CONCLUSION AND SUGGESTION

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5.1 CONCLUSIONS

The Technical Education System is designed to create technical manpower who in turn help in the development of society. When a student from technical institute is useful for the development of self, industry, society and the nation, then one can say that the objectives of technical education are achieved. The objectives of technical education can be achieved only by developing the competent technical manpower fulfilling the requirements of society at large. This requires the support and participation of various stakeholders along with qualitative mechanism which includes curriculum and curriculum delivery and evaluation system.

The researcher undertook comparative study of the system of Technical Education in developed (Germany) and developing country (India) and employed survey method (Historical/Descriptive) to investigate the system of technical education in these countries. In the previous chapter the researcher has analyzed the responses received through questionnaire. On the basis of analysis the researcher has come to the following conclusions.

GENERAL

1. The Technical Education in Germany and India is designed to develop technical manpower at three levels viz. craftsman, middle level manager (Technician) and manager (practical (on-line) manager and research engineers). The entry requirement and duration of the craftsman level programme is not the same in Germany and India but varies to a great extent in respect of entrance requirement, duration of programme, degree obtained and orientation to courses for technical education at technical and managerial levels.
The word "Beruf" i.e. "Profession" has very significant place in the Technical Education System in Germany.

2. The Teachers qualifications and training in the system of Technical education in Germany differs to a greater extent to that in India.

3. The participation of Industry/occupation is common and many a times it is the part of the system of Technical education in Germany unlike in India. The role of Chamber of Industry and Commerce is significant in curriculum development, training and evaluation.

4. The educational qualification gained by the student is related and as per requirements of work in establishing the business/enterprise in Germany.

5. The training in vocation is compulsory to study at vocational schools, Fachschule, Fachhochschule and university.

6. The practical orientation to programmes and courses in Germany are in respect of objectives of programmes.

7. Technical Institute in Germany develop proper technical manpower to fulfill the manpower requirements at different levels.

8. The aims and objectives of Technical Education in Germany and India are same except the emphasis on profession and professional training, in objectives of technical education in Germany.

**PATTERN OF TECHNICAL INSTITUTION**

9. The vocational schools, University of Applied Science and Universities in Germany are autonomous institutes.

10. The Vocational school in Germany adopts statewide common curricula unlike in India, which is common nation wide.
11. The University of Applied Science in Germany and Universities are having Academic Autonomy status and design their own curricula unlike in India where very few institutes have Autonomous status.

12. The degree certificate at Vocational schools, Fachhochschule (University of Applied Science) and University is awarded by institute itself unlike in India except by few Autonomous institutes.

13. The administrative setup is similar in Technical Institutions in Germany and India.

14. There is direct linkage between Fachhochschule and Ministry of Higher Education and same is case for University in Germany.

**ADMISSION POLICY, CURRICULA AND EXAMINATION SYSTEM**

15. The admission of candidates to the vocational schools, universities in Germany is made by institute itself except in the case of restricted admission in the universities where the admissions are done through Central admission procedure unlike in India except Indian Institute of Technology and very few special institutes.

16. There is restricted intake (student places) for each programmes (30-80 in vocational schools and 70-150 in university of Applied Science) at vocational schools and university of Applied Science in Germany except certain programmes having restricted admissions. The student places are restricted in all institutes in India for all programmes.

17. There are no restrictions on student places in Universities in Germany except in certain programmes having restricted admissions unlike in India.

18. The vocational schools in Germany offer education for Craftsman training and Technician education under the same roof except in few institutes of technician education (fachschule), where as the craftsman training and Technical Education is provided by different institutes and set up in India.
19. The duration of Technical Education programmes in Germany and India differ to a great extent at undergraduate and postgraduate study levels.

20. The final examination in Technical institutions in Germany is conducted by institute itself except for craftsman training in dual system and master craftsman for which examination is conducted by competent body (Chamber of Industry and Commerce).

21. The final examination in technical institutes in India is conducted by either State Board of Vocational Education (for certificate course of Vocational skills) or State Board of Technical Education for Technician (Polytechnic) and by concerned University for undergraduate education except by those having Autonomous status.

22. The semester pattern of examination is followed in Germany except for Vocational technician education where the examination is conducted at the end of the year / programme.

23. The pattern of examination in Maharashtra is of heterogeneous nature i.e. the vocation schools and 93% of polytechnic conduct yearly examination, where as 100% Autonomous institutes and the institutes offering undergraduate programmes conduct term end (semester) examination.

24. The facilities for using various media are available in classrooms and Laboratories in Germany unlike in India.

25. The teaching methods like lecture, improved lecture, seminars, tutorials, exercises, assessments are adopted at Fachhochschule and universities in Germany.

26. The conference of teachers (Subject area) meet annually to discuss educational aspects in Germany.
27. The involvement of industry, teachers having industrial/occupational experience and activities like consultancy and Research and development, design curricula as per the needs of profession in Germany.

28. The courses taught at Fachhochschule and University in Germany are up to postgraduate level and are the same as that of courses included in undergraduate and postgraduate courses in India. They differ as far as the flexibility, orientation and focus of learning in institutions of Germany.

29. Review of curriculum is done every five years in Germany and Maharashtra and this is done on the basis of feedback from industry and faculty.

30. In all most all technical institutes in Germany and India, the learning resource materials are available.

31. Very high degree of interaction and intimate linkages with industry and other occupational organizations is a feature of German education.

32. The participation of Chamber of Commerce and Industry (Vocational training, examination) was seen in Germany.

COURSE, CURRICULUM DEVELOPMENT PROCESS AND FEEDBACK MECHANISM

33. The courses taught at vocational schools in Germany and India are the same except on their focus on profession and professional training in Germany.

34. The emphasis on practical training and exposure to professional life is given in industrial training institutes and very few (04%) of polytechnics are having sand-witch pattern/training provision (1/4 months)

35. The mechanism used in Maharashtra to take feedback is examination results unlike in Germany where feedback is taken in institute and at department level.
36. The care of curriculum implementation is done at department level in Maharashtra and at individual faculty level in Germany.

37. The curriculum development process in Maharashtra involves teachers, Industry personnel and curriculum development experts, where as teachers, industry personnel, students and Labour unions are involved in Germany.

38. 65.28% of Teachers use teaching methods in technical institutes in Maharashtra.

39. Majority of institutes in (90.57%) Germany and (68.52%) India provides feedback on student’s assessment.

40. Majority of the students from technical institutes in Maharashtra had clear idea about curriculum objectives, selection of courses of their own choice and were provided the opportunity for industrial visits similar to Germany.

41. The curriculum objectives of sub system of Technical education related to manpower in industry in Germany and Maharashtra were same in respect of output, except the emphasis on quality and professional training in Germany.

42. The status of output from fachhochschule is treated as professional master and that in the University as postgraduate (academic) level and these qualifications are gained in single entry unlike in India.

43. The types of Technical manpower developed in Germany and India were same but places of learning (institution types) were found to be different.

**INDUSTRY – INSTITUTE – INTERACTION**

44. 100% of Technical institutes in Maharashtra and Germany were willing to co-operate with industry. (18.18% respondents from Germany did not respond to this question)

45. The institution in Maharashtra has good interaction with the industry in the area of Industrial visit, Implant training, Project Work, Teachers Training and Apprentice Training
but poor in the rest of areas, where as the institutions in Germany have excellent interaction in the areas of, implant training, vocational training, exchange of staff and Project Work; Good interaction in the area of curriculum development but poor interaction in rest of the areas.

46. 70 % of Technical institutes in India expected the co-operation of industry in curriculum development, 90% expected on-the-job training. 100% expected training of teachers, 80% expected exchange of staff and 50% of Technical institutes in India expected the cooperation of industry in the areas of Learning Resource Development.

47. 77.27% of Technical institutes in Germany accepted the co-operation of industry in on-the-job training.

48. 86.36% of Technical institutes in Germany and 50% in Maharashtra received feedback from industry on quality of passed out.

49. 31.88% of industries in Maharashtra and 72.73% in Germany were having separate establishments/sections/departments for training in industry.

50. All most all industries in Germany and India showed willingness to co-operate with institutes.

51. The present constraint in the interaction with institute in Maharashtra was due to lack of initiative on the part of institutes.

52. Majority of students from technical institutes in Maharashtra get response from the industry.

53. Majority of industries in Maharashtra did not get required quality of manpower from present technical education system, and the major cause was lack of practical orientation to courses.
54. The industries in Germany and India felt the need for training in the areas of automation and computer-based system.

**QUALIFICATION AND TRAINING OF TEACHERS**

55. The qualification and training of teachers for vocation education differs to a great extent in Germany as compared to India. The qualification and training requirements in Germany are of high level as compared to that in India.

56. The qualification and training of teachers of technical education fachschule (part of vocational school) in Germany and Polytechnics in India are same except the training in pedagogy which is part of qualification for teachers in Germany. The practical training of 18-24 months is essential to become teacher at Technician Education institutes in Germany unlike in India.

57. The qualification and training requirements to become teacher at undergraduate programme institute in Germany differ from that in India.

58. The professional / occupational experience of five years is required to become teacher in fachhochschule (University of Applied Science) unlike in India (college of engineering or Regional Engineering Colleges). And the qualification of Habilitation (postdoctoral Research) is required to become profession in University in Germany unlike in India.

59. The education at Fachhochschule and University in Germany is treated as "of equal standing" but not of "equal type".

**QUALITATIVE ASPECTS OF TECHNICAL EDUCATION**

60. The pupil-teacher ratio in universities is 9, 27 in Fachhochschule, 13.1 in vocational school and 12.4 in Fachschule in Germany (1994).

61. The system of primary and secondary education supports the education of students at vocational school/Higher education.
62. The intake capacity at vocational school, Fachschule is 30-70 and hence class size is small. (Per Programme).

63. The faculty and staff at vocational school and Fachschule were having higher education in their relative subject areas along with pedagogy.

64. Technology centers and technology parks in the institute/ city are found.

65. The teacher, in Fachhochschule has to undergo industrial training for six months (one semester) in every five years in Germany.

66. The training facilities (trainer, machinery and equipments) in industry is the decision factor of allocation training centre in industry in Germany.

67. The average pupil- teacher ratio was 16 and 16.72 in polytechnic and engineering colleges respectively in India.

68. Almost all faculties in polytechnics had undergone staff development and industrial training programmes of the duration 1 - 3 months.

69. The consultancy and research done at Indian Institute of Technology makes the teacher come closer to day to day world of knowledge and problems.

70. The involvement of industry and teacher in curriculum development at Polytechnics and autonomous institutes is found in India.

71. 50% of institutes in Maharashtra responded that, there existed ‘Quality assurance’ system at the state level.

72. 69.91% of institutes in Maharashtra were having feedback mechanism at departmental level.

73. The teachers in Germany and Maharashtra responded that the level of learning attitude in the students of technical institute was average and not of high degree.
74. Majority of institutes in Germany and India provided academic facilities to the faculty. The facilities provided in Germany were greater than that in Maharashtra.

75. There was no separate department taking care of curriculum implementation in majority of institutes in Germany and India.

76. 65.74% of faculty in Maharashtra agreed that the talent did not attract towards teaching profession and 56.94% faculty mentioned that the reason was unattractive pay scales. 50% of institutes agreed that the talents did not attracted towards teaching due to unattractive pay scales in India.

77. Majority of students (88.37%) mentioned that, they were assessed on their work progressively and received feedback (87.21%) on their performance.

78. The co-curricular activities were provided to students in the technical institutes in Maharashtra and students were encouraged (64.53%) for better performance in functions.

**INDUSTRY BASED EDUCATION**

79. Two-practice semester (practical training in industry) are built in curriculum structure in all Universities of Applied Science (fachhochschule) unlike in the Engineering College in India. The two practice semester are provided only at Birla institute of technology, and few engineering colleges.

80. The vocational training is pre-requisite for Technical Education in Germany, which is unlike India. The vocation training of 3-6 Month duration is prerequisite for admission to fachhochschule unlike any technical institute in India.

81. The pre-requisite for admission to Fachhochschule (University of Applied science/technology) in industrial/ vocational training is of minimum (3-6 months duration depending upon vocation).
82. The diploma thesis at Fachhochschule is based on Applied research and hence students get opportunity to face real life problems (Professional).

83. The diploma thesis at university is Research based and many a times the project thesis is based on problems related to industry at the basic research level.

84. It is observed that, the extent of interaction is poor in India in the areas of curriculum development, implant training, vocational training, exchange of staff and industry based education.

85. Majority of institutes in India expects the co-operation with industry in the areas of curriculum design and implementation, on-the-job training for the students, training of teachers, exchange of staff and co-operate in developments of learning resources.

86. Majority of industries in India (75.36%) were not satisfied with quality of technical manpower developed in the institutes and suggested for developing need base and practical orientation courses.

5.2 SUGGESTIONS

Keeping in view the prevailing technical education in India and Germany in general and the Technical education (polytechnic level) in particular a few suggestions are offered. Testifying by the data gathered these suggestions could act as corrective measures.

Suggestion for System Designer – National / State Level

1. The control on number of technical manpower to be developed be done at National and state level so as to create appropriate technical manpower required at National Level and also for better utilization of human resource and other physical resources.
2. The Networking among the Institutes, regions, states and national level be designed in technical education. It should be made in related to quantitative and qualitative aspects so that, there is close contact and monitoring for quality in technical education.

3. Autonomy to each technical institute be granted for quality improvement. The autonomy so granted be restricted to academic, administrative and managerial aspects, so that quality in technical education be achieved.

4. Mechanism be established at Institute/region/state and National level for effective Industry-Institute-interaction by signing memorandum of understanding at these levels and by granting certain incentives to the industry.

5. Sufficient training in industry and pedagogy be provided for teachers to improve quality of teaching profession in technical institutions.

6. One year practical training in industry be made compulsory for students in polytechnics and engineering colleges.

7. Involvement of industry, teachers, students (passout) be made for curriculum development.

8. Flexible and modular curricula be developed to cater to the needs of technical manpower.

9. Mechanism be established at Institute level/regional level/state level/ national level for Quality Assurance in technical education.

10. Research institutions be established at State level to carryout research in technician and technical education related areas.

11. The entry level of students be raised the Higher secondary level. This will ensure the technician and vocational training more useful and fruitful.

12. In view of point (11), the programme duration for Technician education can be reduced from 3 years to 2 years.
13. The concentration be given to education in the multi-disciplinary technology.

14. Polytechnic curriculum be based on competency profile of diploma engineers. It should be oriented towards technology application and learning industrial field practice.

15. The Autonomous Polytechnic institute be transferred to deemed to be university status and opportunity be provided for Technician for upgradation skill to Degree level and Professional master level.

16. The Teaching / training method used should be project based.

17. Legal foundation be sought for the development of field education and sincere industry-institute-cooperation.

Suggestions for Industry / Industry Association

1. The academic and training support to institute be provided to improve the quality of work in industry.

2. Mechanism be established at the State level/Regional level/District level so as to provide academic support and to develop close interaction with institutes. The memorandum of understanding be signed for cooperation in the field of curriculum development and training.

3. The “Board of Technical Education and Training in Industry” be formed at state level involving identified academic partners from industry and technical institutes of different levels and periodic (yearly) discussions/seminars be conducted to develop effective technical education and training system which benefits to both to industry and institutes.
**Suggestion for Teachers/Faculty**

Disciplinewise forum of technical teachers working at different levels (craftsman/Technician/Technical education) be formed separately. The forum so established can work collectively at regional/state levels in respect of curriculum development and implementation and also to identify training needs for effective implementation of curricula. The Disciplinewise Forum can be restricted in number of members for close coordination in issues related to a particular discipline. The school system be reformed to prepare the base for future education in vocational, technical and Higher education.

**Suggestions for Further Research**

As the continuation of this study, following could be considered as the most promising areas for further research.

1. A Study on Nature and Extent of Autonomy to Technical Institutes in Germany could be conducted.

2. A Study on Nature and Extent of Industry-Institute-Interaction in Germany could be conducted.

3. A Study on Nature of Training in Industry at vocational and Fachhochschule in Germany could be conducted.


5. A survey could be conducted of the Technical institutes at the State/National level to study the prevailing condition of technical education in context with the standards laid down by A.I.C.T.E. and N.B.A. So as to suggest necessary measures and to develop prospective plans for the institutes.