a final examination at the end of each semester of about five months duration. It was causing administrative difficulties for the
Board to conduct public examination at the end of each semester. The Board therefore delegated the responsibility of conduct of odd semesters (first, third and fifth) examination to the institutes and retained the responsibility for even semesters with itself.

The assessment done by the institutions in the odd semesters was not included to judge the overall performance of the students. As a result the entire teaching learning process of these semesters became an eyewash. The semester system has its origin in the complete integrity and reliability of teachers who with the passage of time were reported to have yielded to the pressure and favoritism. 47 On the dismemberment of One Unit Provincial Boards of Technical Education were setup in the Punjab, Sindh and NWFP provinces. The Boards in the Punjab and NWFP continued to conduct only even semesters examination. The Sindh Board of Technical Education however assigned due weightage to the practical examinations conducted at institutional levels in all the six semesters. 48 This was helpful in ensuring proper attention to imparting practical skills which is also the main objective of technician training. The Task Force on Examination in Sindh 49 considered this step as a reasonable via media by which a system of external evaluation had been inducted in the semester examination to rectify the imbalance which occurred due to a total internal evaluation. The internal assessment system was more conducive in


determining learning outcomes comprehensively. But without assigning proper weightage the system could not yield its results in the existing social set up.

In the internal assessment at polytechnic level much of the testing was carried through objective questions. The Report on Examination Reforms\textsuperscript{50} indicated a definite need to improve the quality of tests. Difficulties were reported in the use of objective tests in public examination. Copying was considered to be the most common complaint. Many of the questions were addressed to the low levels of cognitive domain. However, in the domain of practical skill testing there was a visible shift to adopt the modern concept of process and product testing.\textsuperscript{51}

\textbf{Roles of Boards}

The Boards of Education had been focusing their activity mainly on examination work. The National Education Policy indicated a shift in the role of Boards:

"The improvement of examination system will entail a substantial change in the roles of the Boards of Intermediate and Secondary Education from merely examining bodies to research-oriented professional organizations primarily concerned with the development and standardization of achievement, aptitude and admission tests".\textsuperscript{52}

The Implementation Strategy for Examination Reforms in Technical Education, referred earlier, also included a master plan of reforms including following actions:

1. Reflecting class room testing in final examination


\textsuperscript{51} Sindh Board of Technical Education, Attendance and Promotion Rules. op. cit., p. 2.

\textsuperscript{52} National Education Policy; op. cit., p. 17.
2. Deformalization of testing techniques and methods to suit the individual subjects and learning outcomes
3. Revision of procedure for evaluation practical skills based on modern approaches to trade testing
4. Establishment of a large catalogue of pretested item banks
5. Training of staff in educational measurement
6. Conducting research into examination processes

The above Report which was presented in the National Education Conference on Examination (1977) convened by the Federal Ministry of Education, has dealt in detail the background of examinations in polytechnics which were based on semester system, institutional evaluation and role of Boards to improve the quality of instructional process. The recommendations which were in the form of an action plan aimed to bring gradual shift to internal assessment, improvement of class room testing, establishing relevance between test contents and curriculum objectives and strengthening the research role of the Boards of Technical Education.

The increase in the scope of activities of the Boards of Technical Education as elaborated above required sizable finances. The financial condition of the Boards had been one of the limiting factors in under-taking these roles. Describing the situation Deakin\(^3\) stated:

"They (Boards) donot seem to have any great problem other than financial probably, because the number of institutions and students with which they are concerned is at present quite small. These Boards have to provide examination which are much more expensive to arrange especially for small numbers, than the common run of secondary level examination. They are hampered by lack of funds and it would be in the interest of educational development if they are given subventions to enable

them to plan for a considerably extended role as the New Education Policy (1972 - 80) is implemented."

The Role of Boards is heavily aimed to quality control of the product of education system. It should therefore be provided with adequate resources to be able to render its services in a more purposeful way. The notion that education boards had to be self-sufficient in all respects needed to be reviewed under the changing role expected from the Boards.

Managerial Process

The organisational structure of education in Pakistan represents a descending hierarchy of management functions from Federal Ministry of Education to the bottom level of educational administrative unit in subdivision of a district. Education is a concurrent responsibility in the constitution of Pakistan, that the federal and provincial governments enjoyed the powers of legislation within their respective jurisdictions. However in the case of curriculum and textbooks the federal government had exclusive powers which were mandatory to all the federating units. At the provincial level the management of education was undertaken through the Department of Education. The size of the education department in the provinces varied according to the local requirements. At the federal level the Science and Technology wing of the Ministry of Education was responsible for the coordination of activities within the provinces in the matters relating to technical education. The management of technical education in the province was carried through the Directorates of Technical Education which were responsible for planning, implementing, administration and supervision of the programmes. The management pattern varied according to the needs of the provinces. In Punjab a three tier system was functioning with a provincial Directorate of
Technical Education and two Regional Directorates with the Education Department at the apex of the organisation. In Sindh and NWFP it was a two tier system consisting of the Directorates of Technical Education at provincial levels only. In Balochistan which had only one polytechnic till this study was carried out there was no separate organizational set up for the management of technical education. The Director of College Education was also responsible to exercise the administration of technical education. At the federal government level a single tier system was operating with the institutions (Women Polytechnic Islamabad, and NTTTC Islamabad) functioning under the autonomous board of governors with the Federal Education Secretary as its Chairman. Education Management Organisational structure of the federal and provincial governments are placed at Appendices N - R.

The Directorates of Technical Education were also responsible for administration of the vocational and commercial education programmes which for historical and administrative reasons had remained as a part of technical education system in Pakistan and also in other countries of the region. Though commercial education was also under the jurisdiction of the general education the terminal nature of the Certificate in Commerce (C.Com.) and Diploma in Commerce (D.Com.) had placed the Commercial Training Institutes under the purview of the Directorates of Technical Education. These courses aimed to train middle level manpower for commerce and business sector. With the passage of time and under pressures other than academic, the commercial institutes in Punjab and NWFP were converted into Commerce Colleges to offer B. Com. Courses alongwith certificate and diploma course. In Sindh also there was a pressing demand for similar action. With most of the student qualifying the Diploma course taking admission to the B. Com. courses, instead of seeking employment, the certificate and diploma programmes were loosing their terminal nature and had become
feeder courses. The situation had developed a duality of operation between the Directorates of College Education and Technical Education.

With the setting up of the Provincial Training Board for the vocational training programmes the administrative control of all vocational training institutes for boys in Punjab was already transferred to the said Board. There were indications that Sindh and NWFP would also follow suit. The changing scenario of administration indicated that it would not be too far when the Directorates of Technical Education and Boards would be left to oversee the technician education programmes only. The reduction in the affiliating institution in particular would pose further financial constraints for the Boards of Technical Education in due course.

For the purpose of academic control, examination and certification autonomous Boards of Technical Education were established in Punjab, Sindh and NWFP. In Balochistan and at Federal level these functions were carried out by the respective Boards of Intermediate and Secondary Education. A recent development is Sindh was the establishment of a Regional Office of the Board at Sukkur which was an innovative approach towards establishing a two tier system in Boards of Technical Education.

**Issues in Management**

The style of management of technical education described above had developed over a period of time. During last twenty years there had been a multifold expansion in the number of institutions and their enrollment as well as programmes offered by the institutes. But the development in administrative infrastructure and the expenditure on direction and supervision had not kept pace with the expansion of the system.
A reference to Table 15 will indicate that the expenditure on supervision through the Directorates is only 0.3% of the actual allocations for the institutes both in the Punjab and Sindh.

<table>
<thead>
<tr>
<th></th>
<th>RECURRING BUDGET FOR TECHNICAL EDUCATION</th>
<th>INSTITUTIONS AND DIRECTORATES.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIRECTORATE OF</td>
<td>POLYTECHNICS/</td>
<td></td>
</tr>
<tr>
<td>TECHNICAL</td>
<td>VOCATIONAL INSTITUTION</td>
<td></td>
</tr>
<tr>
<td>EDUCATION</td>
<td>(RS. MILL.)</td>
<td></td>
</tr>
<tr>
<td>(PS. MILL.)</td>
<td>(RS. MILL.)</td>
<td></td>
</tr>
<tr>
<td>Sindh (1988 - 93)</td>
<td>Rs. 2.01 MILL.</td>
<td>Rs. 62.4 MILL.</td>
</tr>
<tr>
<td>Punjab (1987 - 88)</td>
<td>3.244</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>0.411 Regional DTE</td>
<td>62.47</td>
</tr>
<tr>
<td></td>
<td>Rawalpindi</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.529 Regional DTE</td>
<td>74.70</td>
</tr>
<tr>
<td></td>
<td>Kulteh</td>
<td></td>
</tr>
</tbody>
</table>

Source: Directorate of Technical Education Sindh / Punjab (1987 - 93)

Successive policies and reports on development of education in Pakistan had emphasised the need for efficient management of educational system. The Report of the Commission on National Education (1959), stated that "if educational administration was to operate effectively it must be organised and staffed in such a way as to respond to problems not only with efficiency but also with professional competence".

The National Education Policy 1978 stated that the existing institutions, structures and modes of operation could not accommodate effective implementation of policies and proposed educational management would be further decentralised for effective supervision and management.\(^5\)\(^6\)

A UNESCO - ROEAP study\(^5\)\(^6\) indicated that:

"Several problems of educational management relate to personnel inefficiency. Most educational administrators are senior teachers turned administrators. While their competence is unquestionable they find themselves handicapped in managing routine office business".

The efficient management and administration of technical education programmes require, (1) necessary inputs in terms of staff training and development, (2) the availability of appropriate tools to monitor and evaluate the process of curriculum delivery and (3) the adequate delegation of authority to persons responsible for the implementation of programmes. The foremost issue relevant to institutional management was the inadequacy of monitoring and inspection services for the institutes under the Directorates of Technical Education. Under the prevalent system the Director was required to inspect and monitor the institutes. However, his preoccupation with routine administrative problems was, understandably, a major obstacle to the performance of these duties. The innovative measure taken by the Government of the Punjab to establish two Regional Directorates appeared to be a much needed action. Sindh was also said to follow suit where Regional Inspectors were to be appointed for technical institutions. To ensure proper and effective functioning, these regional

\(^5\) National Education Policy, op. cit., p. 18.

offices must enjoy appropriate powers for decision making also otherwise their existence would only add one more step in the organisational ladder, resulting in more delays.

Management Information System

An important area of concern in technical education was the inadequacy and almost non-existence of management information system. The major component of an educational information system include a means of gathering and maintaining up-to-date statistics, administrative data, planning, monitoring and evaluation information. Furthermore such information needed to be processed in a standard format for rapid comparison and stored in a way that promotes ready retrieval when required. Instances were not lacking when time again the same information was called for from the institutions.

The ADB Report\textsuperscript{57} described the situation in these words:

"The management at this sector level is hampered by a serious lack of reliable data and statistics. There is no modern data retrieval and dissemination system for education either at national or provincial level".

The study group on Technical Education\textsuperscript{58} also referred the issue and stated:

"The managerial structures and process, whether system wise or institute based have remained primarily unattended and remain centralised and outdated. They fail to promote the use of tools techniques of modern management aimed at the maximisation of resources, increasing the productivity of the system and maintaining effective relevance with the environment."

\textsuperscript{57} "Pakistan : Sector Study on Education", op. cit., p.69.

In the present situation in absence of any uniform system the extent of information available in the institutes, Directorates and Boards varied and depended on the perception and personal initiatives of the officers concerned. The problem needed to be attended to render it possible to measure the internal efficiency of the system on equitable comparison basis.

System Evaluation

During the thirty five years since the establishment of the first polytechnic in 1955 only occasional exercises were initiated to evaluate some components of the system of technical education. These initiatives included the following:

1. "Manpower Survey to revise the Polytechnic Curriculum" by Sindh Board of Technical Education, 1974.
3. "Review and Evaluation of Physical Facilities of Polytechnics in NWFP" by Education Department, Govt. of NWFP., 1982

It was evident that these studies have covered a wide range of subjects. But they were limited to supply related issues only as seen from their focus. These efforts might
help to identify specific imbalances in the inputs and processes of the system to which they pertained. But in view of the fact that they had addressed to specific issues mostly at provincial levels they lacked the wholism, when seen in the national background. These studies therefore did not have the cumulative impact and also they overlooked the demand led issues. It was therefore necessary to establish appropriate criteria of performance to provide a uniform basis for inter provincial comparison and objective assessment of the system. Based on a critical success factors approach for institution and programme evaluation the performance indicators for evaluation should include a number of factors such as; awareness of needs, surveys of job analysis, quality of output, employability and relevance of curriculum, admission policy and selection criteria, utilisation of physical and financial resources, staffing position, recruitment policy and service conditions of teachers, competence of teachers, efficiency of teaching and learning process, textbooks and instructional material, use of media and methods, system of student evaluation, internal and external efficiency, and relations with industry.59 Seen in this context the evaluation process of the institute being a comprehensive exercise required both the human as well as material resources to do proper justice to the issues at hand. To make evaluation a comprehensive goal oriented exercise capable of assisting in decision making process a framework of formative and periodic evaluation at local, regional and national levels should be developed. While the local and regional evaluation may focus on specific operational and management issues pertaining to internal efficiency of the system the evaluation at national level should relate to matters on policy planning, manpower assessment and futuristic trends.

Developmental Processes

Research in Technical Education

There was an acute shortage of documentation pertaining to research in technician education problems. The need for research as a tool to improve quality and standard of education and augment the effectiveness and excellence of educational standards cannot be over emphasised. To achieve the objectives of technical education the system needed to be developed on perspective educational planning with the use of modern techniques of forecasting manpower needs. In the evaluative studies on technical education problems conducted by different provinces, referred earlier, there was an over riding emphasis on the supply side aspects of technical education, (with the exception of "Manpower Survey" and "Study of Relevance of Technologies"). There was lack of evidence in the demand related research in problems significant to needs of employers, studies of passouts, requirements of trained manpower in new emerging technologies. There was insufficient investment in research and development activities which has resulted in widening the gap between the institutional programmes and the objectives of growth in the industrial and commercial sectors. Research enriches the system with innovative ideas to keep it alive to the changing needs. The training contents, methods and structures have to be developed through research in curriculum design and delivery system. The teacher education programmes and staff development activities needed to be organised on the basis of a sound system of educational services.
Emphasising the need for research a UNESCO study states:

"The traditional form of educational research has tended to be narrow in its outlook and scope. Problem oriented research has to bring together the insight from a variety of disciplines. The first and immediate issue which needs attention is to ascertain the extent to which facilities for technical education and training are actually keeping pace with present and prospective technological needs in the country."

_Institute Industry Interaction_

One of the weakest link in technical education system was the lack of cooperation between training institutions and industry. The subject was also the focus of discussion in the National Workshop for Updating of Polytechnic Curriculum and Approaches to Cooperation Between Industry and Technical Institutes, held in 1980. Such cooperation was necessary to facilitate the transition from education to the world of work. Institutions should be required to collaborate with employers organisations and industries on a regular and systematic basis. The modalities of such cooperation should be clearly identified. Such modalities may involve sharing of staff and facilities, participation of employers in student and programme evaluation, interchange of information between institutes and industry and providing work experience to students and staff in the industry.

_Future Development_

The Seventh Five Year Plan (1988-93) had set the direction for further development of technical education. The plan which was formulated in 1988 might undergo changes in priorities in the light of the Recommendations of the

---

National Education Conference which was held by the new Government in 1989. Some of the recommendations pertaining to the technical education sector are summarised as under:

"One polytechnic institute for male students should be established at those district headquarters where it does not exist and one polytechnic institute for female student be established in each division.

A College of higher learning in technology should be established at each divisional headquarters which would offer 2 years B.Tech followed by 2 years M.Sc. Tech./ B.Sc.(Eng.) courses prepared by the respective Boards of Studies of the affiliating engineering universities.

Legislation for providing industrial training for engineering and technical graduates should be enacted.

A Resource Cell should be established at the National Technical Teachers Training College, Islamabad to distribute audio visual cassettes and to produce books and manuals by competent scholars/writers.

Production units should be attached to selected technical and vocational education institutions to make them partly self-financing.

A Council of Technical and Vocational Education should be established for planning, coordinating and evaluating the entire range of technical and vocational programmes".

Future development of technical education as envisaged in the Seventh Five Year Plan included increase in the polytechnic intake capacity to 19000 from 9000 at the end of the Sixth Five Year Plan. The strategies for achieving this objectives as indicated in the Plan included setting up of


62. Seventh Five Year Plan; op. cit., p. 249.
additional polytechnics and monotechnics in the public sector and encouraging private sector to set up 14 institutions through loans from Small Business Finance Corporation. The Seventh Five Year Plan had also recommended structural changes to bring the polytechnic diploma programme in line with the system of general education.

In the area of quality improvement of technical education the Ministry of Education\textsuperscript{63} had also proposed measures such as; faculty training programme, large budget for practical training and equipment, induction of graduate engineers as teacher in Grade 17, with one third of them placed in selection grade BPS-18 and Industrial training as per provision of the Bill already submitted to the cabinet. A significant development expected during the Seventh Plan was the commencement of full operations by the National Technical Teacher Training College at Islamabad. It would be responsible for master planning of technician education, renewal of curricula, identification of emerging technologies, training of master trainers and structural improvements. The NTTTC thus had a challenge to bring technical education at a level that it should be able to meet the demands of the twenty first century.

Summary

The input to the system of polytechnics came from secondary stage of education. An average of 4% of the passouts from the secondary stage entered the technical education system during each Five Year Plan period. Need for vocational guidance and suitable entry test was imperative.

There was a shortage of qualified faculty which had resulted in high student teacher ratio. Suitable measures to attract and recruit qualified persons to teaching jobs

needed to be adopted. Majority of teacher were with diploma qualifications and most of them had no exposure to industrial experience. The shortage of faculty was proposed to be removed through the pre-service education programmes to be under taken by the NTTC.

The allocation of recurrent budget for instructional supplies were on the lower side compared with actual requirement.

The original curriculum which was developed on the concept of engineering technician underwent changes to train industrial technicians with more practical basis. This required the strengthening of physical facilities and competencies of teachers to yield desired results of curriculum changes. There was more concentration of enrollment in basic technologies of civil, electrical and mechanical which accounted for 70% of the total enrollment.

The teaching learning strategies in polytechnics was generally based on traditional chalk and board approach. There were few indications of use of modern methods and media. The teaching methods in laboratories also needed a shift from the traditional to inquiry approach. There was acute shortage of textbooks and learning material. Student evaluation was a mixed responsibility between the Boards and institutes and the process needed improvement.

Different types of organisation and management styles existed in the Federal and provincial governments for polytechnic institutes. But in all of them the absence of management information system was prominent. Performance criteria for the evaluation of institutes and system were non-existent. Research in demand related aspects of training was an imperative need to link the system with the manpower requirements.

Plans for development of technician education indicated a forward look to expand the system with due consideration to quality improvement aspects.
CHAPTER FIVE

OUTPUT OF TECHNICIAN EDUCATION SYSTEM

Demand Related Studies

Technical education is a job oriented programme. The intentions had always been there to relate the contents of technical education with the requirements of labour market. Yet, both, the planners and also the executors of the programme considered that the system had failed to come up to the expectations in this vital aspect, to meet the objectives. Following two instances substantiated the situation:

"The training programmes donot orient the students to work with their hands and to acquire practical skills. This has contributed to the increase in difficulties experienced in absorption of technical manpower".¹

At another place it was stated that inspite of several efforts in the past the technical and vocational education was still not job oriented.²

------------------
1. Fifth Five Year Plan, op.cit., p. 23.

As stated in the previous Chapter there was a marked absence of studies on demand side of technical education. Only three studies could be located which dealt with this aspect of programme. But their focus was however narrow.

One such study related to the survey which was undertaken in 1974 by the Manpower Division of GOP for Sindh Board of Technical Education in connection with the revision of polytechnic curricula. The main focus of the survey was to identify issues pertaining to the relevance of curriculum with the needs of employment. Some of the findings relating to the employment aspects were as under:

- Out of 375 responding passouts from polytechnics who graduated during 1967-71, 230 were employed, 17 were self-employed and 6 were employers.  
- Only 27.67% of the 253 respondents were earning "reasonable" wages which was between Rs. 400 - 500 in 1974.  
- About 66.13% of the 375 respondents endorsed the desirability of on-the-job training.  
- Among responding graduates 72% considered (practical) training deficient due to lack of proper equipment in the institutes.  
- In 266 responding establishments 2053 polytechnic graduates were employed as supervisors, 466 as Technicians and 305 as Tradesmen.

------------------------
4. Ibid., p. 30.
5. Ibid., p. 44
6. Ibid., p. 54.
7. Ibid., p. 67.
Out of 266 only 100 responding establishments were satisfied with the performance of polytechnic diploma holders as "supervisor", but 145 have stated that the training standards have gone down.8

The Study of Quality of Input and Output of Technical and Engineering Institutions in Pakistan, referred earlier, had indicated an output efficiency of 65% during the period from 1970-82. On the quality of output the study limited itself to academic performance of passouts in terms of their distribution in different divisions in the Board results. Due to a varying system of student evaluation adopted by the different Boards the data did not provide any equitable basis of comparison. Aspects related to the employment market were not considered.

The Study on the Relevance of Technologies and Trades of Polytechnics and Vocational Institutes in NWFP to the needs of Employment Market, conducted by the Directorate or Technical Education, NWFP in 1988 (referred in the previous chapter) had brought out following issues related to the contents of the programme:

1. Only 40% employers (out of total 48) considered the knowledge and skill possessed by the technicians as adequate.9
2. Only 25% employers provided employment after 2 or more years of experience.10
3. The absorption capacity of the market was reported to have shown signs of rapid decline.11

8. Ibid., p. 67, 68.
10. Ibid., p. 13.
11. Ibid., p. 27.
These studies though narrow in their scope helped to understand the existing trends in the employment and other related issues and problems faced by the technician on completing their training. But due to their specific parameters and the objectives their utility was limited. At best they could serve as benchmarks of reference for the comparison in subsequent period.

**Tracer Studies**

To assess the existing trends in the output component for this study, which was patterned after input-process-output model, tracer studies were mounted to obtain information through the principals of polytechnic institutes, passouts of polytechnics and the employers of polytechnic graduates. The respondents to the questionnaires included: 21 Principals and Heads of Department of polytechnics, 30 Employers of Polytechnics passouts, and 104 Passouts from polytechnics. Details of respondents are given in Appendices. G & H. Formats of questionnaires are placed at Appendices J, K, L, & M.

The information obtained by these tracer studies did not give the complete picture, neither it was expected so. By its very objectives it was intended to locate the trends and pattern and should in no case be considered as exhaustive. It only helped to develop a profile of external efficiency of the system and matters related with the rate of passout, time taken for training, absorption in the labour market, on-the-job performance, and earning potential, cost of training and benefits from training. These indicators to some extent helped in assessing the transformation efficiency of the system.
Quality of Output

The criticism about the deterioration in the quality of education needed no elaboration. The quality of education itself consisted of both qualitative as well as quantitative aspects. From measurable and tangible aspects such as the rate of annual passouts, time taken in completion of training programmes to more complex issues such as relevance of curricula and cost-benefit were the subject for scrutiny. Based on the information obtained through the tracer studies an attempt has been made in the following to provide a profile of external efficiency of technician education system in Pakistan as observed during the study.

Annual Output

A major indicator of external efficiency of any education system is the rate of passouts. The complicated system of examination in the polytechnics allowed failure students to make a number of attempts till they qualify for the diploma. This system rendered the comparison of passouts with the relevant cohort impossible as the Boards did not maintain the record on cohort basis. The result of the failing student of the previous years was compiled with the regular students of the following years.

<table>
<thead>
<tr>
<th></th>
<th>1985</th>
<th>1986</th>
<th>1987</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>524</td>
<td>743</td>
<td>937</td>
<td>P: Passed</td>
</tr>
<tr>
<td>P</td>
<td>429</td>
<td></td>
<td></td>
<td>A: Appeared</td>
</tr>
<tr>
<td>%</td>
<td>69%</td>
<td>51%</td>
<td>46%</td>
<td>Average 56%</td>
</tr>
</tbody>
</table>

Source: Tracer Study
Table-16 gives the data of passouts from 12 institutes covered by the tracer study. This indicates a gradual decline in the pass percentage from 69% in 1985 to 46% in 1987 resulting in a cumulative decline of 23%. In view of the fact that majority of the entrants to the polytechnic institutes happened to be students with A grade or I divisioners this low output rate reflected serious imbalance in the teaching learning processes. The 69% pass rate of 1985 was very close to 65% average for years 1978-82 reported in the Study of Input and Output referred above. But the average of 53% indicated a declining trend.

Completion of Course

**TABLE 17 : TIME TAKEN FOR COMPLETION OF COURSE**

<table>
<thead>
<tr>
<th>TECHNOLOGY</th>
<th>TIME TAKEN FOR COMPLETION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 YEARS</td>
</tr>
<tr>
<td>Civil</td>
<td>50%</td>
</tr>
<tr>
<td>Electrical</td>
<td>30%</td>
</tr>
<tr>
<td>Mechanical</td>
<td>40%</td>
</tr>
<tr>
<td>Average</td>
<td>40%</td>
</tr>
</tbody>
</table>

Source: Tracer Study

The enrollment in Civil, Electrical and Mechanical technologies accounted for about 70% of the total enrollment of all polytechnics. The sample in the data in Table - 17 represented 15% of the student population in these technologies. The time taken varies between technologies. In Civil technology 50% of the students could complete the programme in minimum prescribed duration of 3 years where as

---

in Electrical technology it was 30% and 40% in the Mechanical technology. Students once admitted preferred to complete the programme even though they had to take longer time because the admission was difficult and competitive. The dropout occurred only under very special circumstances such as financial inability to pay for the training expenses. The system of repetition of only failing courses made it possible for the student to leave the institute and appear as external candidate after once completing the attendance requirement of the 3 years programme. There was no system of private candidates as in general education. There was however need to put a limit on the total number of attempts which a failing student should be allowed to make.

Relevance of Training with Employment

Many of the responding employers regarded the contents of polytechnic training as inadequate and below standard although they have failed to specifically identify the job requirements of a technician in their organisation. In response to the questionnaire, 70 employers (out of 28) indicated their familiarity with the objectives of polytechnic education where as 20 had recorded their "unfamiliarity".

The criticism about the inadequacy of the contents was also seen in the context that no educational programme could be tailored to the specific needs of individual employer. Instead the employers should make up the deficiency through on-the-job training to make the fresh passout more productive for the specific needs of their industry.

Institutes can only provide a broad based training which prepare for employment in a cluster of industries related to a particular field of technology such as civil, electronics, mechanical. Further specialization may be attained after initial industrial training.
Deficient Aspects of Training

The passouts had responded to prioritise such aspects which according to them have made their training deficient. Table 18 shows their responses in terms of percentages which determined the priority ranking for improvement in particular aspect of training.

<table>
<thead>
<tr>
<th>ASPECTS</th>
<th>PERCENTAGE</th>
<th>RANKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Curriculum is not matching the needs of industry</td>
<td>27</td>
<td>4</td>
</tr>
<tr>
<td>2. Instructors don't possess practical skills</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>3. Instructors don't possess up to date knowledge of subject</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>4. Institute does not have proper equipment</td>
<td>42</td>
<td>2</td>
</tr>
<tr>
<td>5. Sufficient raw material in not provided for training</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>6. Suitable textbooks are not available</td>
<td>27</td>
<td>4</td>
</tr>
<tr>
<td>7. No information given about industrial atmosphere</td>
<td>45</td>
<td>1</td>
</tr>
<tr>
<td>8. Instructors were not aware of proper methods of teaching</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>9. Adequate material was not provided</td>
<td>23</td>
<td>5</td>
</tr>
</tbody>
</table>
The above data provided some interesting information. Forty Five percent of the respondents have indicated "lack of information about industrial atmosphere" making this as the most critical issue. Their exposure to the industry without any previous knowledge has led to this situation. This suggested the needs for closer cooperation between institute and industry.

The next aspect in order of priority was "non availability of proper equipment" responded by 42%. Though most of the institutions were reasonably equipped to meet the training needs, the specific situation could be interpreted in terms of particular type of industrial equipment to which students may not have been familiarised. "Lack of practical skill in the instructors" was a relevant observation in the light of the fact that many of the teachers normally found their way to the polytechnics teaching jobs direct from the institutes without any exposure to the industrial experience. The issue was already discussed in the previous chapter. Suitable staff development programmes were necessary to correct the situation. "Inadequacy of raw material" also ranked at third position with 28% respondents. This aspect has already been discussed in detail in connection with financial allocations for training in the previous chapter and called for suitable enhancement in the recurrent budget of the institutions. It was interesting to note that "textbooks" and "curriculum" having a direct bearing on the training did not find a prominent place in the ranking. Probably the passouts were more concerned with the immediate issues affecting their job performance which was understandable. The stage of their dependence on book has already phased out.
Waiting period for Employment

Another indicator of external efficiency of training programme is the time lag between the graduation and securing first employment. This however is also influenced by other factors such as the demand in the labour market for a particular skill, the choice of employment by the passout and also the recruitment policies of employing agencies with their own preferences. Fifty six percent of the passouts reported to secure first employment within 6 months of their graduation. With another 20% securing jobs within 12 months indicated a reasonable response of the employment market. The information may, however, not be considered conclusive because the survey had not covered the overall unemployment aspects.

Earning of Passouts

The earning capacity of the passout relates to the external efficiency of the system. In the shape of contribution to the national product this adds to the overall development of national economy. The responding passouts could be grouped as under according to their salary ranges:

<table>
<thead>
<tr>
<th>Rs. Range</th>
<th>Passouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 - 2000</td>
<td>26</td>
</tr>
<tr>
<td>2000 - 3000</td>
<td>16</td>
</tr>
<tr>
<td>3000 - 4000</td>
<td>18</td>
</tr>
<tr>
<td>4000 - 5000</td>
<td>5</td>
</tr>
<tr>
<td>Above Rs. 5000</td>
<td>5</td>
</tr>
</tbody>
</table>
The year-wise breakup of the above passouts is given in Table - 19.

**TABLE 19 : EARNINGS OF TECHNICIANS**

<table>
<thead>
<tr>
<th>YEAR OF PASSING</th>
<th>1000-2000</th>
<th>2000-3000</th>
<th>3000-4000</th>
<th>4000-5000</th>
<th>ABOVE-5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1980</td>
<td>9</td>
<td>4</td>
<td>12</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1980</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1981</td>
<td>5</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1982</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1983</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1984</td>
<td>5</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1985</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1986</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1987</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1988</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Source: Tracer Study*

The above table shows a progressive increase in the salaries as experience was gained. Considering the fact that the initial salaries structure about ten years ago was comparatively low, there appeared to be a substantial gain in the earnings of the passouts. Secondly, for the purpose of academic equivalence the technician diploma was bracketed with intermediate level qualifications. But in terms of earning capacity of the individuals both at the initial level and also in the rate of acceleration with the gain in experience it compared favorably with higher level such as...
graduation or trained graduate teachers. This was one of the reasons for high social demand for this type of education which was considered as investment.

**Self Employment**

The survey also included 20 self employed technicians out of which 17 responded to the questionnaire. They reported as doing business in the following trades:

- Servicing and maintenance, refrigeration and air conditioning, radio, television, VCR, and electrical installation work.
- Small scale manufacturing and fabrication work.
- Marketing and selling business, operating own shops.

For most of the respondents self employment was not the "first choice". Failure to secure government or private service had let them to do their own business. Three of the respondents have undertaken self employment to "supplement their normal income" as they held regular employment also. The respondents have also indicated following difficulties in operating own business:

1. "Lack of financial resources", understandably, was considered the most difficult factor in starting business.
2. About 50% of the respondents considered "lack of knowledge of business practices/rules and regulations" as another constraint.
3. All the respondents have endorsed the need to "arrange financial assistance" and "interest free loan" to start business.
4. About 55% of the respondents have suggested that courses in "entrepreneurial training" be included in the curriculum.
It was necessary to strengthen the self employment potential of the trainees in technician education. This would not only help to reduce the pressure on government and private jobs but would also generate employment. The Youth Investment Promotion Services (YIPS) may be further expanded to assist in this matter more liberally. The curricula may also be reviewed to make provision for imparting entrepreneurial skills to the passouts.

Cost - Benefits

Most of the technician education was provided by the institutions in the public sector. The enrollment in private institutes was only 10% of the total enrollment.

The user charge included tuition fee, registration fee, admission fee and non-government dues. Table - 20 gives a sample fee structure for diploma course in Government Polytechnic / College of Technology for 1988. Describing the low rate of tuition fee in government institution, the Working Papers for National Education Conference\(^3\) stated that user charges had remained constant for almost last forty years. The cost of professional and higher education in Pakistan was perhaps the lowest in the world. The complicated system of budgeting and expenditure and combination of different training levels within the same institution (such as diploma and B.Tech.) which shared common facilities and resources as well as the faculty rendered it very difficult to make a full analysis of unit cost of training. The situation was further complexed by inclusion of non-academic expenditure on housing, security, maintenance of buildings and grounds with the training budget. With the above limitations and lacking specificity,


op.cit., p.122.
an attempt was made to provide some indication of the cost of training technician and resulting benefit to the individual.

### TABLE - 30: FEE SCHEDULE FOR POLYTECHNIC AND COLLEGE OF TECHNOLOGY: 1987 - 88

<table>
<thead>
<tr>
<th>ITEM</th>
<th>RATE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission Fee</td>
<td>Rs. 10</td>
<td>(At the time of admission)</td>
</tr>
<tr>
<td>Tuition Fee</td>
<td>Rs. 150</td>
<td>(Per Semester)</td>
</tr>
<tr>
<td>Instruction Material Fee</td>
<td>Rs. 20</td>
<td></td>
</tr>
<tr>
<td>Sport Fund</td>
<td>Rs. 18</td>
<td></td>
</tr>
<tr>
<td>Students Fund</td>
<td>Rs. 6</td>
<td></td>
</tr>
<tr>
<td>Medical Fee (First Aid Only)</td>
<td>Rs. 5</td>
<td></td>
</tr>
<tr>
<td>Magazine Fee</td>
<td>Rs. 6</td>
<td></td>
</tr>
<tr>
<td>Identity Card Fee</td>
<td>Rs. 5</td>
<td>(At the time of admission)</td>
</tr>
<tr>
<td>Institute's Exam. Fee</td>
<td>Rs. 15</td>
<td>(Per Semester)</td>
</tr>
<tr>
<td>Bus Card Fee</td>
<td>Rs. 3</td>
<td>Per year</td>
</tr>
<tr>
<td>Security Deposit [Refundable]</td>
<td>Rs. 30</td>
<td>(At the time of admission)</td>
</tr>
<tr>
<td>Library Security Deposit [Refundable]</td>
<td>Rs. 30</td>
<td></td>
</tr>
<tr>
<td>Building &amp; Furniture Repair</td>
<td>Rs. 100</td>
<td></td>
</tr>
<tr>
<td>Library Fee</td>
<td>Rs. 12</td>
<td>(Per Semester)</td>
</tr>
<tr>
<td>BTE Registration Form Fee</td>
<td>Rs. 2</td>
<td>(At the time of admission subject to changes from time to time)</td>
</tr>
<tr>
<td>BTE Registration Fee</td>
<td>Rs. 70</td>
<td></td>
</tr>
<tr>
<td>BTE Sports Fund</td>
<td>Rs. 10</td>
<td></td>
</tr>
<tr>
<td>Industrial Tour Fee</td>
<td>Rs. 100</td>
<td>(Per Semester (Not-refundable))</td>
</tr>
</tbody>
</table>

Source: Directorate of Technical Education - Sindh, (1987 - 88)

154
Table - 20 gives the estimates of direct expenditure borne by the student/parent. It however did not include indirect expenses which would include cost of books, stationary and supplies, transportation to and from institute, boarding and lodging expenses, if applicable. Table - 13 referred early in Chapter IV in connection with the financing of the institutions was used to determine the average costing. For the purpose of costing only recurrent expenditure was the basis. With each institution having a different history of development, different sources of financing including bilateral assistances and loans, and with buildings and equipment at different level of wear and tear, their calculation of amortization was further complicated. Another limitation was also the aggregating the cost of training in different technologies as a single programme.

**TABLE 21: SOCIAL COST OF TRAINING**

<table>
<thead>
<tr>
<th>Expenditure inclusive of all expenses</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>For 18 institutions the annual recurrent</td>
<td>Rs. 88,547,442</td>
</tr>
<tr>
<td>Total number of trainees</td>
<td>18,198</td>
</tr>
<tr>
<td>Cost per trainee / years (average)</td>
<td>4,885</td>
</tr>
<tr>
<td>Cost for the total course (3 Years)</td>
<td>14,595</td>
</tr>
<tr>
<td>With a pass percentage of 50% (Table - 18)</td>
<td>6,421</td>
</tr>
<tr>
<td>Additional cost (training wastage)</td>
<td></td>
</tr>
<tr>
<td>Total cost borne by the Government</td>
<td>21,016</td>
</tr>
</tbody>
</table>

**PUPI: BORNE COST:**

| Direct cost, fee etc. (3 Years) | 2,500          |
| (based on Table - 20)           |                |
| Foregone earnings (not included) |                |
| Total Social Cost (Cost + Pupil borne cost) | 23,515         |

Say Rs. 23,500

Sources: Table 13 & Table 16 of Study.
Social Benefits:
Increased Earnings.

A sample wage differential will indicate the benefits of the training against the cost incurred. From the data in Table - 19 the average starting wage of a polytechnic diploma holder may be fixed at Rs. 1,500 per month, but in government service the starting salary could be in BPS - 14 amounting to Rs. 2,000 per month. Instead of pursuing polytechnic education in 13 years the individual could also acquire alternate qualification equivalent to intermediate level or in professional qualifications of 2 years certificate from a technical training center or qualify as trained primary teacher. This would qualify him for a job at BPS - 9 with Rs. 1,500 month. The training in polytechnic thus provided a salary differential of Rs. 500 per month with a cumulative benefit of Rs. 6,000 per year enabling to defray the (additional) training cost in about 4 years. Incidentally in government institutions there was little difference in the fee structure of polytechnics or general education at intermediate level. Thus the choice of the polytechnic institute education benefited the individual in the increased initial earning capacity as well as accelerated enhancement in the emoluments with the passage of time. According to Vietch14 "the life-time earning of the graduates from technical training institutes are two to five times higher than those of graduates in social disciplines. A positive aspect of these returns was the fact that these started at an earlier stage of life as compared to those of the graduates in non-technical subjects".

-------------------
Development Pattern of Technician Education

In the foregone analyses some aspects of the efficiency of the transformation process as indicated through the attainment of various goals have been highlighted. An attempt was made to quantify the learning process gains in terms of annual passouts and time taken for completion of courses. The educational gains were measured against the criteria of acceptability of the passouts in the industrial environment and their capability to adjust to the needs of employment as well as their potential for self employment. The earnings of the individuals in terms of salaries were the indicators of the attainment of economic goals to discount for the additional time and cost spent by the passout. In view of the specific nature of this study the measurement of societal goals could not be included.

The essential attributes of education as an open system is reflected in its capability to respond to the expectations of social and economic goals. This ability in technician education system was demonstrated through the system's efficiency in the utilisation of resources and futuristic look in adjusting to the social tune which governs the development pattern. Table-22 provides information related to allocation and utilisation of resources, growth of institutions and their capacities on a common base of five year plans.

Resource Allocation

Technical education had to compete with other sectors for allocation of resources. Inspite of pronounced commitments by the successive governments the allocation of funds had not been commensurate with the actual needs of this sector considering the heavy capital out lay needed per student. The funds allocated to technical education when
compared on the basis of total allocation for education sector exhibited a near constant ratio of about of 9-10% during all the plan periods. The exception was the Third Five Year Plan when about 19% of the total funds were allocated to technical education.

<table>
<thead>
<tr>
<th>Item</th>
<th>1st FYP</th>
<th>2nd FYP</th>
<th>3rd FYP</th>
<th>4th FYP</th>
<th>5th FYP</th>
<th>6th FYP</th>
<th>7th FYP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation(a)</td>
<td>27.9</td>
<td>51.7</td>
<td>258.7</td>
<td>314.6</td>
<td>166.8</td>
<td>1074.0</td>
<td>2000.0</td>
</tr>
<tr>
<td>(Rs. Million)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>8.2</td>
<td>78.6</td>
<td>57.10</td>
<td>283.9</td>
<td>412.2</td>
<td>677.0</td>
<td>--</td>
</tr>
<tr>
<td>Allocation</td>
<td>337.7</td>
<td>551.7</td>
<td>1346.3</td>
<td>2998.1</td>
<td>11464.8</td>
<td>13775.3</td>
<td>22580.0</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Number of(b)  | Polytechnics | 4 | 10 | 14 | 26 | 34(SF) | 42(SF) | 72(20F) |
|               | Colleges     | (F) | Women Polytechnics |

<table>
<thead>
<tr>
<th>Annual</th>
<th>Intake(c)</th>
<th>400</th>
<th>2100</th>
<th>2500</th>
<th>5271</th>
<th>5900</th>
<th>9000</th>
<th>14000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual output</td>
<td></td>
<td>402</td>
<td>NA</td>
<td>2506</td>
<td>2550</td>
<td>3070</td>
<td>4096</td>
<td>-</td>
</tr>
<tr>
<td>Enrollment</td>
<td></td>
<td>700</td>
<td>5846</td>
<td>7820</td>
<td>13000</td>
<td>17300</td>
<td>31000</td>
<td>40000</td>
</tr>
</tbody>
</table>

Sources: (a) Aziz Meen, Review of Education Policies; MOE, 1986
(b) Seventh Five Year Plan (c) Sixth Five Year Plan
Resource Utilisation

Efficiency in utilisation of resources proved a major determinant of the performance of the system. Seen in this context technical education had exhibited very high performance during the Second Five Year Plan when the utilisation exceeded the targets to reach 126%. This accelerated development accounted to the fact that as a sequence to the Report of Commission on National Education (1959) adequate funds were provided in all sectors of education and through setting up of Implementation Unit in the MOE proper utilisation was also ensured. Again, during the non-plan period (1970-78) the utilisation factor could reach 90% which was the second highest rate. Incidentally, during both the periods the country was administered through the presidential form of government although partly in the latter period. The Third Five Year Plan period recorded the lowest utilisation performance of allocated funds (37%) although the total allocation to technical education was the highest of all the plan period (19%). Probably the above figure, though given in the Fourth Five Year Plan, did not account for the subsequent cut back in the allocation due to change of priorities as a result of 1965 war. There was evidence of gradual improvement in the utilisation factor in the Fifth and Sixth plan periods.

Growth of Institutions

The growth in the number of institutions was linked with the allocation and utilisation of resources. The Second Five Year Plan recorded 150% growth over the preceding period by increasing the institutions from 4 to 10. The next higher increase occurred during the Non Plan period (1970-78) when the growth rate was recorded as 100% (from 14 to 28). The overall increase during the period of study (1955-1988) was about 10 times. This accounted for the
growth in the public sector only. Though small in number there had also been the participation of semi government agencies and private sector in the development of technician education which accounted for about 10% enrollment.

**Enrollment Growth**

The annual intake of all polytechnics in public sector for the period ending the Sixth Five Year plan was 9000 which indicated 22.5 times increase since the inception of polytechnic education in Pakistan in 1955. This gave a theoretical average annual growth of 55%. The 10 times increase in the growth of institution as stated above and 22.5 times increase in the enrollment, gave ratio of 1:2.25 in the growth of the institutes and the intake capacity. This accelerated increase in the intake of institutes reflected high social demand.

**Output Trend**

The annual output recorded 10 times increase on the benchmark of 1955. This also indicated an output efficiency of 55% which compared very closely with 56% determined through the tracer study (Table-16).

**Future Trends**

Reference to the graphical presentations in Figs. 6 and 7 indicates a normal growth tendency in the institutional development up to 1985. But the steep in the curve due to the projections of the targets of 7th Five Year Plan indicates rather high targets which will need mobilisation of sizable material and manpower resources. The sudden rise in enrollment is visible. This was due to introduction of second / double shifts in the polytechnics.
Development of New Courses

Beginning with the traditional courses of civil, electrical and mechanical technology new courses have been introduced according to the growing needs of industry with more sophisticated disciplines in the later period. (Appendix-I)

Table 23: Development of New Courses in Polytechnic Institutes

<table>
<thead>
<tr>
<th>Period</th>
<th>Technology courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1955</td>
<td>Civil, Mechanical, Electrical</td>
</tr>
<tr>
<td>1955-65</td>
<td>Auto &amp; Diesel, Auto &amp; Farm, Electronics,</td>
</tr>
<tr>
<td></td>
<td>Drafting &amp; Designing, Foundry &amp; Pattern,</td>
</tr>
<tr>
<td></td>
<td>Machinshop, Power, Welding &amp; Sheet Metal,</td>
</tr>
<tr>
<td></td>
<td>Clothing &amp; garments</td>
</tr>
<tr>
<td>1965-1975</td>
<td>Architecture, Civil Drafting, Precision</td>
</tr>
<tr>
<td></td>
<td>Instruments Refrigeration Air-Conditioning,</td>
</tr>
<tr>
<td></td>
<td>Chemical, Watch &amp; Instrument.</td>
</tr>
<tr>
<td>1975-1985</td>
<td>Glass &amp; Ceramics, Printing &amp; Graphics,</td>
</tr>
<tr>
<td></td>
<td>Optical Instrument.</td>
</tr>
<tr>
<td>1985 on-wards</td>
<td>Biomedical, Computers, Metallurgy,</td>
</tr>
<tr>
<td></td>
<td>Telecommunication secretarial.</td>
</tr>
<tr>
<td>7th FYP</td>
<td>Microprocessor, Digital Electronics,</td>
</tr>
<tr>
<td></td>
<td>Mining, Sugar, Paper, Gas &amp; Petroleum,</td>
</tr>
<tr>
<td></td>
<td>Manmade Fibres.</td>
</tr>
</tbody>
</table>

Source: Tracer Study

In the context of new courses attention should also be paid to offer post diploma short courses, distinct from B.Tech., to cater to further specialisation in the existing disciplines.

The training scene as described in Table - 23 is however dominated by such technologies which were oriented to the needs of large industrial complex in the urban areas only. There was however total absence of technical education
facilities in the rural areas related to the rural economy. The needs of rural economy will require a totally different approach in curriculum designing to integrate multifaceted skills related to the improvement of quality of life in the rural areas. The training, for example will include agro-industrial engineering, animal science and dairying, tube well engineering, wool technology, etc. Cost effective measures through the use of mobile units and establishing existing nearest polytechnic as "rural centre of technology" needed to be considered. Courses for women polytechnics may also include interior decoration, commercial arts, pharmacy, cosmetology and beauticians which were more suitable for the female in their choice of vocation.

Demographic Trends

Table - 24 attempts to provide a relationship in the population growth and growth of technician education system. During last two decades the intake of polytechnics and colleges of technology has grown steadily from 55/million of population to 82 per million in 1990. For the same period the intake of engineering colleges and universities has also grown from 24 per million to 41 per million.

Table 24 : POPULATION GROWTH AND TECHNICAL EDUCATION : 1971-1993

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population ** (in million)</td>
<td>65.2</td>
<td>84.2</td>
<td>100.7</td>
<td>110.3</td>
<td>122.8</td>
</tr>
<tr>
<td>No. of Polytechnics</td>
<td>14</td>
<td>28</td>
<td>34</td>
<td>42</td>
<td>72</td>
</tr>
<tr>
<td>Annual intake(Poly.)</td>
<td>3500</td>
<td>5200</td>
<td>5900</td>
<td>9000</td>
<td>12000</td>
</tr>
<tr>
<td>Annual intake(Engg.)</td>
<td>1500</td>
<td>2821</td>
<td>3850</td>
<td>4900</td>
<td>5000</td>
</tr>
<tr>
<td>Intake/mill (Poly.)</td>
<td>55</td>
<td>61</td>
<td>58</td>
<td>62</td>
<td>97</td>
</tr>
<tr>
<td>Intake/mill (Engg)</td>
<td>23</td>
<td>31</td>
<td>38</td>
<td>41</td>
<td>40</td>
</tr>
<tr>
<td>Ratio Engg.: Poly.</td>
<td>1:2.3</td>
<td>1:2</td>
<td>1:1.5</td>
<td>1:1.1</td>
<td>1:2.4</td>
</tr>
</tbody>
</table>

( ** 7th FYP p. 81.)
A gradual increase is visible in the ratio of intake of engineers to technicians from 1:2.3 in 1971 to 1:1.1 in 1990. If the targets of 7th FYP for the annual intake of technicians were not attained this competing trend in the intake ratio would create imbalance in the output ratio between these two categories of manpower. Ultimately it would affect the total stock of manpower. For sustained industrial growth the normal ratio of engineers to technician was expected to be about 1:4-5. The above situation in Pakistan suggested a narrow based structure of manpower. This tendency would ultimately result in overlapping of functions of engineers and technicians.

The above demographic distribution of overall intake when compared with the intake of polytechnics in different provinces indicated some imbalances. The population distribution of Pakistan was estimated to account for 57% Punjab, 25% Sindh, 13% NWFP and 5% in Balochistan. The province wise annual intake of polytechnics (Table-5) gives a distribution of 50% for Punjab, 40% for Sindh, 8.5% for NWFP and 1.5% for Balochistan. The annual intake of 82 per million for the polytechnics for 1990 when apportioned according to the above ratio will work out to 41/million in Punjab, 32/million in Sindh, 7/million in NWFP and 2/per million of population in Balochistan. The apparently higher intake for Sindh in proportion to its population may be justified to the increased industrial and commercial activities in the province as compared to other provinces. While literacy and basic education programmes may and must provide equitable access to all sectors and regions the programmes at tertiary levels should be more planned to adequately serve the local employment needs. In particular technician and engineering programme which are job related must also ensure proper placement of the passouts. This did not pre-empt the need of designing appropriate programmes which can generate and also provide employment to the population belonging to the rural and less industrially
developed areas. This required a sound and realistic manpower planning strategy which is one of the most important element in economic development.

**Summary**

The average passout rate during recent years (1985-87) had been 56%. Generally about 40% students completed the programme in the prescribed three years period. Training contents had been considered inadequate by the employers. The passouts also considered the need to improve some aspects of training. About 50% of the passouts could secure first employment within 6 months of graduation. With adjustments in the curriculum the self employment potentials of the passout could be further enhanced. The training provided social benefits at a higher level with comparable qualifications in general education.

The development pattern of technician education indicated a 10 times rise in the number of institutes during the period covered by the study. The annual intake had increased by about 55% per year. The output efficiency of the institutes remained about 55% on the basis of students passed out each year.

The share of technical education had been about 9-10% of the total funds allocated for development of education during five year plans. Except in the second plan period the utilisation of funds were below the targets.

There was a rising trend in ratio of intake of engineers to technicians reflecting an elitist tendency.

The demographic trends in the development of institutions and enrollment indicated a high ratio of intake to population in the urban areas.
CHAPTER SIX

COMPARISON OF CONTEMPORARY SYSTEMS
OF TECHNICAL EDUCATION

Rationale for Comparison

Among Southeast Asian countries Pakistan occupied a prominent position. A comparison of Pakistan's technician education system with some of the regional countries could help to study the trends in the regional scene. The choice of countries for comparison should be based on some commonalities and identical reference points. Countries which are forced to functioning within similar boundaries of economic constraints provide a more valid basis of comparison among themselves. In this context a comparison within the technician education systems of Bangladesh, India and Pakistan was useful. Pakistan had social, economic and political linkages with these two countries through a number of pacts and alliances such as Commonwealth, Colombo Plan and the South Asian Association for Regional Cooperation (SAARC). The foremost consideration was the fact that until 1947 all the three countries worked under a common system of education in the British India. Alongwith Afghanistan, Burma and Nepal all the six countries belonged to income group with per capita GNP of US$ 200 or less, in 1980. Comparisons with other system which were alien and operating under different socio cultural environment would not serve beyond a model for reference.
System of Education

All three countries had 10 years of schooling after which a student could join a 3 year technician education programme. In Bangladesh and India it was offered in polytechnics where as in Pakistan it was offered in polytechnics and also in colleges of technology which were composite institutions offering B. Tech degree courses also.

Pre-Vocational Courses

Within the secondary education Pakistan had introduced pre-vocational courses in the form of agro-technical studies. In India diversified courses were introduced in the form of "Socially Useful Production Work" (SUPW) at secondary and higher secondary levels to provide work experience to students. In Bangladesh a programme of community schools at thana and union level was introduced for the training of rural youth. Besides, industrial arts education was imparted to students at secondary level.1

Both in India2 and Pakistan3 the efforts of vocationalisation of secondary education had suffered due to lack of appreciation, lack of proper attitude of administrators, inadequate preparation, shortage of trained staff to operate the programmes and paucity of resources.


2. Policy Planning and Administration of Technical and Vocational Education: India op. cit., p. 51.

Fig. 9: Structure of Technical Education

Bangladesh: University, Polytechnics—Technicians, Vocational Schools

India: Engineering Colleges, Polytechnics for Technicians (Diploma), Apprenticeship in Industry, Intermediate University, Vocational Schools

Pakistan: Polytechnic Technician Diploma, Vocational Schools

Adapted from: "Technician Education and Training Systems in Colombo Plan Countries: a Graphic Presentation", L S Chandra Kant, CPSUC
Technical Education

India had recorded a 6 times growth in the number of polytechnics, (from 53 in 1947 to 300 in 1980). The intake in the same period increased from 3700 to 50000, i.e. about 14 times. The intake capacity on the basis of population (665.8 million in 1980), was 75 per million. There were 25 polytechnics for women also. In Bangladesh the number of polytechnics increased from only one in 1955 to 23 in 1980 which included 5 monotechnics and one polytechnic for women. The annual intake capacity of 5000 catered to 56 per million of population (88.6 mill). The growth rate in Pakistan had recorded an increase of 6 times, from 4 to 25 in 1980 (with the existing number of 42 including 8 for women). The annual intake capacity of 9000 catered to the requirements of 85 per million of population. Pakistan had the highest enrollment capacity on the basis of population probably due to second shift programmes as discussed in earlier chapter.

Course Structure

The technician diploma course in Pakistan and Bangladesh were totally institution based with full time studies for three years. In recent years four years evening diploma courses had also been introduced in Pakistan. But India was distinct in starting technician training courses on sandwich pattern also. This was a very cost effective model of imparting training and due consideration should be given by Pakistan and Bangladesh.


Different initiatives had been taken by all the three countries for the continuing educations of technicians. Pakistan had started B.Tech course in the colleges of technology. Bangladesh had set up a separate engineering college for the passouts of diploma courses to pursue higher education. In India technicians enrolled in evening courses in engineering colleges to obtain engineering degrees. All the three countries, however, favoured a separate stream for the higher education of technicians to maintain distinct features of technological training in contrast to engineering programmes.

The needs of individual country however determined the types and contents of courses. India with its large population and size of industrial complex provided technician training in 55 technologies, Bangladesh in 19 areas including specialised training in Jute, Textiles, Printing, Ceramics and Leather for which monotecnics were established. Pakistan offered courses in 25 disciplines.

A significant development in India was the emergence of "Rural" or "Community polytechnics" which offered courses of training in activities related to rural economy such as agricultural engineering and agro industries.

Administration

In all the three countries technical education was administered through identical organisational set up. In Bangladesh it was through a single Directorate of Technical Education at the national level, in India by the State Directorates of Technical Education and in Pakistan through the provincial Directorates of Technical Education.

The academic control was vested with the Boards of Technical Education. In India however there was an All India Council of Technical Education (AICTE) with the counterparts in the States also. This was an advisory body with the Union Minister of Education as its Chairman. Besides, there was
also the All India Board of Technical Education which exercised the functions of determination of needs of technical education and developing plans to recommend to the AICTE. This set up had helped in according a proper identity to the technical education in the Indian national set up. In Pakistan also a Council of Technical Education existed which was first created on the recommendations of the Pakistan Educational Conference, 1947 and reactivated during 1960-70. But gradually it became ineffective due to lack of official patronage. In the present set up the nearest to this arrangement was the Standing Committee of Technical Education in the National Education Council which had not been able to create any visible impact. The imperative need to establish a Council of Technical Education could not be overemphasised.

Quality Improvement Thrusts

In Pakistan until nineteen eighties the technician education system was allowed to expand without much regard for the quality. The Boards of Technical education which had the legal responsibility to oversee the standard of education mainly conducted the examinations and curriculum development and renewal activities. It was during nineteen eighties that quality improvement initiatives were undertaken by the MOE through organising workshops, courses and conferences. The main quality improvement thrust was envisaged in 1981 when the scheme for the National Technical Teacher Training College was approved but it was only in 1988 that the college became functioning. The College was offering Diploma courses for polytechnic teachers which included pedagogy, content updating and industrial training.

In India quality improvement of technician education was entrusted to the Technical Teacher Training Institutes (TTTI) through sponsorship by the Union Government. Four such Institutes were set up to cater to the four
geographical regions in India. These institutes were responsible to provide educational services including development of teaching learning materials, staff development programmes, and research into methods and media. Besides teacher training Diploma long term courses leading to Bachelor and Master degree in technical teacher education were also offered by the TTTIs in India. The TTTIs though started in seventies had very rapidly built up their image as centre of leadership and guidance in technician education through their own efforts and due patronage by the Government.

In the regional countries Bangladesh was the first to establish a Technical Teacher Training College in 1964. In the early stage it offered B.Ed. Technical programme with the dual purpose to satisfy the demand of higher education of diploma holders and also as a means to upgrade the polytechnic teachers for senior posts which were vacant due to shortage of engineering degree holder instructors. Since the programme was based on a narrow scope and due to subsequent shortage of teachers it could not continue longer as there had been reports of under utilisation of the facilities of the College. It was necessary that both in Pakistan and Bangladesh due consideration be given to Teacher Training Colleges for the proper utilisation of facilities for training of teachers and rendering educational services.

Innovative Approaches

Innovative ideas and futuristic approach are among the indicators of critical success factors of performance and responsiveness of institutions to the changing needs. Among the Colombo Plan regional countries India and Pakistan have

offered a very large number of innovative projects. Out of 69 inventories of innovations in the region, 25 belonged to India and 18 to Pakistan and one to the Bangladesh.7 The innovative projects related to a number of areas:

Pakistan : Student and Programme Evaluation (4), Curriculum (6), Teaching - Learning Resources (3), Management of Institutes (2), Staff Development (3).

India : Teaching Learning Resources (5), Evaluation (4), Staff Development (8), Institute Industry Relation (1), Management of Institutes (7).

Bangladesh : Institute Industry Relations / Cooperation (1).

In case of Pakistan it was a matter of satisfaction to note that most of the innovative projects were initiated by the Boards and Directorates of Technical Education inspite of their obvious limitations of staff and expertise.

In India the innovative projects, in a number of cases, were undertaken by the faculty of TTTIs, with overwhelming participation from TTTI Bhopal which enjoyed high professional reputation.

Problems and issues

All the three countries had problems related to their specific areas as well as some common between them. Lack of cooperation between industry and technician education institutions was highlighted as the most acute problem commonly faced by all the three countries. India had tried to reduce the gravity of situation through amending the

Apprenticeship Act to cover the training of the passouts of polytechnics and engineering institutions. Bangladesh had tried to ease the problem by introducing post diploma industrial experience financed and sponsored by the Bureau of Manpower Employment and Training. This helped in increasing the employability of the passouts and better performance on the first job. In Pakistan, however, draft of an Industrial Training Act was on the anvil for over a decade.

India faced the dilemma of defining the technicians function as there was reported to be overlapping of functions between the technicians, engineers and craftsmen due to which only middle 40% position in the spectrum of technician jobs were left for the technicians.8 Lack of data for micro level planning vitiated the planning process of technician education. Similar concerns were also shared by Pakistan and Bangladesh. Management training of administrators of technician education programme was equally an area of concern for all the three countries. The systems in the three countries also suffered due to lack of recognition of the status of technician in the society. Unlike engineers there was no professional organisation of technician which would have served as a forum to build up a proper image of the technician in the manpower team.

Shortage of qualified teachers was an important problem faced by Bangladesh. Inadequacy of curriculum resulting due to insufficient information on manpowers statistics by the field of specialisation was affecting the quality of output. Insufficient budgeting for training purpose was a problem in Bangladesh which was also shared by Pakistan. High centralisation or administrative powers, which was mainly due to unitary system of government, slowed down the developmental processes in Bangladesh. Pakistan faced the

problem of attracting and retaining qualified teachers in the wake of competition by the industries who could offer them better emoluments. Shortage of text books and teaching learning material was also an equally serious problem.

In conclusion, all the three systems had their weaknesses and strengths inherent in their socio economic conditions, financial constraints and management styles. Yet they have much to learn from each other in their success and failures in improving their own systems.

Summary

The system of education in Pakistan, Bangladesh and India had identical length of 10 years of general education followed by 3 years technician training. The systems also provided pre-vocational technical bias at secondary level.

Technician education programmes in Bangladesh and Pakistan were totally institution based. In India sandwich type programmes were also in operation.

Significant development in India was the establishment of rural polytechnics to cater to the needs of less developed rural areas.

The annual intake capacity of polytechnics in India was 75 per million of population, in Pakistan 85 and in Bangladesh 56 per million. In actual numbers it was 50,000, 9000 and 5000 per year respectively.

In all the three countries administration of technician education was carried through the Directorates and Boards of Technical Education. In India an All India Council of Technical Education also played an important role in assisting the government in policy formulation in technician education.

----------------------
In India the quality improvement thrusts had been provided through augmentation of staff development services and establishment of technical teacher training institutions.

All the countries shared common concern in the lack of cooperation between technician institutes and industry, insufficient data for micro level manpower planning and need for management training for administrators. Problems specific to individual countries included shortage of qualified teachers, inadequacy of funds and shortage of books and learning material.
CHAPTER SEVEN

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to document the development of technical education in Pakistan. The study aimed to examine the objectives and achievements, problems and issues and to serve a basis for further improvement of technical education. More specifically the study was designed to critically examine the following aspects of technical education:

1. The quantitative development
2. The quality aspects
3. Relationship with manpowers needs, and
4. Measures for further improvement

The study was structured to specifically focus on those aspects of technical education which related to the education and training of technicians who formed a middle level industrial manpower between the engineers and craftsmen.

The following assumptions were made in this study:

1. The history of technical education of Pakistan can be documented.
2. Some developmental pattern can be identified that would establish the direction in which technical education was moving.
3. Deficiencies in technical education can be located for correction.

The information for the study was obtained from the documents related to technical education which included mainly the following sources:

1. Government policies on education
2. Report of Task groups and study groups
3. Five year development plans
4. Literature on conceptual issues.
5. Studies by individuals on contemporary developments specially the monographs of Colombo Plan Staff College for Technician Education and Unesco reports.

For nearly 35 years in government service the writer of this study had participated in the planning, implementation and evaluation of technical education programmes in Pakistan. This has helped to recall the missing bits in the documented sources of this study.

Additional information was generated through responses to questionnaires which were administered to the passouts of polytechnic institutes, principals and senior staff of polytechnics and industrial establishments employing the polytechnic graduates. This information enhanced the qualitative dimensions of the study as sufficient documentary evidence was not available on the demand led issues of the study.

The material of the study also included a comparative study of the growth of technical education in Pakistan, Bangladesh and India which provided a means to examine the performance of contemporary systems with identical constraints.

A set of recommendations have also been formulated to suggest measures for the improvement of the system of technical education in Pakistan.
The theoretical framework of the study was planned on systems approach to document and examine the available information by delineating as related and interlinked components of input, process and output of technician education system for the time sequence of 1947 to 1988, for which this study was conducted. The information obtained was therefore presented in keeping with the systems approach as explained above.

**Summary of Findings**

During the last forty years Pakistan had established the system of technical education through major investment in physical and human resources. This study was undertaken to critically examine the developmental trends and matters associated with the quantitative expansion and growth of technician education system, its qualitative aspects in relation to the efficiency of teaching learning processes, the management process and relevance of training to manpower requirements. The following is an analysis of some pertinent aspects of the findings of the study.

**Educational Policies**

Educational development in Pakistan exhibited four distinct trends viz Policy Formulation (1947-58), Expansion (1958-71), Innovation and Experimentation (1971-77) and Quality Improvement (1977-88). The need for a planned development of technical education was recognised from the early stage when on the recommendations of Pakistan Educational Conference 1947, a Council of Technical Education was appointed. The Report of Technical Education Committee 1950, which incorporated the relevant provisions of Sargent’s Report of 1944 provided a basis for policy formulation. Later in 1959 the Report of Commission on National Education provided a framework for the development
of technical education as a part of the overall system of education. In the initial period which continued up to 1971 the main focus was to develop a system to meet the growing demands of industrial development. During the last two decades educational development was subjected to experimentation, consolidation and quality improvement thrusts under the Education Policy 1972-80 and National Education Policy 1978 which was the last policy document on education when this study was undertaken.

The pattern of educational development which emerged during the period covered by the study reflected the objectives of the successive government to provide a system to meet the requirements of human resources for the planned economic development of the country. It was however observed that except for the report of Commission on National Education (1959) which was prepared on the basis of comprehensive field studies the educational policies in the subsequent periods were based on subjective opinion and lacked the required validation. Frequent changes of educational policies without evaluating the impact of on-going policies created element of uncertainty in the system. It was high time that any further change in the educational policy should be undertaken after an in-depth study of the entire system to ensure that the change was relevant to the realities of the situation that existed.

Growth of Polytechnic Education

During the period from 1947 to 1988 there was a 10 times rise in the number of institutions (from 4 to 42) and the intake capacity increased by 25 times. In 1988 the enrollment in all the polytechnic institutes and colleges of technology was 31000 including the private institution. There were 42 institutes in the government sector including 8 for women. Courses were offered in 25 technologies. During last 20 years the average intake to polytechnic institutes
was approximately 4% of the output of matriculates in each five year plan. The annual intake capacity in 1988 was recorded as 5000 students. The output from the institutions during 1988 was 5000 which represented 55% of the number of students who appeared in the examinations conducted by the respective Boards of Technical Education in the provinces. Insipe of the conceptual and operational shortcoming the growth of the system as seen in the above picture indicated a general forward look and determined efforts of the planners and implementators to develop the system.

It was however observed that the enrollment in private institutions was about 3000 which accounted for only 10% of the total in 1988. Though the policy of nationalisation was relaxed the private sector still seemed hesitant to come forward. The Seventh Five Year Plan proposed to provide loans through Small Business Corporation for setting up private institutions. But the need to supplement the operating budget through grant in aid was more imperative. The grant may be linked with a criteria of performance of the institute and not merely on the basis of deficit.

There was also steady rise in the number of technologies offered. Starting with the traditional fields in civil, electrical and mechanical the courses offered indicated a gradual shift to sophisticated disciplines. However, the enrollment in civil, electrical and mechanical technologies accounted for almost 70% of the total enrollment. This trend was likely to continue till the facilities are developed at grass root level. But the need for high tech era and sophistication in the industrial processes demanded to fill the gap at the earliest possible. The introduction of courses in micro processor, digital electronics, mining, chemical, gas and petroleum, manmade fibres was very evident. It was necessary to undertake micro level analysis of manpower requirement. In general courses
of study aimed to train engineering technicians but some programmes were also operating on donor led concepts of industrial technicians.

Resource Allocation and Utilization

During the period under study five development plans were implemented which included the First to Sixth Five Year Plans. During the period from 1970-78 no formal fourth plan was formulated but development programmes were implemented on the basis of annual development plans.

The successive five year development plans which determined the tempo of development acknowledged the role of technical education in economic growth of the country. It was observed that inspite of its smaller size in the education sector the share of technical education in the development funds maintained a steady proportion of 9-10% of the total allocations for education. The overall performance in the utilisation of allocated funds during the period under study was 62%, while during the Second Five Year Plan the utilisation exceeded the target by 26%. During the No Plan Period (1970-78) also the utilisation was as high as 90%.

Manpower Imbalance

Another aspect related to the growth of the institutions and programmes was the need to match the manpower requirement in terms of its quantity. For sustained industrial growth a ratio of 1:4-5 between the engineers and technicians was considered a desired ratio. In Pakistan this ratio of engineers to technicians was already on the lower side being 1:2.3 in 1971. Further during last two decades there was accelerated increase in the intake capacity of engineering institutions but the growth in the technician training institutions did not keep pace. This resulted in a
gradual decrease in the ratio which was 1:1.5 in 1987 and projected to attain 1:1.1 in 1990 and afterwards. This indicated an elitist trend in the system which would ultimately create imbalance in the overall manpower stock. The situation called for a coordinated planning of future manpower development programmes.

**Rural Polytechnics**

In the context of quantitative imbalance it was also observed that there was no organised planning to develop and establish training programmes suited to the needs of 70-80%-population which resided in the rural areas. In contrast to the requirement of traditional urbanised employment the concept of rural polytechnics should be developed to provide training facilities to suit rural economy. It would require integrated approach to develop a curriculum for imparting multifaceted skills related to activities aimed to improve the quality of life in the rural areas. This would also help generate employment in the rural areas and arrest the urban migratory trend. Through the use of mobile units the existing polytechnics could serve as centre of technology for the surrounding rural areas to render monitoring and advisory services and facilities also.

**Female Technicians**

It was apparent that for a number of social as well as cultural barriers there was no parity in the technical training facilities between men and women. In terms of number of institutions it was 4:1 (34:8) and in terms of intake capacity 12:1 (8300:700). It was also observed that the policy of introducing electronics and architecture in most of women polytechnics needed investigation of employability which would become saturated if allowed to expand unplanned. Manpower survey to identify potential
areas for female employment may be undertaken. Such areas may include pharmaceutical, chemical, food, hotel industries and similar occupation which were more suitable to female temperament.

**System Efficiency**

The study rendered information to judge the internal and external efficiencies of the system and matters related to the quality of teaching learning processes.

The teaching learning strategies in the polytechnic institutes was in general based on traditional methods and approaches with little use of modern media and techniques. In most cases lecturing and dictation was the only medium of communication.

There was acute shortage of reading material and textbooks.

There was high dependence on class notes dictated by the teachers.

Laboratory and workshop training lacked relevance to the technician jobs. The training also suffered in quality due to shortage of funds for training material. For almost 40% institutes the training funds were below average. The net allocation of funds gradually decreased over the years. Substantial increase in training material funds was necessary to maintain minimum standard of skill training.

Students evaluation practices indicated need for improvement in the quality of skill testing.

There was a general shortage of teachers in polytechnic institutes with 20-50 % posts remaining vacant. Only 28% of the faculty had pedagogical training or experience. Updating of knowledge of subject matter was considered the priority areas for staff development.
The functioning of National Technical Teachers Training College at Islamabad in 1968 added a new dimension to the technician education system. The role assigned to the college would have its own impact on the qualitative improvement of technician education in due course of time. Three teachers training wings which were established in selected polytechnics in Punjab, Sindh and NWFP needed to be reactivated to develop working linkages with the NTTTC.

The evidently low internal efficiency profile of the system also had its impact on the quality of output from the system and its performance efficiency. Some of the indications were as under:

Only 40% students were able to complete the programme in the prescribed duration of three years.

Fifty six percent of the passouts were able to secure first employment within 6 months of graduation.

Some of the passouts also demonstrated capability for establishing their own business.

The industrial employers criticised about the poor quality of skills possessed by the passouts. In many cases such criticism was a result of unawareness about the objectives of the programme and over expectations.

The passouts also indicated the need to improve the deficient aspects of training to match with the needs of the industries.

Provision of adequate equipment and instructional material for workshops, improvement in the practical skills of teachers and industrial orientation prior to graduation from institutions were some of the areas of the concern expressed by the passouts.

The entire system appeared to be in imperative need for comprehensive evaluation which was never under taken ever since the establishment of the first polytechnic in 1955. The situation rendered the performance of the system as an undetermined dimension.
The evaluation of Revised Curricula was overdue since its introduction about a decade ago, lest it may over live its effective life span due to drastic changes in the industrial requirements. In this context the reversal of the roles between the federal and provincial governments for curriculum and related issues needed due consideration to provide more flexibility to the provincial agencies.

System Management

Various aspects of system efficiency and performance as discussed above were closely linked with the management style of the system of technical education. In the Federal Ministry of Education the management of technical education was vested at a level corresponding to a Deputy Secretary in the Science and Technology Wing. In the provincial Education Department a Section Officer represented the highest level of processing of technical education matters. Thus at both federal and provincial levels there was no separate identity of technical education at higher levels in the secretariat which left the matters with the non professional juniors.

At the next lower levels the Directorates of Technical Education and Boards of Technical Education exercised the administrative and academic control respectively. With limited powers often these organisations proved an additional stage of bureaucracy between the institutions and the government. Further, the Boards though autonomous in nature, depended heavily on positive response from the Directorates in the matter of recognition of institutions, disciplinary actions against students and teachers and conduct of examinations.

There was also no effective mechanism to oversee the performance of the Directorates, Boards and the institutions to judge whether the quality and the number of the technicians produced were in conformity with the objectives of the development plans and programmes. There was also no
flow of information between these organisations on a regular basis. Appropriate management Information System as a tool for effective management and planning was not in existence.

Management structures which varied from single to three tier system virtually remained static over last 20 years despite the phenomenal growth in the number of institutions, increase in the size of enrollment and staff and complexities of operational problems due to changing socio-politico environments. Recent experiments of establishing the Regional Directorates of Technical Education in Punjab and Regional Office of Board of Technical Education in Sindh appeared to be a much needed measure towards decentralisation. These measures along with the performance of federally administered institutions under the board of governors needed to be monitored to study their impact in improving the administrative efficiency of the system. Unless regional officers were given adequate power their existence would add additional administrative steps causing delays.

Technical Education Authority

The plurality of the management system of technical education in the form of Directorates and Boards of Technical Education of which neither was in a position to exert its authority effectively called for a review of the situation. In the general education in addition to regional Directors there was also a Director of Public Instruction who happened to be professional enjoying the powers and status of an administrative secretary. In keeping with the specific nature of technical education and the magnitude of its management and administration it also deserved to be accorded due status.
At the Federal level the Director of NTTTC should be upgraded to a Director General level and all matters pertaining to technical education should be entrusted to the NTTTC which was established to function as a technical arm of the Ministry of Education. In the provinces a Technical Education Authority be created by merging the Directorates and Board of Technical Education. The proposed Authority will be organised in different functional divisions by regrouping the functions of the Boards and the Directorate in to appropriate line and staff organisational setup. The pooling of the expertise and manpower available in both the organisation will enhance the administrative capabilities of the proposed Authority. Besides the Authority shall have adequate powers in the matters of staff and personnel and adequate resources for the planning and implementation of programmes. The institutions may also be given more functional autonomy under Boards of Governors.

A Council of Technical Education at the national level may be set up to act as supreme body to provide the required leadership in planning technical education. The NTTTC may serve as the Secretariat of the Council. A similar set up of National Training Board and Provincial Training Boards was already functioning as a more efficient organisational model for the vocational training institutes in Pakistan.

Cost Benefits and Cost Effectiveness

It was analysed that in terms of cost-benefits the technician training programmes rendered higher social benefits with comparable qualifications in general education. Individuals completing the programme not only enjoyed increased initial earnings but also accelerated enhancement in the emoluments. The abrupt and sometimes apparently unplanned expansion of the institutes was also attributed to the high social demand of programme which needed to be controlled to avoid imbalancing of the system.
In search of cost effective models of training programme it was observed that all the programmes were totally institute based requiring heavy capital outlay. Sandwich type training programmes as a cost-effective mode needed to be experimented. Such programmes have the additional advantage of imparting training in real situation of industrial environment which helped in developing higher proficiency of skills through exposure to industrial practices from an early stage in the training programme.

Another cost-effective measure lies in sharing common facilities by a number of institutes particularly in the case of such laboratories in which expensive equipment was used only for a part of the semester.

**Employers’ Attitude**

The attitude of the employers as the end users of the training programme happened to be the over riding factor in the ultimate acceptability of the programme. It was however observed that the performance of the passouts met severe criticism by the employers, in general. But it was also noted that the situation was not altogether the fault of the educational institutions. The employers also showed little involvement in the training programmes. Industry expected the training institutions to produce fully qualified and job oriented individuals who could make immediate contributions in the production activities. Such expectations were beyond the scope of any broad based training programme even in developed economies. The situation could be corrected by providing the required on-the-job training to the fresh entrants to the industries. The entire situation was a result of gap between training institutions and the industries resulting in the lack of information on manpower profiles. Industrial Advisory Committees needed to be activated to serve as a liaison between the institutes and industry.
The need to provide arrangements for industrial training to the students and passouts had been under consideration ever since the development of technician education programmes had gained tempo. For over a decade a draft of Industrial Training Act was in process. The enactment of the draft needed to be accelerated. But as an immediate via media the Apprenticeship Act 1962 could be amended to include the provisions for the training of polytechnic students and passouts and also the engineering graduates. Graduate Apprenticeship schemes are in force in many industrially developed countries.

Higher Education of Technicians

Formal technician education as a post matric diploma programme of three years duration appeared to branch out as an offset from the main stream of education. Though this is a normal pattern in many of the regional countries, in Pakistan the lack of strong roots of prevocational secondary education and absence of proper linkage with higher education had isolated the technician education from the main system. The programme to introduce prevocational studies in the form of agrotechnical course had to be slowed down due to its prohibitive cost. Further it also needed to be weighed in terms of its expected benefits in improving the quality of entrant to technical institutions. At the output end the diploma programme faced the crisis of identity with the corresponding two year intermediate course which was the only established route to engineering courses. This situation led to the introduction of B.Tech. courses which was a four year programme with alternate layers of industrial training. In spite of a total of seven years post matric technical and industrial education and training the B.Tech. programme was not recognised at par with the engineering.
The situation as described above suggested the restructuring of technical education system by establishing sound roots of pre-vocational courses at the secondary level and reorganising the tertiary level to proceed in blocks of 2 years each consisting of Certificate in Technology (Intermediate level), Bachelor of Technology (Degree level) and Master of Technology (Post graduate level), respectively. The Master of Technology (M.Tech.) with a total of 16 years of education (or six years post matric as in engineering) should be equivalent to engineering degree. In case the 3 years post matric diploma was to continue then it should be eventually linked with a further 3 year post diploma programme to be equated with engineering. The nature of technician occupations at higher level which require continued emphasis on application distinguishes technology from engineering. The higher education of technicians should aim to cater to this requirement of industrial manpower.

In keeping with the distinct nature of occupations of technologists, technicians and craftsmen, all being related to application aspects in contrast to theoretical designing, due consideration may also be given to establish a separate body such as 'Council of Technology' for their registration and recognition.

Research and Evaluation

Research and evaluation appeared to be one of the weakest area of quality improvement in technician education. Some isolated studies were available but their focus was more on the supply led issues pertaining to teaching learning processes, curriculum and physical facilities. There was a total absence of documentation on demand led issues, management styles and performance of passouts and such aspects which could help to determine the external efficiency of the system and its sensitivity to the industrial needs. Tracer studies revealed some trends of
employability, earning potentials, relevance of training to employers' needs and gaps in the training programmes. The situation as above required to strengthen the Boards of Technical Education to undertake action research programmes and studies.

The system also lacked evidence of manpower studies to predict the points at which curriculum revision exercises should be undertaken so that revised or fresh programmes could be introduced to meet the fast changing requirement of high tech era.

The National Technical Teachers Training College required to provide the leadership in integrating the research activities through the Research Centers functioning in the Boards of Technical Education. Technician education being a cost intensive programme needed to be subject to continuous research and evaluation to maximise the returns on investment.

Regional Comparisons

The system of technician education in Pakistan competed favorably with Bangladesh and India which were operating under similar constraints. The system in Pakistan also shared the common concern in matters related to lack of cooperation with industry, insufficient data on microlevel manpower planning, absence of management information system and need for managerial training. However the role of Technical Teachers Training Institutes in India in bringing about a massive quality improvement in the polytechnics programmes offered much for further study in the context of the role of NITTC in Pakistan. Similarly the introduction of 3 years post diploma courses in Bangladesh as a route for the higher education of technicians could serve as a model to resolve the pending issue in this country also.
Conclusions

The critical appraisal of the information obtained through various sources and evidences examined in this study helped to draw following conclusions about the technician education system in Pakistan:

1. The approach of successive governments to education was visible through the changing focus of the educational policies. In general the policies lacked indepth field validation prior to their adoption.

2. Financial allocation for the development of technician education were reasonable compared to its smaller size in the education sector.

3. The utilisation of funds demonstrated varying efficiency indicating the need to improve the utilisation process.

4. The attainments of physical targets during the period of the study was reasonable within the limitations of the system. The highest attainment of target was recorded in the Second Five Year Plan when it was 100 percent.

5. There was apparent need to develop appropriate training programmes to suit the rural economy, to meet the needs of high tech era and for the training of the females.

6. The system indicated the need for improvement in the operational efficiency of teaching learning processes, provision of teachers, student evaluation, provision of T-L resources, and adequate funding for laboratory and workshop instruction.

7. The programmes faced criticism for lack of relevance to the industrial needs.
8. The system lacked efficient management style and also suffered the absence of appropriate management information system.

9. The evaluation of programmes and institutions was overdue. The system was functioning without any set of criteria of success factors to determine the minimum operational efficiency.

10. There was need to adopt cost effective modes of training, such as sandwich programmes and pooling of existing facilities for common sharing.

11. There was imperative need to undertake research in supply and demand related aspects of technician education. The NTTTC was required to exert a coordinating role to integrate the activities of research in the Boards and Directorates of Technical Education.

12. The problem of higher education of technicians needed to be resolved keeping in view the need to develop technical manpower capable of handling jobs requiring high technological competence.

13. The structure of technician education needed to be streamlined to develop proper linkages at entry and exit points.

14. The system of technician education in Pakistan competed favourably with other systems in the region.

15. The plurality of administrative agencies suggested the establishment of an autonomous Technical Education Authority as a more efficient mode of administration of technician education system.

16. The reactivation of Council of Technical Education as national planning body for technical education was needed.
17. The establishment of a Council of Technology was needed to serve as professional body for the registration of craftsmen, technicians and technologists.

18. The development of engineering and technician education needed to be coordinated to remove imbalance and ensure proper ratio between these categories of manpower.

Recommendations

The critical analyses of the problems and issues covered by this study of technical education in Pakistan led to draw the conclusions as stated above. The study further identified a number of areas which required action for improving the system. Some of the aspects of the system which called for planned action related to policy formulation, curriculum design, efficiency of curriculum delivery system, relevance of the programme to the manpower requirements and the management aspects of the system. The actions proposed in the set of recommendation aim to achieve the following objectives of improvement of the system:

1. In terms of quantity and quality the system should develop into a demand led responsive model.
2. The management of the system should be efficient.
3. The system should be cost effective and resource efficient.

The following recommendations have been grouped on a system centered model of input, process and product which was adopted as conceptual framework in organising this study. In conformity with the format adopted in the study the recommendations have been delineated in respect of their applications to improve the input, process or product of the system.
Measures to Improve the Inputs to the System

Students
1. The quality of students seeking admission to technician education programmes should be upgraded through a system of guidance, counselling and admission test.

Faculty
2. The competence of teachers should be upgraded through a well planned staff development programme with due emphasis on content updating and improving the practical skills of teachers.
3. Effective linkages should be developed between the National Technical Teachers Training College and the Teachers Training Wings functioning in the polytechnics. The NTTTC should also organise off campus programmes to increase the participation of local staff.
4. The shortage of teachers should be removed by adopting speedy measures of recruitment and providing better service conditions.

Budget
5. The operating budget of the institutes should be fixed in relation to enrollment and in keeping with the requirements of training material on a realistic basis.

Curriculum
6. The curricula should be revised or designed afresh to reflect the needs of the industry through detail task analysis and job profile.

Equipment
7. Deficiencies in physical facilities in the institutes should be removed through balancing and modernising programme.
Pre-vocational Courses

8. The roots of technical education at secondary level be established through suitable pre-vocational courses which are cost effective also.

Private Institutes

9. System of grant-in-aids to private organisations may be considered on the basis of performance. Development loans may also be provided to establish new institutions.

Measures to Improve the Implementation Processes of the System

Teaching Learning Strategies

10. The teaching learning strategies should be improved by removing the shortage of reading material. Teachers should be trained to use modern methods and media. The NTTTC should undertake to develop instructional material and learning packages.

Student Evaluation

11. The system of students evaluation should be reviewed to lay proper emphasis to assess the attainment of practical skills also.

Sandwich Programmes

12. Sandwich training system as a cost effective mode of training may be given a trial in selected institutes located in the vicinity of industrial areas.

Manual of Standards

13. The Manual of Standard for Polytechnics should be revised to include updated norms of operation, physical facilities, operational policies and practices.

197
14. To reduce dependence on imported equipment an inventory of locally manufactured equipment should be developed.

**System Management**

15. Appropriate infrastructure should be established to develop management information system and database at various levels including Federal Ministry of Education, Provincial Education Departments, Directorates and Boards of Technical Education, respective polytechnic institutes and colleges of technology.

16. Staff should be trained in collecting, analysing, storing, retrieval and dissemination of the information.

17. Flow of information between concerned agencies be established through standardisation of required formats and use of computers.

**System Administration**

18. The establishment of Regional Directorates of Technical Education should be made more purposeful through delegation of powers and responsibilities.

19. The establishment of Regional offices of Boards of Technical education should aim to render speedy service to students and parents in areas away from the Board’s Head Office.

**Technical Education Authority**

20. The establishment of a Technical Education Authority in the provinces should be considered as a long term measure to stream-line the technical education administration.

**Council of Technical Education**

21. The Council of Technical Education should be reactivated as a national planning body for technical education.
Institutional Autonomy

22. Institutions may be placed under Boards of Governors to enjoy greater degree of freedom of operation. On experimental basis selected institutes in each province be placed under BOG.

Management Training

23. Senior staff at institutional, Directorates and Boards levels may be provided administrative and managerial training through bi-lateral assistance programmes, fellowships and study tours of regional countries.

Measures to Improve Demand Led Aspects of the System

Future Development

24. Future development of technician education should be based on a mapping exercise to identify gaps both in content and size of the programme keeping in view the trend of industrial development.

Rural Polytechnics

25. Polytechnic programmes in rural areas should be developed to match the requirements of rural economy and to suit the profiles of rural employment market.

26. Cost effective training modes should be used in the form of mobile units and area polytechnics as centre of technology.

27. The curriculum in rural polytechnics should focus to develop combined and multifaceted skills in the maintenance of rural utility services, repairs to tools and equipment used in agro-based industrial activities and to develop innovative approaches in improving the quality of life.
System Evaluation

28. Evaluation of technician education programmes should be undertaken as periodical activity.

29. The evaluation should encompass all the aspects of the system and its critical success factors.

Manpower Cell

30. A manpower cell may be established in the Federal Ministry of Education and Directorates of Technical Education in the provinces to undertake manpower studies for effective planning of technician education programmes.

Higher Education of Technicians

31. The status of B. Tech. programme may be finalized by maintaining its characteristic as a special form of programme distinct from traditional engineering. Post Diploma short courses may also be designed.

32. A council of Technology may be established as a statutory body for the professional registration of craftsmen, technician and technologist. The body may also ensure the standards of training at the above levels of technical manpower.

Industrial Training

32. Action be expedited for the enforcement of industrial training act.

33. The Apprenticeship Act 1962 may be amended to include provision for the training of students and passouts from the technical and engineering institutes.

Pre-Service Teacher Education

34. National Technical Teachers' Training College, Islamabad, should start courses of B.Ed. Tech. for the pre-service education of teachers.
Restructuring of System

35. As a long term measure the technician education system may be restructured to ensure mobility between various levels by incorporating proper linkages between them.

Problem for Further Study

This study was primarily aimed to examine the objectives and achievements of technician education in Pakistan during 1947-88. An attempt was made to evaluate the achievements critically in terms of efficiency of the processes in the system and its capability to respond to the industrial needs of the country. However, during the conduct of the study a number of related issues of sufficient importance warranting investigation have emerged. They were as follows:

1. Relationship between investment in staff development programmes and the quality of output.
2. Role of regional offices of the Directorates and Boards of Technical Education in enhancing the administrative efficiency of the system.

Yet another important aspect which had also emerged during the study pertained to the determination of specific relationship of technical and vocational education to economic growth. Insipite of the cost intensive factor many regional countries could not resist the temptation of launching massive programmes in pre-vocational studies as panacea for economic prosperity and ready solution for unemployment. The complexity of the situation with many variables warranted further investigation to establish the relationship between investment in technical and vocational education programmes and corresponding growth in the national economy.
A. BOOKS:


**B. JOURNALS AND PERIODICALS:**

Hussain, S. "Pakistan", *Bulletin of the Unesco Regional Office for Education in Asia and Oceania* No. 21, Bangkok: June 1980, pp. 137, 152.


**C. UNPUBLISHED WORKS / REPORTS:**


Chandrakant, L. S. "Methodological Approaches to Planning and Designing Technician Education Systems." mimeograph, Singapore, 1978.


REPORT OF THE SCIENTIFIC RESEARCH AND TECHNICAL EDUCATION COMMITTEE.

The scientific research and Technical Education Committee, appointed by the Pakistan Educational conference met in the committee Room of the office of the Development Board in Block No.44 from 27th to 29th november 1947. The following members were present:—

Dr. Nazir Ahmed.
Dr. M. D. Qureshi.
Dr. Bashir Ahmed.
Mr. Hakim, Ali.
Dr. A.M Sheikh.
Dr. Manek Pithawala
Dr. P. Maheshwari.
K.B.A.G.Khan.
Mr. C.H. Sheikh, Secretary.

Dr. H.K. Gore of the Ministry of Law and Labour (Resettlement and Employment Organisation ) was coopted as a member of the Committee on 28th November 1947.

2. Dr.Qureshi proposed and Dr.Sheikh seconded Dr. Nazir Ahmed's name for the chairmanship of the committee. It was unanimously agreed to.

3. The Chairman stated relevant information and the issues on which our recommendations are required are given in the papers supplied by the education office.

4. Dr. M. D. Qureshi suggested a general discussion on the terms of reference before proceeding to consider the items on the agenda individually. A general discussion ensued in which all the members participated.

5. The committee then took up items 1 and 2 of the agenda together.

6. Dr. Nazir Ahmed said that in regard to these items he should like to put the following issues before the committee:

   1. Whether a survey should be carried out? If so, what should be its objects, scope and mechanism?
   2. Whether the committee would like to suggest any terms of reference for the survey?
   3. Should a Council of Technical Education be set up and if so what should be its composition and functions?

7. The committee recommended that it was necessary that a survey should be carried out of the existing post-matriculate Technological Institutions and suggested that for the present technical schools catering for the artisan or pre-matric classes should not be included. Dr. Nazir Ahmed said that as industry in Pakistan had to be reconstructed and reorganised and properly planned, the committee would perhaps consider it necessary that a survey should be made of the existing higher types of technological institutions in Pakistan with a view to finding out what were their present resources for training pupils in different subjects and what were Pakistan's requirements which were not being met with and whether any of these institutions could be developed for meeting these requirement. After due deliberation the committee resolved to recommend that a special officer should be appointed by the Government of Pakistan Education Department for three months in the first instance, to visit these institutions and collect necessary data.
which should be classified and co-related. The Special Officer should prepare a questionnaires with expert advice and get the replies on the spot from different institutions in the provinces. The officer should include Agricultural Colleges in this survey.

8. The committee unanimously recommended the setting up of a council of Technical education for Pakistan. The council should consist of official and non-official members as follows:

(i) Chairman, to be nominated by the Government.

(ii) Four representatives one from each of the Ministries of Industries, Education, Communication and Agriculture.

(iii) Two members of the constituent Assembly.

(iv) Two representatives of the State acceding to Pakistan elected by themselves by rotation.

(v) Four representatives of Industry and commerce to be nominated by associations from eastern and western Pakistan.

(vi) Two representatives of labour.

(vii) Two Headmasters representing Eastern and Western Pakistan, one each.

(viii) Two principals of Technical Institutions in Eastern and Western Pakistan one for each.

(ix) One representative of each of three Universities.

(x) Two nominees to be appointed by the Government to represent any other interest.

(xi) One representative from each of the provincial governments, West Punjab, Sindh, N.W.F.P., and East Bengal.
9. The following should be the objects of the Council:—

1. To advise the Government of Pakistan on matters relating to the advancement of Technical Education at all stages.

2. To survey the existing facilities for technical education in Pakistan, especially in the higher stages and suggest ways and means of making up the deficiencies in as short a time as possible resulting from the partition of India.

3. To prepare a comprehensive scheme for the reorganisation and development on modern lines of Technical education in all its aspects suited to the economic needs of the country and the peculiar genius of the people of Pakistan.

4. To draw up a five years scheme for the training of scholars at home and abroad in technical subjects and suggest ways and means of implementing that scheme.

10. The Committee then took up the question of the continuance of the overseas scholarship Scheme for the year 1948-49. A good deal of discussion, touching several aspects of the overseas training scheme took place and keen interest was evinced by all the members in the scheme. While the consensus of opinion was in favour of the continuance of the overseas scholarship scheme it was considered desirable that the question should be examined in the light of the data which is being collected with regard to the needs and deficiencies of the central and provincial Government and Universities by the scientific Man-power committee appointed by the Government of Pakistan. The committee therefore, suggested that:—

(1) The needs of the various Government, Central, Provincial and states should be ascertained afresh in view of the situation created by the partition of India, and
(ii) That the question of making fresh awards should be entrusted for careful examination to an ad-hoc committee, consisting predominantly of experts and representatives of Government Department; that similar committee be set up in the provinces and states for the purpose.

11. As regards those scholars who had been selected but had not so far proceeded abroad for training, the committee suggested that in view of the changed circumstances arising out of the partition of the country, their cases should individually be referred to the sponsoring departments with a view to making such readjustments in their subjects as were possible to suit the requirements of the Government. The committee thought it essential that the best use should be made of these technically trained scholars after their return and for this purpose they suggested that the Education Division should prepare a 'Career follow-up' card for each scholar and that details of such scholars as might be surplus to the needs of the Government department should be circulated to universities Technical Institutions, Chambers of Commerce and other private bodies well in advance of their arrival in Pakistan, with a view to their employment in suitable posts.

12. In view of the difficulties experienced by overseas scholars in getting factory training, the committee recommend that Government agencies, while placing orders for machinery or for supplies in foreign countries, should embody in the terms of contract a condition to the effect that a certain number of students would be trained in these countries.

13. As regards the subjects for which scholarships should be awarded, the committee felt that an ad-hoc committee should consider them in the light of the needs of the Government Departments.
14. The committee also thought that the question of the communal quota should be determined according to the policy of the Government of Pakistan, provided that suitable persons were available.

15. As regards the selection of scholars for overseas training in the future, the committee were of the opinion that it should be done by the public services commission, and that in order to get the best results, the following procedure should be followed:

Qualifications for the candidates should be prescribed by the departments concerned in consultation with the ad-hoc committee. Applications should be received by the Public Services Commission who will select candidates for interview in consultation with the department concerned and the ad-hoc committee. The final selection should be made by the public service commission jointly with one representative of the Department and one of the ad-hoc committee.

16. The committee was of opinion that an immediate survey should be carried out of the existing post matriculate technical institutions in Pakistan in the manner suggested above (part 7) to find out which of these institutions could be immediately developed to fulfill the needs of imparting technical education in those branches of technology for which facilities did not exist as a result of partition. If as a result of this survey, it was found that new technical institutions for specialised branches of technology were necessary, immediate steps should be taken by the Government to draw up schemes with the help of the Expert Committee (part 11 above) for such institutions which should be established at an early date. In the meantime the deficiencies in technical personnel in specialised branches of technology should be made up by continuing the overseas scholarship scheme which should be re-modelled in the light of the changed conditions with
the help of the Expert Committee. The committee, however wished to make it quite clear that the Overseas Scholarship Scheme could only be regarded as a temporary palliative and that the real remedy for providing technical personnel in different kinds and at different levels of technology lay in the establishment of full fledged technical institutions in Pakistan. In this connection the committee desired especially to bring to the notice of the Government the deficiencies in the following branches of technology and engineering and commended that steps should immediately be taken for the removal of these deficiencies either by the expansion of the existing institutions or by setting up new institutions with special emphasis on—

1. Mining Engineering and Petroleum Engineering.
2. Marine Engineering.
3. Chemical Engineering and Technology.
5. Aeronautics.
6. Textile Technology.

17. The committee was of opinion that the Pakistan Government should make every effort to promote (a) fundamental, as well as (b) scientific and industrial research in Pakistan.

18. Fundamental research being primarily the concern of Universities and other educational and research institutions should be organised by the Education Departments of the central and provincial Governments. The committee wished to point out that the existing facilities for fundamental research in Pakistan were inadequate, and must, therefore, be strengthened and
expanded immediately by adopting the following measures:-
(a) making adequate research grants to various universities and institutions engaged in fundamental research;
(b) instituting research Fellowship and scholarships;
(c) appointing eminent scientists, if necessary, from outside, for guiding research, and
(d) by providing facilities to scientific staff of the existing scientific and research institutes to go abroad and obtain specialised training in research.

19. With regard to the promotion of scientific and industrial research, the committee recommended that a Council of Scientific and Industrial Research should be set up by the Central Government with the object of promoting, fostering, planning, financing and supervising scientific and industrial research with a view to utilising the economic resources of the country to the fullest possible extent.

20. As scientific and industrial research hinged on all aspects of life and concerned various Ministries of the Government it was suggested that the council be attached to the Hon'ble the Prime Minister's Department and that its composition and constitution should be worked out by an ad-hoc committee of experts.

21. The committee was of opinion that the proposed Council of Scientific and Industrial Research, soon after its establishment should draw up plans for the establishment of National Laboratories and Technical Institutes in Pakistan.

Extracts from the Report of Technical Education Committee

Council of Technical Education was set up in June, 1948. The Technical Education Committee of the Council in its report suggested a plan for development at various levels and categories of technical and vocational manpower. According to the Committee report, the plan of technical education to be evolved must provide:

i) A sound foundation on which the super-structure of technical education is to be built up.

ii) Technical bias during the secondary stage of education.

iii) Facilities for pursuing on completion of secondary stage a technical course with a strong practical bias.

iv) The technical degree course embodying provision for basic course, specialization course and an honours course.

v) Facilities for the production of skilled technicians, semi-skilled workers and entrepreneurs for small scale industries.

vi) Opportunities for part-time course.

Such a plan, it was felt, would cover the entire ground for production of technical personnel of all essential categories like:

i) Factory executives.

ii) Technical specialists.

iii) Supervisory technical personnel.

iv) Skilled technicians, semi-skilled workers and entrepreneurs.

The committee discussed in detail as under the role of polytechnic institutes in the industrialization process:

"The degree colleges, university departments and the research institutes can provide training facilities for the first two categories of personnel i.e. the factory executives and the specialists. The next very important category is of the supervisory personnel. Though this category of personnel is of a much lower standard than the first two, we refer to them as "very important" as the speed and quality of production entirely depends upon them. They form the link between the workers and the management. They have to provide the 'know how' of production. They must be capable of guiding and controlling labour. They must have the quality of judging the capability and capacity of the workmen under them and should have the ability of creating such conditions as to make it possible to get the maximum efficiency. To quote Mr. Abbott, 'This supervisory grade personnel ought to have sufficient knowledge and intelligence to understand the instruction of the former (management) and sufficient powers of expression to communicate and interpret them to the latter (operatives). At the same time they should have sufficient practical skill to earn the respect and confidence of the operatives whose work they direct, control and supervise.'

"Such a type of personnel cannot be fully trained in any institution. The qualities required by the efficient foremen and supervisors in factories can only be achieved by experience. But the process of achieving these qualities can be shortened by providing suitable training facilities. Intelligent young men, if properly trained, can easily make efficient supervisors. Frequently with sound education and proper experience they rise even to higher executive positions. Under the present arrangements, the diploma course of the engineering college and one or two other institutions only provide technical education for this category. Again, these courses are limited to general engineering branches only. The students coming out of the institution usually seek employment in Government departments and very few are engaged in industry. Actually industries are to a certain extent not inclined to absorb them straightway without experience or without training in that particular branch of industry. The blame neither lies with the industry nor with the student."
"In our opinion it must be laid at the door of the system of education which provides only a meager scope for training. It is but natural that the general cadre of students cannot dream of getting anything higher and has to make the best of whatever facilities are provided. Similarly, employers cannot be expected to employ insufficiently trained candidates just because there are no facilities for proper training. Now that the demand for technicians, particularly of the most important category, the supervisory personnel, is increasing, immediate steps should be taken to establish institutions to provide a variety of courses to satisfy the needs of different industries.

"We recommend polytechnics as the best type of institutions for training this category of personnel, and these should be established at the earliest possible opportunity. Polytechnics should impart technical education up to diploma standard in branches of engineering and technologies depending upon the type of industries existing and contemplated in the particular region. The type of training should not be general in character, but of a particular level of employment in the industry on entry. The standard of teaching may be gradually raised from the diploma to degree standard if circumstances require. Boys completing the secondary education from technical high schools should be admitted to these courses. Until a sufficient number of technical high schools are established, students completing the general high school's courses may also be admitted. The duration of the courses in general should be of three years with one year's compulsory practical training in an industrial concern.

"Taking into consideration the plans for development of industries and the number of industries, existing and anticipated, within the next five years, we feel that at least three polytechnics will be required for producing the minimum number of supervisory personnel required".

About the vocational training requirements the Report said:

"The fourth category covers the class of workers called "skilled workers" most of whom will not aspire to executive positions. Such personnel require training in single occupation and are usually employable in large scale industries. For the training of such personnel, we recommend the establishment of trade schools. In such schools
real trade experience will be given. Students completing the course in such schools will require a short training in industry itself to adjust themselves to factory conditions. This type of worker should have sufficient education to understand clearly the working of machines and tools as he will be required to perform operations in an intelligent way and to achieve a high standard of precision. We recommend that the admission standard to the trade school should be completion of the present middle stage i.e seven years of education. The duration of the trade school course should be three years inclusive of one years training under factory conditions.

"For the training of semiskilled workers for industry generally and for entry into small-scale industries, we recommend the establishment of "Artisan Classes". Students after completion of the primary stage of education will be admitted to these classes. We would have deemed it more proper to recommend the technical training for preparing workers of this category should commence at a more advance age than 11 years and a higher educational standard viz. the middle stage, but in view of the low standard of living of our people we are forced to keep the standard of admission low."

"Artisan Classes should impart training in such crafts only as are in vogue and in demand in the locality. The duration of such classes will vary according to the vocation and standard required in the locality."
<table>
<thead>
<tr>
<th>COMPONENT - I</th>
<th>Period</th>
<th>Paper</th>
<th>Final</th>
<th>Internal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week</td>
<td></td>
<td>Exam.</td>
<td>Eval.</td>
</tr>
<tr>
<td>1. English - I</td>
<td>3</td>
<td>1</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>2. (a) Urdu-I/Sindhi-I/Gujrati-I</td>
<td>2</td>
<td>1</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>(b) Sales Sindhi-I/Sales Urdu-I</td>
<td>2</td>
<td>1</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>(Mon another tongue)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geography of Pakistan-I</td>
<td>4</td>
<td>1</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>(for foreigners)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Islamiat (for muslim)</td>
<td>2</td>
<td>1</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>Civic (for non muslim)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| COMPONENT-II                     |       |       |       |          |
|                                  |       |       |       |          |
| 1. Mathematics-I                 |       |       |       |          |
| (a) Arithmetic                   | 2      | 1     | 50    | 25       |
| (b) Algebra and Geometry         | 2      | 1     | 100   | 50       |
| 2. Science-I (Physics and Chemistry) | 4     | 1     | 100   | 50       |

| COMPONENT-III                    |       |       |       |          |
| 1. Technical Drawing             | 4      | 1     | 100   | 30       |
| 2. Trade Theory                  | 4      | 1     | 100   | 30       |
| 3. Trade Practical               | 18     | 2     | 300   | 100      |

| COMPONENT - Y                    |       |       |       |          |
| (Compulsory Non-Exe)             | 15 minutes daily before first period Physical Education | | |
## TECHNICAL SCHOOL CERTIFICATE PART - II

### MARKS

<table>
<thead>
<tr>
<th>Component</th>
<th>Period</th>
<th>Paper</th>
<th>Final Exam</th>
<th>Internal Eval.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. English-II</td>
<td>4</td>
<td>1</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>2. (a) Urdu-II/Sindhi-II/Gujarati-II</td>
<td>2</td>
<td>1</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>(b) Sales/Sindhi-II/Sales Urdu-II (Non Mother Tongue)</td>
<td>2</td>
<td>1</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geography of Pakistan-II (for foreigners)</td>
<td>4</td>
<td>1</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>3. Pakistan Studies</td>
<td>2</td>
<td>1</td>
<td>50</td>
<td>25</td>
</tr>
</tbody>
</table>

### Component II

<table>
<thead>
<tr>
<th>Component</th>
<th>Period</th>
<th>Paper</th>
<th>Final Exam</th>
<th>Internal Eval.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mathematics-II</td>
<td>4</td>
<td>1</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>2. Science-II</td>
<td>3</td>
<td>1</td>
<td>75</td>
<td>35</td>
</tr>
<tr>
<td>(a) Physics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Chemistry</td>
<td>3</td>
<td>1</td>
<td>75</td>
<td>35</td>
</tr>
</tbody>
</table>

### Component III

<table>
<thead>
<tr>
<th>Component</th>
<th>Period</th>
<th>Paper</th>
<th>Final Exam</th>
<th>Internal Eval.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Technical Drawing-II</td>
<td>4</td>
<td>1</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>2. Trade Theory-II</td>
<td>4</td>
<td>1</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>3. Trade Practical-II</td>
<td>2</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

### Component IV

(Compulsory Non-Examination) 15 minutes daily before subjects Physical Education First Period

Source: Sindh Board of Technical Education
## Appendix D

**DIPLOMA OF ASSOCIATE ENGINEER CURRICULUM - 1980**

**CURRICULUM OUTLINES**

**FIRST YEAR COURSE**

This is a preparatory course, designed for graduates of secondary schools who have not had sufficient training in vocational skills upon which to base (d) their training as technicians. This first year course is required of students in all specialized fields except chemical technology and the diploma course in architecture. While some of the first year subjects are required in these fields, their special requirements make specialization from the first year necessary.

### First Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Hours</th>
<th>T.</th>
<th>P.</th>
<th>C.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 113</td>
<td>Electricity and Magnetism</td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Math. 113</td>
<td>Mathematics I</td>
<td></td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Sc. 113</td>
<td>Applied Science I</td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Drg. 113</td>
<td>Drawing I</td>
<td></td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Shop. 113</td>
<td>Wood Work</td>
<td></td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 112</td>
<td>English</td>
<td></td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Shop 132</td>
<td>Welding</td>
<td></td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>or</td>
<td>C.T. 122 Building Materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Second Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Hours</th>
<th>T.</th>
<th>P.</th>
<th>C.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 122</td>
<td>Basic Electricity</td>
<td></td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Math. 123</td>
<td>Mathematics II</td>
<td></td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Sc. 123</td>
<td>Applied Science II</td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Drg. 123</td>
<td>Drawing II</td>
<td></td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Shop. 143</td>
<td>Metalwork</td>
<td></td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Shop. 123</td>
<td>Foundry</td>
<td></td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>or</td>
<td>C.T. 112 Surveying I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mgm. 122</td>
<td>Occupational Guidance</td>
<td></td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Mgm. 131</td>
<td>Social Guidance</td>
<td></td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

---

* T : Theory       P : Practical       C : Credit Hour,

---

# CIVIL TECHNOLOGY CURRICULUM

## SECOND YEAR

**First Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 214</td>
<td>Construction I</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 222</td>
<td>Estimating I</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 232</td>
<td>Plumbing</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 243</td>
<td>Building Drawing</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 253</td>
<td>Surveying II</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 263</td>
<td>Strength of Materials</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 211</td>
<td>Reporting Writing</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Second Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 273</td>
<td>Structural Drawing</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 283</td>
<td>Elementary Theory of Structure</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 293</td>
<td>Estimating II</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 2A3</td>
<td>Hydraulics</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 284</td>
<td>Water Supply</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 2C2</td>
<td>Materials testing</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Mgm. 221</td>
<td>Public works Account &amp; Forms</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

## THIRD YEAR

**First Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 313</td>
<td>Construction II</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 322</td>
<td>Estimating III</td>
<td>0</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 334</td>
<td>Surveying III</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 344</td>
<td>Highways and Air Ports</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 354</td>
<td>R.C.C. Design</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 362</td>
<td>House Planning</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

**Second Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 374</td>
<td>Irrigation and Pumps</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 384</td>
<td>Railways, Docks &amp; Harbours</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 393</td>
<td>Sewerage and Sewage treatment</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 3A3</td>
<td>Civil Engg. Eqpt. and Plants</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 3B3</td>
<td>Civil Engineering Project</td>
<td>0</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 331</td>
<td>Safety Practices</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

---

228
# ELECTRICAL TECHNOLOGY CURRICULUM

## SECOND YEAR

### First Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 215</td>
<td>Electrical Circuits I</td>
<td>3 6 5</td>
</tr>
<tr>
<td>E.T. 223</td>
<td>Electrical Wiring</td>
<td>1 6 3</td>
</tr>
<tr>
<td>P.T. 273</td>
<td>Heat Engines</td>
<td>2 3 3</td>
</tr>
<tr>
<td>Sc. 233</td>
<td>Applied Mechanics</td>
<td>2 3 3</td>
</tr>
<tr>
<td>M.T. 213</td>
<td>Machine Drawing I</td>
<td>1 6 3</td>
</tr>
<tr>
<td>Math. 222</td>
<td>Mathematics III</td>
<td>2 0 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>11 24 19</strong></td>
</tr>
</tbody>
</table>

### Second Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 235</td>
<td>Electrical Circuits II</td>
<td>3 3 5</td>
</tr>
<tr>
<td>E.T. 243</td>
<td>Electrical Lighting</td>
<td>2 3 3</td>
</tr>
<tr>
<td>E.T. 254</td>
<td>Electrical Machining I</td>
<td>2 6 4</td>
</tr>
<tr>
<td>E.T. 263</td>
<td>Elect. Instruments &amp; Measurements I</td>
<td>2 3 3</td>
</tr>
<tr>
<td>Shop 213</td>
<td>Machine Shop practice</td>
<td>1 6 3</td>
</tr>
<tr>
<td>Math. 241</td>
<td>Basic Psychology and Personality Development</td>
<td>1 0 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>11 24 19</strong></td>
</tr>
</tbody>
</table>

## THIRD YEAR

### First Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 315</td>
<td>Electrical Machine II</td>
<td>3 5 5</td>
</tr>
<tr>
<td>E.T. 323</td>
<td>Electrical Appliances</td>
<td>2 3 3</td>
</tr>
<tr>
<td>E.T. 333</td>
<td>Elec. Instruments &amp; Measurements II</td>
<td>2 3 3</td>
</tr>
<tr>
<td>E.T. 345</td>
<td>Generation, Transmission and</td>
<td>3 6 5</td>
</tr>
<tr>
<td></td>
<td>Distribution of Elec. Power</td>
<td></td>
</tr>
<tr>
<td>Mgm. 252</td>
<td>Practical Business English</td>
<td>2 0 2</td>
</tr>
<tr>
<td>P.T. 3A3</td>
<td>Hydraulics &amp; Hydraulic Machines</td>
<td>1 3 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>13 21 20</strong></td>
</tr>
</tbody>
</table>

229
### Second Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 354</td>
<td>Electrical Equipment, Maintenance &amp; Repairs</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>E.T. 364</td>
<td>Switchgear &amp; Protective Devices</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>E.T. 373</td>
<td>Electrical Installation Planning &amp; Estimating</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>R.T. 3D5</td>
<td>Elements of Electrical Communication</td>
<td>3</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Mgm. 363</td>
<td>Business Management and Accounting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>24</td>
<td>19</td>
</tr>
</tbody>
</table>

---

### MECHANICAL TECHNOLOGY CURRICULUM

#### SECOND YEAR

### First Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.T. 213</td>
<td>Machine Drawing I</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>M.T. 221</td>
<td>Safety Practices &amp; Procedures</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>M.T. 232</td>
<td>Elementary Metallurgy</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Shop 213</td>
<td>Machine Shop Practices</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Math. 233</td>
<td>Applied Maths</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 274</td>
<td>General Electricity</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>P.T. 273</td>
<td>Heat Engines</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>21</td>
<td>19</td>
</tr>
</tbody>
</table>

### Second Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.T. 243</td>
<td>Machine Drawing II</td>
<td>1</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>M.T. 252</td>
<td>Production Methods</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>M.T. 273</td>
<td>Metallurgy and Heat Treatment</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>M.S. 224</td>
<td>Advance machine Shop Practice</td>
<td>1</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>F.T. 233</td>
<td>Pattern Making</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Sc. 233</td>
<td>Applied mechanics</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 241</td>
<td>Basic Psychology and Personality Development</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>27</td>
<td>19</td>
</tr>
</tbody>
</table>

---

230
### Third Year

**First Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.T. 3C4</td>
<td>Fundamentals of Machine Design</td>
<td>3 3 4</td>
</tr>
<tr>
<td>M.T. 324</td>
<td>Tools Design &amp; Tool Making I</td>
<td>2 6 4</td>
</tr>
<tr>
<td>M.T. 331</td>
<td>Technical Report Writing</td>
<td>2 0 1</td>
</tr>
<tr>
<td>Shop 312</td>
<td>Advanced Foundry Practice</td>
<td>1 3 2</td>
</tr>
<tr>
<td>Shop. 322</td>
<td>Advanced Welding Practice</td>
<td>1 3 2</td>
</tr>
<tr>
<td>P.T. 3A2</td>
<td>Hydraulics &amp; Hydraulic Machines</td>
<td>1 3 2</td>
</tr>
<tr>
<td>Mgm. 363</td>
<td>Business management &amp; Accounting</td>
<td>2 3 3</td>
</tr>
</tbody>
</table>

**Second Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.T. 344</td>
<td>Materials Testing and Inspection Techniques</td>
<td>2 6 4</td>
</tr>
<tr>
<td>M.T. 353</td>
<td>Tool Design and Tool Making</td>
<td>2 3 3</td>
</tr>
<tr>
<td>M.T. 362</td>
<td>Production Planning</td>
<td>1 3 2</td>
</tr>
<tr>
<td>M.T. 373</td>
<td>Production Planning</td>
<td>1 3 2</td>
</tr>
<tr>
<td>Shop. 332</td>
<td>Metal and Wood Finishing</td>
<td>1 3 2</td>
</tr>
<tr>
<td>M.T. 383</td>
<td>Materials and Processes</td>
<td>3 0 3</td>
</tr>
<tr>
<td>Mgm. 372</td>
<td>Industrial Management and Human Relations</td>
<td>2 0 2</td>
</tr>
</tbody>
</table>

---

Total Credits: 11 21 18

Total Credits: 12 21 9
### Appendix E

**CURRICULA AND SCHEME OF COURSES**

*First Year Common Preparatory Courses*

**First Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Subject</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mgm. 112</td>
<td>English - I</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>E.T. 11</td>
<td>Electricity and Magnetism</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Math. 113</td>
<td>Maths - I</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Sc. 113</td>
<td>Applied Science (Physics)</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Drg. 113</td>
<td>Drawing - I</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Shop. 113</td>
<td>Wood Work</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 121</td>
<td>Social guidance</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Shop. 113</td>
<td>Welding</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 122</td>
<td>Building Materials</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

(for C.T. Students only)  Total 14 24 22

**Second Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Subject</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 122</td>
<td>Basic Electrical Wiring</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Math. 123</td>
<td>Maths - II</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Sc. 123</td>
<td>Applied Science - II (Chemistry)</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Drg. 123</td>
<td>Drawing - II</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Shop. 143</td>
<td>Metal Work</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 142</td>
<td>English - II</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Mgm. 131</td>
<td>Occupational Guidance</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Shop. 122</td>
<td>Foundry</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 112</td>
<td>Surveying</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

(for C.T. students only)  Total 15 30 52

**Source**: DAE Curricula, West Pakistan Board of Technical Education, 1970.
## CIVIL TECHNOLOGY

### SECOND YEAR

#### Third Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 213</td>
<td>Hydraulics</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 222</td>
<td>Estimating - I</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 232</td>
<td>Plumbing</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 244</td>
<td>Building Drawing &amp;</td>
<td>1</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Blue Printing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.T. 252</td>
<td>Material Testing</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 253</td>
<td>Strength of Materials</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 211</td>
<td>Report Writing</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Mgm. 211</td>
<td>P.W. Accounts Forms</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total** 10 24 18

#### Fourth Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 273</td>
<td>Structural Drawing</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 283</td>
<td>Elementary Theory of Structures</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 293</td>
<td>Estimating - II</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 2A4</td>
<td>Construction - I</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 2B4</td>
<td>Water Supply</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 2C4</td>
<td>Surveying - II</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total** 10 27 19

### THIRD YEAR

#### Fifth Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 314</td>
<td>Construction II</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Civil Engg. Eqpt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.T. 322</td>
<td>Estimating III</td>
<td>0</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 335</td>
<td>Survey III</td>
<td>3</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>C.T. 342</td>
<td>House Planning</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 354</td>
<td>Railway, Docks &amp; Harbours</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>M.T. 221</td>
<td>Safety Practices &amp; Procedures</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>C.T. 381</td>
<td>Irrigation Drawing</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total** 12 21 19
<table>
<thead>
<tr>
<th>Sixth Semester</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 364</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 373</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 383</td>
<td>0</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 394</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 3A4</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>11</td>
<td>21</td>
<td>18</td>
</tr>
</tbody>
</table>

**ELECTRICAL TECHNOLOGY**

**SECOND YEAR**

<table>
<thead>
<tr>
<th>Third Semester</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 235</td>
<td>3</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>E.T. 243</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 254</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>E.T. 263</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Shop. 213</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 211</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>11</td>
<td>24</td>
<td>19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fourth Semester</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 276</td>
<td>4</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>E.T. 283</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 293</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 2A5</td>
<td>3</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Mgm. 223</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>13</td>
<td>21</td>
<td>20</td>
</tr>
</tbody>
</table>

**THIRD YEAR**

<table>
<thead>
<tr>
<th>Fifth Semester</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 315</td>
<td>3</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>E.T. 323</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 333</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 345</td>
<td>3</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>R.T. 303</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 331</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>13</td>
<td>21</td>
<td>20</td>
</tr>
</tbody>
</table>
### Sixth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.T. 354</td>
<td>Electrical Equipment Maintenance &amp; Repairs</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>E.T. 364</td>
<td>Switchgear and Protective Devices</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>E.T. 373</td>
<td>Electrical Instruments and Planning and Estimating</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>R.T. 3E3</td>
<td>Industrial Electronics</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>M.T. 233</td>
<td>Hydraulics and Hydraulic Machines</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Mgm. 313</td>
<td>Business Management and Accounting</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total** 11 24 19

---

### MECHANICAL TECHNOLOGY

### SECOND YEAR

### Third Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.T. 213</td>
<td>Machine Drawing - I</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>M.T. 221</td>
<td>Safety Practices &amp; Procedures</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>M.T. 223</td>
<td>Heat engines</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Math 214</td>
<td>Applied Mathematics</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Shop. 224</td>
<td>Machine Shop Practice</td>
<td>1</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>E.T. 274</td>
<td>General Electricity</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Mgm. 211</td>
<td>Basic Psychology and Personality Development</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total** 12 24 20

---

### Fourth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.T. 242</td>
<td>Elementary Metallurgy</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>M.T. 253</td>
<td>Machine Drawing - II</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>M.T. 262</td>
<td>Production Methods</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Sc. 213</td>
<td>Applied Mathematics</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Shop. 234</td>
<td>Advanced Machine Shop Practice</td>
<td>1</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Shop. 243</td>
<td>Pattern Making</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 322</td>
<td>Industrial Management and Human Relations</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total** 10 27 19

235
## THIRD YEAR

### Fifth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Total Design &amp; Tool Making-I</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.T. 314</td>
<td></td>
<td>2</td>
<td>6</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>M.T. 325</td>
<td></td>
<td>Applied Thermodynamics</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>M.T. 332</td>
<td></td>
<td>Hydraulics an Hydraulic</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Shop. 312</td>
<td></td>
<td>Advanced Foundry Practice</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Shop. 322</td>
<td></td>
<td>Advanced Welding Practice</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Mgm. 331</td>
<td></td>
<td>Report Writing</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Mgm. 313</td>
<td></td>
<td>Business Management and</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accounting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>12</td>
<td>21</td>
<td>19</td>
</tr>
</tbody>
</table>

### Sixth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Fundamentals of Machine Design</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.T. 345</td>
<td></td>
<td>4</td>
<td>3</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>M.T. 352</td>
<td></td>
<td>Material Testing</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>M.T. 362</td>
<td></td>
<td>Industrial Planning</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>M.T. 373</td>
<td></td>
<td>Production Project</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>M.T. 383</td>
<td></td>
<td>Tool Design &amp; Tool Making-II</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>M.T. 392</td>
<td></td>
<td>Heat Treatment</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Shop. 332</td>
<td></td>
<td>Metal and Wood Finishing</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total** 11 24 19
### D.A.E. REVISED SCHEME

#### CIVIL TECHNOLOGY

#### FIRST SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths. 113</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Gen. 113</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Gen. 121</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>C.T. 112</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 123</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 143</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 112</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 134</td>
<td>1</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL** 24

#### SECOND SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths. 213</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Gen. 212</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Gen. 221</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>C.T. 214</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 244</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 233</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>C.T. 224</td>
<td>1</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL** 21
### THIRD SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths. 313</td>
<td>Applied Mathematics III</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>S.G. 313</td>
<td>Applied Science</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 313</td>
<td>Quantity Surveying I</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>C.T. 323</td>
<td>Civil Drafting III</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>C.T. 333</td>
<td>Strength of Materials</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 351</td>
<td>Safety Practices</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>C.T. 311</td>
<td>Islamiat &amp; Pak. Studies III</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>C.T. 344</td>
<td>Construction II (C.P.)</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

**TOTAL:** 21

Source: Attendance and Promotion Rules, for DAE Examinations, Day/Evening Session Programmes, Sindh Board of Tech. Educ. 1982.

### CIVIL TECHNOLOGY

### FOURTH SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 414</td>
<td>Hydraulics</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>C.T. 432</td>
<td>Water Supply</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>C.T. 443</td>
<td>Quantity Surveying II</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>C.T. 453</td>
<td>Theory of Structures</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 463</td>
<td>Project Management I</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Gen. 411</td>
<td>Islamiat &amp; Pak. Studies IV</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>C.T. 425</td>
<td>Surveying III</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

**TOTAL:** 21

### FIFTH SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 513</td>
<td>Quantity Surveying III</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>C.T. 524</td>
<td>Concrete Technology</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>C.T. 553</td>
<td>Bridge Engineering</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 563</td>
<td>Soil Mechanics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 563</td>
<td>Project Management II</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Gen. 511</td>
<td>Islamiat &amp; Pak. Studies V</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>C.T. 534</td>
<td>Construction III</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

**TOTAL:** 21

238
## SIXTH SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.T. 615 R.C.C. Design</td>
<td>3</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>C.T. 633 Railway, Docks &amp; Harbour</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 643 Sanitary Engineering</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>C.T. 654 Irrigation Engineering</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>C.T. 625 Highway, Airports &amp; Traffic Engg.</td>
<td>3</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Gen. 611 Islamiat &amp; Pak. Studies VI</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>C.T. 661 Civil Engg. Project</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL** 22

---

## D.A.E. REVISED SCHEME

### ELECTRICAL TECHNOLOGY

## FIRST SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths. 113 Applied Maths. I</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Gen. 112 English I</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Gen. 121 Islamiat &amp; Pak. Studies I</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>E.T. 113 Basic Elect. &amp; Circuits I</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 122 Electrical Materials</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>E.T. 132 Electrical Drawing I</td>
<td>0</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>E.T.S.H.147 Elect. Workshop Practice I (C.P)</td>
<td>1</td>
<td>18</td>
<td>7</td>
</tr>
</tbody>
</table>

**TOTAL** 18

## SECOND SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths. 213 Applied Maths. II</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Gen. 212 English II</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Gen. 221 Islamiat &amp; Pak. Studies II</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>E.T. 214 Basic Elect. &amp; Circuits II</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>E.T. 222 Electrical Drawing II</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>E.T.S.H.237 Elect. Workshop Practice II (CP)</td>
<td>1</td>
<td>18</td>
<td>7</td>
</tr>
</tbody>
</table>

**TOTAL** 19

---

239
### THIRD SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths. 313</td>
<td>Applied Maths. III</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Gen. 311</td>
<td>Islamiat &amp; Pak. Studies III</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Sc. 313</td>
<td>Applied Science</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 323</td>
<td>Elec. Instruments &amp; Measurements I</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 334</td>
<td>Polyphase A.C. Circuits</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>E.T. 344</td>
<td>Utilization of Electric Energy</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>E.T 314</td>
<td>D.C. Machines (C.P.)</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>22</td>
</tr>
</tbody>
</table>

### FOURTH SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sc. 413</td>
<td>Applied Maths. III</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mgm. 413</td>
<td>Islamiat &amp; Pak. Studies III</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Gen. 411</td>
<td>Applied Science</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>E.T. 423</td>
<td>Elec. Instruments &amp;</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>E.T. 433</td>
<td>Polyphase A.C. Circuits</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 444</td>
<td>Utilization of Electric Energy</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 416</td>
<td>Utilization of Electric Energy</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>23</td>
</tr>
</tbody>
</table>

### FIFTH SEMESTER

<table>
<thead>
<tr>
<th>COURSE</th>
<th>T.</th>
<th>P.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MGM. 511</td>
<td>Report Writing</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Gen. 511</td>
<td>Islamiat &amp; Pak. Studies V</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>E.T. 515</td>
<td>A.C.Machines II</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>E.T. 544</td>
<td>Telecommunications</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E.T. 552</td>
<td>Safety Practices</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>E.T. 524</td>
<td>Installation Planning/Estimation(CP)</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>
# SIXTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>TPMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>MGM. 613 Industrial Management and Human Relations</td>
<td>3 0 3</td>
</tr>
<tr>
<td>Gen. 611 Islamiat &amp; Pak.Studies-VI</td>
<td>1 0 1</td>
</tr>
<tr>
<td>E.T. 613 Industrial Electronics</td>
<td>2 3 3</td>
</tr>
<tr>
<td>E.T. 625 Switchgear &amp; Protective Devices</td>
<td>3 6 5</td>
</tr>
<tr>
<td>E.T. 643 Traction</td>
<td>2 3 3</td>
</tr>
<tr>
<td>E.T. 636 Repair &amp; Maint.of Elect.Equip.(CP)</td>
<td>2 12 6</td>
</tr>
</tbody>
</table>

**TOTAL** 21

# D. A. E. REVISED SCHEME

MECHANICAL TECHNOLOGY

# FIRST SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>TPMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen. 112 English</td>
<td>2 0 2</td>
</tr>
<tr>
<td>Gen. 121 Islamiat &amp; Pak. Studies I</td>
<td>1 0 1</td>
</tr>
<tr>
<td>Maths. 133 Applied Mathematics I</td>
<td>3 0 3</td>
</tr>
<tr>
<td>M.T. 112 Safety Practices and Procedure</td>
<td>2 0 2</td>
</tr>
<tr>
<td>M.T. 124 Basic Engg. Drawing</td>
<td>1 9 4</td>
</tr>
<tr>
<td>M.T. 137 Workshop Practice I (C.P.)</td>
<td>1 18 7</td>
</tr>
</tbody>
</table>

**TOTAL** 19

# SECOND SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>TPMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen. 212 English II</td>
<td>2 0 2</td>
</tr>
<tr>
<td>Gen. 221 Islamiat &amp; Pak.Studies II</td>
<td>1 0 1</td>
</tr>
<tr>
<td>Maths 213 Applied Mathematics II</td>
<td>3 0 3</td>
</tr>
<tr>
<td>M.T. 212 Materials &amp; Processes</td>
<td>2 0 2</td>
</tr>
<tr>
<td>M.T. 224 Machine Drawing I</td>
<td>1 9 4</td>
</tr>
<tr>
<td>M.T. 237 Workshop Practice II (C.P.)</td>
<td>1 18 7</td>
</tr>
</tbody>
</table>

**TOTAL** 19
### THIRD SEMESTER

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen. 311</td>
<td>Islamiat &amp; Pak. Studies III</td>
<td>1 0 1</td>
</tr>
<tr>
<td>Gen. 313</td>
<td>Applied Science</td>
<td>2 3 3</td>
</tr>
<tr>
<td>Maths 313</td>
<td>Applied Mathematics III</td>
<td>3 0 3</td>
</tr>
<tr>
<td>M.T. 313</td>
<td>Production Methods and Control</td>
<td>2 3 3</td>
</tr>
<tr>
<td>M.T. 323</td>
<td>Machine Drawing II</td>
<td>0 9 3</td>
</tr>
<tr>
<td>M.T. 332</td>
<td>Welding</td>
<td>1 3 3</td>
</tr>
<tr>
<td>M.T. 344</td>
<td>Workshop Practice III (C.P.)</td>
<td>0 9 3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>

### FOURTH SEMESTER

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen. 511</td>
<td>Islamiat V</td>
<td>1 0 1</td>
</tr>
<tr>
<td>M.T. 513</td>
<td>Hydraulics &amp; Hydraulic Machines</td>
<td>2 3 3</td>
</tr>
<tr>
<td>M.T. 522</td>
<td>Industrial Planning &amp; Estimating</td>
<td>1 3 2</td>
</tr>
<tr>
<td>M.T. 534</td>
<td>Applies Thermodynamics</td>
<td>3 3 2</td>
</tr>
<tr>
<td>M.T. 554</td>
<td>Theory of Machines</td>
<td>3 3 2</td>
</tr>
<tr>
<td>M.T. 554</td>
<td>Applied Electricity</td>
<td>2 6 4</td>
</tr>
<tr>
<td>M.T. 563</td>
<td>Production Project II (C.P.)</td>
<td>0 9 3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>17</td>
</tr>
</tbody>
</table>

### FIFTH SEMESTER

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen. 411</td>
<td>Islamiat &amp; Pak. Studies IV</td>
<td>0 0 1</td>
</tr>
<tr>
<td>M.T. 421</td>
<td>Report Writing</td>
<td>1 0 1</td>
</tr>
<tr>
<td>M.T. 412</td>
<td>Applied Mechanics</td>
<td>2 6 2</td>
</tr>
<tr>
<td>M.T. 424</td>
<td>Boilers and Head Engines</td>
<td>2 6 4</td>
</tr>
<tr>
<td>M.T. 434</td>
<td>Foundry Practices</td>
<td>1 9 4</td>
</tr>
<tr>
<td>M.T. 454</td>
<td>Inspection Techniques and Quality Control</td>
<td>1 3 2</td>
</tr>
<tr>
<td>M.T. 462</td>
<td>Production Project I (C.P.)</td>
<td>0 6 2</td>
</tr>
</tbody>
</table>

### SIXTH SEMESTER

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen. 611</td>
<td>Islamiat VI</td>
<td>1 0 1</td>
</tr>
<tr>
<td>MGM. 613</td>
<td>Industrial Management &amp; Human Relations</td>
<td>1 0 1</td>
</tr>
<tr>
<td>Gen. 632</td>
<td>Engineering Economics</td>
<td>2 0 2</td>
</tr>
<tr>
<td>M.T. 615</td>
<td>Machine Design</td>
<td>3 6 5</td>
</tr>
<tr>
<td>M.T. 625</td>
<td>Tool Designing &amp; Making</td>
<td>3 6 5</td>
</tr>
<tr>
<td>M.T. 631</td>
<td>Industrial Control Devices</td>
<td>1 0 1</td>
</tr>
<tr>
<td>M.T. 644</td>
<td>Heat Treatment and Material Testing</td>
<td>3 3 2</td>
</tr>
<tr>
<td>M.T. 653</td>
<td>Production Project III (c.P.)</td>
<td>0 9 3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>
Appendix G

Data of Respondents to Tracer Studies

1. Passout of Polytechnic Institutes.... 83
   Employed in Industrial Establishments

2. Distribution of Passout by year of passing:
   Before 1980 ... 34
   1980-1984 ... 30
   1985 onwards ... 19

3. Salary range of respondents:
   Up to Rs.1000 / - month ... 4
   Rs. 1000-2000 ... 26
   Rs. 2000-3000 ... 16
   Rs. 3000-4000 ... 18
   Rs. 4000-5000 ... 5
   Above Rs.5000 ... 5

4. Field of specialisation:
   Electrical, (27); Mechanical (28); Electronics (13);
   Chemical (6); Refrigeration & Air Conditioning (2);
   Ceramics (2); Instrumentation (2); Auto & Diesel (3)

5. Number of self employed passouts .... 21

6. Year of Passing Before 1980 ... 7
   1980-1985 ... 6
   1985 onwards ... 7

7. Fields of specialisation:
   Civil (1); Electrical (6); Electronics (4); Mechanical
   (6) Auto & Diesel (2); Chemical (1); Un-Identified (1)

8. Respondents to questionnaire on programme
   assessment:.... 21
   Punjab(8); Sindh (4); NWPF (5); Balochistan (3);
   Federal Government (1)
9. Programmes assessed:
   Civil Technology (3); Electrical Technology (3);
   Mechanical Technology (3); Auto & diesel, Electronics,
   Architecture, Garment Technology (12)
10. Type of industries employing the polytechnics passouts:
   1. Pharmaceutical manufacture
   2. Electrical goods manufacture
   3. Porcelain table ware manufacture
   4. Fertilizer manufacture
   5. Erection & Fabrication works
   6. Motor and cycle manufacture
   7. Cable and Conductor manufacture
   8. Sewing and hosiery machine manufacture
   9. Vegetable ghee products
  10. Automobile Workshop
  11. Office Equipment Sales
  12. Spare parts manufacture, clock movements
  13. Tins and cans manufactures
  14. Iron and steel products
  15. Research and development activity
  16. Cotton yarn manufacture
  17. Packaging board manufacture
  18. Pencil and ballpen manufacture
  19. Textiles
  20. Wire rod products
  21. Diesel engine manufacture
  22. Yarn manufacture
  23. Cereal and food products
Appendix - H

Respondents to Establishment Survey

List of Establishments included in the survey of Passouts of Polytechnics/Colleges of Technology/Engineering University.

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wyeth Laboratories (Pakistan) Ltd.</td>
<td>10-11 Industrial Area Gulberg, Lahore.</td>
</tr>
<tr>
<td>2. Syed Bhai's Ltd, Lahore</td>
<td>200, Ferozepur Road, Lahore.</td>
</tr>
<tr>
<td>3. Power Electronics Pakistan (PVT) Ltd.</td>
<td>112, Kotlakhpat Industrial Estate, Lahore</td>
</tr>
<tr>
<td>4. Regal Ceramics Ltd.</td>
<td>G.T. Road, Gujranwala</td>
</tr>
<tr>
<td>5. Ranjha Industries (Pvt) Ltd.</td>
<td>G.T. Road, Kamoke, Gujranwala</td>
</tr>
<tr>
<td>6. EMCO Industries Ltd.</td>
<td>19 KM Lahore-Sheikhupura Road, Sheikhupura</td>
</tr>
<tr>
<td>7. Panjdarya Limited</td>
<td>26/27 Km Lahore Road, Sheikhupura</td>
</tr>
<tr>
<td>8. Newage Cable (Pvt) Ltd.</td>
<td>18 Km Lahore Sheikhupura Road</td>
</tr>
<tr>
<td>9. Shezad Electric Works</td>
<td>160-A Sheikh Colony, Faisalabad</td>
</tr>
<tr>
<td>10. Hafiz Industries</td>
<td>68, Dijkoot Road, Faisalabad</td>
</tr>
<tr>
<td>11. Refhan Maize Products Co.</td>
<td>Faisalabad</td>
</tr>
<tr>
<td>12. Pak-Arab Fertilizers Ltd.</td>
<td>Khanewal Road, Multan</td>
</tr>
<tr>
<td>14. Arif Motors Multan</td>
<td>Khanewal Road, Multan</td>
</tr>
</tbody>
</table>
15. Gestetner (Pvt) Ltd. P.O. Box No. 270, Multan
16. Standard Auto Precision Works St. 8, H.B-665 Gurunanik Pura, Multan
17. Pakistan Ployproptene Packages 100-Industrial Estate Multan
19. Pakistan Steel Zulfiqarabad, Karachi
20. SUPARCO P.O. Box 3209, Karachi
21. PIAC Precession Engg. Division Karachi Airport Karachi
22. Naghma Cotton Mills Ltd. SITE Karachi
23. Baghpatee Industries Ltd. SITE Karachi
25. Progressive Industries Ltd. 57-D Nooriabad Industrial Estate, Dadu
26. Falcon Industries Nooriabad, Dadu
27. Bela Engineers Ltd. B-41, Hub River Road, Karachi (Plant: Lasbela, Balochistan)
28. Kohat Textile Mills Ltd. P.O. Box 221, Jamrud Road Peshawar
29. Climax Engineering Co. Ltd. G.T. Road Gujranwala
30. Kohinoor Textile Mills Ltd. P.O. Box 44, Faisalabad
### Polytechnic Institutes and Colleges of Technology

**Programmes, Intake Capacity and Enrollment 1987-88**

<table>
<thead>
<tr>
<th>Institute</th>
<th>Programmes</th>
<th>Intake Capacity</th>
<th>Total Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td><strong>Punjab</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. GCT Lahore</td>
<td>Ar: AD: C; E: M; El: RA</td>
<td>550</td>
<td>250</td>
</tr>
<tr>
<td>1. CPI Printing &amp; Graphic Arts. Lahore</td>
<td>PG</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>3. GFI Sargodha</td>
<td>C; E: M; E</td>
<td>300</td>
<td>250</td>
</tr>
<tr>
<td>4. GCT Rawalpindi</td>
<td>C</td>
<td>250</td>
<td>150</td>
</tr>
<tr>
<td>5. GIT Jhelum</td>
<td>E: M; RA</td>
<td></td>
<td>73</td>
</tr>
<tr>
<td>6. GFI Multan</td>
<td>AD: C; E: M</td>
<td>300</td>
<td>250</td>
</tr>
<tr>
<td>7. SPUT Gujrat</td>
<td>AD: E: FP; T: M; EE: WS : Bn</td>
<td>160</td>
<td>60</td>
</tr>
<tr>
<td>8. BPI Women Lahore</td>
<td>DD: EI</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>9. GCT Multan</td>
<td>C: E; M: Ch: T: EI</td>
<td></td>
<td>400</td>
</tr>
<tr>
<td>10. GCT Faisalabad</td>
<td>C: E: M; CD: AF: T</td>
<td>300</td>
<td>150</td>
</tr>
<tr>
<td>11. GCT Bahawalpur</td>
<td>AF: C; E: M; EI</td>
<td>250</td>
<td>150</td>
</tr>
<tr>
<td>12. GFI Chakwal</td>
<td>C: E: K</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>13. GCTT Multan</td>
<td>C: E</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>14. GCT Sahiwal</td>
<td>AF: C: E: E</td>
<td>300</td>
<td>150</td>
</tr>
<tr>
<td>15. BPI Women Faisalabad</td>
<td>DD</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>16. GFI Women Multan</td>
<td>DD: EI</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>17. GFI Women Bahawalpur</td>
<td>DD</td>
<td>50</td>
<td>-</td>
</tr>
</tbody>
</table>

**Sindh**

<table>
<thead>
<tr>
<th>Institute</th>
<th>Programmes</th>
<th>Intake Capacity</th>
<th>Total Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>1. GCT Karachi</td>
<td>AD: C; E: M: Ch: El: P:</td>
<td>600</td>
<td>350</td>
</tr>
<tr>
<td>2. Saffa Eida Zabti</td>
<td>C: E: M</td>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>3. Jamia Millia Inst. of Technology Karachi (Motor)</td>
<td>C: El: Bn</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>4. PSTI Landhi, Karachi</td>
<td>E; M; CG; WS: MW</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>5. GFI Women Karachi</td>
<td>Ar: El: CG; SC</td>
<td>200</td>
<td>-</td>
</tr>
<tr>
<td>6. GCT Hyderabad</td>
<td>AD: C; E; M; CG; TD</td>
<td>400</td>
<td>300</td>
</tr>
<tr>
<td>7. CPI Dodo</td>
<td>C: E</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>8. GFI Mirpurkhas</td>
<td>C: E</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>9. Habib College of Tech. Nawabshah</td>
<td>Ch: E; M</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>10. GCT Khairpur</td>
<td>AD: AF; C; E; M; RA</td>
<td>300</td>
<td>200</td>
</tr>
<tr>
<td>11. CPI Sukkur</td>
<td>El</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>12. GFI Women Sukkur</td>
<td>CC</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>13. GFI Jacobabad</td>
<td>C; E; M</td>
<td>150</td>
<td>150</td>
</tr>
</tbody>
</table>

247
<table>
<thead>
<tr>
<th>Institution</th>
<th>Programmes</th>
<th>Total Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCT Peshawar</td>
<td>AD; C; E; M; Ch</td>
<td>250 - 918</td>
</tr>
<tr>
<td>GFI D.I.Khan</td>
<td>C; E; M</td>
<td>150 - 438</td>
</tr>
<tr>
<td>GFI Haripur</td>
<td>C; E; M</td>
<td>150 - 477</td>
</tr>
<tr>
<td>GFI Nowshera</td>
<td>C; E; M</td>
<td>150 - 497</td>
</tr>
<tr>
<td>GFI Swat</td>
<td>E; M</td>
<td>100 - 219</td>
</tr>
<tr>
<td>GFI Women Peshawar</td>
<td>E; CG</td>
<td>100 - 195</td>
</tr>
</tbody>
</table>

**Balochistan**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Programmes</th>
<th>Total Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFI Quetta</td>
<td>C; E; M</td>
<td>150 - 438</td>
</tr>
</tbody>
</table>

**Federal Government**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Programmes</th>
<th>Total Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFI Women Islamabad Ar; El</td>
<td></td>
<td>40 - 100</td>
</tr>
</tbody>
</table>

**Semi Govt/Private Institutions**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Programmes</th>
<th>Total Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahmad Hussain Polytechnic Lahore</td>
<td>C, E, M</td>
<td>Estimation: 3000</td>
</tr>
<tr>
<td>Institute of Technology, Sargodha</td>
<td>C; E; M; Pr</td>
<td></td>
</tr>
<tr>
<td>Jinnah Polytechnic Inst., Karachi</td>
<td>C, E, M</td>
<td></td>
</tr>
<tr>
<td>Zubaida Polytechnic, Karachi</td>
<td>C, E, M</td>
<td>For all Institutes</td>
</tr>
<tr>
<td>Pak Swiss Training Centre, Karachi</td>
<td>Pr, Optics</td>
<td></td>
</tr>
<tr>
<td>Metallurgical Training Centre, Karachi</td>
<td>El, Me.</td>
<td></td>
</tr>
<tr>
<td>Pakistan Steel Mills, Pipri</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank of Oman Institute of Tech, Peshawar</td>
<td>C, El, RA</td>
<td></td>
</tr>
<tr>
<td>Petromen Institute, PERAK, Karachi</td>
<td>Computer</td>
<td></td>
</tr>
</tbody>
</table>

**Source**: Directorates of Technical Education/Board of Technical Education

**Note**: Ar: Architecture; AD: Auto and Diesel; AF: Auto & Farm; Sm: Biomedical; C: Civil; Ch: Chemical; CG: Clothing Garment; CO: Civil Drafting; DD: Dress Design Dress Making; E: Electrical; El: Electronics TV; I: Instrumentation; M: Mechanical; P: Power; Pr: Precision Instruments; RA: Refrigeration Air Conditioning; Se: Secretarial; T: Textiles; TS: Textile Spinning; TW: Textile Weaving; FP: Foundry Pattern Making; WS: Welding Sheet Metal; WM: Wood Work Cabinet Making; GC: Glass Ceramics; FG: Printing Graphic; W1: Watch Instrument.
QUESTIONNAIRE FOR ESTABLISHMENT SURVEY

(Employers view on training)

1. Name of Organization ____________________________________________

2. Address. ______________________________________________________

3. District ________ Division ________ Province ________

4. Principal business/industrial activity ___________________________

5. No. workers employed. (Pl. /)
   Less than 50 [_____] 50-100[_____] 100-500 [_____]
   Above 500 [_____]

6. Type of workers employed. (Please indicate number in each category).

<table>
<thead>
<tr>
<th></th>
<th>Semi-Skilled (Tech/Voc. School)</th>
<th>Skilled (TTC/GVI)</th>
<th>Technician (Polytech)</th>
<th>Engineers (Desg. College / Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10</td>
<td>-------</td>
<td>------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>10-20</td>
<td>-------</td>
<td>------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>20-50</td>
<td>-------</td>
<td>------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>50-100</td>
<td>-------</td>
<td>------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Above 100</td>
<td>-------</td>
<td>------</td>
<td>-------</td>
<td>-------</td>
</tr>
</tbody>
</table>

249
7. What is your experience of using the following workers?

<table>
<thead>
<tr>
<th></th>
<th>Very Good</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi skilled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technician</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female Worker</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Are you familiar with the training objective off?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tech/Voc. School</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TTC/GVI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polytech./College of Tech.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering College</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. For a vacancy in skilled worker's category what would be your first choice?

a. Middle school with TTC/GVI Training
b. Tech/Voc. School Trained (Matriculate)
c. TTC/GVI Trained
d. General High School with work experience

10. Do you have arrangements for on the job training (OJT) of new recruits.

YES ________ NO ________

11. Do you have qualified instructors to provide on the job training

YES ________ NO ________
What is the minimum duration of OJT when an employee is fully useful:

<table>
<thead>
<tr>
<th></th>
<th>3 Months</th>
<th>3-6 Months</th>
<th>6-12 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tech/Voc. School</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TTC/GVI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polytech/College of Technology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engg. College</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Have you recruited students having matriculation and vocational training in high schools (Not. TTC).

YES __________  NO __________

If YES how do you rate their performance:

They are same as other workers: ________________________

They are better                                  ________________________

They are not as good                               ________________________

If you consider that they are not so good, why?

a. They lack theoretical knowledge                ________________________

b. They lack practical knowledge                   ________________________

c. They are not trainable                          ________________________

What are the trades/technology in which you find difficulty in recruitment of workers.

<table>
<thead>
<tr>
<th>TTC/GVI (Level)</th>
<th>POLYTECHNIC (Level)</th>
<th>ENGINEERING (Level)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

251
QUESTIONNAIRE
SURVEY OF PASSOUTS OF TTC / GVI / POLYTECHNIC /
COLLEGE OF TECHNOLOGY/ ENGINEERING UNIVERSITY

1. Name

2. Age.

3. Home Address

4. Field of Training _______ Year of Passing _______

5. Name of TTC / GVI / Polytechnic / College of Technology/
Engineering College / University

6. Educational Qualifications
   (i) Below Class VIII _______ Tech High School _______
   (ii) VIII - X _______ TTC/GVI Certifi. _______
   (iii) X Passed _______ Polytech.Diploma _______
   (iv) Above class x _______ Engineering Degree______
       (Please specify)

7. Name of organization presently employed _________
   a. Address of Organization _______ District Division Province

8. Principal Industrial/Business activity. ____________
9. Did you have further training after completing TTC / GVI polytechnic/College of Tech./Engg College or University.

YES ___________ NO ___________

10. If the answer is YES:
   (i) Give the name of trade/technology: ___________
   (ii) Duration of Training (in months): ___________
   (iii) Nature of training: On the job ___________
        Any other: ___________

11. When did you get the first employment after passing the TTC/ GVI/ Polytechnic/ College Tech./Engg. University/ College.

   Within 6 months: _______  With one year: _______
   After one year: _______

12. Please give your employment/unemployment record.

<table>
<thead>
<tr>
<th>Period</th>
<th>Name of factory/ Industry of employed.</th>
<th>Title</th>
<th>Monthly</th>
<th>Reason for leaving</th>
</tr>
</thead>
<tbody>
<tr>
<td>From:</td>
<td>Self employed if own business, family business; Unemployed if without job or seeking job</td>
<td>Job</td>
<td>Salary</td>
<td></td>
</tr>
</tbody>
</table>
13. Describe to what extent your training was relevant to your first job?

Very much:____ to some extent:____ Not at all:____

14. In what aspect your training was lacking the job requirements

Lack of theoretical knowledge ______________________
Lack of practical training _______________________
Unfamiliarity with equipment ______________________
No Knowledge of industrial Production ______________________

15. Are you satisfied with your present job.

YES _______ NO _______

16. Do you think that your employer is fully aware of the concept and contents of TTC/GVI/Polytechnic/College of Tech./Engineering education.

YES _______ NO _______

17. If you found your training deficient, it is because of:

(Please ✔)

(i) Curriculum is not matching the needs of industry. ______________________
(ii) Instructors do not possess practical skills. ______________________
(iii) Instructors do not assess up-to-date knowledge of subject. ______________________
(iv) Institute does not have proper equipment. ______________________
(v) Sufficient raw material is not provided for training. ______________________
(vi) Suitable text books are not available. ______________________
(vii) No information given about industrial atmosphere. ______________________
(viii) Instructors were not aware of proper methods of teaching.

(ix) Adequate equipment was not provided.

18. Based on your industrial experience what new areas of training would you recommend for introduction in

TTC/GVI ......................................

Polytechnics ..............................

Engg.University/College .................

19. How can the prospects of employment in industry be enhanced for:

(i) The pass out of TTC/GVI ..............

(ii) Polytechnic diploma holder ..........

(iii) Engineering University/College
     Degree holders ..........................
QUESTIONNAIRE

SURVEY OF SELF EMPLOYED PASSOUTS OF TTC/GVI/POLYTECH.,/COLLEGE OF TECHNOLOGY/ENGINEERING UNIVERSITY

1. Name. ____________________________________________

2. Age. _____ Sex: Male _____ Female ______

3. Home Address ____________________ District __________ Division ______ Province ______

4. Field of Training _________ Year of Passing. ________

5. Name of TTC / GVI / Polytech / College of Tech./Engineering College / University

   Name ________________________________ District __________ Division ______ Province ______

6. Educational Qualifications

   (i) Below Class VIII _____ Tech High School ________

   (ii) VIII - X ________ TTC/GVI Certifi. ________

   (iii) X Passed ________ Polytech.Diploma ________

   (iv) Above class X (Please specify) ________ Engineering Degree ________
7. Please give your employment / unemployment record since passing:

<table>
<thead>
<tr>
<th>Period</th>
<th>Name of factory/ Industry of employed.</th>
<th>Title</th>
<th>Monthly Salary</th>
<th>Reason for leaving</th>
</tr>
</thead>
<tbody>
<tr>
<td>From:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Name of business presently operating:

   a. Address: ___________________________  District  Division  Province

9. Nature of Business:
   - Manufacturing: ______________________
   - Servicing/repair, maintenance: _______
   - Selling: ____________________________
   - Any other: __________________________
                    (Please specify)

10. Please describe your business by major operations involved: __________________________

257
11. Is your business relevant to your technical qualification/training.

YES ____________ NO ____________

12. Reasons for choosing self employment (own business):

a. Family occupation

b. Government/private service not available.

c. Govt/private service unattractive

d. Any other ______________________________

13. What do you consider the most difficult factor in starting and continuing to operate your own business:

__________________________ Financial Resources

__________________________ Technical Know-how

__________________________ Knowledge of business practices, rules, regulations.

__________________________ Experience of business management technique. (Supervision, accounting, book keeping).

Any other ______________________________

14. What was the source of financing of your business:

Private Investment : _________________________

Bank loans : ______________________________

15. Did you up-grade your knowledge/practical skill after passing out:

Knowledge : __________________ Skill : ____________

Before starting the business : __________________
During the business operation: _________________________

16. Details of training received (Ref. 15)
Type of training: _________________________

Organisation: _________________________

17. Do you feel the need to go back to institute for further education/practical training:
YES _________________________ NO _________________________

18. If YES what type of training / course would you like to have: _________________________

19. Do you consider the need to include Courses on entrepreneurial (i.e. operating own business) training as a part of the curriculum for all students.
YES _________________________ NO _________________________

20. If YES indicate the names of Courses to be included: _________________________

21. Please give some suggestions to enhance the opportunities of self employment in your trade/technology:
a: _________________________
b: _________________________
c: _________________________
d: _________________________
Appendix - M
(No. Q - 4)

Questionnaire on Programme Assessment

1. Name of the Institute: ____________________________

2. Address: ____________________________
   (City) (District) (Province)

3. Programme to be assessed: ____________________________ technology

4. Year when this programme first started: __________

5. Annual intake capacity: ______ No. admitted: ______ Section: ______

6. Number of applicants for admission: __________

7. Background of students enrolled in the current session:

<table>
<thead>
<tr>
<th>Class</th>
<th>Matriculates</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>ISc/FSc</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

260
8. Number of students appeared and passed in final diploma exam.

<table>
<thead>
<tr>
<th>Year</th>
<th>Appeared</th>
<th>Passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1987</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1988</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Average time taken by students to complete 3 years programme. (Indicated in percentage of intake)

<table>
<thead>
<tr>
<th>(3 years)</th>
<th>(4 years)</th>
<th>(5 years)</th>
<th>(more than 5 years)</th>
</tr>
</thead>
</table>

10. What percentage of passout students are able to secure employments?

within 6 months

6-12 months

12-24 months

beyond 2 years

No information available

11. What is staff position in the department?

<table>
<thead>
<tr>
<th>Post</th>
<th>Sanctioned</th>
<th>Vacant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head of Deptt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sr. Instructor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jr. Instructor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shop Instructor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shop Asstt./ Attendant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12. What is the average teaching load per teacher in the department?

__________________ contact Hrs/week

13. What are the qualifications of teachers?

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering degree or above</td>
<td>______</td>
</tr>
<tr>
<td>B-Tech degree</td>
<td>______</td>
</tr>
<tr>
<td>Diploma of Associate Engr.</td>
<td>______</td>
</tr>
<tr>
<td>Certificate from TTC</td>
<td>______</td>
</tr>
<tr>
<td>Any other qualification</td>
<td>______</td>
</tr>
</tbody>
</table>

14. What is the industrial experience of teachers?

Experience: Above 10 Yr 5-10 Yr 3-5 Yr L/than 3 Yr No Exp.

Numbers: ________ ________ ________ ________ ________ ________

15. How many teachers in the department hold the following qualifications?

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma in tech. Teacher Education</td>
<td>______</td>
</tr>
<tr>
<td>Certificate in Tech. Teacher Education</td>
<td>______</td>
</tr>
<tr>
<td>Short course certificate in T.T.Educ.</td>
<td>______</td>
</tr>
</tbody>
</table>

16. How many teachers have acquired higher qualifications during the service in polytechnic?

__________________

17. In what areas teacher need training on priority basis?

<table>
<thead>
<tr>
<th>Area</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving knowledges of subject</td>
<td>______</td>
</tr>
<tr>
<td>Improving practical skills</td>
<td>______</td>
</tr>
<tr>
<td>Industrial/field experience</td>
<td>______</td>
</tr>
<tr>
<td>Methods of teaching/pedagogy</td>
<td>______</td>
</tr>
</tbody>
</table>
18. Do you agree that the theoretical contents of the curriculum are relevant to employment need?
   YES          NO

19. List topics which in your opinion are irrelevant?

   Course          Topics
   __________________________
   __________________________
   __________________________
   __________________________

20. What additional topics do you like to be added?

   Course          Topics          Reasons
   --------------------------
   --------------------------
   --------------------------
   --------------------------
   --------------------------

21. Is the skill training component adequate in relation to employment needs?
   YES          NO

22. If NO what additional practical skills need to be included?

   Course          Skills
   --------------------------
23. Do you consider that the time allocated for the courses is adequate?

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
</table>

24. If NO indicate the actual time requirements.

<table>
<thead>
<tr>
<th>Course</th>
<th>THEORY</th>
<th>PRACTICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prescribed Periods</td>
<td>Actual Periods</td>
</tr>
<tr>
<td></td>
<td>Prescribed Periods</td>
<td>Actual Periods</td>
</tr>
<tr>
<td></td>
<td>Prescribed Periods</td>
<td>Actual Periods</td>
</tr>
<tr>
<td></td>
<td>Prescribed Periods</td>
<td>Actual Periods</td>
</tr>
</tbody>
</table>

25. List the courses in which text books/manuals are required?

<table>
<thead>
<tr>
<th>Course</th>
<th>Theory</th>
<th>Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

26. List the courses for which laboratory/workshop equipment is NOT available.

<table>
<thead>
<tr>
<th>Courses</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

264
27. Are the following buildings / physical facilities adequate?

<table>
<thead>
<tr>
<th>Buildings</th>
<th>YES</th>
<th>NO</th>
<th>If NO given requirements number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class rooms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratories</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workshops</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

28. Are the funds for students practical adequate?

| YES | NO |

29. What percentage of weekly contact hours for practical work is actually utilised in workshops/labs.

100%  75%  50%  Less than 50%  

30. State reasons for under utilisation.

   a. shortage of raw material  
   b. shortage of equipments  
   c. anyother reason  

31. What steps may be taken to adopt the curriculum to modern technological needs?

   a. changes in courses contents  
   b. structural changes in curriculum  
   c. modernising workshop and laboratories  
   d. retraining of teachers  

265
32. Are you satisfied with the present supervision of training programme?
   a. inspection of teaching methods    YES  NO
   b. inspection of training materials  YES  NO
   c. inspection of w/shop and labs.    YES  NO
   d. inspection of student practicals  YES  NO
   e. follow up action on results        YES  NO

33. Who should be responsible for inspection and what must be the frequency of inspection?

<table>
<thead>
<tr>
<th></th>
<th>Each Semester</th>
<th>Yearly</th>
<th>Longer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional Director</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chairman of Tech.Board</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

34. In your opinion which THREE of the following measures would MOST improve the quality of training in your technology?
   a. improving buildings
   b. improving equipment
   c. increasing consumable supplies
   d. improving teachers subject knowledge
   e. improving practical skill of teachers
   f. improving student-teacher ratio
   g. improving inspection process
   h. Any other

Questionnaire complete by

Name: ____________________________ (Signature)

Designation: ____________________________

Date: __________
CURRICULUM VITAE

MIR MOHAMMAD ALI

Date of Birth      : 8th October, 1927.
Place of Birth    : Hyderabad (Deccan)
Permanent Address : B-257, Abbasia, Block-10, Federal 'B' Area, Karachi-38, Pakistan.
Telephone (Residence) : 682142 / 682736

1. Academic Qualification:
   B.E.(Mech.Engg.) 1950 : Osmania University (1st Division)
   M.S.(Tech.Edu.) 1955 : Oklahoma State University, U.S.A. (3.5 G.P.A.)
   Certificate in cataloging Short course 1957 : Dhaka University / British Council
   Fellow of the Institution of Engineers Pakistan : Since 1965

2. Distinctions & Awards:
   i. First Class First Position in the University Receptient of three gold medals, (1950).
   ii. President's Award for Outstanding Teacher in Technical Education (1969).

3. Service Record:
   1982 - 1988 Chairman Sindh Board of Technical Education. (Retired)
   1980 - 1982 Faculty Consultant, Colombo Plan Staff College for Technician Education, Singapore.
1976 - 1980 Chairman Sindh Board of Technical Education.

1973 - 1976 Additional Education Secretary, Govt. of Sindh / Chairman Sindh Board of Technical Education.

1972 - 1973 Director Technical Education, Govt. of Sindh / Chairman Sindh Board of Technical Education.

1962 - 1972 Principal of Polytechnic Institutes.

1954 - 1962 Head of Department/Head Teacher Trainer Polytechnics.

1950 - 1954 Engineering Field Service

3.a Directed following projects/studies of Federal/Provincial Government.


- Revision of Polytechnic Curriculum. (1976)

- Study of Standards of Higher Education in Sindh. (1979)


- Development of Manual and Teachers' guides for Agrotechnical Courses. (1983)


3.b **Foreign Service:**

On deputation as Faculty Consultant at Colombo Plan Staff College for Technician Education, Singapore. Conducted Staff Development Programmes in Pakistan and Bangladesh. Study visits of Technical Teachers Training system in India. 1980-1982

3.c **Present Assignment:** Serving as CTA/Senior Consultant with UNESCO, Jakarta. Served as Technician Education Specialist to Hawthorn Institute of Education, Victoria, Australia.

4. **Participation in Seminars and Conferences:**

- Colombo Plan Seminar, Karachi (Alternate Leader of Pakistan Delegation) : 1974
- First Technical Education Study Conference at Colombo Plan Staff College, Singapore. : 1975
- Team Leader UNESCO Mobile Team Programme Technical and Vocational Education : 1984
- Visiting Faculty Colombo Plan Staff College, Country Course held in Tehran. : 1986
- Advisor CPSC Sub Regional Workshop, (participated by Bangladesh, India, Iran, Nepal, Pakistan & Srilanka.) : 1987

5. **Publications:**

Authored following books:


iii. Maiyar-e-Taleem aur Tadreesi Masail
(Book in Urdu), Karachi: Pakistan Organisation of Workers in Education Research, 1987

iv. Standard of Education and Aspects of Planning and Evaluation
Karachi: Sindh Board of Technical Education, 1987

Karachi : 1985

vi. Development of Technical Education in Sindh
Karachi: Kifayat Academy, 1986

vii. Sindh Educational Journal
(1983-1987)

6. Membership of professional organisations:

- Registered as Technical Education Expert with UNESCO, (Paris), Asian Development Bank (Manila), and Colombo Plan Staff College (Manila).

- Member Pakistan Engineering Council.

- Life Member Pakistan Association of Scientists and Scientific Professions.

- Life Member Institution of Engineers, Pakistan and Member Central Council (1980-1989).


7. Visits abroad:

Stayed in USA from Feb. 1954 - Jan 1955 in connection with higher education.

Visited Iran in 1966 as a member of Pakistan delegation to Cento Conference on Engineering Education.

Visited Singapore to represent Pakistan in First Study Conference at Colombo Plan Staff College, 1974.
Stayed in Singapore from November 1980 to January 1982 as Faculty Consultant at Colombo Plan Staff College for Technician Education.

Visited Bangladesh, Indonesia, Malaysia, India, Iran to conduct staff development programmes and on professional assignments.

Visited Japan, Thailand and the Philippines as Team Leader of UNESCO Mobile Team Programme in Technical and Vocational Education 1984.

Visited U.K., Saudi Arabia, Iraq and Syria on Cultural and recreational visits.