Government of Karnataka

Department of Education

Τεχηνιχαλ Εδυχατιον Σεχτορ Στυδψ

Current Status, Major Issues and Key Strategies

August, 2001

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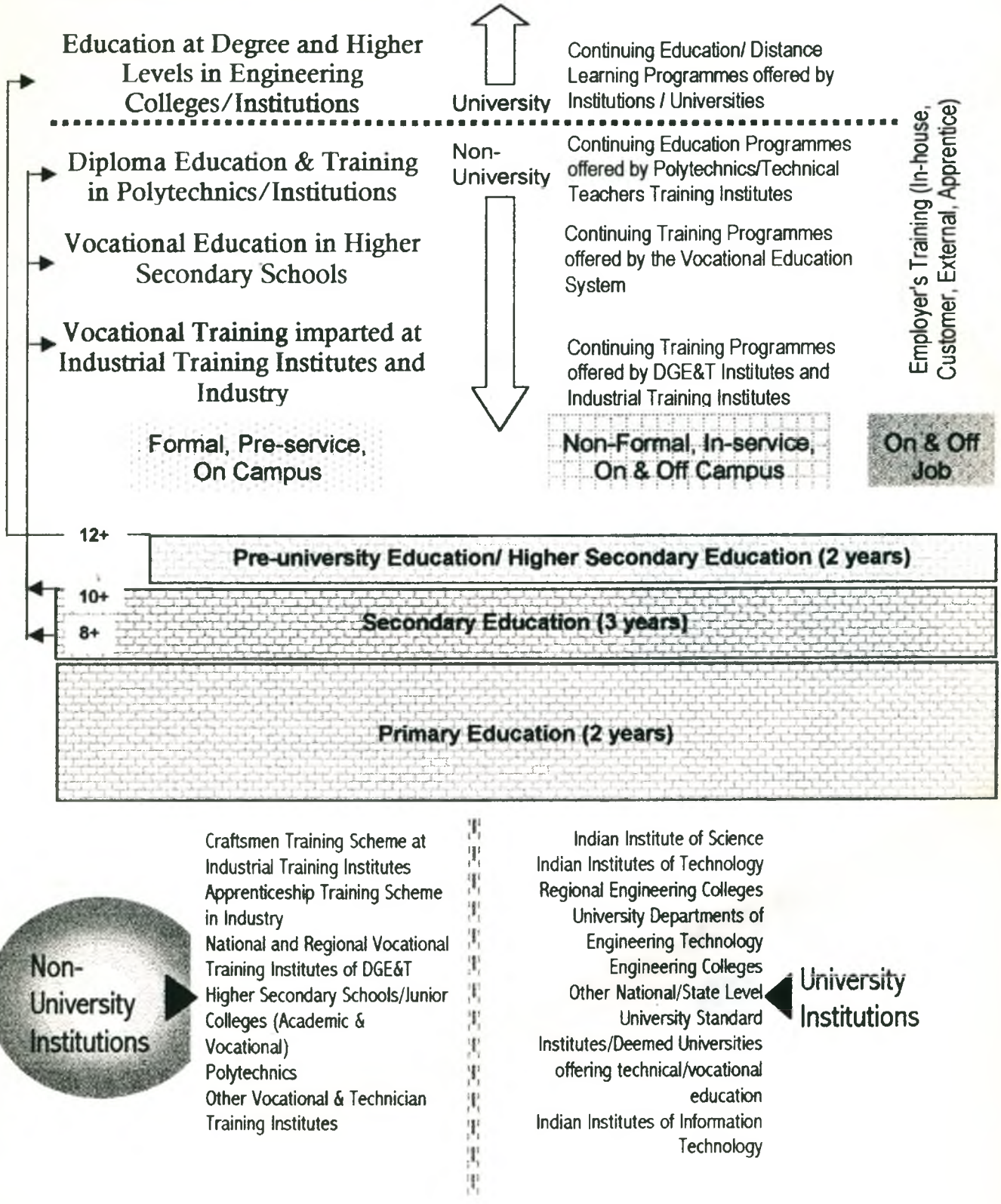
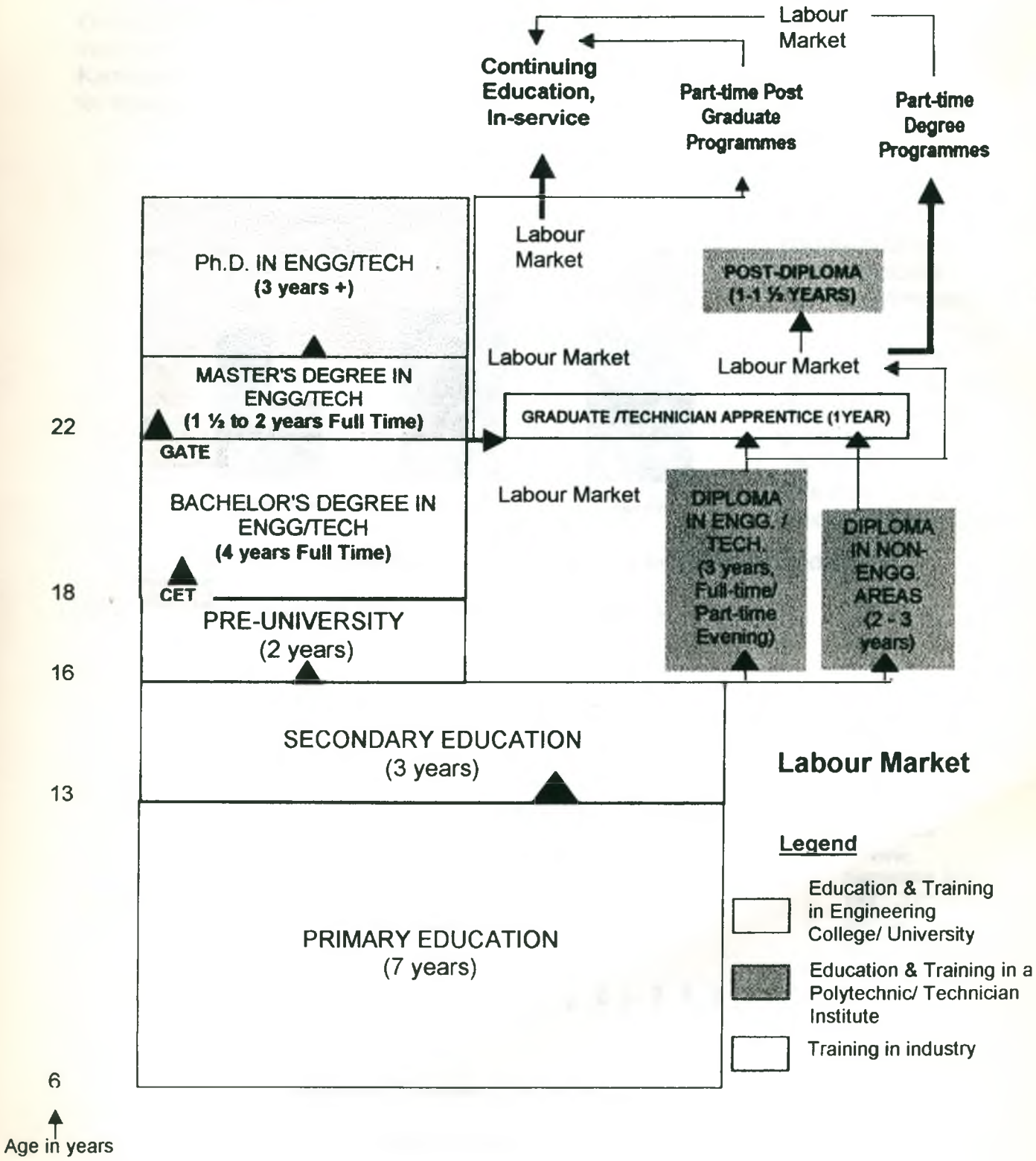


Figure 1: An overview of Technical Education System in India

2. STRUCTURE OF DIPLOMA, DEGREE AND POST-GRADUATE PROGRAMMES IN TECHNICAL EDUCATION IN KARNATAKA



GATE - Graduate Aptitude Test in Engineering for admission to Post-graduate courses

CET - Common Entrance Test for admission to Professional Colleges in Karnataka

Figure 2: Structure of Technical Education System in Karnataka

3. THE SIZE OF TECHNICAL EDUCATION SYSTEM IN KARNATAKA

3.1 Karnataka's position

On an all India basis, Karnataka accounts for about 11% of the number of post-graduate institutes, 12% of degree institutions and 16% of diploma institutions. Intake wise, Karnataka's share is 6% for Post-graduate courses, 17% for degree courses and 17% for diploma courses. *An analysis of 1997 batch indicates that migration to Karnataka from other states was about 16% for post-graduate courses, 25% for degree courses and 6% for diploma courses. Whereas, migration of students from Karnataka to other states was less than 2% for post-graduates, less than 1% for degree and less than 1% for diploma* courses.

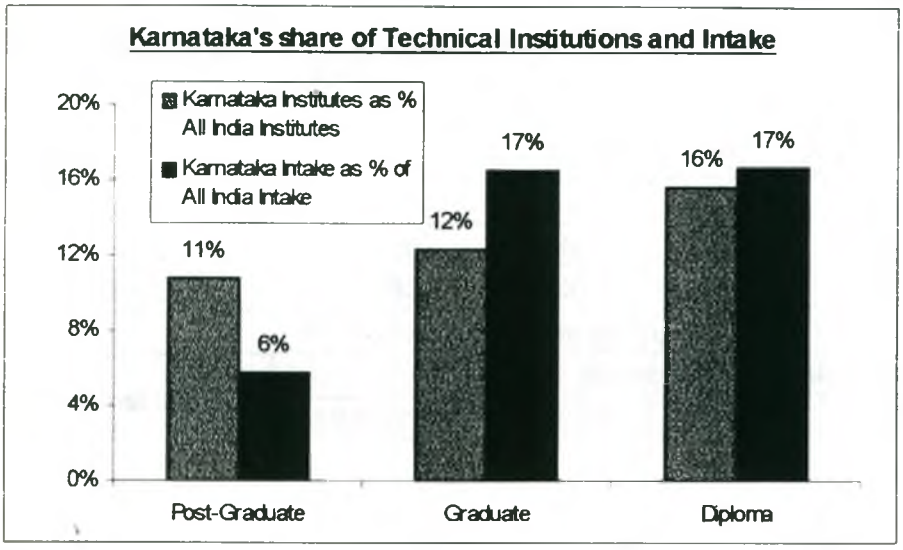
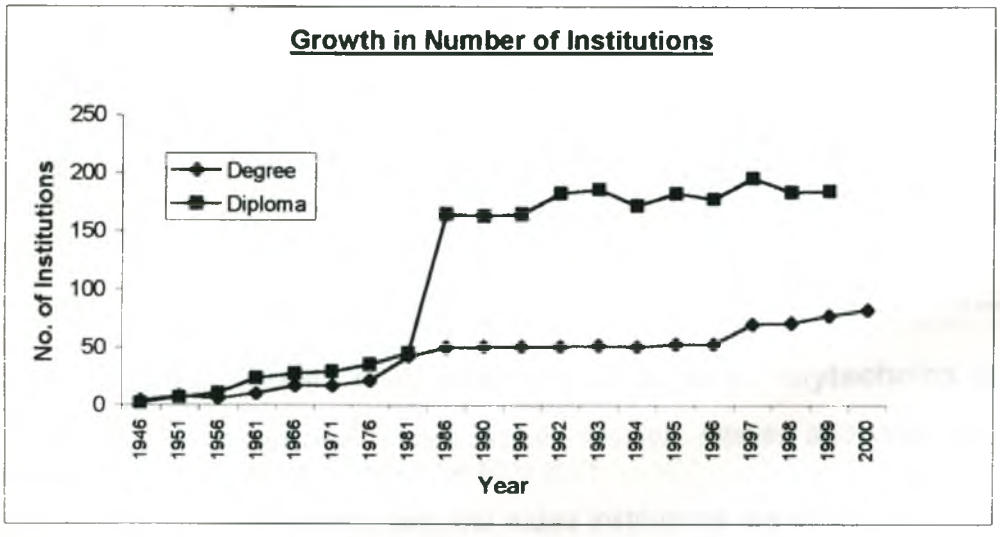


Figure 3: Karnataka's share of Technical Institutions and Intake

3.2 Growth in number of institutions in Karnataka



Source: NTMIS, Nodal Centre for Karnataka State, Annual Technical Manpower Review, Karnataka State, 1997-2001 and Annual Administration Reports, DTE, Bangalore

Figure 4: Growth in Number of Institutions

Average annual growth rates %

Period	Degree	Diploma
1946- 76	14	55
1976-81	20	6
1981-99	10	39

3.3 Growth by type of Institution

There are three categories of engineering colleges based on the type of management and financing.

a. Government Institutions – managed and financed by the government/university
b. Aided Institutions - managed privately and aided financially by the government
c. Self-financing Institutions – managed and financed by private sector

Type of Institutions	Number of Institutions in					
	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
Engineering Colleges						
Government	6	6	6	6	6	6
Aided	11	11	11	11	11	11
Unaided	36	36	53	54	60	65
TOTAL	**53**	**53**	**70**	**71**	**77**	**82**

Polytechnics (excluding FTI, NTTF & GTTC)					
Type of Institutions	Number of Institutions in				
	1995-96	1996-97	1997-98	1998-99	1999-2000
Government	39	37	38	37	38
Aided	7	7	7	7	7
Unaided	137	134	151	140	140
TOTAL	**183**	**178**	**196**	**184**	**185**

The growth in intake tabulated above is shown in Figure 5.

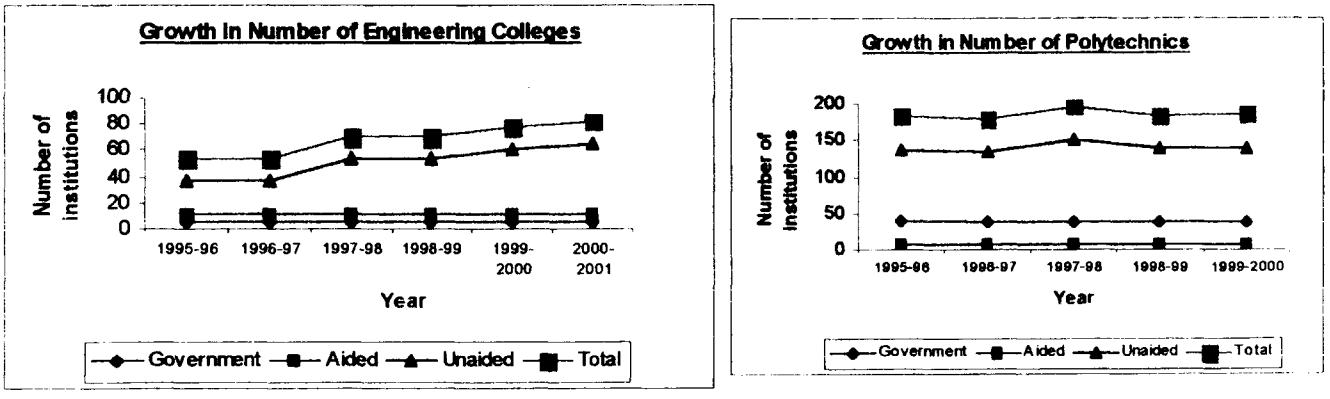
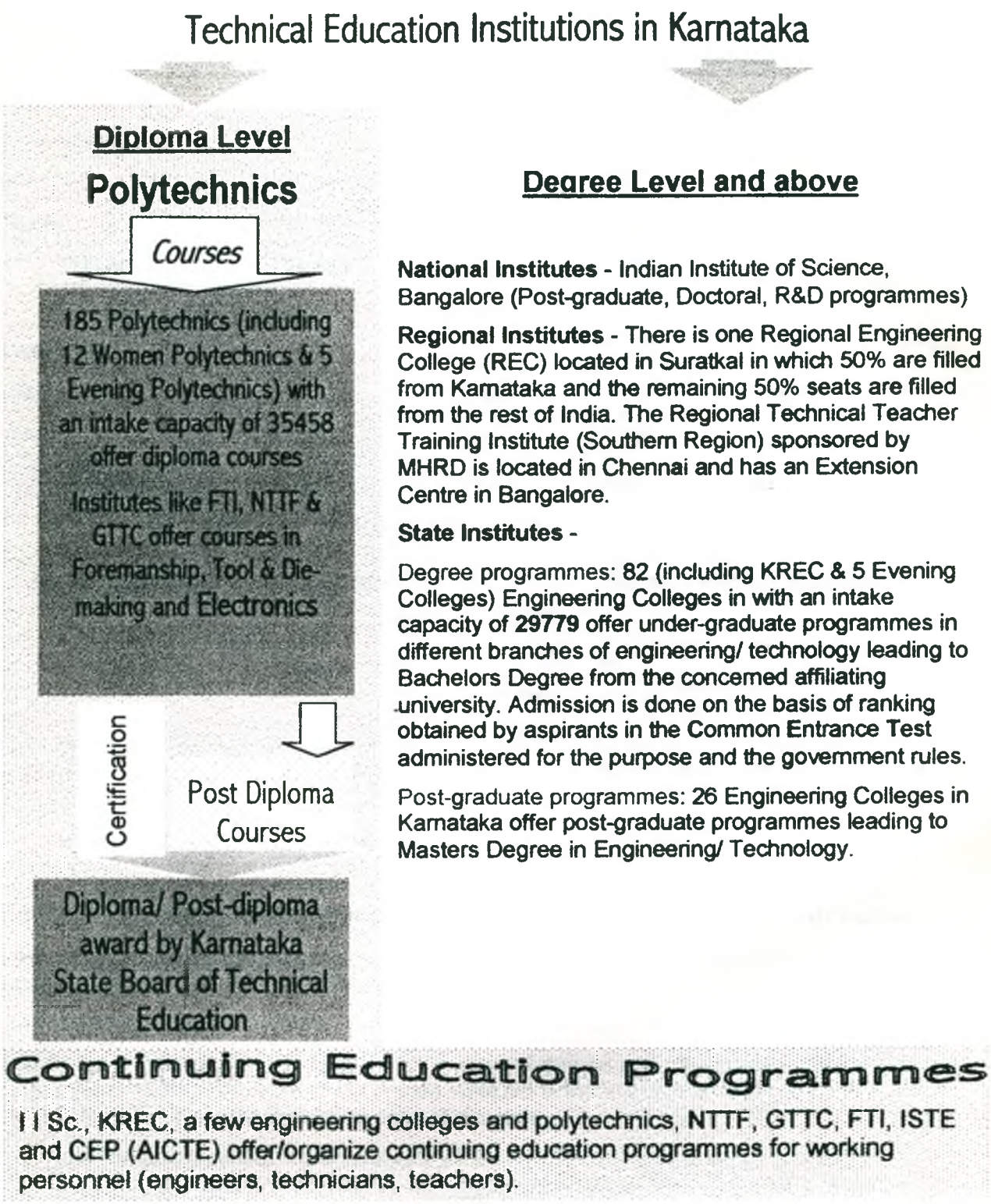


Figure 5: Growth of Engineering Colleges & Polytechnics in Karnataka

Source: Annual Administration Reports 1996-97, 1997-98, 1998-99, 99-2000(draft) of DTE, Bangalore and data collected from DTE's office for 2000-2001

While the number of Government and Aided institutions are steady at 6 and 11 for engineering colleges respectively and 38 and 7 for polytechnics respectively, the number of private engineering colleges have increased phenomenally from 36 to 65. There is a marginal increase in the number of private polytechnics from 137 to 140 in case of polytechnics. According to television and newspaper reports, about 40 new unaided engineering colleges are likely to be added in 2001-2002 taking the total unaided colleges to 105 and the total number of engineering colleges to 122.

3.4 Institutions and Programmes offered - an overview



List of Institutes with intakes are given in Annex 1

3.5 Growth in intake

3.5.1 Intake by type of institution

Type of Institution	Year				
	1996-97	1997-98	1998-99	1999-2000	2000-2001
Degree					
Government	1368	1344	1382	1406	1522
Aided	5305	4998	5077	5022	5857
Private	12772	17459	17925	19864	22400
TOTAL	**19445**	**23801**	**24384**	**26292**	**29779**
Diploma					
Government	6711	7770	7534	8294	7840
Aided	2120	1848	1838	1884	1967
Private	19884	22262	23196	24451	25651
TOTAL	**28715**	**31880**	**32568**	**34629**	**35458**

The growth in intake tabulated above is shown in Figure 6.

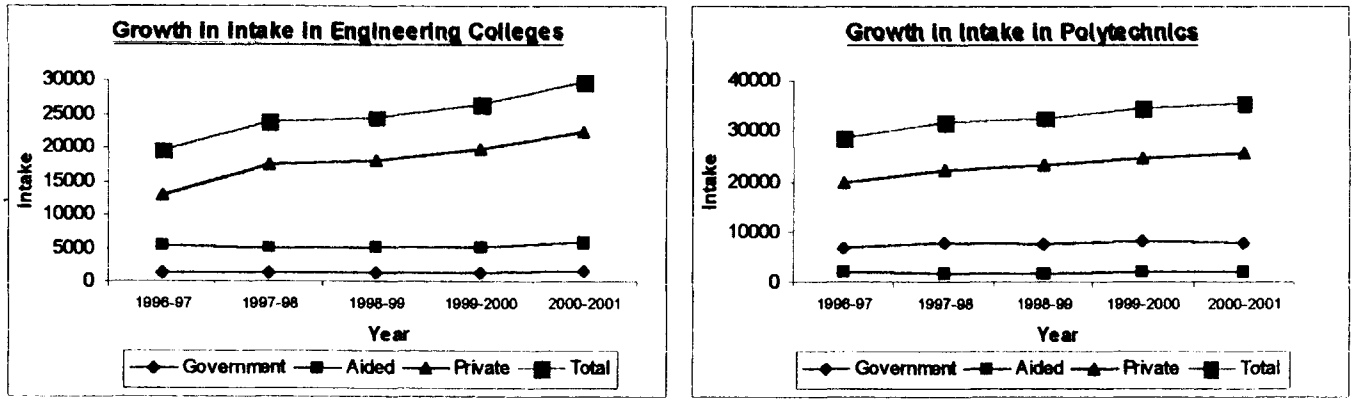


Figure 6: Growth in intake in engineering colleges and polytechnics in Karnataka

Source: Annual Administration Reports 1996-97, 1997-98, 1998-99, 99-2000(draft) of DTE, Bangalore and data collected from DTE's office for 2000-2001

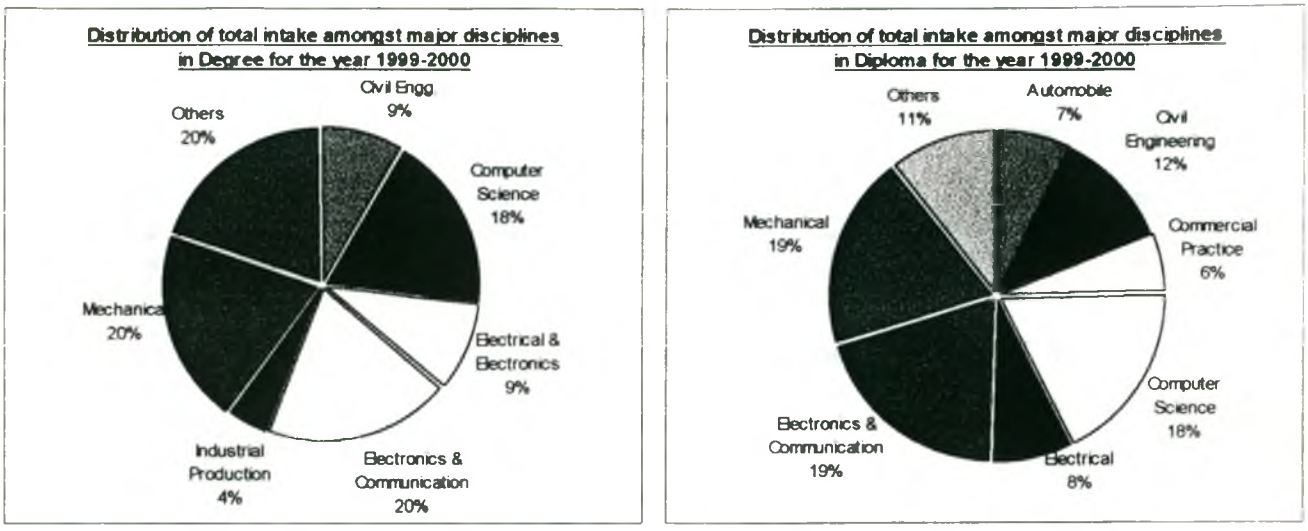
From the above table and graphs, it is seen that

- Average annual growth in intake is 11% in case of degree and 5% in case of diploma during the years 1996-2000, whereas in private institutions the average annual growth in intake is 15% in case of degree and 6% in case of diploma.
- Private (unaided) institutions account for 75% and 72% of the total intake capacity in engineering colleges and polytechnics respectively whereas the Government/ Aided institutions account only for 25% and 28% of the total intake capacity in engineering colleges and polytechnics respectively.

If 40 new private engineering colleges start in 2001, the unaided colleges will account for nearly 80% of the total intake.

3.5.2 *Intake by discipline*

Annex 2 gives details of intake by discipline for all programmes. The distribution of total intake amongst major disciplines for the year 1999-2000 is shown Figure 7.



Source: Annual Administration Report 1999-2000 (draft) of DTE, Bangalore

Figure 7: Distribution of intake among major disciplines in 1999-2000

There is a 28% increase in the intake in post-graduate programmes from 1995-99, and 53% increase in degree programmes and 23% in diploma programmes from 1996-2000.

The increase/decrease in intake for major disciplines during 1996-99 is tabulated below.

Programme	Computer Science & Engineering	Electronics & Communication Engineering	Mechanical Engineering	Information Science	Civil Engineering
Degree	32% increase	25% increase	16% increase	13% increase	8% decrease
Diploma	34% increase	64% increase	43% increase	-	8% decrease

Source: Annual Administration Reports 1996-97, 1997-98, 1998-99, 1999-2000 (draft), DTE, Bangalore

3.5.3 *Admission to intake ratio*

Annex 3 gives details of admission to intake ratios as % of total for total number of students, girls, SC and ST in case of engineering colleges and polytechnics in Karnataka.

In case of degree programmes utilization of intake capacity was 100% in 1996-97, 86% in 1997-98 and 92% in 1998-99 and 87% in 1999-2000. *This trend may have a serious consequence on the new engineering colleges that are likely to come up during 2001-2002.* The admission of *girls* has increased from 19% in 1996-97 to 24% in 1999-2000. 7% of the total admissions were admitted among the *Scheduled Caste* in 1996-97 where as only 5% of the total intake were admitted in 1999-2000. The admission of *Scheduled Tribes* varied from 1% to 2% of total admissions from 1996-2000.

In case of diploma programmes utilization of intake capacity was 70% in 1996-97, 68% in 1997-98 and 67% in 1998-99 and 59% in 1999-2000. *This trend indicates that more than 40% of the capacity in polytechnics is not being utilized calling for immediate attention of the government.* The admission of *girls* has increased from 15% in 1996-97 to 19% in 1999-2000. The admission of *Scheduled Caste* varied from 8 to 9% and admission of *Scheduled Tribe* remained at 2% of the total admission from 1996-2000.

The trends described above are shown in Figure 8 below.

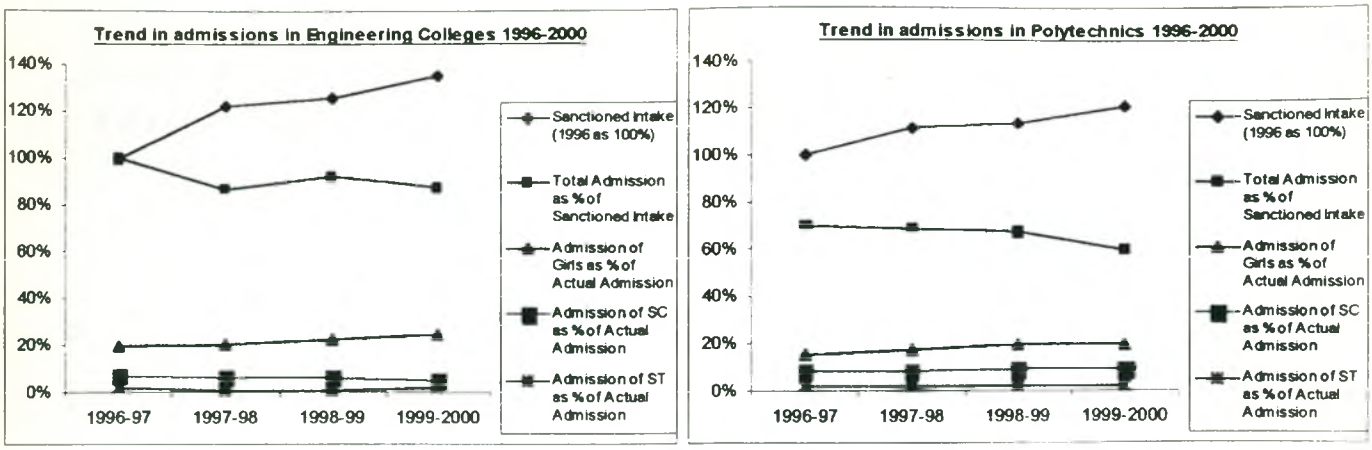


Figure 8: Trend in total admission, admission of Girls, SC & ST

3.5.4 Outturn-Intake Ratio

Year	% Ratio Outturn to Intake		
	Post-graduate	Degree	Diploma
1995	-	64	49
1996	70	65	70
1997	83	69	42
1998	83	62	30
1999	89	61	35

Source: NTMIS, Nodal Centre for Karnataka State, Annual Technical Manpower Review, Karnataka State, 1997-2001

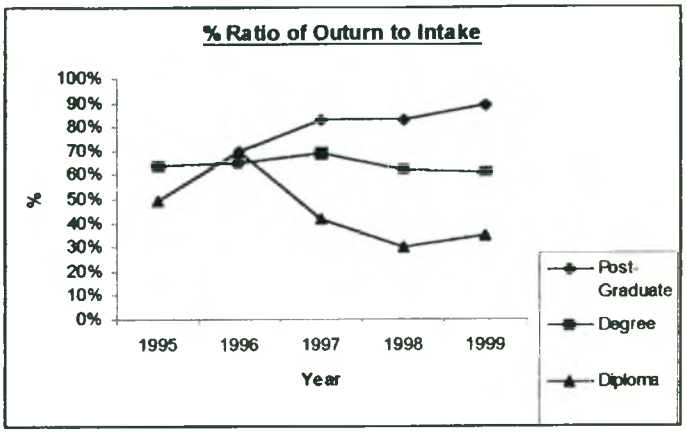


Figure 9: Out-turn to intake ratio

Note: The intake figures are taken for those years depending on the duration of the courses (Post-graduate 18 months, degree 4 years, diploma 3 years)

An interesting study made in one of the well known aided engineering colleges is summarized below.

Discipline	Number of students who completed the course in the normal duration of 4 years as % of students admitted in the category in 1995			
	General Merit	SC/ST	BCM/BCT	Management
Civil	78	33	38	100
Mechanical	96	0	56	33
Industrial Production	90	0	64	71
Electrical Electronics	88	25	70	80
Electronics & Comm.	86	29	79	80
Instrumentation Tech.	85	25	69	50
Computer Science	95	38	74	83
Environmental Engg	94	33	71	0
Polymer Science	100	20	67	75
Average	**90**	**23**	**65**	**64**

3.6 Enrolment in Technical Education

Annex 4 gives the details of Enrolment from 1996-1999 for degree and diploma programmes.

3.6.1 Enrolment by type of institution

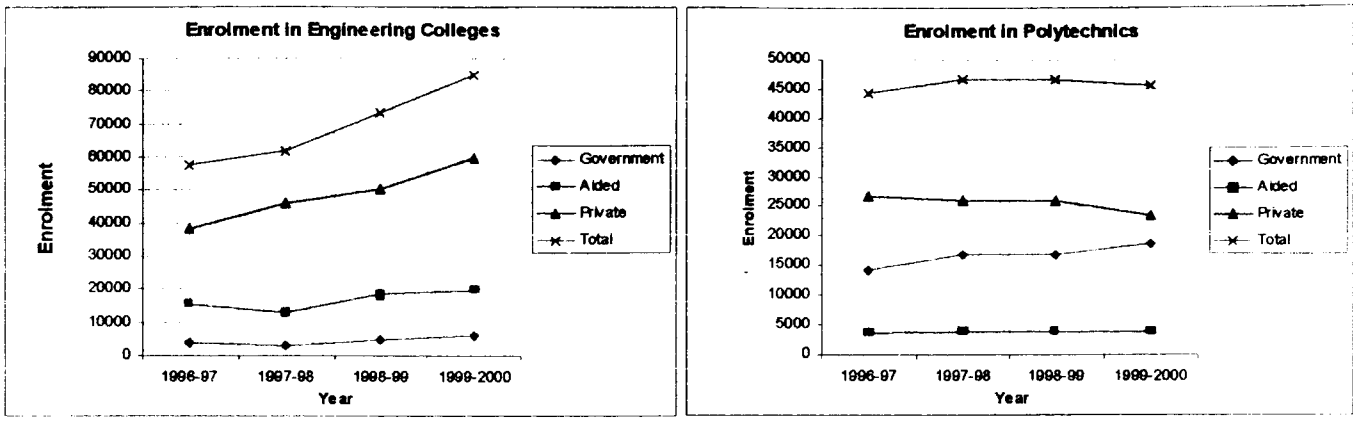


Figure 10: Enrolment by type of institution

The increase in enrolment during the years 1996-2000 in engineering colleges is primarily due to increase in enrolment in private institutions. In case of polytechnics, the trend is increasing enrolment in government institutions and decreasing enrolment in private institutions.

3.6.2 Enrolment of Girls, SC & ST by type of Institution

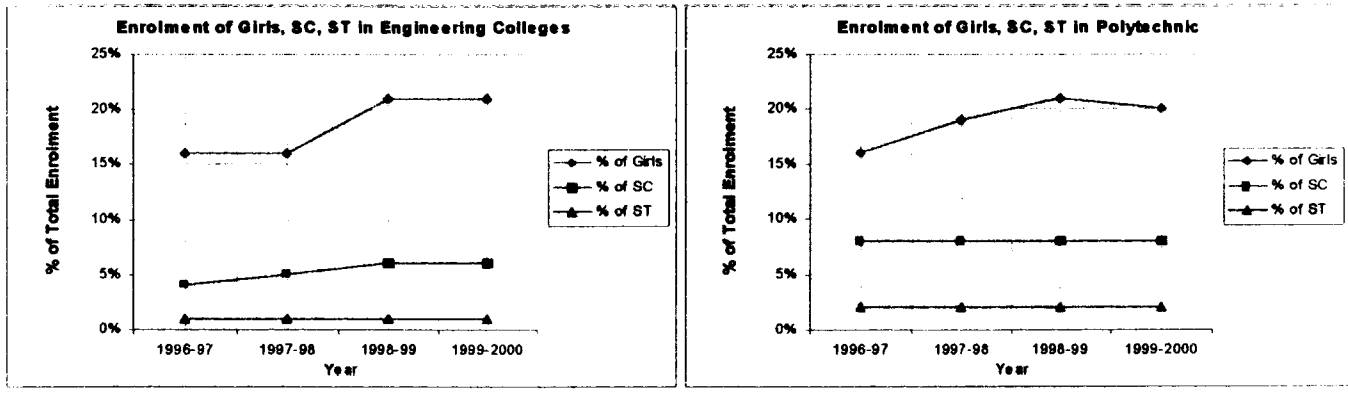


Figure 11: Enrolment of Girls, SC & ST

From 1997-98 to 1998-99 there is a big jump in girls enrolment from 16% to 21% in engineering colleges and a drop of 1% from 1998-99 to 1999-2000 in polytechnics. While the SC enrolment in engineering colleges has increased by 2% over the last three years, ST enrolment is steady.

Student Migration

Number of Non-Karnataka students who	1999	2000
appeared for CET	32623	35366
qualified in CET	32573	35340
were admitted	2606	2582

Roughly a third of the total number appearing for CET are from other states. The decrease in the number of admissions is probably due to opening of more colleges in other states.

Migration of students from other states to Karnataka is more than the migration of Karnataka students to other states in India.

3.6.3 *Enrolment of Girls, SC & ST by discipline*

Disciplines in which Girls share of enrolment in 1999-2000 is > 30%			
Degree		**Diploma**	
Bio-medical Engg.	59%	Civil Draftsmanship	100%
Environmental	58%	Library & Information Science	100%
Architecture	48%	Apparel Design & Fashion Technology	98%
Medical Electronics	41%	Modern Office Practice	83%
Tele Communication	39%	Interior Design	80%
Transportation	37%	Business Administration	63%
Polymer Science	37%	Chemical Engineering	35%
Instrumentation Technology	34%	***During 1996-99, the girls share of enrolment increased by 21% in Bio-medical Engg. and decreased by 16% in Telecommunication in Degree; Increased by 31% in Business Administration, 17% in Modern Office Practice and decreased by 20% in Interior Design in diploma programmes during the same period.***	
Textile Technology	33%		
Silk Technology	32%		
Electrical Engg.	31%		
Disciplines in which SC share of enrolment in 1999-2000 is > 15%			
Degree			
Metallurgy	26%	Mining	15%
Diploma			
Sound & Television	47%	Heat Power Technology	21%
Mining	35%	Cinematography	21%
Leather Technology	31%	Welding & Sheet Metal	16%
Business Administration	27%		
Disciplines in which ST share of enrolment in 1999-2000 is > 3%			
Degree			
Metallurgy	7%	*In other disciplines, ST enrolment is <3%*	
Diploma			
Cinematography	8%	Chemical Engineering	3%
Polymer Technology	7%	Heat Power Technology	3%
Sound & Television	6%	Textile Technology	3%
Printing Technology	6%	Civil Engineering	3%
Metallurgy	4%	Ceramics	3%

3.7 Faculty

Annex 5 gives details of faculty strength, composition and educational profile. A summary is presented below.

3.7.1 *Strength & Composition*

*Faculty Strength 1998-99** *Faculty Composition 1999-2000***

3.7 Faculty

Annex 5 gives details of faculty strength, composition and educational profile. A summary is presented below.

3.7.1 Strength & Composition

	Faculty Strength 1998-99*			***Faculty Composition 1999-2000****			
	Total	%AS/SS	S :T Ratio	Total	Women	SC	ST
Degree	6290	92	19 :1	5528	913 (17%)	129 (2%)	19 (0.3%)
Diploma	5384	91	16 :1	4238	874 (21%)	248 (6%)	65 (1.5%)

Source:

a) *NTMIS, Nodal Centre for Karnataka State, Annual Technical Manpower Review, Karnataka State, 1995-1999, 1996-2000, 1997-2001*

b) *Annual Administration Report 1999-2000 (draft), DTE, Bangalore*

AS/SS means Actual Strength/ Sanctioned Strength; S : T Ratio means Student-Teacher Ratio

The Student-Teacher ratio recommended by AICTE in its Norms & Standards 1999 is 10 :1 for Engineering Colleges as desirable and 15 :1 as maximum. For Polytechnics, the desirable Student-Teacher ratio is 11:1 and a maximum of 16 :1.

The % ratio A/S which is generally more than 90% in Engineering Colleges and Polytechnics show that *more than 90% of the teaching posts* have been filled.

The actual Teacher-Student ratio shown in the table above exceeds the desirable norm in case of Engineering College and close to the maximum norm in case of Polytechnics.

In Engineering Colleges Student-Teacher ratios:

- Are either close to or in excess of 30 :1 in departments of Cement & Ceramics, Chemical Engineering, Computer Science, Polymer Science & Technology;
- Range from 6 :1 to 10 :1 in departments of Civil Engineering, Electrical Engineering and Metallurgy.

There is no teaching staff in departments of Bio-medical Engineering, Environmental Engineering, Information Science, Manufacturing Science, Medical Electronics, Printing Technology, Transportation Engineering and Telecommunication Engineering in Engineering Colleges. Staff of other departments is deployed to teach in these.

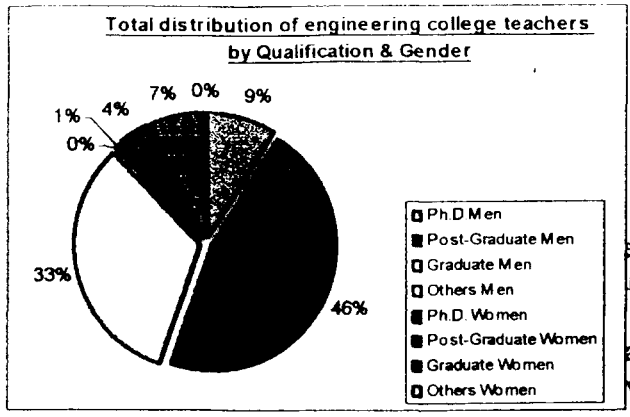
In Engineering Colleges, the % ratio AS/SS for Cement & Ceramic is 57 and for Polymer Technology it is 56, which means there is a serious shortage.

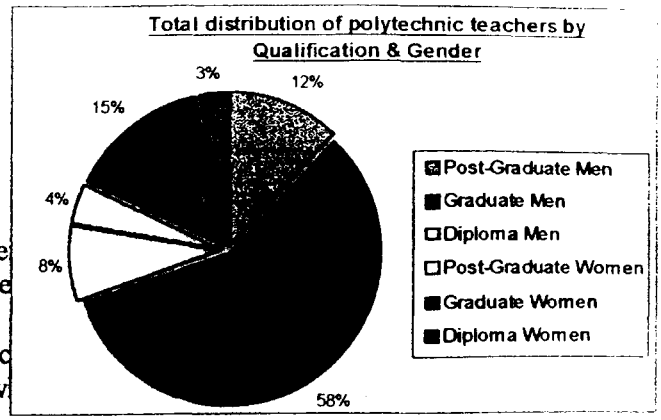
In Polytechnics Student-Teacher ratios:

- Are either close to or in excess of 30 :1 in departments of Computer Science, Architecture & Commercial Practice, Machine Tool Technology, Welding & Sheet Metal;
- Range from 4 :1 to 9 :1 in departments of Business Administration, Ceramics, Civil Engineering, Civil Draughtsmanship, Heat Power Technology and Sugar & Paper

According to information available from DTE's Office, the current staff position in government institutions is not very satisfactory with % vacancies ranging from 33% to 100%. A sample survey conducted for this study through a questionnaire indicates that there is 25-30% shortage in polytechnics. According to an AICTE survey student -teacher ratio varies from 39:1 to 52:1 for IT courses against a norm of 15:1.

3.7.2 *Educational profile of teachers*





3.8 Stakeholders in Technical Education

Students in polytechnics and engineering colleges form the most important stakeholders since they join these institutions with plenty of hopes and aspirations for the future not only on their personal behalf but also on behalf of their parents and family members and fully or partially pay the educational costs..

The faculty is responsible for satisfying the students in meeting their learning needs in technical, social, managerial and personal competence areas and participates in building a corporate image for the institution through various academic, R & D activities.

The institute managerial personnel are responsible to provide the required educational, health, recreational and residential and boarding services to the students and faculty management services.

The parents and families are responsible to share the educational costs of their son/daughter/relatives and participate in monitoring their academic progress.

Technical education is incomplete without the participation of employers of technical personnel in a spirit of partnership with the institute so that there is no mismatch between what is required by them and what the institute produces.

Regulatory and professional bodies and the governments at the state and the centre –all have a role to play making the system responsive to the needs of the economy and the society and to produce very high quality engineers and technicians acceptable at national and international levels.

Figure 12 diagrammatically represents all the stakeholders involved in technical education in Karnataka.

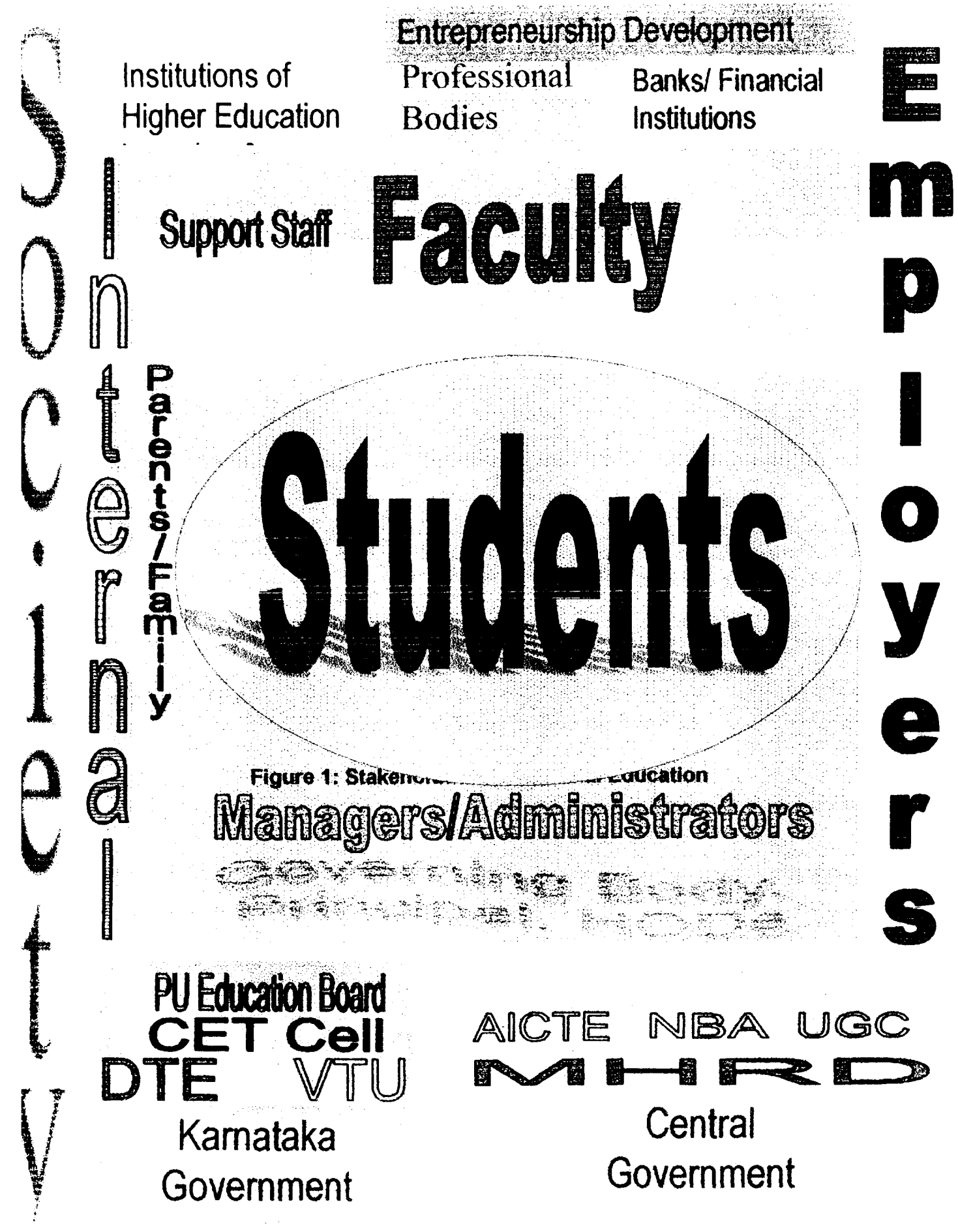


Figure 1: Stakeholders in Education

4. ENGINEERING LABOUR MARKET

4.1 Engineering Manpower

The engineering manpower pyramid and basic educational levels is given in the figure below.

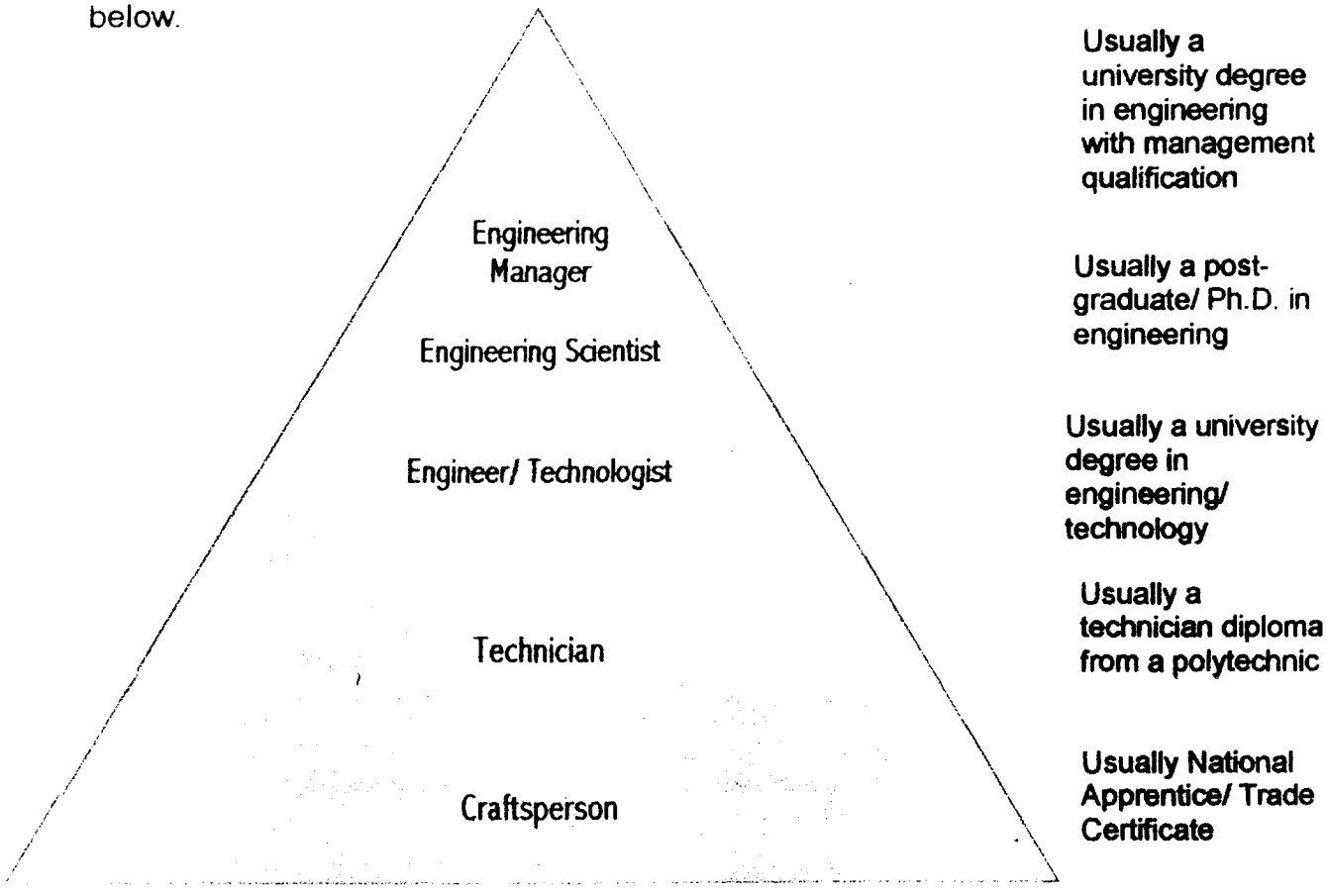
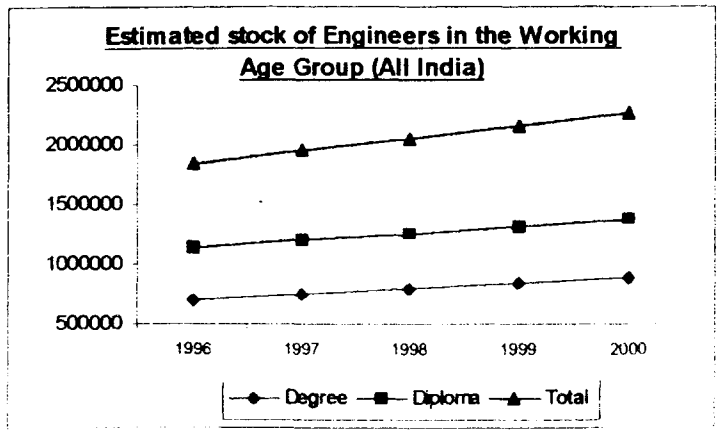


Figure 13: Engineering Manpower Pyramid

4.2 Stock Analysis

Annex 6 gives the estimated stock of engineers (degree & diploma) in the working age group by selected disciplines on an All India basis. Following is its summary.

Year	Degree	Diploma	Total
1996	704500	1138500	1843000
1997	751900	1197300	1949200
1998	798400	1255500	2053900
1999	845600	1313100	2158700
2000	892500	1371300	2263800



The average growth rate of stock of degree and diploma holders is 5% from 1996-2000.

Source: Manpower Profile India Yearbook 2000, IAMR, 2000

4.3 Suppiy-demand analysis

4.3.1 Engineering/ Technology

Annex 7 gives the estimated gap between supply and demand of engineers by 2001.

It appears that the supply position of the number of engineers at post-graduate, graduate and diploma level is very satisfactory exceeding the demand in almost all disciplines.

Source: NTMIS, Nodal Centre for Karnataka State, Annual Technical Manpower Review, Karnataka State, 1997-2001

Electronic Engineers (Electronics, Electronics & Telecommunication, Electronics & Communication, Electronics Instrumentation, Digital Electronics & Radio Engineering, Electronics & Sound Engineering and Industrial Electronics) will be in surplus even if the admissions to the courses both at under-graduate and diploma level are maintained at the current level.

Source: Requirements of Electronics Engineers upto 2001, IAMR1998

In industry-specific fields of engineering/technology like Ceramics, Dairy, Leather, Man-made Fibre, Mining, Paper, Petro-chemicals, Polymer & Rubber, Printing, Sugar, and Textiles except for marginal shortages in a few fields, the supply position is satisfactory compared to the demand.

Source: Requirements of different categories of engineers, IAMR1998

4.3.2 Information Technology (IT)

IT includes Computer Science, Information Technology, Electronics (including Microelectronics), Tele communications and MCA. It also includes specialization such as Artificial Intelligence, Computer Aided Manufacturing (Robotics, FMS, CNC Machine Tools), Computer Integrated Manufacturing, Computer Aided Design, Computer Aided Drafting, etc.

Knowledge-led businesses are set for rapid growth contributing roughly to two-thirds of growth in global GDP. India has a new *mantra* - Information Technology, and almost everyone is chanting it. It is estimated that the total size of IT industry in India will exceed US $ 100 billion by 2008 (an estimate by an MIT Professor who is a Computer Guru places this figure at US $ 3 Trillion by 2008) and will become single largest contributor to the GDP of the country.

Annex 8 gives IT manpower estimates based on NASSCOM-McKinsey Study and Government of India estimates.

NASSCOM Estimates		
Categories	Hardcore IT Sector	1,100,000
	IT Enabled Services	1,100,000
Total No. of IT Professionals required by 2008		**2,200,000**
Ministry of information Technology, GOI Estimates		
Categories	A - Professionals for SW Products	200,000
	B - Professionals for IT Services & E-Business	577,000
	C - Professionals for IT Enabled Services & E-Business	1,290,000
Total No. of IT Professionals required by 2008		**2,367,000**

International Demand - Shortage of IT Professionals	
By 2004 in USA International Demand (according to IDC study as reported in http://www.nastracindia.com/Final/itforum.html)	1,000,000
By 2000 in European Union (as reported in http://www.idsa-india.org/an-apr011.html)	400,000
Total International Demand (as reported in http://www.idsa-india.org/an-apr011.html)	1,400,000
Total International Demand at 20% of domestic requirement (as reported in http://www.education.nic.in/htmlweb/itdiscussionpaper1.htm)	440,000
Total IT Manpower Demand by 2008	**3,767,000 (Max) or 2,640,000 (Min)**

Supply position is satisfactory in quantitative terms so far as the manpower requirements by India are concerned. If we aim at supplying manpower globally to meet the shortage of IT manpower in the US, the European Union and other countries, quantitative expansion of IT Education & Training would be required. But the *thrust should be on international standards of quality* both in case of existing institutions and new institutions. The recent recession in US economy resulting in significant layoffs had an impact on Indian IT industry and therefore quantitative expansion of IT education and training capacity is not warranted at least for the next one year.

4.4 Employment of engineering manpower

Annex 9 gives details of sector-wise employment of engineering manpower.

4.4.1 Distribution of Employment for freshers in different sectors

Private sector is the largest employer of engineers and technicians and this trend is likely to continue with greater share of employment by the private sector due to liberalization and privatization policies pursued by the central and state government.

4.4.2 Absorption by Private Sector

Percentage employed in private sector ranges from 40% to 70% in case of post-graduates, 53% to 95% in case of graduates. Geo-technical Engineering, Production Management, Materials Engineering, Bio-medical Engineering are the disciplines in which *post-graduates* are employed in good numbers by private sector.

Metallurgy, Textiles, Architecture, Chemical Engineering, Electronics & Communication Engineering, Industrial Production, Instrumentation Technology, Computer Science and Mechanical Engineering are the disciplines in which *graduates* are employed in good numbers by private sector.

Automobile, Business Management, Chemical Engineering, Electronics & Computer Science, Mechanical Engineering and Mining are the disciplines in which *diploma holders* are employed in good numbers by private sector.

4.4.3 Size for employing establishments 1997 batch

Establishments employing about 500 employees account for over 70% of employment of graduates and post-graduates and 86% of diploma holders. Small establishments account for nearly 50% of employment degree in architecture and civil engineering whereas they account for about 99%, 70%, 64% and 50% employment of diploma holders in architecture, computer science, civil engineering and automobile engineering respectively.

4.4.4 Discipline-wise absorption by small establishments (<50) (as %)

Small establishments employ about 50% of the *graduates* in Architecture and Civil Engineering and more than 50% of *diploma holders* in Architecture, Computer Science, Civil Engineering, Commercial Practice and Automobile

5. PRIVATE SECTOR PARTICIPATION IN TECHNICAL EDUCATION

By the end of the fifth five-year plan (1979), there was considerable pressure for expansion of technical education. As the governments at the centre and the states were finding it difficult to invest their scarce financial resources on expansion, some states viz., Andhra Pradesh, Kamataka, Maharashtra and Tamil Nadu decided to permit private registered societies and trusts to establish and run technical institutions on a self-financing basis. As a result a large number of private engineering colleges and polytechnics came into existence in these states.

As the number of such institutions (especially the engineering colleges) kept on increasing, controlling their functioning especially in respect of fees charged by them for admitting students under the management quota of seats became a problem. Failure of the executive led to the intervention of the Supreme Court of India, which defined norms for admission and fee structure for all self-financing engineering colleges.

The private sector participation in respect of number of institutions and sanctioned intake is shown in the figure below.

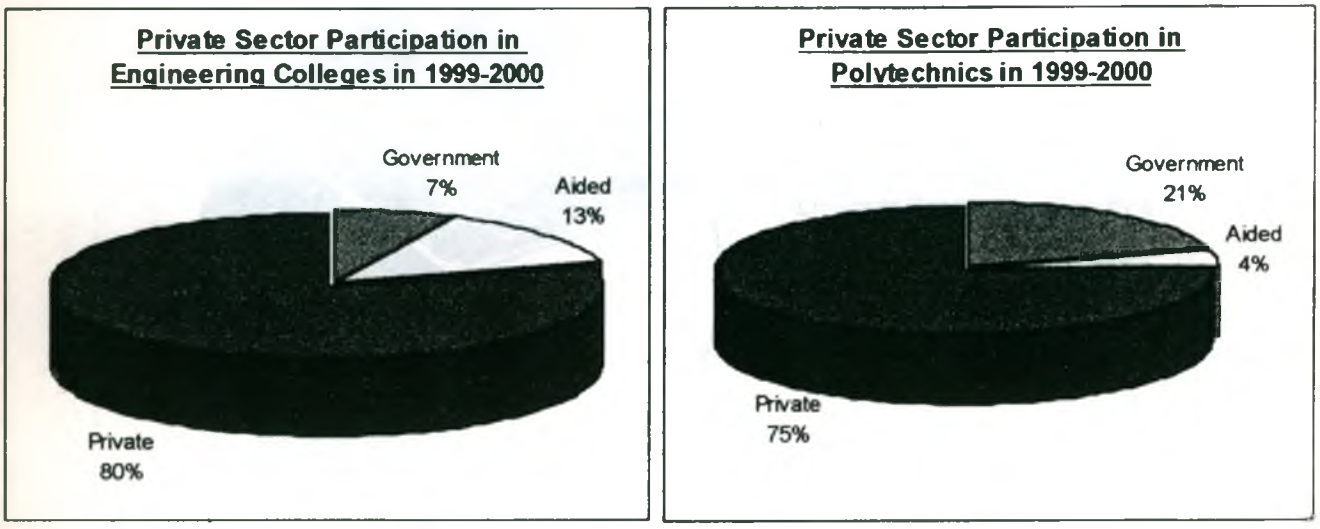


Figure 14: Private Sector participation by Number of Institutions

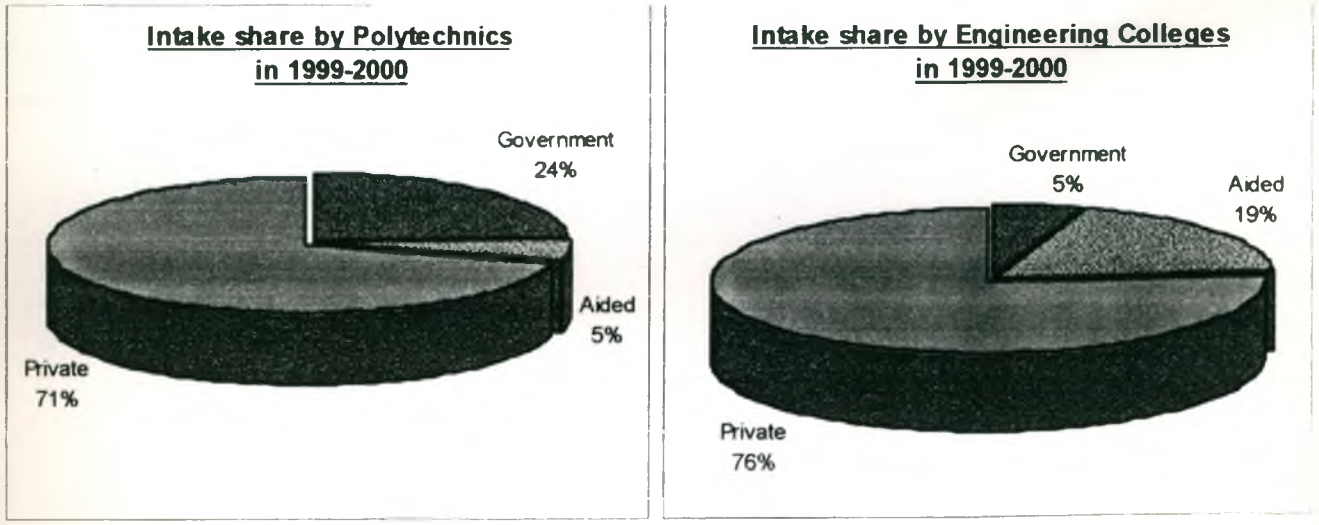


Figure 15: Private Sector participation by Intake

6. QUALITY AND RELEVANCE

6.1 Current Quality Assurance Mechanism

The National Board of Accreditation (NBA) of the AICTE is vested with the authority to periodically assess the quality of technical education institutions and programmes offered by them. NBA has started accrediting degree and post-graduate programmes and institutions. The accreditation parameters are as follows. Their relative weightages are shown in Figure 16 and Figure 17.

Mission, Goal & Organization	Financial & Physical Resources, their utilization
Human Resources - Faculty & Staff	Human Resources - Students
Teaching-Learning Processes	Supplementary Processes
Industry-Institute Interaction	Research & Development

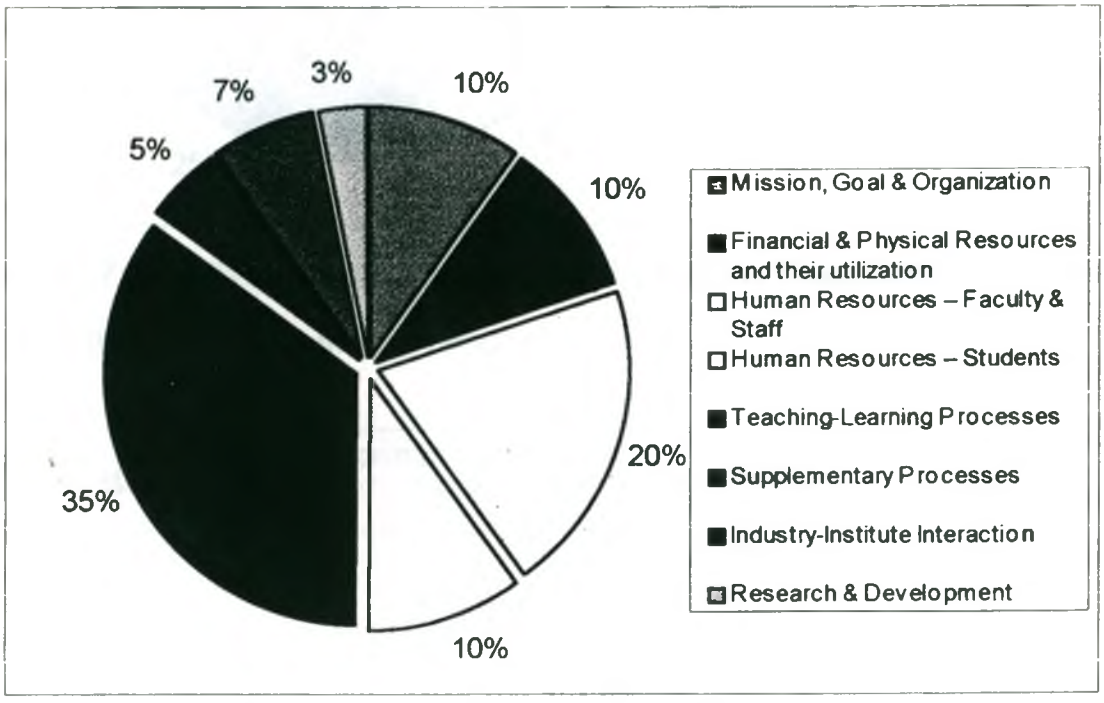


Figure 16: Relative weightages of NBA parameters - Degree Programs

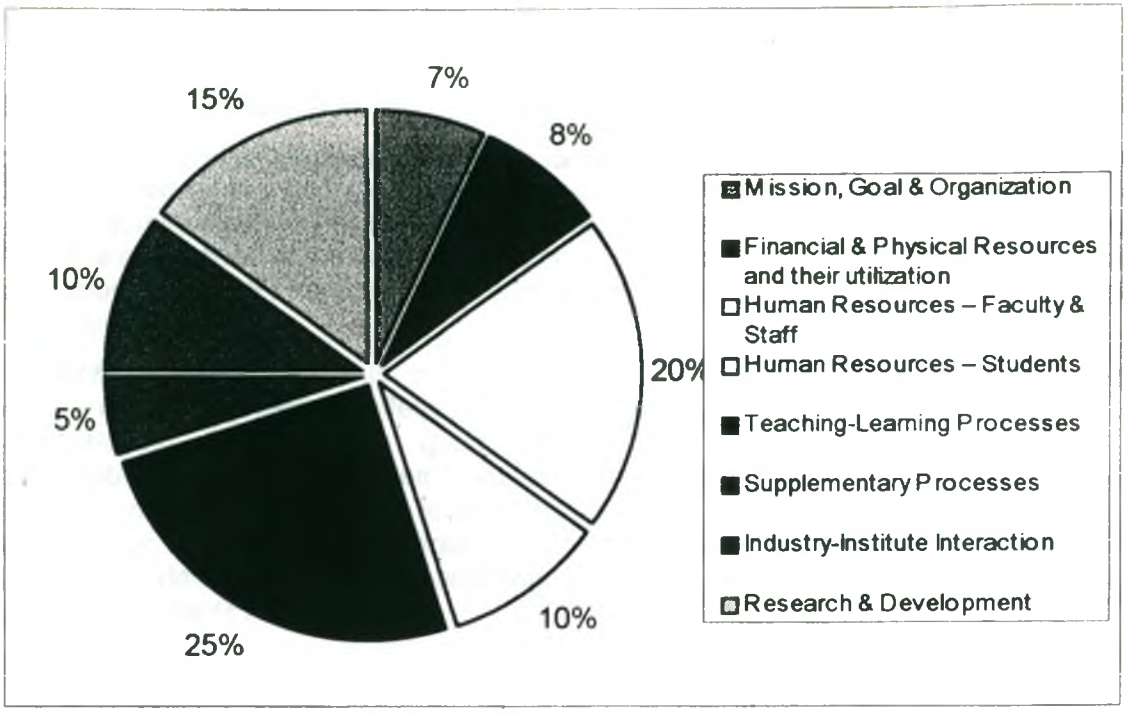


Figure 17: Relative weightages of NBA parameters - Post-graduate Programs

6.2 Institutions/programs are rated as follows.

Point Scale

Parameter	Points		Parameter	Points	
	UG	PG		UG	PG
Mission, Goal & Organization	100	70	Financial & Physical Resources, their utilization	100	80
Human Resources - Faculty & Staff	200	200	Human Resources - Students	100	100
Teaching-Learning Processes	350	250	Supplementary Processes	50	50
Industry-Institute Interaction	70	100	Research & Development	30	150

Rating Criteria

Criteria	Points	Grade
Meets all criteria or exceeds them	750 and above	A
Meets the minimum criteria and any deficiencies are marginal and can be improved within a short time	650 to 749	B
Deficiencies exist but the institution has the potential to make up within a foreseeable future, say, 1 to 2 years	550 to 649	C
Not ripe for accreditation in view of deficiencies .		NA

Source: National Board of Accreditation, Volume IV, The Accreditor's Manual, AICTE New Delhi 1998

6.3 Key Quality Issues

6.3.1 Quality of Students at Entry

a) Engineering Colleges

Admission to first year engineering degree course is done through Common Entrance Test (CET) conducted by the CET Cell which started in June 1996. The marks secured in the CET and Pre-university exam in Physics, Chemistry and Mathematics are considered on 50:50 basis and ranks are assigned to the candidates in order of merit. The seats are allocated on the spot through counseling. CET ranking and the reservation rules of the state government form the basis of admission.

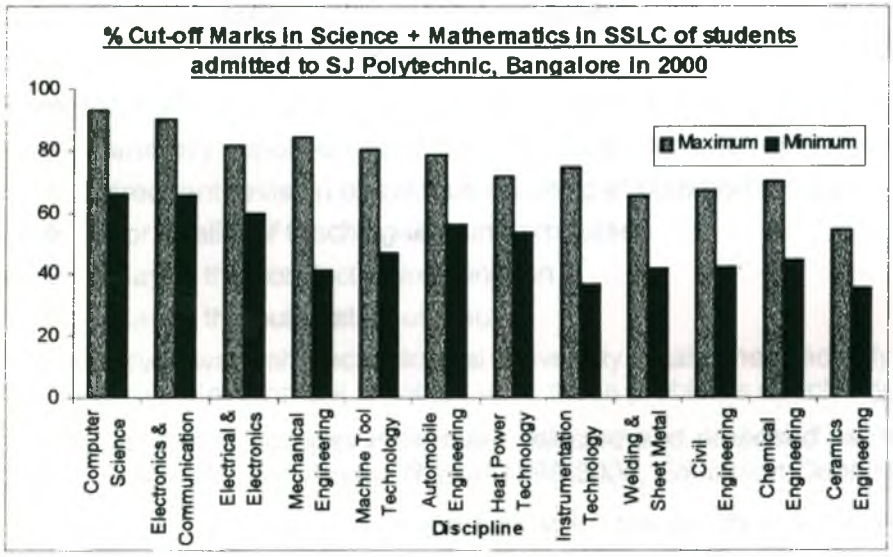
CET cut-off ranking is the only indicator available regarding the academic preparation of students entering engineering colleges. Generally students securing very good ranking in CET prefer colleges considered as good and choose Computer Science, Electronics & Communication Engineering as their fields of study. Students securing relatively lower ranking in CET have very little option either to choose a college or field of study. In 1999-2000, the CET cut-off rank for a GM (General Merit) seat in Civil Engineering was 27359 and for a PKA (Payment Karnataka) seat in Electronics was 27549. This situation results in wide variation in the quality of students at entry.

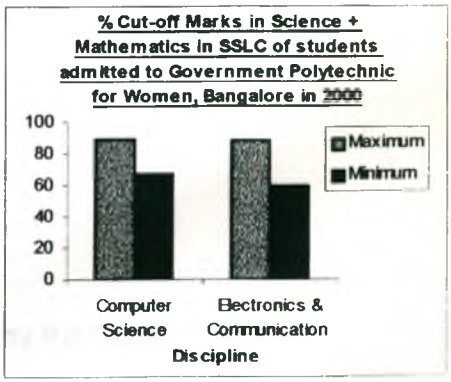
b) Polytechnics

Admission to diploma courses in polytechnics is based on the marks secured in Science and Mathematics in the SSLC examination for all the courses. For diploma courses in Business Administration, Library & Information Science, Sound & Television and Cinematography the eligibility for admission is a pass in PUC. Admission is done based on marks obtained in the qualifying examination and the reservation rules of the state government.

In case of polytechnics, cut-off marks in the qualifying examination (SSLC) is indicative of the quality of input.

As an example, in 2000, the maximum and minimum cut-off % marks in Science + Mathematics in SSLC for admission to SJ Polytechnic and Government Polytechnic for Women, Bangalore is given in Figure 18.





Source: Information collected from SJ Polytechnic and Government Polytechnic for Women, Bangalore

Figure 18: Percentage of Cut-off Marks in two polytechnics

The above graph shows that in the first year class on Computer Science in SJ Polytechnic or Women's Polytechnic, the variation in students quality ranges from 66% to 93% and 67% to 90% respectively which is very significant. In first year class on Mechanical Engineering, the variation is as high as 43%. The average range is about 27%.

In a questionnaire survey conducted for this study:

- 83% responses indicated that between 50-70% of the students are well prepared in the qualifying programme to easily follow the institute programme of studies. and 17% responses indicated that between 30-50% of the students only are well prepared;
- 17% of the respondents indicated that between 70-90% of the students demonstrate intense activity during studies (an indicator of motivation level) and 83% indicated that between 50-70% of the students demonstrate intense activity during studies.

6.3.2 Quality of Institutions

a) Engineering Colleges

In 1987 Government of Karnataka appointed an Expert Committee headed by Prof. M.H.Dhananjaya to recommend intake to the engineering colleges in the state commensurate with the facilities available. The Committee graded the colleges relatively into A, B, C and D (A Excellent-Good; B Good-Fair; C Fair-Satisfactory; D Poor) based on a Total Index Number arrived at by considering faculty, equipment, library and supporting staff, output-input ratio, recurring expenditure for academic work, floor area for academic activities, amenities for students and adjunct programmes.

Source: Report of the Expert Committee 1987, Department of Technical Education, Government of Karnataka

Though this exercise had an impact in improving the quality of facilities in many colleges, continuous quality improvement did not take place as the exercise had the limited objective of fixing the intake.

The universities to which the engineering colleges are affiliated are responsible for:

- Preparation of syllabi and their approval
- Conduct of examination
- Award of degrees
- Maintenance of academic standards
- Fix qualification for teachers
- Promote research and developmental work
- Provide funds to the colleges

However, engineering colleges are facing many problems such as:

- Generally supply-driven mind sets of teachers and administrators
- Infrequent revision of syllabus resulting in outdated programmes
- Poor quality of teaching-learning processes
- Delay in the conduct of examination
- Delay in the publication of results

The Visweswaraiah Technological University established recently by the Government of Karnataka Government is yet to tackle these problems effectively.

12 engineering colleges have been selected and proposed as centres of excellence to MHRD, New Delhi. Source: Annual Report 1999-2000, Education Dept, GOK

Presently, there are two indicators by which the quality of an engineering college is being perceived.

a. Student's perception of quality as judged by the preference for the institute he/she gives during admission

b. Accreditation by the NBA

Top rank holders in CET from different categories usually choose colleges considered as good (based on information from seniors and classmates and parents). Lower CET rank holders will have no option but to accept admission in whichever college it is offered.

Only two engineering colleges in Karnataka have obtained Accreditation from NBA. These are - the KREC, Surathkal and SJCE, Mysore. The details of accreditation are as follows.

KREC Surathkal

Programme	Grade	Validity Period (Years)
B.E. Electrical & Electronics Engg.	A	3
B.E. Electronics & Communication Engg.	B	3
B.E. Mechanical Engg.	B	3
B.E. Chemical Engg.	B	3
B.E. Civil Engg.	A	3
B.E. Computer Engg.	B	5
M.Tech. Power & Energy Systems	B	5
M.Tech. Hydraulics & Water Resources Engg.	A	3
M.Tech. Marine Structures	A	3
M.Tech. Industrial Structures	A	3
M.Tech. Geotechnical Engg.	A	3

SJCE Mysore

Programme	Grade	Validity Period (Years)
B.E. Electrical & Electronics Engg.	B	3
B.E. Electronics & Communication Engg.	B	3
B.E. Mechanical Engg.	B	3
B.E.Industrial & Production Engg.	C	3
B.E. Computer Engg.	B	3
B.E. Polymer Science Engg.	B	3
B.E. Instrumentation Engineering	B	3
B.E. Civil Engineering	B	3
B.E. Environmental Engineering	A	5

Source: www.aicte.com and SJCE, Mysore

b) Polytechnics

Student's perception of quality as judged by the preference for the institute he/ she gives during admission is the only indicator of quality.

Students getting very high percentage of marks in SSLC examination generally seek admission either in Computer Science or Electronics. Students getting lower percentages many a times have to seek admission to less popular courses.

6.3.3 Quality of Curriculum

AICTE norms for curriculum are as follows.

Degree		Diploma	
Area of study	Time Allocation	Area of study	Time Allocation
General	5-10%	General	5-10%
Basic Science	15-25%	Applied Sciences	10-15%
Engineering Sciences & Technical Arts	15-25%	Basic Engineering/Technology	20-30%
Professional Subjects	55-65%	Applied Engineering/Technology	40-55%
		Specialized Courses(Electives)	5-10%

The curriculum design has the following deficiencies.

- The curricula are essentially subject-centred and supplier driven and not competency-based and customer (student & labour market) driven. As the curriculum is mostly designed by the teaching community, the emphasis is more on the know - why at the cost of the know - how. Creative problem solving does not form a prominent part of the

curricula. (Students may do better in tests/examinations set to test how much they know than on tests/examinations that ask them to apply that knowledge in new situations. The students may even go on strike if such questions are asked branding them as *out of syllabus* questions!) The relevance of the curriculum to meet the industry requirement is questionable since industry's involvement in curriculum design for most programmes is either absent or notional. Very little or no attempt is made to develop a mix of knowledge, skills and attitudes to convert them into a useful marketable product or service in the shortest possible time. Evaluation system is outdated. No attempts are made to conduct *open book/ take home* examinations.

- Most curricula are rigid, straightjacket and wholly institution-based. They neither have the flexibility to allow the student to complete the course depending on his/ her ability and convenience nor to choose a blend of courses (For example choosing a particular combination of design and practice courses) that suits his interests and aptitudes.
- Even in the liberalized economic scenario, the tendency of copying/ cutting/ pasting/ diluting as the techniques of curriculum design still remains with our Boards of Studies in universities and State Board of Technical Education. Institutes do not have freedom to devise own curricula depending on the *think global and act local* philosophy.

The Visweswaraiah Technological University prescribes the curriculum for engineering colleges in Karnataka except for the University Visweswaraiah College of Engineering, Bangalore and the BDT College of Engineering, Davanagere. *There is no institutional mechanism in the state (either in VTU or in DTE or in individual institutions) to encourage and motivate teachers to evolve, develop and tryout innovatory approaches in curriculum development and teaching-learning processes.*

The AICTE Centre for Continuing Education and the Curriculum Development Centres publish and market printed and electronic media on several areas useful to teachers. The Centres of Educational Technology in IITs produce and market videotapes of courses taught by good teachers.

For polytechnics, Karnataka State Board of Technical Education prescribes the curriculum. Standard textbooks and BIS (Bureau of Indian Standards) materials are available in the market. The Technical Teachers Training Institutes produce and market textbooks and instructional materials including electronic media targeted at polytechnic education.

During 1999-2000, 8 government and aided polytechnics have been given autonomous (only academic) status. Source: Annual Report 1999-2000, Education Dept, GOK

6.3.4 Faculty

The salaries of technical teachers were revised five times during the last fifty years limiting the faculty shortage to about 25% at present. The current AICTE pay scales of engineering college and polytechnic teachers are as follows.

Engineering College	
Category	**Pay Scales (Rs.)**
Lecturer	8000-275-13500
Lecturer (Sr. Scale)	10000-325-15200
Lecturer (Selection Grade)	12000-420-18300
Asst. Professor	12000-420-18300
Associate Professor	16400-450-20000
Professor	16400-450-20900 -500-22400
Principal	18400-500-22400 (Min 19,400)
Source: ISTE Newsletter, Vol XX, No.1, Jan/Feb 2000	

Polytechnics	
Category	**Pay Scales (Rs.)**
Lecturer	800-275-13500
Lecturer (Sr. Scale)	10000-325-15200
Senior Lecturer	10000-325-15200
Lecturer (Selection Grade)	12000-420-18300
HOD	12000-420-18300
Principal	16400-450-20000
Source: ISTE Newsletter, Vol XX, No.2, Mar/Apr 2000	

The job description includes academic, research and consultancy, administration and extension duties. Service condition include accountability, performance appraisal, reimbursement of cost of PC, pension and other retirement benefits, opportunities for higher studies, special benefits for women, sabbatical leave, etc.

Though AICTE has recommended 10% leave and reserve, due to the existing shortage of teachers, this is not being done.

Non-availability of faculty and its poor quality are the main concerns on the quality front in engineering colleges and polytechnics. According to an AICTE survey teacher-student ratio varies from 1:39 to 1:52 for IT courses against a norm of 1:15. With expansion of facilities for IT education and training, the problem will become more serious. Subject-competence, teaching competence and competence in the profession of engineering in which he/she has specialized are the three important attributes of a good technical teacher. Except for the subject knowledge acquired during their B.E. or M.Tech. or Ph.D., most teachers in the engineering colleges and polytechnics do not possess any industrial/ professional experience in their specialization. They also do not have any formal education or training in teaching. Since 2 out of 3 attributes of a good technical teacher are generally missing, one can imagine the plight of the student! While the society and employers need engineers with creative problem solving skills and design capabilities, they cannot be produced in vacuum through conventional, textbook-oriented, mediocre teaching.

More attractive salaries and service conditions are offered by industry (especially the IT industry). This is a big challenge to technical education institutions and administrators. Recruiting good talent and retaining the existing faculty are serious problems. Though monetary compensation is an important factor, the way in which the teachers are treated is equally important.

A Questionnaire Survey of engineering colleges and polytechnics conducted for this study reveals that recruiting good faculty is a problem especially in computer science on account of more attractive salaries and service conditions offered by industry. Faculty development programmes including in-industry training, IT training and teacher training are not adequate. Faculty members are not fully involved in institutional activities. They should be made to manage continuing education, consultancy and industry-institute interaction and contribute to the development of the institution. Performance appraisal should be done according to AICTE recommendations.

6.3.5 Support Staff

The support staffs include the following:

a) **Workshop staff (Workshop Superintendent, Assistant Workshop Superintendent/Foremen, Mechanic, Attendant)**

b) **Library Staff**

c) **Physical Education Staff**

d) **Laboratory Staff**

e) **Compute Centre Staff**

f) **Department Staff**

g) **Administrative Staff**

According to the AICTE norm, the ratio of non-teaching to teaching staff should not exceed 3:1. *Though training opportunities are available for their training, these are not utilized due to lack of motivation and incentives.*

The JSS polytechnic at Nanjangud offers diploma programs as cooperative programs in which students spend about 30% time in industries and 70% in the polytechnic. So far there is 100% employment of diploma holders from the polytechnic.

6.3.6 *Availability and use of IT*

a) IT enabled teaching

IT application in teaching	Polytechnics		Engineering Colleges	
	Extensively used *	Moderately used **	Extensively used *	Moderately used **
Accessing internet learning resources in specially established browsing centres:	10%;	50%	30%	30%
Learning through CD ROMs/ packages on selected topics supplementing class-room teaching)	10%	30%	30%	30%
Using application SW on drafting/ designing/ manufacturing/ machining/ process planning/ production planning/ construction planning/ quality control, etc	20%;	15%	60%	-

The figures give the percentage responses to a questionnaire survey.

** used for more than 50% of the course topics; ** used for less than 50% of the course topics*

Source: Questionnaire study of 13 polytechnics and 3 engineering colleges, 2001

Except in providing Internet access to students in a few institutes, the penetration of IT in teaching is minimal in all the engineering departments barring computer science. Demonstration type of CAD/ CAM/ CNC and Robotic equipment is used in some of the institutes in the field of mechanical engineering. This is an area requiring further study to identify those courses in different branches in engineering which can be taught through computers and associated software.

b) IT enabled services

Range of IT enabled services in the Institute	% of respondents using	
	Polytechnics	Engineering Colleges
Office Administration (Correspondence, Inventory, Payroll, Accounts, Managing body meetings, decisions, E-mail communication, Courses, Curriculum, Intake, enrolment, drop-outs, etc)	60	60
Staff information Database system maintenance (General, Attendance, Test scores, Examination scores, In-industry Training, Project, Certification data, Placement, Alumni data)	50	60
Student information Database system maintenance (General, Attendance, Leave, Salary, Service register, Performance appraisal, Staff training, Promotion, Transfer, Achievements & awards)	50	60
Institute services information system (Institute services information system: Continuing education/ training, Consultancy services, Research & Development, Library & Resource centre)	30	60

The figures give the percentage responses to a questionnaire survey.

Source: Questionnaire study of 13 polytechnics and 3 engineering colleges, 2001

The staff of government and aided engineering colleges and polytechnics has been trained in MIS at TTTI Chennai and provided with the software. The DTE's Office has introduced MIS for its operations.

6.3.7 *Laboratory equipment and consumables*

AICTE norms and standards published in 1999 do not prescribe any norms for equipment and consumables for engineering colleges. A student-teacher ratio of 15:1 is recommended for laboratory/ workshop/ drawing classes.

In case of polytechnics, equipment norms are recommended depending on the type of skills to be developed, utilization, grouping of students. Rs. 3240 per enrolled student per year is recommended for minimum expenditure covering training cost, contingent expenditure, maintenance expenditure, library expenditure and expenditure for replacement of obsolete equipment.

Some modernization has been made possible in engineering colleges and polytechnics due to the AICTE MODROBS (Modernization and Removal of Obsolescence and TAPTEC (Thrust Area Programmes in Technical Education) schemes.

6.3.8 Facilities

AICTE has laid down minimum norms in respect of land, buildings, staff and other infrastructure for engineering colleges and polytechnics (Norms and Standards, AICTE, 1999).

Out of 44 colleges covered in the report, 8 were rated 'A', 12 were rated 'B', 9 were rated 'C', 8 were rated 'D'. Equipment, recurring expenditure and floor area for academic work and amenities for students were considered in assigning these ratings. The ratings indicate that a majority of colleges lacked these facilities. Perhaps by now, there could be some improvement. The only way to ensure the provision of all the required facilities is through the process of accreditation by the NBA. It is disheartening to note that only 2 out of 82 engineering colleges have gone through the process of accreditation by the NBA.

Source: Report of the Expert Committee 1997, Department of Technical Education, Government of Karnataka

6.3.9 Research and Development

The R & D activities in engineering colleges and polytechnics is almost nothing except in a few engineering colleges like KREC, SJCE and RVCE where some sponsored projects are undertaken. The laboratory facilities are essentially used for material testing. There is no linkage between institutes and industry in identifying problems of relevance leading to new materials/ processes/ products. Research and development in the field of technical education in evolving new curriculum models, innovative teaching - learning strategies & resources is totally absent.

6.4 Relevance of training

Relevance should be assessed in terms of the fit between what the society needs from engineering colleges and polytechnics and what they do. Extent of employment/ unemployment is an indicator of relevance.

6.4.1 *Extent of unemployment of engineering manpower*

301 post-graduates, 13496 degree holders and *42346 diploma holders* in engineering had registered with the Employment Department in Karnataka by November 2000 Discipline-wise registration is shown in Figure 19.

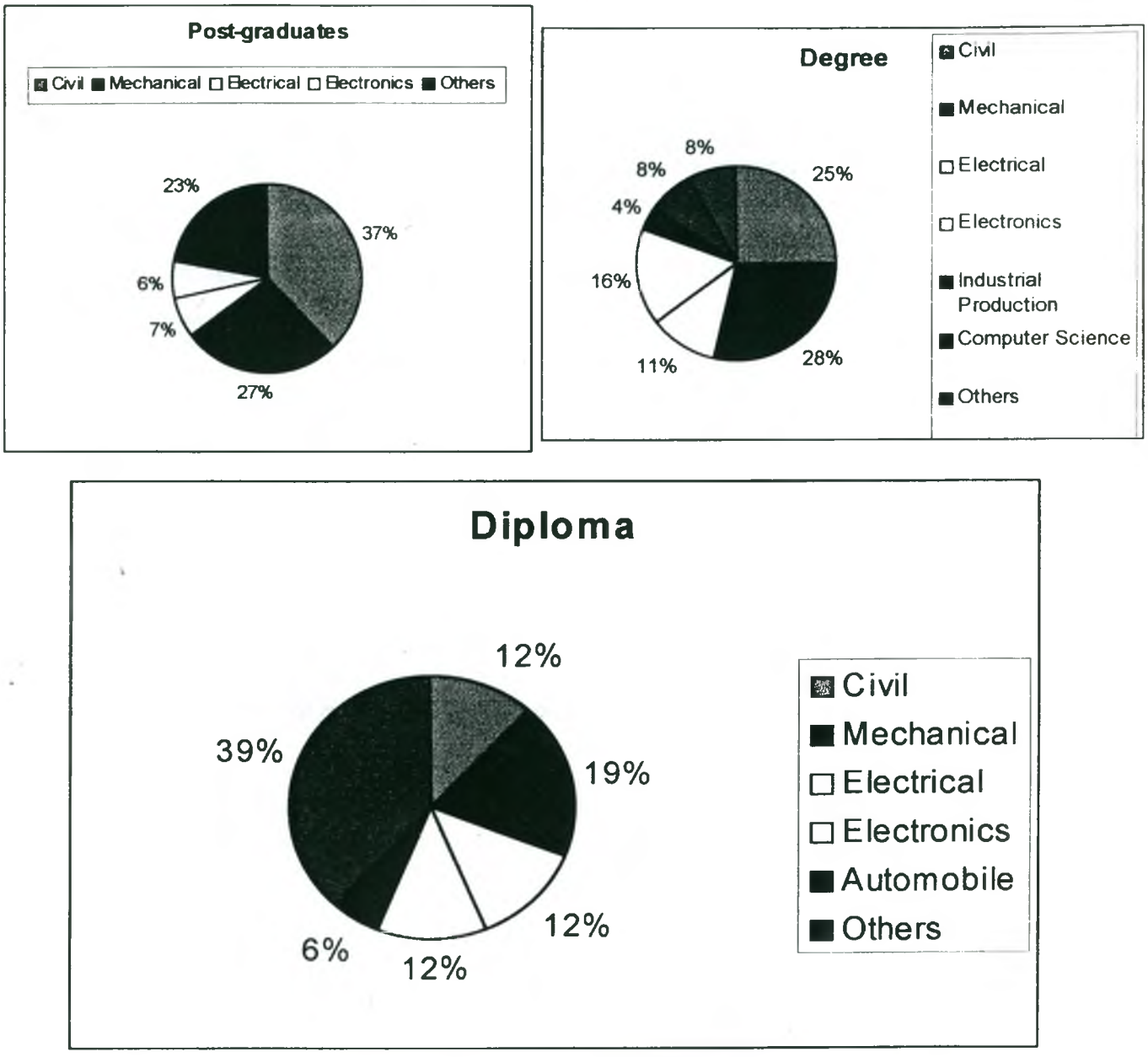


Figure 19: Discipline-wise registration by November 2000 in Karnataka
[Source: Letter dated 6.1.2000 from the Joint Director (Employment), GOK to SJCE]

6.4.2 *Employment after graduation*

Statistical information is given in Annex 9.

Waiting Period

83% post-graduates, 80% graduates *and* ***79% diploma holders*** *of the 1997 batch got first paid jobs* ***within one year*** *after completing studies. Another 13% post-graduates, 17% graduates and 17% diploma holders of the 1997 batch got first paid jobs between 12 and*

21 months after completing studies. Only 4% of post-graduates, 3% of graduates and 4% of diploma holders in the batch had to wait for more than 21 months

*Amongst the **post-graduates** 100% in Power Electronics, 60% in Computer Science, 75% in System Analysis & Computer Application, 71% in Industrial Electronics, 66% in Industrial Structures and 47% in Bio-medical got employed **in less than 3 months.***

*Amongst the **graduates** 58% in Bio-medical, 58% in Metallurgy, 55% in Chemical, 53% in Architecture, 50% in Computer Science and 45% in Mining, got employed **in less than 3 months.***

*Amongst the **diploma holders** 86% in Architecture, 69% in Machine Tool Technology, 69% in Civil, 65% in Automobile, 61% in Costume Design & Dress Making, 58% Civil D'manship and 50% in Computer Science got employed **in less than 3 months***

Source: NTMIS, Nodal Centre for Karnataka State, Annual Technical Manpower Review, Karnataka State, 1997-2001

Graduates entering training related occupations

Details of post-graduates, graduates and diploma holders of 1997 batch entering different engineering occupations are given in Annex 9.

27% post-graduates, 9% graduates and 9% diploma holders enter the teaching profession.

Earnings

A post-graduate's starting salary is about Rs. 12,000 per month, a graduate's starting salary is about Rs.8000 per month and a diploma holder's starting salary is about Rs. 2800 per month.

Software industry offers nearly twice the salaries mentioned above.

Source: NTMIS, Nodal Centre for Karnataka State, Annual Technical Manpower Review, Karnataka State, 1997-2001

6.4.3 Perceptions of graduates and employers on the effectiveness and relevance of training

Indian employers generally do not care about the effectiveness and relevance of training imparted in engineering colleges and polytechnics as long as they continue to get the kind of manpower they need from these institutions. They miss no opportunity in criticizing the quality and relevance of education and training imparted at these institutions. The technical education institutions also do not care about the relevance and quality of education and training they are imparting on the plea that providing employment is not their concern. At best they are satisfied with the internal efficiency of the system they are operating. The result is that the technical education system largely remains supplier-driven rather than a customer-driven. It is reasonable to accept that no technical educational institute can produce a graduate or a diploma holder who can fit in to world of work, which is very diverse. it is also reasonable to accept that such products must demonstrate their technical, methodological, social and personal competence with a flair for problem solving. It would not be an exaggeration to state that no technical education institute and its faculty know the competence for which they are educating and training their students. We still live in a world of degrees, diplomas and certificates and not the world of competence. Unless the mind sets of students, teachers and administrators change to replace the present system by a competency-based education and training system, the question of relevance and quality remains unanswered.

Some engineering colleges and polytechnics have started Industry-Institute Interaction Cells towards bringing about greater relevance and quality of education and training suiting to the requirements of industry. Their impact is yet to be felt and assessed.

6.4.4 Continuing Education

a) Polytechnics

Continuing Education Cells have been established under the World Bank assisted Technician Education Project in the following polytechnics.

SJ Government Polytechnic, Bangalore	Government Polytechnic, Belgaum
Government Polytechnic, Tumkur	Government Polytechnic, Bijapur
Government Polytechnic, Gulbarga	KHK Polytechnic, Dharwad (Aided)

These cells plan and conduct short courses in CNC Programming, Auto CAD, Computer Programming, AMIE Classes, and Personality Development. The target groups are teachers, government employees, industrial workers, agricultural workers, health workers, women, handicapped and students. The Continuing Education Centre at the Directorate of Technical Education monitors the activities of CE Cells.

GTTC, NTTF, FTI and CIPET offer continuing education and training programmes in the areas of machine tools, electronics, tool & die making and plastics technology.

b) Engineering Colleges

The Indian Institute of Science, KREC, SJCE, SJCE-STEP and a few other institutions are offering Continuing Education Programmes.

The duration of these courses varies usually ranging from a day to about 2-3 weeks.

AICTE has established a Continuing Education Centre in Bangalore to identify Continuing Education needs of industries, prepare course materials and sponsor programmes in the form of workshops, short courses, long courses, seminars and conferences.

Center for Electronics Test Engineering (CETE), an Indo-German Training Organization, provides hands-on training in the areas of test engineering, manufacturing practices, calibration, quality assurance and quality system management.

Most continuing education and training programmes currently offered aim improving the knowledge base of the participants in most cases with a few aimed improving the practical skills with the intention of improving the performance of the participants in their respective job environments. They are not aimed at improving the qualifications of the participants.

No systematic assessment has been made of either the need for continuing education and training nor the impact of currently offered continuing education programmes on the performance improvement of those who have undergone such programmes.

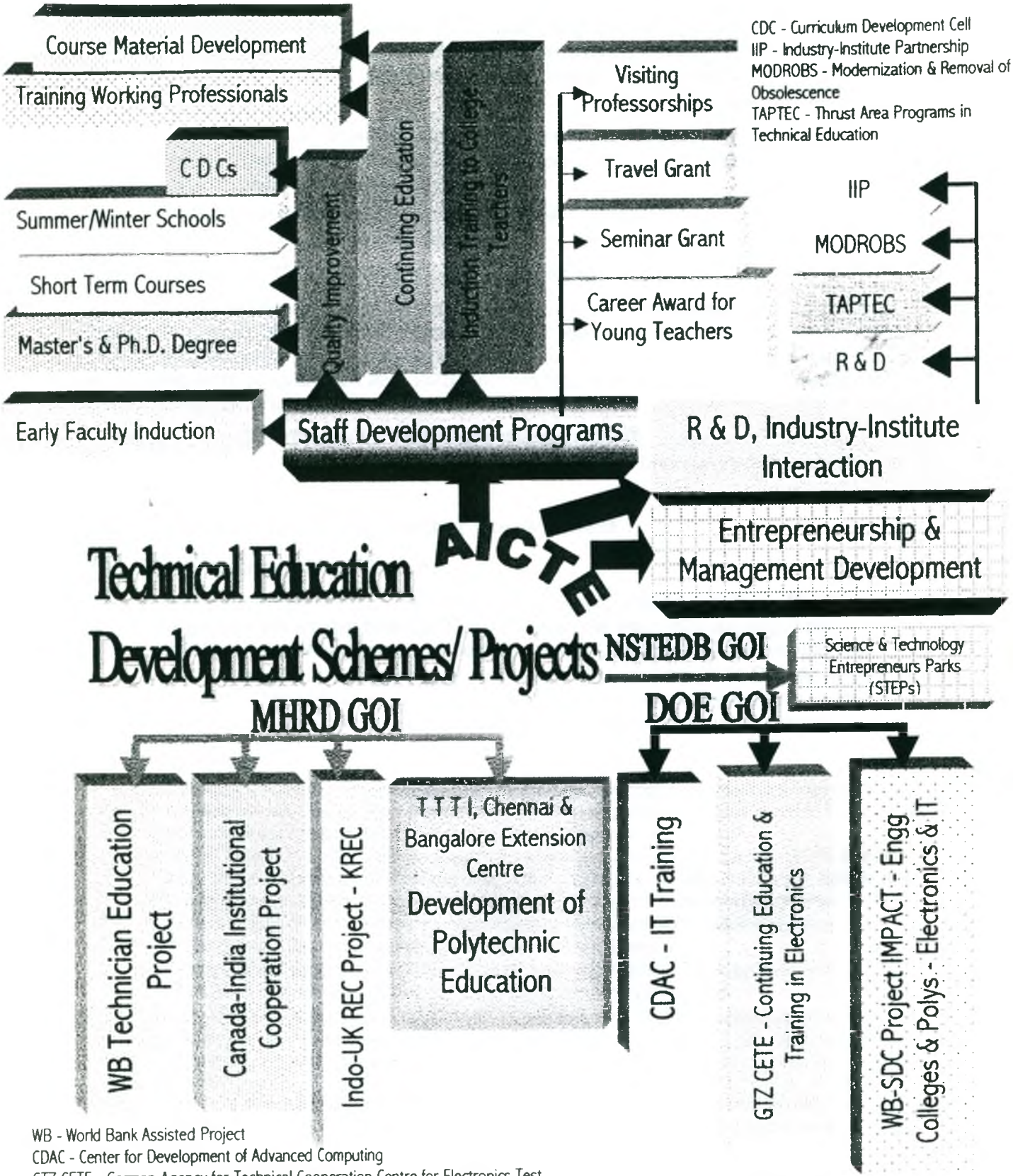
6.4.5 Assessment of the effectiveness of the community outreach programme

Community Polytechnic Scheme

This is a **direct central assistance scheme** under which financial grants (one time non-recurring grant of Rs. 10 lakh and recurring grant of Rs. 7 lakh per year) is provided directly to selected AICTE approved polytechnics whose proposals are recommended by the State Directorate of Technical Education. As on date, there are 53 Community Polytechnics in Karnataka of which 25 are government polytechnics, 5 are aided and 23 are private.

These polytechnics have created awareness; educated, trained and motivated rural people to use the technologies developed by research institutions and laboratories (Ex: Drip irrigation, bio-gas plants, two-pit latrine, brick making, solar appliances, etc.). Short-term non-formal training courses have been offered to the rural people to provide basic skills aimed at self-employment (Ex: Tailoring, TV servicing, electrical repairs, beauty culture, etc.). A number of villages have been assisted by these polytechnics in repair & maintenance of agricultural implements & equipment and support services to enhance the productivity of the rural people. Information on new technologies, farm equipment, rural sanitation, family planning, child health, etc have been disseminated through leaflets, video films, brochures, exhibitions and so on.

7. TECHNICAL EDUCATION DEVELOPMENT SCHEMES/ PROJECTS



WB - World Bank Assisted Project
CDAC - Center for Development of Advanced Computing
GTZ CETE - German Agency for Technical Cooperation Centre for Electronics Test Engineering
SDC - Swiss Development Cooperation; TTTI - Technical Teachers Training Institute
MHRD - Ministry of Human Resource Development; GOI - Government of India
DOE - Department of Electronics; AICTE - All India Council for Technical Education

Figure 20 Technical Education Development Schemes/ Projects

Brief information on some of the projects/ schemes is given in Annex 10.

7.1 TTTIs and Development of Polytechnic Education

MHRD has established four Regional Technical Teacher Training Institutes at Bhopal (Western Region), Calcutta (Eastern Region), Chandigarh (Northern Region) and Chennai (Southern Region) with main objectives of developing polytechnic education.

These institutes undertake:

- ☐ *polytechnic staff development through long term and short term courses;*
- ☐ *design and revision of curricula of technician education and training courses;*
- ☐ *development of instructional materials;*
- ☐ *research and development projects relevant to technician education;*
- ☐ *extension and consultancy services.*

Courses offered by TTTI, Chennai is given in Annex 10.

TTTI Chennai has an extension centre in Bangalore in the campus of SJ Polytechnic to cater to the needs of polytechnic education in Karnataka. Under the Technician Education Project, 175 teachers from Karnataka amounting to 7000 person weeks have been trained in the Long-term programmes and 3375 teachers from the state amounting 5090 person weeks have been trained in Short-term courses

TTTIs and the Indian Society for Technical Education (ISTE) organize short training courses annually for polytechnic teachers under the Quality Improvement Programme financed by AICTE.

7.2 Engineering College Teacher Development

The Quality Improvement Programme

MHRD (then Ministry of Education) Government of India initiated a Quality Improvement Programme (QIP) In 1971 with the main aim upgrading the qualifications of engineering college teachers. Opportunities are provided for serving teachers of degree level institutions to pursue Master's Degree and Ph.D. Degree. This is an in-service programme and teachers sponsored under this programme are paid full salaries and allowances during the study period.

AICTE Schemes

Induction Training Programme - *Newly recruited teachers and teachers with short experience are offered short technical teacher training courses (about 3 weeks) by utilizing the infrastructure available in Academic Staff Colleges in universities.*

Short Term Courses – *Seven Quality Improvement Programme Centres at the five IITs, IISc, and the University of Roorkee offer short courses for serving teachers to update their knowledge and skills in advanced and emerging areas of engineering/technology.*

Summer and Winter Schools – *1 to 4 weeks short courses in subject updating and pedagogical skills are organized by ISTE all over the country.*

Curriculum Development – *The CD cells in the QIP centres undertake revision of curriculum, preparation of textbooks, monographs and teaching aids.*

Early Faculty Induction Programme – *Talented engineering college/institution students in their last semester of undergraduate studies will be selected for a teaching career. After completing degree, they will be placed in selected national institutions to enable them to acquire Master's Degree. Each selected trainee will be paid a stipend of Rs. 10, 000 per month till the completion of the Master's Degree. Afterwards they are required to teach for at least three years in an engineering institution. The response to this programme is very poor.*

In addition to the above, AICTE funds Career Awards, Seminar Grants and Industry-Institute Interaction programmes.

7.3 The STEPs

The National Science & Technology Entrepreneurship Development Board with the following objectives initiated the Science & Technology Entrepreneurs Park programme.

- To forge close linkages between universities/academic institutions and industry;
- To promote entrepreneurship among S & T persons;
- To provide R & D support and other facilities to small scale industries.

SJCE-STEP at Mysore was established in 1985, KREC-STEP was established in 1994 and efforts are being made to establish a STEP at Bagalkot Engineering College.

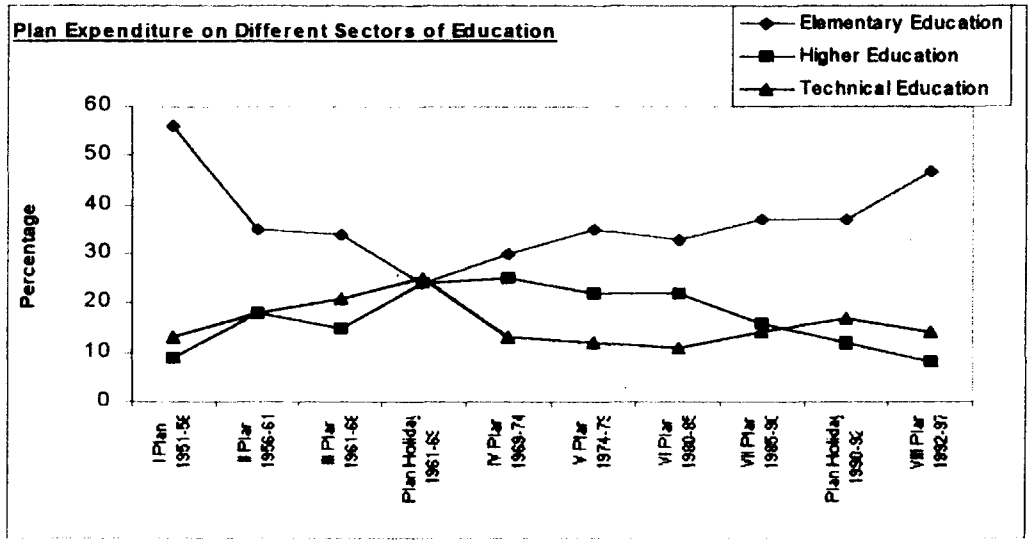
STEPs alone are inadequate to generate the much needed wave of entrepreneurship prevalent in the Silicon Valley in California USA. A strong high technology R & D base, sowing the seeds and culture of entrepreneurship right from school days, re-engineering engineering education and training aimed at producing job producers rather than job seekers and a single window infrastructure and financial support system to encourage entrepreneurial talent are essential to generate this wave.

8. COSTS AND FINANCING

8.1 Public Expenditure

8.1.1 Central Government

Figure 21 shows that expenditure on technical education and higher education is decreasing and expenditure on primary education in the five-year Plans is increasing.



Source: State Funding of Higher Education, Ed. K.B. Powar, Association of Indian Universities, New Delhi, 1998

Figure 21: Trend in Public Expenditure on Technical Education

The 1999-2000 Budget Estimate of the Central Government is shown in Figure 22

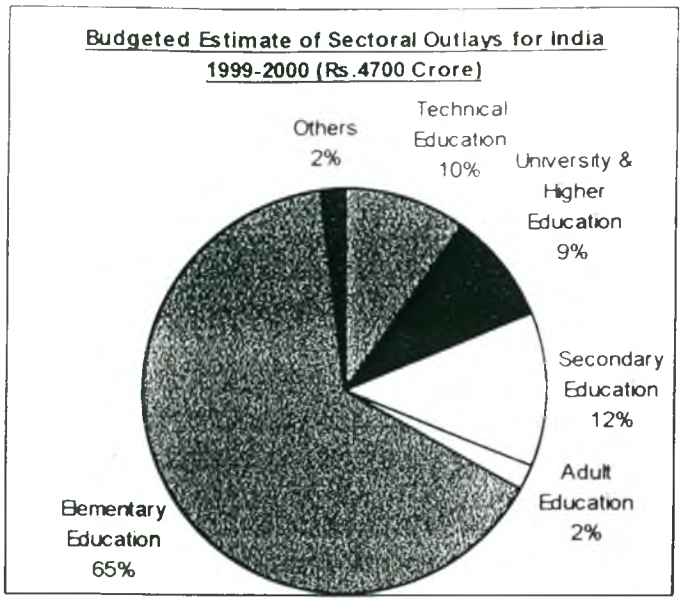


Figure 22: 1999-2000 Budget of GOI showing Technical Education Component

Only 10% of the total outlay is earmarked for technical education and most of it goes towards National Institutes

Source: MHRD Annual Report 1999-2000, Government of India

Nearly 75% of AICTE grants-in-aid were released for R & D/ MODROBS/ TAPTEC Schemes and about 10% were released for Post-graduate Courses & Research in 1997-98.

Source: AICTE Annual Report & Accounts 1997-98

Public investment for development of technical education is of utmost importance and urgency in view of its increasing role in economic development of the country yielding not only high rates of private return but also high rates of social return. If not for maintenance, public funding should increase for faculty development, R & D and innovatory programmes.

8.1.2 Karnataka Government

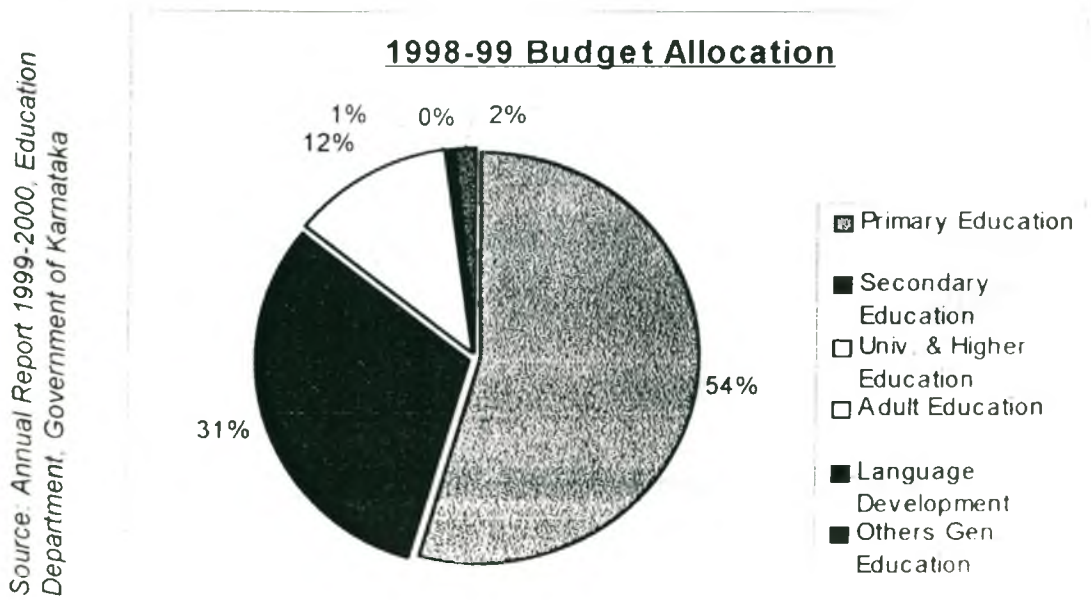


Figure 23: Share of Public Expenditure on Technical Education in Karnataka

The public expenditure on technical education in Karnataka is roughly about 2% of the total budget on education. The bulk (over 60%) of this meager allocation goes towards maintenance of government and aided engineering colleges and polytechnics. In 1998-99 38.64% was allocated to plan sector and 61.36% was allocated to non-plan sector

Type of Expenditure	Expenditure			
	1996-97	1997-98	1998-99	1999-2000
Plan	212.00	139.28	504.43	672.27
Non-Plan	2439.89	2086.27	3762.06	4008.87
Total	**2651.69**	**2225.55**	**4276.49**	**4681.14**

Type of Institute	1995-96	1996-97	1997-98	1998-99	1999-2000
Government Engineering Colleges	58.53	61.19	63.97	79.78	89.24
Aided Engineering Colleges	1046.12	1199.27	1514.45	1443.46	1840.00
Government Polytechnics	1429.04	1680.79	2099.29	2502.43	2782.50
Aided Polytechnics	255.42	241.45	369.10	586.16	509.10
Directorate of Technical Education	185.10	182.91	225.36	319.82	286.64

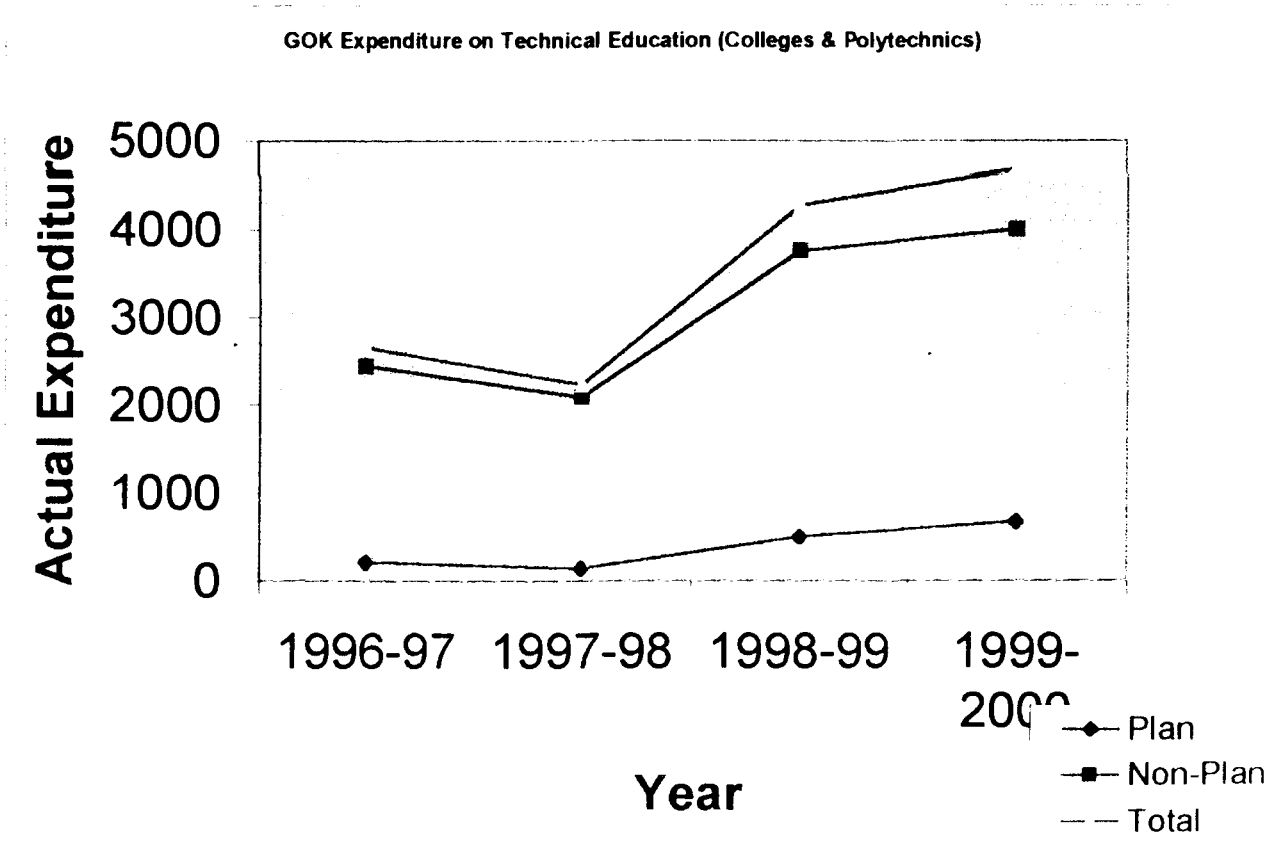


Figure 24: GOK Expenditure on Engineering Colleges & Polytechnics

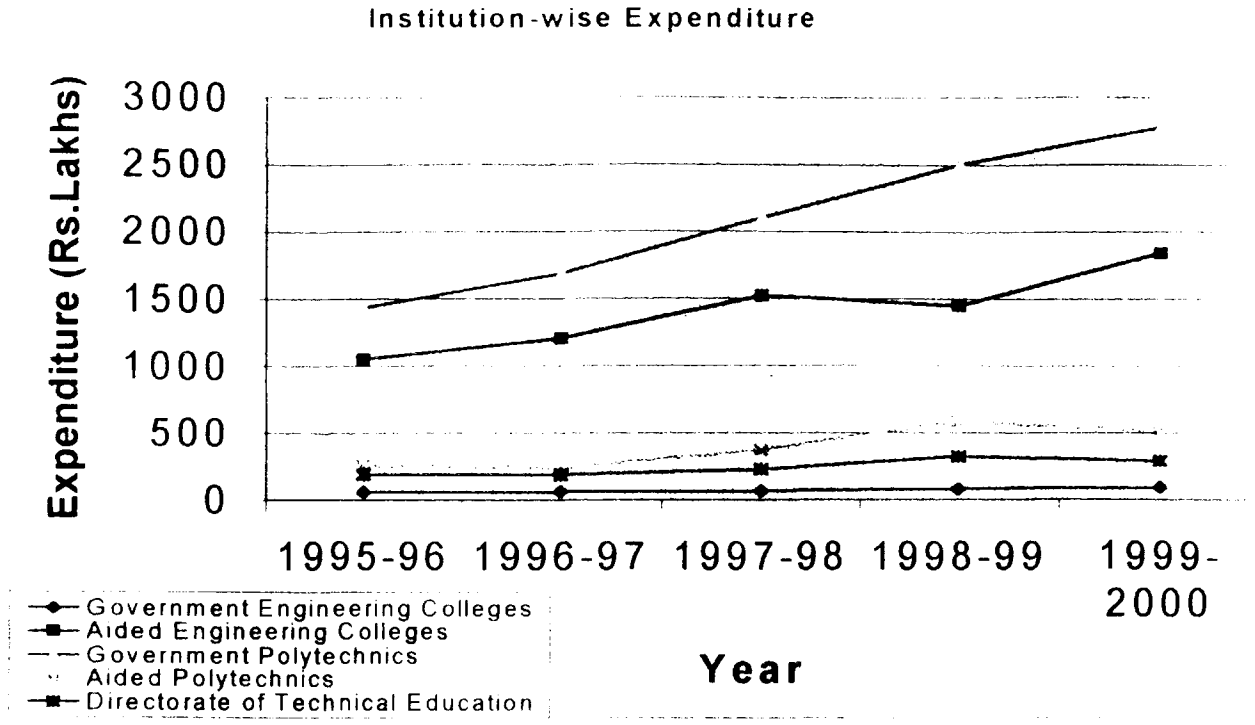


Figure 25: GOK Expenditure on Technical Education by Institutions

8.2 Per student institution cost (Recurring Cost)

Institute	Unit Recurring Cost (Rs.)	Institute	Unit Recurring Cost (Rs.)
Engineering College	~30, 000/-	Polytechnic	~10,000/-

Source: Report of the Standing Committee (Engineering Colleges) 2000 and Report of the Committee (Polytechnics) 1998

The figures however may be higher or lower depending on the branch of study and the enrolment.

8.3 Composition

The salary accounts for nearly 85-90% of the total recurring expenditure.

8.4 Fee structure

8.4.1 Current Policy

The MHRD policy of fee fixation for technical education clearly mentions the following general principles.

- ☐ *Prevention of profit making and ensunng, as far as possible, the principle of no-profit-no-loss.*
- ☐ *Without diluting the fundamental concern of avoiding commercialization, to make allowance in the fee so as to provide for replacement and upgradation of facilities.*
- ☐ *Providing for a transparent and intelligible procedure for fee determination:*
- ☐ *Bnnging all private unaided institutions within the purview of scheme -not merely confining it to colleges and*
- ☐ *Involving the State Governments concerned in the process of fee determination*

According to AICTE, the fee consists of two components namely the *development fee* and *tuition fee*. Besides the management of the institution realize the actual cost of boarding & messing from the students.

The tuition fee will seek to recover the cost of imparting education and the development fee is meant to cover the capital cost of building including landscaping, and hostel and equipment, furniture and amenities. Development fee may be at flat rates to be determined every 3 years by the AICTE. The Task Force appointed by AICTE has suggested raising of fees in Government, Aided and Private (Self-financing) Engineering Institutions (Degree Level) on a gradual scale. The fee to be charged by a private institution in the state is decided by State Fee Committee appointed by AICTE and its mechanism has been notified in GSR 476E dated 20th May 1994.

Higher fees do not necessarily indicate better quality of education in engineering colleges. For instance, a student securing a payment seat in a remote rural engineering college in Karnataka has to pay annual fee of about Rs.32, 600 whereas a student getting admission in IIT Mumbai pays Rs.25, 000, but the difference in quality of education imparted in two institutions is of a very high order.

8.4.2 Fee Structure in Karnataka

a) Engineering Colleges (Fee in Rupees per year for Academic Years 2000-2003)

Type of Seat	Tuition Fee in Rs. with NRI Quota of			Development Fee in Rs.	Total Fee in Rs. with NRI Quota of		
	5%	10%	15%		5%	10%	15%
Free Seats							
1. Government/ University/ Regional Engineering Colleges	6500/-	6000/-	6000/-	-	6500/-	6000/-	6000/-
2. Private and Aided Engineering Colleges	6500/-	6000/-	6000/-	3000/-	9500/-	9000/-	9000/-
Payment Seats							
3. Private and Aided Engineering Colleges	40,000/-	38,000/-	36,000/-	8000/-	48,000/	46,000/	44,000/
NRI Seats							
4. Private and Aided Engineering Colleges	US$ 4000/-	US$ 4000/-	US$ 4000/-	US$ 1000/-	US$ 5000/-	US$ 5000/-	US$ 5000/-

Source: Report of the Standing Committee 2000

b) Polytechnics (Fee in Rupees per year)

Government		Aided		Private	
GM	SC/ST	GM	SC/ST	Karnataka students	Non-Karnataka/ Management quota
1,600	400	3,000	800	6,500	10,500

Note: An addition fee of Rs.500/- per year is allowable in addition to the tuition fee mentioned above

Source: Government Order No 116 TPE 97, Bangalore dated 17th June 2000

8.4.3 Total cost to the student

The costs to the student include the institutional cost and household expenditure on tuition and other fees, books, stationery, study tours, boarding and lodging, travel, clothes, medical expenses, entertainment and miscellaneous.

Household costs per student per year work out to about Rs. 50,000 for an engineering college student and Rs.25, 000 for a polytechnic student. Therefore the *total annual cost per student works out to about Rs. 56,000 for a free seat student and to about Rs.82, 600 for a payment seat student in an engineering college. For a diploma student, the total cost to the student is Rs.27, 000 in a government polytechnic to Rs.37, 000 to a non-Karnataka student.*

8.5 Cost Recovery

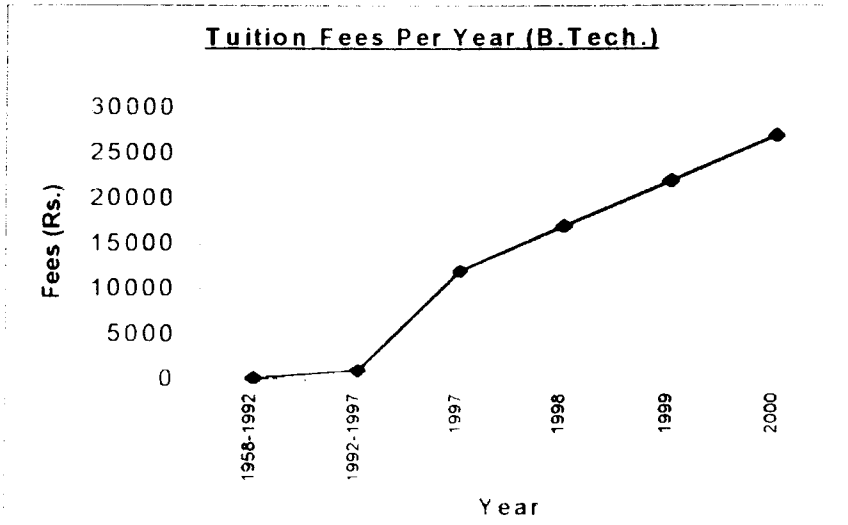
Type of Institute	Fee Income* as % of Annual Recurring Expenditure
Government/ University Engineering College	About 20%
Private Engineering College	**About 100%
Government Polytechnic	About 14%
Aided Polytechnic	About 26%
Private Polytechnic	About 70%

*Based on an intake of 300 students per year excluding scholarships/fee concessions

** Depends on number of seats filled and number of students who pay US$ 5000

The rate of increase of tuition fee in an IIT during the last 40 years is shown in Figure 26.

The existing provision in the banks for student loan schemes should be expanded to cater greater clientele resulting from increase of tuition fees. While presenting the 2001-2002 Union Budget, the Finance Minister said that the Indian Banks Association has agreed to liberal Student Loan Scheme for higher studies in India and abroad.



Year	Fees (Rs.)
1958-1992	200
1992-1997	1000
1997	12000
1998	17000
1999	22000
2000	27000*

** This constitutes about 15-20% of the cost of education*

8.6 Private Financing

Private sector investment on technical education in Karnataka (excluding aided institutions) amounts roughly to over Rs.1000 crores on capital and about 120 crores annually as recurring expenditure. Compared to the government expenditure on technical education, private sector contribution is at least six times larger in monetary terms.

8.7 Financing by Employers

50% or more of the rate of stipend fixed by the government in case of graduate, technician apprentices are the obligation of the employer. Funding scholarships, new laboratories, Chair Professorships by employers are being tapped by IITs.

Donations to educational institutions is not new in India as many leading technological institutions in India like the Indian Institute of Science, Bangalore; BITS, Pilani; the Banaras Hindu University were started with donations from leading industrialists and philanthropists and public personalities. Many companies have donated Chair Professorships and funded Laboratories in IITs.

ICICI, Verifone, Ford Motor Company, Schlumberger Stitchting for Science, Technology & Research, Tecumesh Products Ltd., Power Grid Corp., are some of the industries which have donated Chair Professorships. Texas instruments, Intel Lab, Sun-Wipro Lab, IBM, NIIT are some of the companies which have established labs in the IITs. For more details, web sites of IITs may be contacted.

8.8 Alumni Funding

Past students who graduated from technical institutions are a new source of funding development of these institutions but this mostly restricted to IITs.

It began with Mr. Kanwal Rekhi, an alumnus of IIT Mumbai and President of Indus Entrepreneurs in USA, visiting the institute in 1994. He was stung by the deteriorating conditions of buildings in the institute, which had nourished him academically to rise to great heights in his professional life. He donated US$ 50,000 to the institute and later increased it to $2 million for a School of information Technology Management (named after Mr.Rekhi) on a condition that other alumni would donate an equal sum. The institute in its drive to mobilize financial resources from the alumni has obtained pledges of Rs.90 crores. The Institute has plans to collect Rs.500 crores by the year 2008 with the goal of achieving financial self-reliance in meeting its development expenditure.
IIT Bombay Heritage Fund (IITBHF) is a non-profit organization set up in USA by young and dynamic alumni with exceptional dedication to the vision of IIT Bombay emerging as one of the world's finest educational institutions. One IIT Director has put an open message on the web site requesting the alumni to contribute to the development of their Alma Mater. All IITs have their Alumni Associations (many abroad) which not only provide valuable feedback to the institutes but also mobilize funds.

The human dimensions in teaching play an important role in transforming students into achievers who after graduation not only reach pinnacles of success but also have fond and pleasant remembrances of the time they spent in their alma mater and develop an intrinsic motivation to contribute to its growth. Most alumni who are donating funds to IITs are settled in US where already there are examples of accomplished rich people donating to universities and institutes of higher education.

8.9 Financing Policies

Rethinking on who should pay for technical education has started in the country. The recommendations of UGC (Justice Punnayya Committee) & AICTE (Dr.

Swaminadhan Committee - See Annex 11) Committees, the Block Grant System of Financing IITs introduced by MHRD are pointers in this direction.

The National Policy on Education 1986 focuses on resource generation by the institutes. For financial self-sufficiency and autonomy, institutes, especially the IITs have started generating own resources through consultancy, research, donations etc., To enable the institutes to develop cost effectiveness, accountability, autonomy, futuristic and financial self-reliance, new scheme of funding institute has been introduced by MHRD known as the **Block Grants**.

Non-plan grants by the Government of India for institutes covered under this scheme are frozen at a certain level for a specified period. The institute can use the net revenue earned through consultancy and continuing education programme to augment the grant provided by the government. The savings out of the non-plan grants and the net revenue earned are retained and carried over each year to create an **Endowment Fund.** Government of India will provide 100% matching grant to the institute i.e., an amount equal to the savings out of the non-plan grants and the net revenue earned. Donations etc., can be transferred to the Endowment Fund and the interest on the Fund can be used for development of the institute.

8.10 Internal Resource Generation

Income generated by IITs & IISc from Consultancy & Sponsored Research in 1995-96 (Rs.Lacs) and matching grant earned due to Savings & Donations in 1993-94 and 94-95

Income generation by	IIT-Bom	IIT-Del	IIT-Kan	IIT-Khar	IIT-Mad	IISc-Ban
Consultancy & Spon. Res	717	616	635	853	521	531
Matching Grant earned due to Savings & Donations	332.73	525.01	475.57	856.67	240.02	691.97

In 1996-97, RECs generated Rs.1.20 crores from consultancies and sponsored projects.

Source: Technical Education in Independent India 1947-97, AICTE 1999

An endowment fund for technical education institutions is necessary to achieve financial self-reliance so that these institutions can function in an atmosphere of academic freedom. Consultancy services, converting R&D into intellectual property rights, tapping alumni for resources and converting faculty research into companies are some of the ways of creating and expanding endowment fund and maintaining the performance level of the institutes of very high levels. Example of Harvard University in USA with an endowment fund of $ 1billion is quoted.

Governments around the world are struggling to find resources to maintain all education programs. In this process, the relative costs of employment-centered education, which includes a vast array of equipment and an intensive teaching methodology, are often not well understood. Under-funded employment-centered learning usually does not meet employers' needs and thus leads to unemployment. Governments are often unable to expand tax - based financing for education. Thus, other sources such as students and the employment community must be involved in strengthening the financial viability of this type of education. This suggests that institutions must have the freedom to act to respond to their local markets for learning.

Governments in their planning, policy-making, and funding, institutions in their practices and national/ regional representative organizations in their actions must assist colleges and polytechnics to become more financially viable. Whereas governments must accept the responsibility for the primary role in financing public education, employers and students as direct beneficiaries can also play a supplementary role. As such, institutions need sufficient

freedom to act to respond to their markets for learning and training. Actions may include allowing institutions freedom to respond to the markets they serve, setting and keeping fees for training and developing innovative approaches to income generation.

First World Congress of Colleges and Polytechnics organized by the Association of Canadian Community Colleges at Quebec City, May 29-June 1, 1999 - Source: ISTE New Letter, Indian Society for Technical Education, September 1999-10-15

Cost Reduction and Income Generation are the two additional sources of financing.

The most widely followed system of financing technical education is the negotiated funding. The method of presenting the annual accounts in most institutions is essentially aimed at satisfying the audit. The different courses offered by institutions are not costed individually. Hence it is difficult to judge the cost effectiveness.

No studies are conducted to assess the unit cost of producing a graduate or a diploma holder in different disciplines in different institutes. For example if Institute X produces an electronics graduate at cost C1 and all graduates produced are gainfully employed immediately after completing studies and Institute Y produces an electronics graduate at cost C2 and only a few or none of the graduates produced are gainfully employed immediately after completing studies, then C1 should be the benchmark for cost comparison and funding. If C2<C1, then additional funding to the extent of C1-C2 should be made available to Institute Y to improve its programme. If C2>C1, then Institute Y must cut costs and improve efficiency.

Beginnings are being made in engineering colleges (like KREC, SJCE) towards internal resource generation by way of consultancy, sponsored research and continuing education. A few polytechnics are also generating income through continuing education and training. A very good example of internal resource generation by a training institution in Karnataka is the GTTC. By virtue of the high quality of its long-term and short-term programmes and consultancy, GTTC ploughs back part of its earnings from continuing education and consultancy to improve its long-term training programmes.

8.11 A Case Study

Annex 12 presents a case study of financing an engineering college level institution by borrowings through commercial banks. This study indicates that:

- It is financially feasible for the well-established private educational managements to establish and operate a university standard technical institute by borrowings from financial institutions;
- The management both at the higher level and the institutional level demonstrated how good leadership could respond positively to make an institution financially self-reliant to a considerable extent without adverse impact on the objectives of the institute.

An engineering college/polytechnic can attract funds from sources including the government if it has entrepreneurial leadership, offers programmes of market-driven quality and its activities are multi-dimensional with efficient management of resources at all levels.

9. EQUITY

9.1 Constitutional and Legislative Provisions

The Indian Constitution provides for promotion of educational and economic interests of the weaker sections of the people, and, in particular, of the Scheduled Castes (SC) and Scheduled Tribes (ST), and shall protect them from social injustice and all forms of exploitation. On the basis of this constitutional provision, there is a

reservation of a certain percentage of seats, which must be filled by aspirants belonging to these groups.

In Regional/Government/University/Aided Engineering Colleges, all the seats are filled according to criteria laid down in the State Government Rules. Such rules usually prescribe the number of seats to be filled according to merit and number of seats to be filled under the reserved category (scheduled caste, scheduled tribe, backward classes...) and quota (sports persons, physically disabled, children of armed forces personnel, children of political sufferers, scouts and guides, National Cadet Corps...). Merit seats are 50% and reserved category seats are 50%.

The socially backward people in Karnataka (other than SC/ST) are classified into Category I,
II (A); II (B), III (A) and III (B) based on the caste groups. Percentage of seats reserved for different categories is as follows.

Category I - Most Backward	4%
Category II (A) - Relatively More Backward	15%
Category II (B) - More Backward	4%
Category III (A) - Backward	4%
Category III (B) - Relatively Backward	5%
Scheduled Caste	15%
Scheduled Tribe	3%
Total	50%

Except Category I, if the candidate/ parent/ guardian is serving as Class II Gazetted Officer in the government or in equivalent positions in public sector undertakings/ private sector in a pay scale Rs.2050-3950 (or) is paying income tax (or) is paying sales tax (or) is owning 8 hectares of agricultural land either singly or jointly the candidate is not entitled for reservation.

In Private Engineering Colleges, 50% of the seats known as *free seats* are filled according to merit in the Common Entrance Test (CET) and reservation criteria. 45% of the seats [(45%-unfilled) to Karnataka Students and 15% maximum to Non-Karnataka Students] known as *payment seats* are filled by charging fees at a higher rate of than that of the free seat fees. The remaining 5% seats are allotted to Non-resident Indian/Foreign Students by charging much higher rate of fees than the payment seat fees. In case of Minority Institutions, the free seats, which constitute 50% of the total seats, shall be divided equally between the State Government and the Management. The Supreme Court, the highest court in India, evolved the scheme of free seats and payment seats.

(*Source*: ಭಾಗ-II ಭಾರತ ಸಂವಿಧಾನದ ಅನುಚ್ಛೇದ ೧೬(೪)ರಂತೆ ಸರ್ಕಾರವು ಜಾರಿಮಾಡಿದ ಪುನರ್ವಿಮರ್ಶಿತ ಹಿಂದುಳಿದ ವರ್ಗಗಳ ಮತ್ತು ಪರಿಶಿಷ್ಟ ಜಾತಿ/ ಪರಿಶಿಷ್ಟ ಪಂಗಡಗಳ ಪಟ್ಟಿಗಳು - ಕರ್ನಾಟಕ ಲೋಕ ಸೇವಾ ಆಯೋಗ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ ೧೯೯೬ *CET 2000 Brochure, Government of Karnataka)*

9.2 Participation of Women, SC/ST 1999 -2000

Admission to Degree programmes						
Type of Institute	Number of students					
	%Girls among Others	SC		ST		%Girls among Total
		Total as % of Total Admission	Girls as % SC Total	Total as % of Total Admission	Girls as % ST Total	
Government	32	12	26	6	22	31
Aided	32	10	30	3	28	31

Private	32	4	55	1	28	33
Total	**32**	**5**	**42**	**2**	**26**	**32**
Admission to Diploma programmes						
Government	46	13	33	2	36	44
Aided	41	11	38	1	58	41
Private	11	5	22	2	17	12
Total	**23**	**9**	**29**	**2**	**24**	**24**

Source: 1999-2000 Draft Annual Administration Report, Directorate of Technical Education GOK

SC/ST admission in private engineering colleges and polytechnics and girls' admission in private polytechnics are lower than in government and aided institutions.

9.3 Women's Polytechnics

To provide opportunities and facilities for girls to pursue studies in technical education, 12 polytechnics exclusively for women have been established as follows.

- 6 Government Women's Polytechnics at Bangalore, Hassan, Hubli, Mangalore, Shimoga and Gulbarga
- JSS Polytechnic for Women, Mysore(Aided)
- 6 Private Women's Polytechnics - Ghousia Women's Polytechnic, Bangalore; Smt. Kamala Bai Polytechnic for Women, Bangalore; CSI Goodwill Polytechnic for Women, Bangalore; HKE Society Polytechnic for Women, Gulbarga; Farooquia Polytechnic for Women, Mysore.

The annual intake capacity in these institutes is 1934 including 175 seats for SC and 26 seats for ST. Enrolment in 1999 -2000 was 3256 including 316 ST and 68 ST.

9.4 Technical Education for the Physically Disabled

The JSS Polytechnic for the Physically Handicapped, Mysore has been established for the purpose of providing technical education and training opportunities and facilities for the deaf, dumb and orthopaedically disabled students. Diploma courses in Computer Science, Architecture and Commercial Practice are offered.100 students were admitted in the year 2000 against an intake of 120. No fee is charged to the student. Minimum % of marks for admission is 35% as compared to 45% in other polytechnics. A few seats are reserved in polytechnics for physically disabled.

Source: Annual Administration Report (Draft) 1999-2000 Directorate of Technical Education, GOK; Principal, JSSPPH, Mysore

9.5 Scholarships and Concessions to Students

- *All students belonging to SC/ST and Category I are exempted from payment of tuition fees. Students of economically weaker sections are awarded fee concessions provided their parents' annual income does not exceed Rs.11,000/-.*
- *Under the Special Component Plan and Tribal Sub-plan Scheme, SC/ST students studying in I year Degree and Diploma are being provided with drawing materials worth Rs.1200 per student free of cost. Special Book Bank Scheme is also being extended to all the SC/ST students studying in technical institutions. Textbooks worth Rs.500 per student are supplied to I year Degree and Diploma SC/ST students. Two computers are supplied to each of the 25 government polytechnics for use of SC/ST students.*

9.6 Geographic Imbalance

Annex 13 gives district-wise data on admission of girls, SC/ST in the state.

9.6.1 Polytechnics

Bangalore Urban accounts for a third of the total number of polytechnics. Belgaum, Kolar, Mysore have 11, 10 and 11 polytechnics respectively. Bangalore Rural and Chamarajanagar have only one polytechnic each.

Chamarajanagar has the highest capacity utilization of 88% whereas Gadag has the lowest capacity utilization of 37%.

Girls admission in 1999-2000 was 46% of total in Hassan district which is the highest whereas it was 7% of the total in Bijapur and Chickmagalore districts which is the lowest.

Bangalore Rural admitted 23% of the total as SC candidates in 1999-2000 which was the highest and Udupi admitted only 1% of the SC candidates in the same year which was the lowest. Chitradurga and Chamarajanagar admitted 8% of the total as ST candidates which was the highest and Udupi had no ST candidate admitted in 1999-2000.

9.6.2 Engineering Colleges

Bangalore Urban accounts for more than a third of the total number of engineering colleges. Mysore has 5 colleges whereas Tumkur, Bangalore Rural, Belgaum have 4 colleges each and Dakshina Kannada has 3 colleges.

Hassan has the highest capacity utilization of 95% whereas Bangalore Rural has the capacity utilization of 32% which is the lowest.

Girls admission in 1999-2000 was32% of the total in Kodagu which was the highest whereas in Uttara Kannada it was zero.

Dakshina Kannada admitted 10% of the total as SC candidates in 1999-2000, which was the highest, and it was zero in Uttara Kannada in the same year. Dakshina Kannada admitted 4% of the total as ST candidates which was the highest and Bijapur, Raichur, Uttara Kannada and Udupi had no ST candidate admitted in 1999-2000.

10. REGULATORY FRAMEWORK FOR TECHNICAL EDUCATION

10.1 Norms and Standards

The book "Norms and Standards" published by the AICTE 1999 gives details of **minimum** norms to be maintained in establishing and operating technical institutions at degree and diploma level.

*For **diploma** programmes, the norms cover the programme objectives, programme structures, programme duration, intake, staff norms, infrastructure norms (land, building and furniture) and norms for general recurring expenditure.*

*For **degree** programmes, the norms cover the programme objectives, contact hours, course duration, programme structure, intake, staff norms, infrastructure norms (land, building and furniture).*

The AICTE norms essentially devised in the pre-knowledge economy days seem to overemphasize on the physical capital investment and staff structure required for setting up and operating technical institutions. With modern developments on competency-based learning and on-line learning, these norms require review and modification. Similarly, in the absence of systematic information on unit costs

(Which combination of staff, equipment, building and learning environment can produce a graduate/ diploma holder of required quality and what is the cost?) assessing institutions based on such norms would not be correct.

10.2 GOK Grant-in-aid Code

The provisions of grant-in-aid code of the Government of Karnataka are as follows.

Type of grant	Quantum of grant
Maintenance	85% of the excess approved maintenance expenditure over the 'Direct Receipts'
Towards loss of income	Equal to fee concessions, scholarships carrying freeships and half freeships including refund of fees
Building	Not exceeding half the total expenditure subject to a ceiling of Rs.50,000/- per year
Equipment	Upto 50% of the value subject to annual ceiling of Rs.50,000/- in case of an engineering college and Rs.20,000/- in case of a polytechnic

Source: Grant-in-aid Code of Technical Education Department, 1966, Government of Karnataka

The aided institutions with great difficulty can only meet the approved maintenance expenditure as specified in the grant-in-aid code. There is hardly any money left to meet the cost of raw materials and consumables required for training students. The situation is not very much different in government and private engineering colleges. At best about 40-50% of the norm recommended by AICTE is being met in respect of equipment and consumables. Equipment grant is too inadequate in view of the modernization and replacement requirements due to changes in technology and obsolescence.

10.3 Regulation of Unaided Institutions

The MHRD fee fixation policy for technical education has the following principles.

- *Prevention of profit making and ensuring, as far as possible, the principle of no-profit-no-loss;*
- *Without diluting the fundamental concern of avoiding commercialization, to make allowance in the fee so as to provide for replacement and upgradation of facilities;*
- *Providing for a transparent and intelligible procedure for fee determination;*
- *Bringing all private unaided institutions within the purview of scheme -not merely confining it to colleges and*
- *Involving the State Governments concerned in the process of fee determination.*

According to AICTE, the fee consists of two components - the *development fee* and *tuition fee*. Besides the management of the institution realize the actual cost of boarding & messing from the students.

The tuition fee will seek to recover the cost of imparting education and the development fee is meant to cover the capital cost of building including landscaping, and hostel and equipment, furniture and amenities. Development fee may be at flat rates to be determined every 3 years by the AICTE. A state level committee shall determine the tuition and other fees for a professional college.

Higher fees do not necessarily indicate better quality of education in engineering colleges. For instance, a student securing a payment seat in a remote rural engineering college in Karnataka has to pay annual fee of about Rs.32, 600 whereas a student getting admission in IIT Mumbai pays Rs.25, 000, but the difference in quality of education imparted in two institutions is of a very high order.

It is unimaginable to think of any enterprise educational or industrial to be set up and operated on a no-profit basis. ***For- profit*** education and training has to be encouraged. While government should not participate in such ventures, quality norms could be laid down to make such institutions accountable to the stakeholders. Unaided institutions should have freedom to offer market-driven programmes and charge own fees without any control by the government but must be made accountable to the stakeholders and society regarding the quality of the programmes offered by them.

Many self-financed and privately managed engineering colleges have better facilities and staff and excel some of the government/university colleges in performance. This is demonstrated by the brighter students and their parents when they choose the best college during CET counseling and admission.

The following is an interesting news item.

Credit rating agency Crisil has said that more and more educational institutions are likely to tap debt markets to raise funds in the coming years with increasing private participation in the sector. "The phenomenon of educational institutions accessing capital markets for raising debt resources is relatively new in India. However, Crisil believes that the potential for such a market is vast with growing gap between the demand and supply of educational facilities. It said the demand growth was being aided by the rise in income levels and the growing awareness of the importance of quality education leading to an increase in willingness to pay for education. It said a number of such institutions might enjoy a fairly high credit quality as the growth in demand was expected to provide stability to their cash flows through steady operating expenditure and revenues. In the first such rating of an educational institution, Crisil assigned "high safety" (AA) to Takshashila Educational Society, which runs Delhi Public School at Patna. Assigning "AA" rating to 7.5 crore-debenture issue. Crisil said the current and projected enrolment levels at the proposed fee structure were expected to result in an impressive growth in Takshashila's income with healthy profit margins and comfortable debt service coverage ratios, leading to stable and strong cash flows.

10.4 Institutional Autonomy

The current status of our technical institutes may be expressed as in Figure 27.

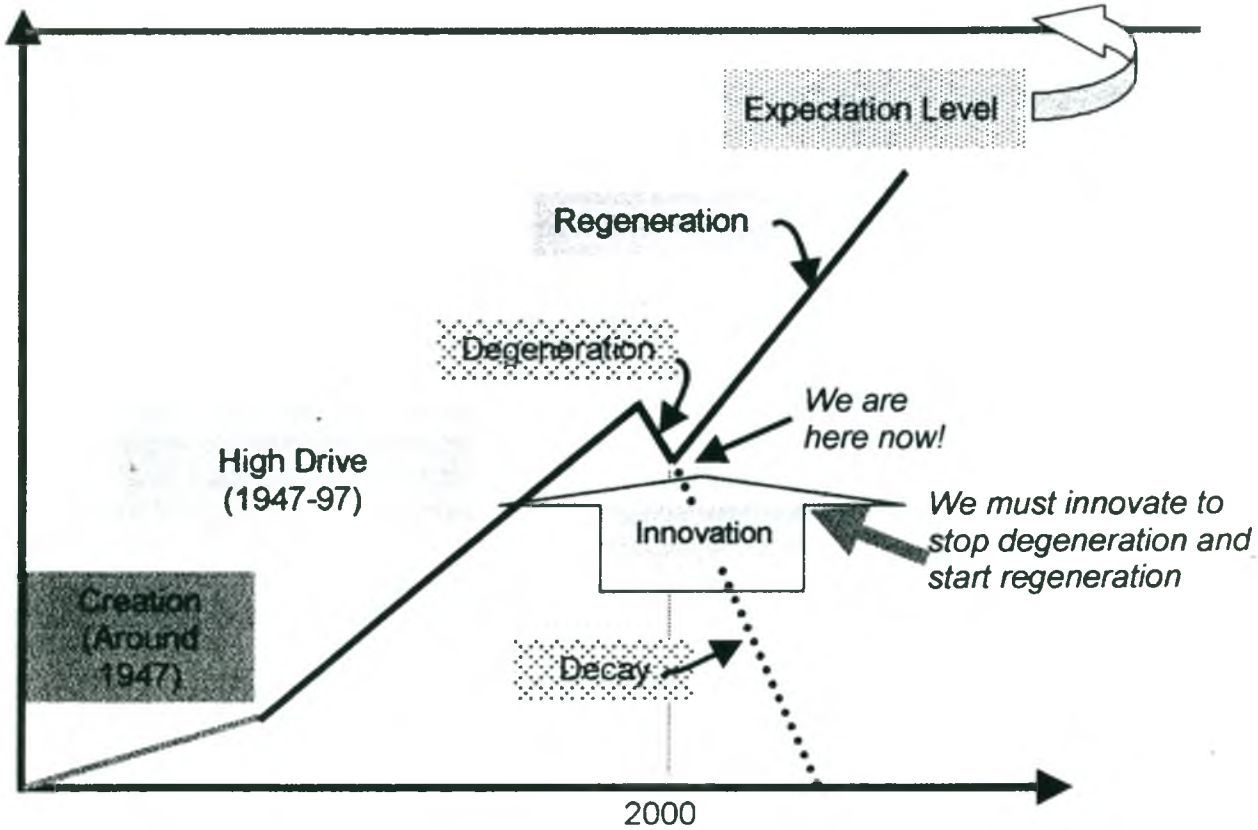


Figure 27: Growth and decay of institutions

Unless efforts are made now to recreate our technical institutions, the present degeneration leads to decay (and finally death) no scope will be left for high drive during the next cycle.

From the past experience, the following could be considered as important factors that contribute to building of institutions of excellence.

- Clarity of mission
- Minimum interference from government
- Freedom with accountability
- Performance orientation in all activities

- Leadership
- Target achievement orientation
- Financial self-reliance and discipline
- Faculty development
- A healthy partnership industry

The examples of IITs, IISc, GTTC enjoying autonomy and performing well, producing world class engineers and technicians are all in front of us. At present, an engineering college is governed by a number of bosses as shown in Figure 27. GOKDTE, AICTE, CET Cell, the concerned university are all governors. Hierarchy of governance of the college begins at the state government in regulating the university function, which in turn regulates the affiliated college. The bureaucratic procedures are more tedious and time consuming in case of government funded/aided colleges since government approval is required on every matter concerned with funds. In addition, teachers union, non-teaching staffs union, the students' union, the management in case of an aided/ self-financed college - all have their own axe to grind. The result - is the college producing the engineer required in the market place? The college principal and faculty may not know the specifications of the end product, which they are trying to churn out. The polytechnics are no better - instead of the university, the Directorate of Technical Education governs them. Instead of continuous interaction with the students who are their primary customers and the world of work and finding innovative approaches, the principal and the faculty have to interact more with the multiple governors to satisfy them that the institute is behaving strictly according to the rules and regulations stipulated by these governors. If the audit party is satisfied, the institute has performed well! This model of multiple governance is self-destructive. *Since there is no autonomy, there is no innovation. Since there is no innovation, there is no quality. If there is no quality, how can we face the challenges of globalization?*

Sir M. Vishveshwariah said "Industrialize or perish". Now is the time to say " Innovate or perish".

We need a model of governance to promote, nurture and support an innovative culture in engineering colleges and polytechnics. These institutions instead of being governed by multiple agencies must become multidimensional corporate entities so that they plan, execute and evaluate education and training programmes (formal and non-formal), undertake R & D and industrial consultancy, provide extension services to the industry and community and become market places of new ideas/ products/ processes. Designing an innovative curriculum to cater for current and future needs, offering market-driven programmes to varied target groups to international standards of quality, mobilizing own resources to meet the development needs cannot take place without full autonomy to institutions. They should compete with each other to perform as world class institutions. Technical institutions should not become social safety nets.

The main aim of technical education is to meet the manpower needs of industry. Government has no role to play in this venture except as a watchdog. Industry and Private Educational Trusts should be given a freehand to start their own institutions and even universities of their own to meet their manpower needs.

One of the key lessons learnt during the implementation of the World Bank Assisted Technician Education Project is that the project could have reached a higher degree of success with greater institutional autonomy of polytechnics and decentralization.

It is reported in the1999-2000 Annual Report of the Education Department, GOK that eight government and aided polytechnics have been given autonomous status. But this autonomy is meaningless since even the syllabus for courses in these polytechnics need approval by the DTE. No engineering college in Karnataka except KREC is autonomous. Perhaps the best example of autonomous education and training institute in Karnataka is the GTTC, which is a GOK enterprise.

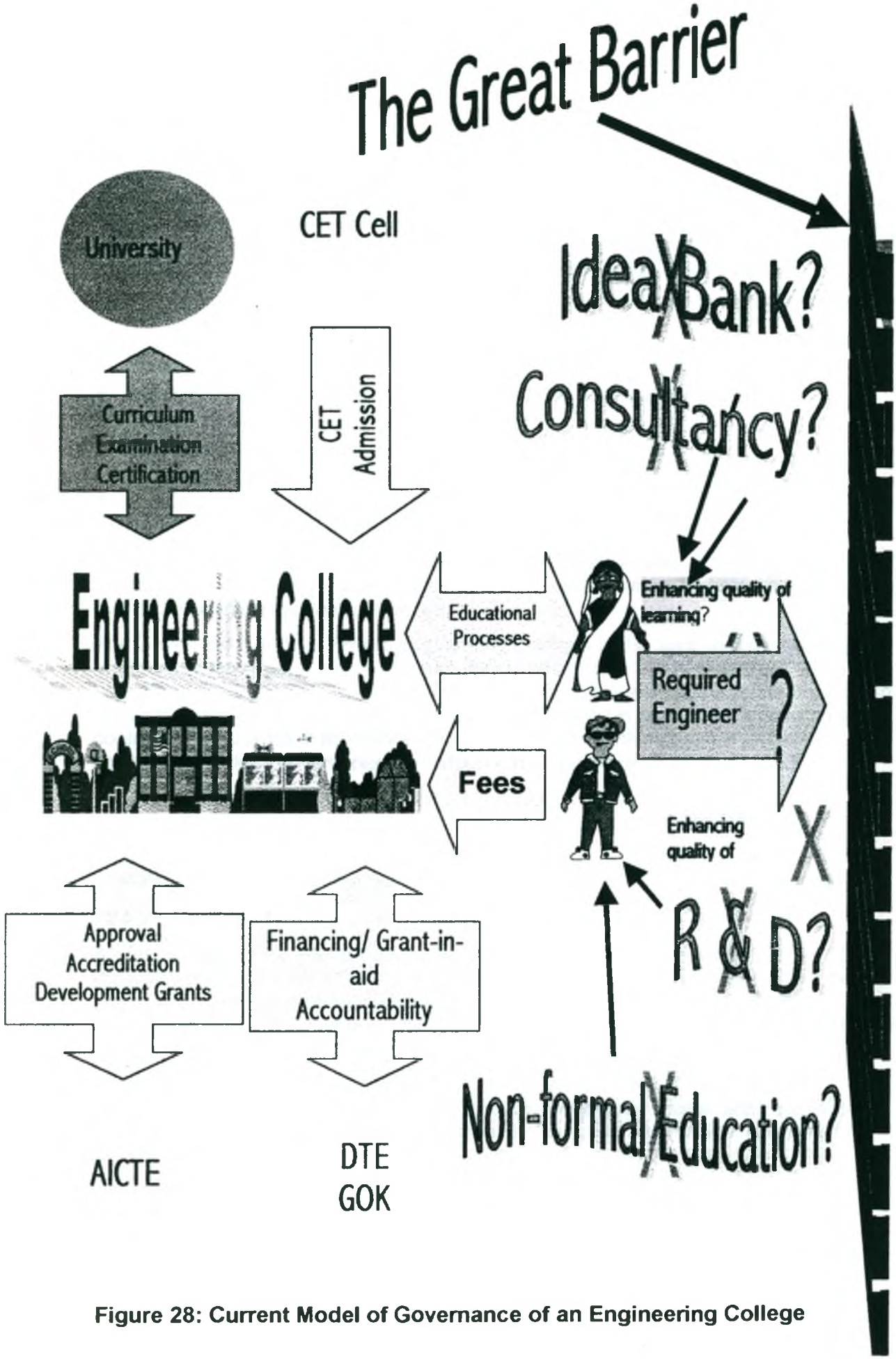


Figure 28: Current Model of Governance of an Engineering College

10.5 Regulatory institutions/authorities

10.5.1 State Level

The Directorate of Technical Education (DTE), Karnataka Government is headed by a Director who is responsible for administration of Technical Education in the state. The Director is assisted by one Additional Director, Six Joint Directors, Ten Assistant Directors, One Chief Administrative Officer, Three Assistant Administrative Officers, One Statistician, One System Analyst, Six Senior Technical Assistants and Twenty Seven Other Officers. The main functions are listed in the Annual Administrative Reports. These are:

a. *Administer, supervise, control, plan & programme development of technical education at degree and diploma levels*
b. *Formulate engineering and studies and courses, recognition of new courses, recommend starting new institutions*
c. *Conduct inspection and periodical review of institutions and maintain standards*
d. *Conduct diploma examinations and award diplomas*
e. *Sanction academic approval for government and aided institutions*
f. *Provide suitable norms and procedures for selection of students for admission to polytechnics*
g. *Release grants and other facilities to the aided institutions*
h. *Select and depute teaching faculty members for higher studies and training*

A review of the role and responsibilities of the Directorate in view of the post-liberalization scenario is necessary to make it responsive to a demand-driven technical education system with autonomy to individual institutions.

The Government and the Private Engineering Colleges in the state will now be affiliated to VTU for academic purposes (curriculum, examinations and award of degree). Though the objectives of the VTU are laudable, their achievement is questionable as the organizational set-up is designed on the typical university model heavily in favour of the government control. As VTU is still in its infancy, this university could attempt a new model of engineering college governance with support from the government and industry.

The Karnataka State Board of Technical Education is supposed to prescribe curriculum, conduct examinations and award diplomas. But DTE performs these functions.

A principal under whose direction, the departmental heads, the faculty, heads each institution and the supporting staff to implement the programmes at the institute level..

10.5.2 Central Level

***All India Council for Technical Education** –AICTE became a statutory body in 1988 with the enactment of the **AICTE Act 1987**. Proper planning and coordinated development of technical education system throughout the country, the promotion of qualitative improvement of such education in relation to planned quantitative growth and the regulation and proper maintenance of norms and standards in the technical education system are the main responsibilities of AICTE under the Act. Refer Annex 14 for salient features of the Act.*

AICTE lays down minimum norms and standards for duration, intake, entry qualification, curriculum, buildings, equipment, staff and other resources for technical education at degree and diploma levels. NBA is responsible for accreditation of institutions and programmes. The All India Board of Technician Education advises AICTE on all matters connected with the development of Technician Education.

The organization of technical education at central level is shown in Figure 29.

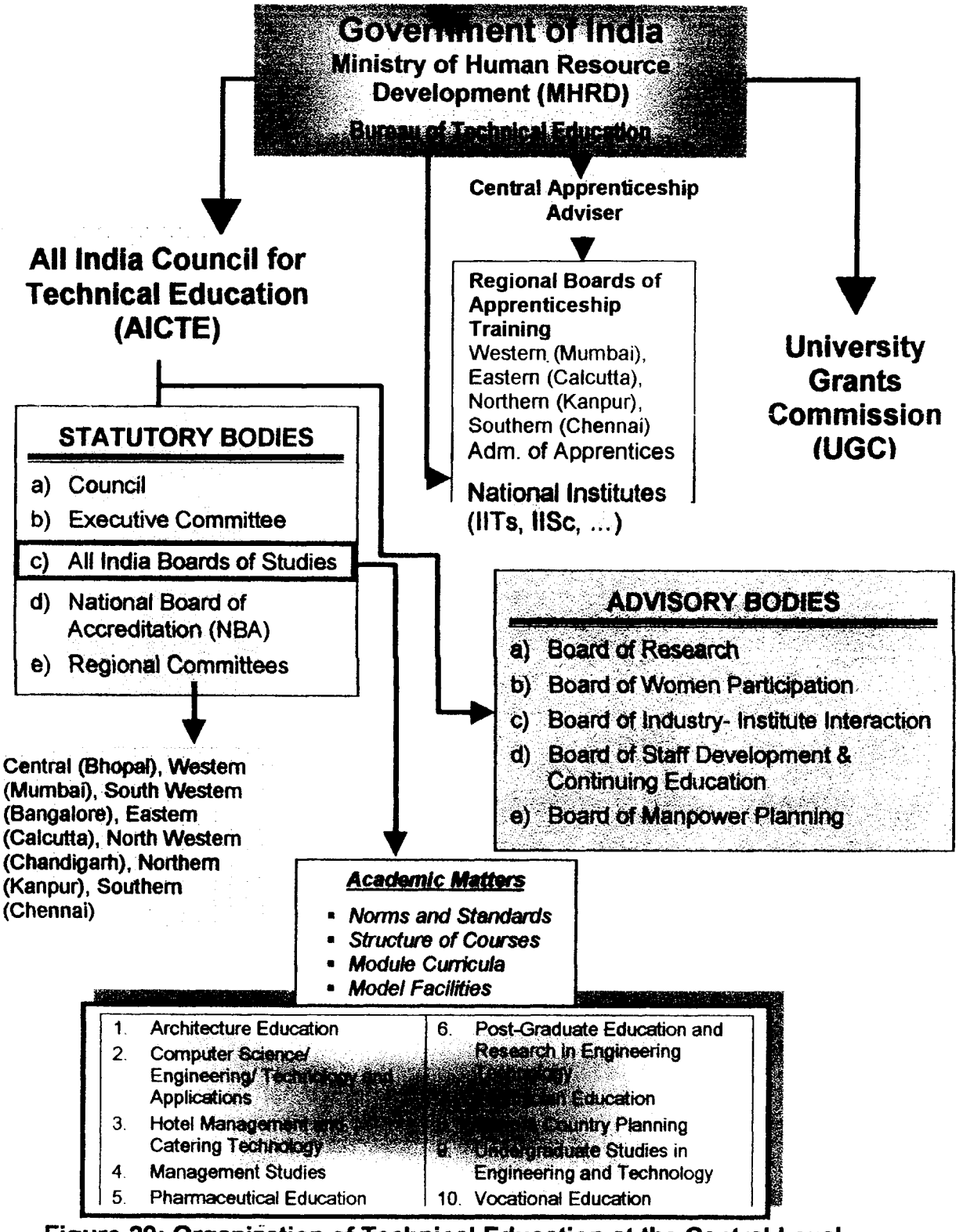


Figure 29: Organization of Technical Education at the Central Level

The Architects Act 1972 stipulates that the Council of Architecture is responsible for laying down minimum standards for architectural education at the degree level.

The Apprentices Act 1961 was enacted to regulate and control the training of apprentices as a step to meet the skilled labour force requirements of industry. *Subsequently the Act was amended in 1973 to bring under its purview engineering graduates and technicians and in 1987 to include vocational education certificate holders at higher secondary stage. Southern Regional Board of Apprenticeship Training, Chennai is responsible for administering the Act in respect of graduate and technician apprentices.*

11. VOCATIONAL EDUCATION AND TRAINING

11.1 Structure

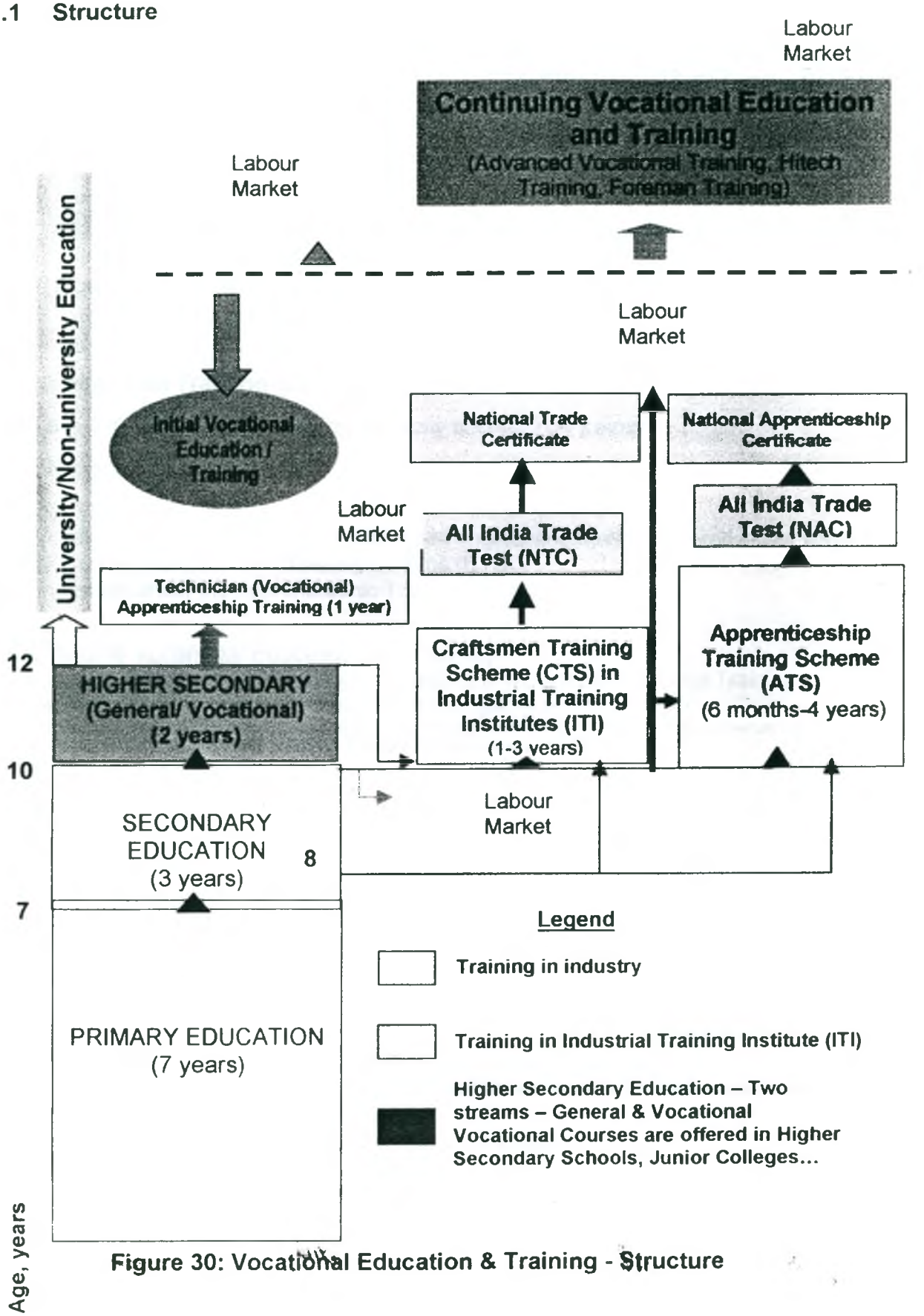


Figure 30: Vocational Education & Training - Structure

11.2 Vocational Training Capacity - Karnataka

	Government	Private	Total
Craftsmen Training Scheme			
Number of Industrial Training	90	262	352
Annual Intake Capacity	7, 916	12, 472	20, 388
Seating Capacity (Juniors+Seniors)	13, 384	21, 472	34, 856
Number of Women ITIs	17	11	28
Intake Capacity of Women ITIs	1548	520	2, 068
Number of Trades implemented	27	29	
Apprentice Training Scheme			
Number of establishments covered under the act			12, 034
Number of establishments where apprentice seats are located			2, 381
Number of seats allocated			22, 425
Number of apprentices on training			10, 195

11.3 Vocational Training Capacity – All India

There are 4, 086 ITIs with a seating capacity of 640, 704 trainees.

11.4 Programs

♣ *Initial Vocational Training*

Initial Vocational Training in engineering and non-engineering trades is offered in two ways.

- ❖ In ITIs under the Craftsmen Training Scheme (CTS)
- ❖ In industries under the Apprenticeship Training Scheme (ATS)

♣ *Continuing Vocational Education and Training*

Continuing education and training programs under the Advanced Vocational Training Scheme (AVTS) are offered at ITI Hosur Road, Bangalore and ITI Hubli.

The Hitech Training Wing at ITI Tumkur Road has established facilities for four first level courses in Industrial Automation, Computer Aided Drafting, Analogue & Digital Electronics and PC Maintenance.

The Foreman Training Institute at Bangalore, which is a DGE&T Institute, offers the following courses.

Course	Duration	Entry requirement	Certificate
Diploma in Foremanship	2 years	NAC/NTC preferably with 2 years experience	NCVT Diploma in Foremanship
Post-Diploma in Foremanship	2 years	Diploma Mechanical/Electrical/ Metallurgical Engineering	NCVT Post-Diploma in Foremanship
Post-Diploma in Foremanship (Maintenance Engineering)	2 years	Diploma Mechanical/Electrical Engineering	NCVT Post-Diploma in Foremanship (Maintenance Engineering)

The Regional Vocational Training Institute, Bangalore, another DGE&T Institute offers vocational training programs for women.

11.5 Vocational Training outside the DGE&T System

A number of government and private agencies outside the DGE&T system are offering vocational training more specifically in the service sector like Aquaculture, Food Processing, Gems & Jewelry, Nutrition & Dietetics, Plastics, Food Crafts, Art & Design etc.,

11.6 Vocational Teacher Training

Instructors in vocational trades are being trained in Advanced Training Institutes (ATI) at Howrah, Hyderabad, Kanpur, Ludhiana, Mumbai and the Central Training Institute (CTI) at Chennai. Duration of the formal training course is one year and comprises training inputs in Trade Technology, Engineering Technology and Training Methodology. The Craft Instructor Training courses are offered in regular and modular patterns. A Model Training Institute (MTI) which is an ITI is attached to each of these CTIs to enable the trainee-teachers to do practice teaching. Those who complete the training and pass the All India Craft Instructors Test are awarded a certificate by NCVT.

Non- formal instructor training consists of short refresher courses offered by these institutes to upgrade the knowledge and skills of instructors

11.7 Vocational Education at Higher Secondary Stage

These programs usually of 2 years duration are offered in the higher secondary schools/senior secondary schools/junior colleges in different states.

Certification - Senior Secondary/Higher Secondary/Pre-university certificates are issued by the concerned state boards of higher secondary/pre-university education.

Courses offered by the Directorate of Vocational Education in Karnataka are as follows.

Agriculture-based: Agri Economics and Farm Management, Agricultural Chemicals, Co-operation, Horticulture, Fisheries, Dairying, Plantation Crops and Management, Poultry Science, Sericulture

Commerce-based: Accountancy and Auditing, Accountancy and Costing, Accountancy and Taxation, Banking, Library Science, Marketing and Salesmanship, Material Management Technology, Office Management, Stenography

Home Science: Pre-school Education, Health and Beauty Care

Technical: Automobile Servicing, Civil Construction Technology, Clock and Watch Repairs, Clothing and Embroidery, Computer Technique, Electrical Wiring, Electronic Technology, Printing and Commercial Art, Printing and Book Binding, Sugar Technology, Textile Technician, TV and Radio Servicing, Two Wheeler Servicing

Paramedical: Dental Technician, Laboratory Technician, Multipurpose Basic Health Worker (Male), Nursing, Pharmacy, Physio Therapy & Occupation Therapy Assistant, Surveying, X' Ray Technician

Vocational Courses at Polytechnics: Printed Circuit Board Making, Garment Making and Embroidery, Office Automation, Personal Computer Servicing, Instrumentation Servicing, Rural Water Supply, Electrical Wiring, Refrigeration and Air-conditioning, Servicing of Electrical Equipment, Machinist, Automobile Servicing, Printing and Book Binding, Textile Technician

11.8 The Apprentices Act 1961

The Apprentices Act, 1961 was enacted to regulate and control the training of apprentices as a step to meet the skilled labour force requirements of industry. The Act makes it obligatory on the part of employers both in public and private sector industries to engage trade apprentices according to the ratio of apprentices to workers other than unskilled workers in designated trades prescribed under the rules.

Trade Apprentices: Persons having undergone training in the relevant trade at an ITI and possessing the National Trade Certificate can join the scheme with an entitlement of rebate in the training period equivalent to the number of years spent in the ITI.

Technician (Vocational) Apprentices - Students who successfully complete the 2 years vocational courses at the higher secondary stage can seek to join as technician (vocational) apprentices under the Apprentices Act.

Graduate/ Technician Apprentices – Degree/diploma holders in engineering/technology can seek to join as graduate/technician apprentices.

11.9 Teachware Development

The Central Instructional Media Institute, Chennai, a DGE&T Institute develops, produces and markets teachware needed for vocational training. The teachware consists of both print media (Manuals – Theoretical & Practical), Overhead Projector Transparencies etc.,

11.10 Vocational Education at the First Degree Level

The UGC Scheme –The University Grants Commission (UGC) has a scheme to encourage the university system to introduce vocational subjects at the first-degree level programs in Arts, Science and Commerce and Rural-based areas.

Under this scheme one vocational subject will be allotted to the college that proposes to start the course subject approval by UGC.

The college as a part of the first-degree program should introduce the vocational subject by dropping one of the conventional subjects in each of the three years of the first-degree program.

The college proposing to start the vocational program will have to make arrangements for supervised on-the-job training in the relevant industrial/service establishments.

11.11 Need to improve Vocational Training System in Karnataka

Need for demand-driven courses in ITIs

ITI Courses are:

- supply-driven and not demand-driven based on requirements of industry which are undergoing continuous changes;
- requirements of industry (customers) are not known by the providers of training;
- rigid and not competency-based.

The annual intake of 20, 388 students in 352 ITIs in the state is too inadequate compared to about 1, 30, 000 students passing SSLC examination each year. Experience during admissions in 1998-99 shows that the ratio of aspirants to ITI admission to available seats is about 8. Nearly 7 out of 10 ITI pass-outs are either employed or join as apprentices.

Therefore there is a need to improve the quality of existing courses and introduce new courses having demand.

Need for upgrading training infrastructure

- The exterior and the interiors of ITI buildings do not provide an environment conducive to high quality training (except in the Hitech Training Wing at ITI, Tumkur Road);
- The training equipment is outdated (except in a few institutes where modernization has been undertaken);
- Shortage of budgetary provision for raw materials, consumables, maintenance and training software.

Therefore there is need to improve the interior and the exterior of existing buildings and provide modern equipment adequate raw materials to improve the quality of training and training environment.

Research relevant to demand for new courses, obsolescence of existing courses, new designs of curriculum and evaluation are absent forcing the management to depend on hunches and common sense in making decisions affecting a large number of ITI students. Therefore there is need to set-up a research facility in the field of vocational training.

Need for upgrading human resources

- In general, the level of training of the staff at all levels in the Directorate and ITIs in Karnataka is not conducive to demand-driven vocational training;
- The competencies required in a vocational trainer, how he/she should be trained, what is expected of him/her in an ITI are not specified;
- There is no plan and budget for staff development to train the existing staff to perform better at all levels in the system

Therefore there is need for training the trainers and improving the management capabilities of staff at all levels through management development programmes.

Need for quality improvement

There is no benchmark established for quality of vocational training in Karnataka. Quality of products produced in ITIs is largely supply-driven. While the quality movement has gained momentum in industry through TQM and ISO 9000 certification, it is yet to make its inroads into the vocational training system.

It is therefore necessary to transform selected ITIs as Centers of Excellence, which can be emulated, by other institutes.

Need to improve training facilities for women

As per 1991 Census, Karnataka's population is 4.48 crores out of which women constitute 2.2 crores. Karnataka Government is committed to the empowerment of women through education and training leading to employment and income generation in industrial and service sectors of the economy. Out of the 90 Government ITIs in the State, only 17 are Women ITIs. 12 out of 27 districts do not have women ITIs. Though the total number of seats for women in the Government ITIs is about 41% of the total seats, the actual admissions are much less due to the following reasons.

a. The trades offered in composite ITIs where seats for women are reserved in the ratio of 1:3 are not suitable for women and there are very few women takers for these seats.

b. Lack of hostel facilities for women students in these composite ITIs.

There is very little interaction and co-ordination between the Department of Employment and Training and the various agencies engaged in the economic well being of women like the Karnataka State Women's Development Corporation, Karnataka Mahila Abhivrudhi Yojana, The Department of Women and Child Welfare.

Therefore there is a need for establishing women wings in selected ITIs with hostel facilities to meet the demand of vocational training of women.

Need to improve training facilities for the physically disabled

Over 13,000 persons qualified from secondary schools with S.S.L.C with one or the other physical disability have registered with the Employment Exchanges in Karnataka. There are many more that have not registered. Though there is a reservation of 3% of seats in the Government ITIs for the physically disabled, they do not opt for these courses as they are not suited to them. Therefore there is a need in the state for a facility to cater to the special vocational education and training needs of these physically disabled persons.

Need to improve continuing education and training facilities for skilled workers

The facilities available for offering non-formal continuing education and training programmes for skilled workers are meager compared the need to offer such programmes in the ever-changing era of technology change. The existing facilities are inadequate and do not cover all the areas in which training is needed like CNC Technology, CAD-CAM, DTP, Electronics, Information Technology.

Need to develop industry-vocational training partnership

The participation and involvement of industry in Karnataka in vocational training is limited to its role in Statutory Apprenticeship Training Scheme despite the fact that industry is a major beneficiary of vocational training. Financing ITIs by industry is non-existent.

Self-employment and entrepreneurship training

Though the Implementation Completion Report - India on Vocational Training Project has indicated that the post-ITI courses on self-employment is a failure, it is mainly due to lack of organized and systematic efforts that has led to such failure. There are instances in Karnataka (RUDSET) where many ITI pass-outs after undergoing the self-employment and entrepreneurship development programmes have been able to set-up own ventures.

It is well known that how-so-ever good is the quality of vocational training for wage-employment, it is impossible for the organized sectors to employ all the products of educational and training institutions. The future of Karnataka and India depends to a large extent on entrepreneurs who can generate wealth and employ people. Therefore there is need to motivate and inculcate the spirit of self-employment and entrepreneurship amongst ITI students and their pass-outs.

11.12 Development Projects undertaken by GOK

Advanced Vocational Training Scheme

Under this scheme, training is imparted in advanced skills. ITI Hosur Road, Bangalore is offering courses in Metrology and Inspection, Indian Standards and Blue Print Reading, Electrical and Electronics Maintenance, Tool & Die Making, Induction to Engineering Technology, Hydraulics and Pneumatics, Machine Tool Maintenance are offered in addition to tailor made courses. ITI, Hubli is offering courses in Electrical and Electronic Maintenance, Mechanical Maintenance and Advanced Welding Technology.

Hitech Training Scheme

Building modifications have been carried out and equipment have been installed at ITI, Tumkur Road, Bangalore for offering courses in Industrial Automation, Computer Aided Drafting, Analogue and Digital Electronics and PC Maintenance. These courses are being trail run now and very soon these courses will be offered to skilled workers from industry needing such training.

World Bank Assisted Vocational Training Project

This project is one of the largest projects in the field of vocational training undertaken by the DGE&T with World Bank lending. Aimed at capacity expansion, quality improvement and strengthening the management of the vocational training system in the Central and the State Governments level, the project that began in June1989 ended in December 1998. Funds utilized up to October 1999 amounted to about Rs.444.31 crores (~US $ 104 million).

Project Component/ Schemes *at the State Level are:*

- Modernization of equipment in existing ITIs
- Provision of Audio Visual Aids in ITIs
- Expansion of existing ITIs by introduction of training in new trades
- Introduction of Post-ITI Skill Development Courses for self-employment
- Establishment of new ITI wings for Women
- Introduction of new trades in existing women ITIs wings

Karnataka has successfully implemented all 11 Schemes under this project utilizing over Rs. 26.44 crores of assistance out of Revised Outlay of Rs. 29.83 crores. Under this project:

- 20 ITIs have been able to modernize equipment to a limited extent according to the then existing syllabus;
- 26 buildings have been constructed;
- Ten Women ITIs and have been established;
- A Basic Training Centre at Peenya has been established;
- Related Instruction Centres-one each at Mysore and Hubli have been established;
- An Advanced Vocational Training Centre has been established at Hubli;
  New trades in existing 7 composite ITIs and 4 Women ITIs have been added;
  Management Information System at the DET's office has been established
- A Hitech Training Facility has been established at Government Industrial Training Institute, Tumkur Road, Bangalore for offering first level training courses in Industrial Automation, Computer Aided Drafting, Analogue and Digital Electronics and PC Maintenance.

11.13 Traditional Skill Training

Skill training passed on from father to son is prevalent since a long time. Some of these skills are taught even now on this basis. The artisan crafts such as blacksmith, pottery, weaving, painting, sculpture, lacquerware, bidriware, cane and bamboocraft are living examples of traditional skill training. As a measure to preserve some of these skills efforts are now being made to impart training in some of these skills in a formal way. Central and Karnataka Handicrafts Development agencies are playing a significant role in preservation of these ancient skills.

11.14 Strategy to Improve the Vocational Training System

Market-driven Training

Training needs should be identified based on market requirements. They must be translated into programmes in the concerned institutes.

The processes of design, development, delivery and evaluation must be planned so that the inputs into the system get an opportunity to become outputs of specified competencies.

The resources like staff, curriculum, equipment, buildings and teachware should be engineered to meet process requirements. All the processes should conform to ISO 9000 certification standards.

Supplier-customer interface must be established in all programmes at all stages. The market-driven approach is diagrammatically shown in Figure 31.

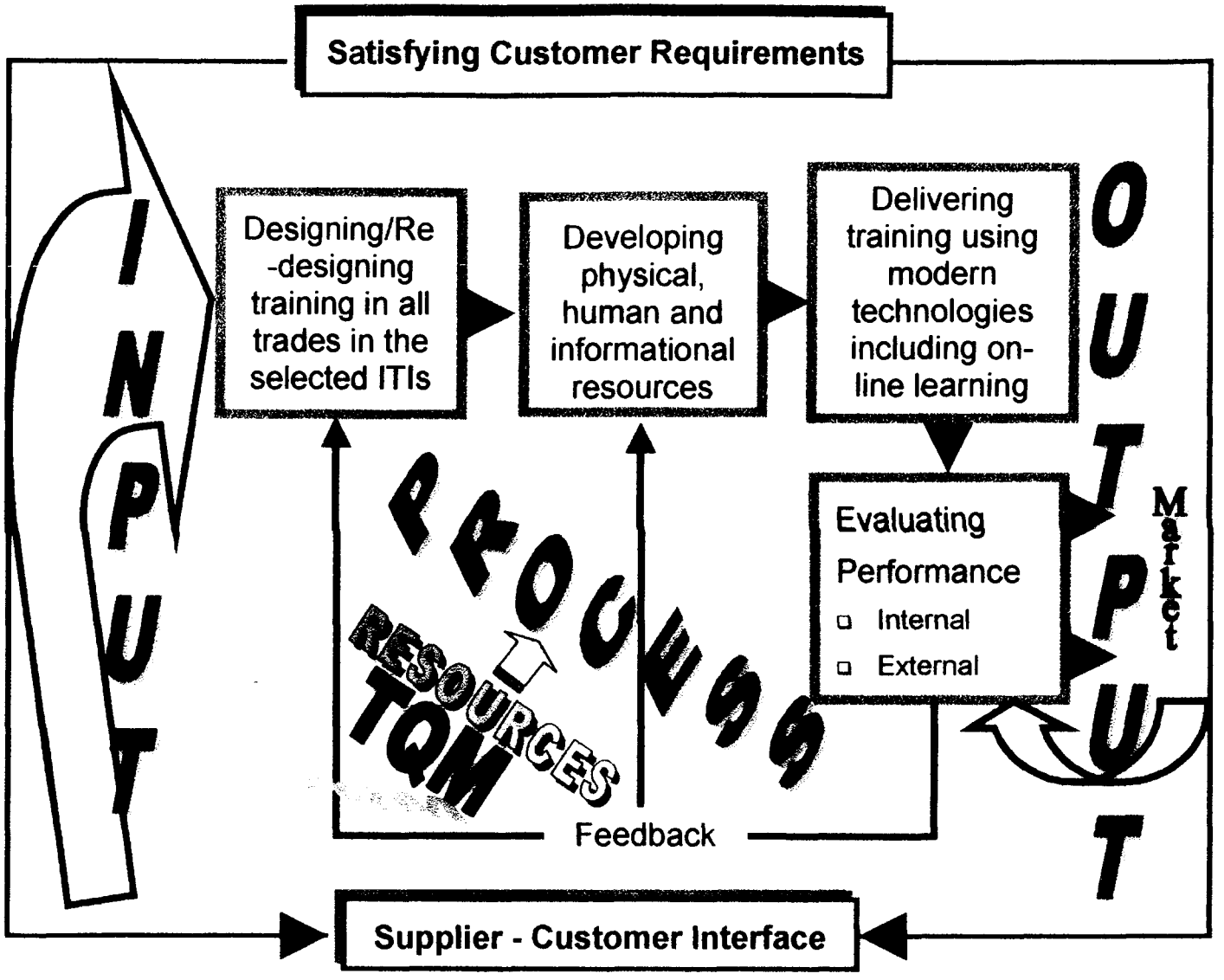


Figure 31: Market - driven Approach to Vocational Training

Interaction for Quality Assurance

Ultimately, the marketability of the product from an ITI largely depends on the quality of training provided to the customer i.e. the student. Quality of vocational training imparted at ITIs depends on many factors. It is therefore necessary to arrive at a commonly understood meaning of quality of training offered in ITIs considering the constraints in the vocational training system as a whole. A quality assurance mechanism for the proposed Centers of Excellence must be arrived at in consultation with industry and other agencies, which have bearing on the quality of vocational training. Necessary interfacing should be established for quality assurance as shown in Figure 32.

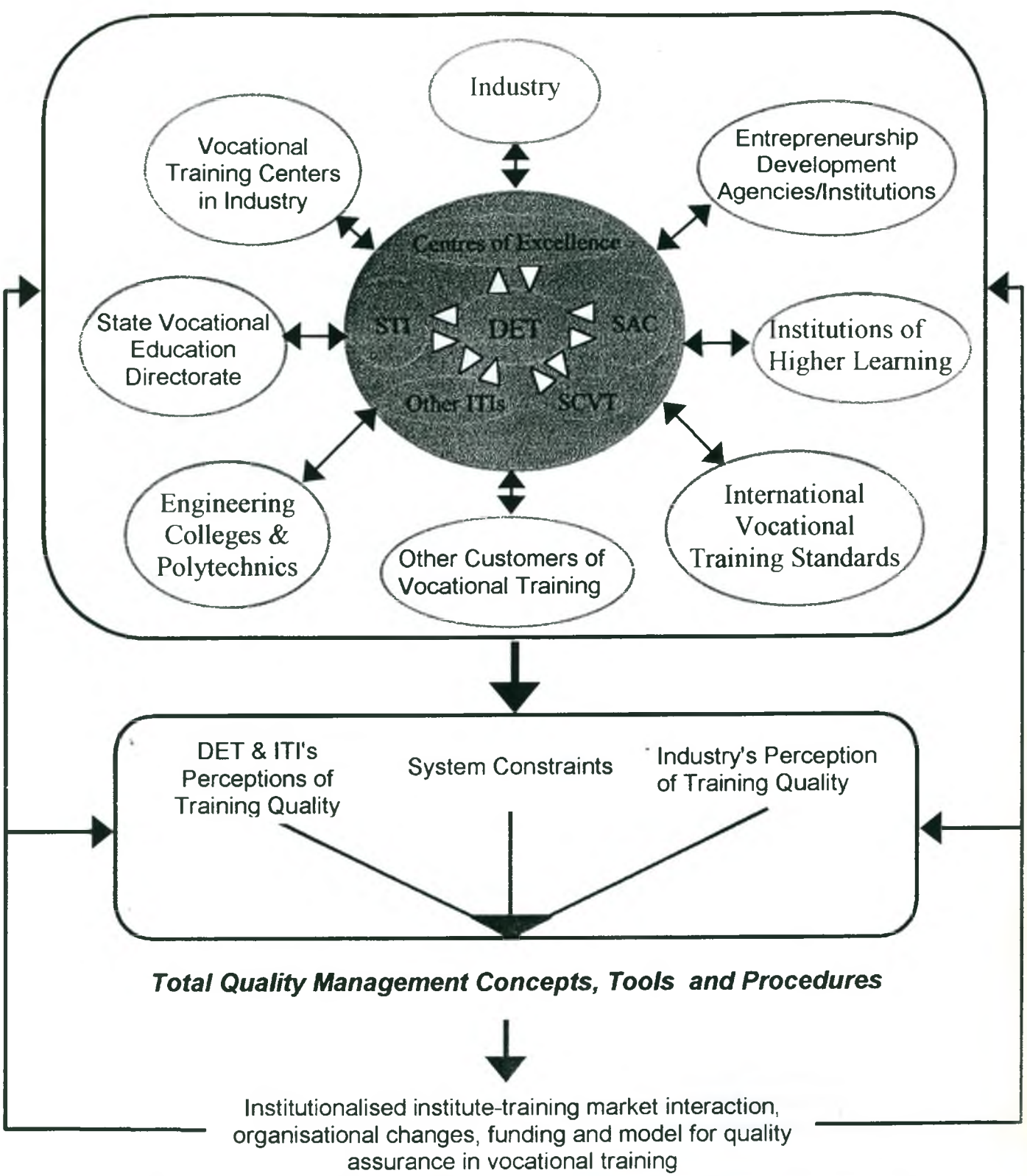


Figure 32: Diagrammatic representation of interfacing with different agencies within and outside the Karnataka Vocational Training System to achieve quality vocational training

STI-Staff Training Institute; SAC-State Apprenticeship Council
SCVT-State Council for Vocational Training; DET-Directorate of Employment and Training

ITI - Industry Interface

Institute Managing Committee (IMC) should be set up in the ITIs.

IMC must comprise the following members.

- 4-5 representatives from leading local industrial establishments
- One representative from CII, Southern Region
- The Principal of the concerned institute
- One senior trainer from the concerned institute
- One student representative from the concerned institute
- One senior officer from the Directorate dealing with training

The Chairman of the IMC must be from the industry

IMC's functions include generation and utilization of finance, student selection, curriculum design, staff development, monitoring training progress and quality, performance appraisal of staff, recommending additional resources for effective training delivery, training and placement of students and performance evaluation of the institute.

IMC may appoint sub-committes to advise on curriculum, equipment and staff.

DET should enter into MOUs with industry/industry associations to develop a sense of partnership between ITIs and industry. A set of indicators will be evolved to assess the performance of IMC. Subject to satisfactory performance, autonomous status may be granted to the concerned ITI.

Changing the mind-set in the DET

The staff in the DET and ITIs should be trained in:

- Concepts, strategies and methodologies for developing a demand driven vocational training system including training needs analysis and design competency-based vocational training;
- Concepts, procedure in ISO 9000 certification and preparations required to be made to obtain the quality mark;
- Concepts and strategies for income generation by selected ITIs to meet targeted recurring costs of the institutes;
- Concepts and methodologies of designing and implementing vocational education programmes for the physically disabled;
- Concepts related to autonomy and accountability of ITIs and management of autonomous institutions;
- Interactive seminars and conferences for developing co-operative and collaborative relationships with agencies involved in vocational rehabilitation of the physically disabled, women development agencies, entrepreneurship development and vocational training;
- Bringing a departmental manual on management of autonomous ITIs

Redesigning the curriculum of existing trades and design curriculum of new trades/courses using Competency-based approach

Technical Competence - **Ability and willingness to apply knowledge and skills gained during education and training to execute technical tasks independently to occupational standards which can be assessed.**

Method Competence - **Ability and willingness to work systematically according to plan while working on a task.**

Social Competence - **Ability and willingness to work as a team member, co-operate and communicate with others constructively in an organization.**

Personal Competence - **Ability and willingness to learn continuously, adapt to new**

Following strategy should be adopted for designing/re-designing the curriculum.

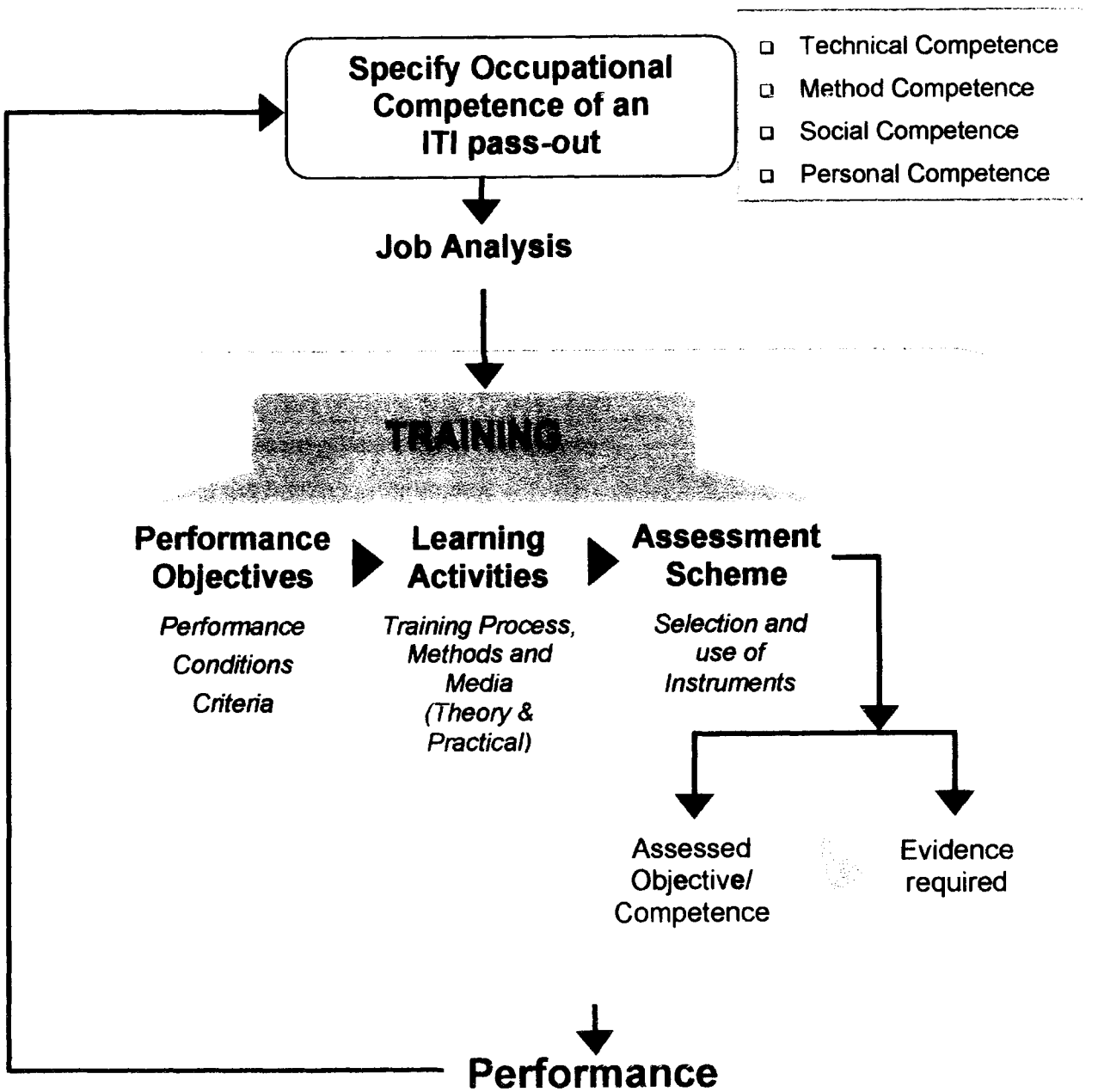


Figure 33: Strategy for Designing/Redesigning Competency-based Curriculum

- Planning and conducting workshops to re-design curriculum of existing trades and design curriculum of new trades/courses by involving training managers and experts from industry and institutions and ITI trainers. Performance objectives, practical

exercises and projects, continuous and terminal assessment schemes and standards of acceptable performance must be worked out in these workshops.

- Training manuals detailing the competencies to be developed in each trade, training plans specifying roles of trainers and trainees in the training process, schedule of assignments/exercises/tasks and projects must be prepared for each trade/course. Readily available training materials developed by CIMI should be fully made use of wherever applicable.

Delivering and Evaluating Training

The re-engineered programmes and new programmes should be delivered using the resources developed. On-line delivery of learning for continuing education and training should be tried in the ITIs. The programs must be evaluated to determine both internal and external efficiencies of the institutions.

Self-employment and entrepreneurship Development

- Establishing organizational linkages with EDII (Entrepreneurship Development Institute of India), SJCE-STEP (Sri Jayachamarajendra College of Engineering-Science & Technology Entrepreneurs Park), RUDSET (Rural Development and Self-employment Training) support systems and financial institutions.
- Planning and conducting awareness and motivation programmes in ITIs.
- Planning and implementing self-employment and entrepreneurship development programmes skilled workers and ITI pass-outs
- Providing follow-up guidance and counseling
- Evaluating the training programmes

These programmes must be conducted in the ITIs.

11.15 Financial Resources for training

a. Financial resources that are required for operating a high quality vocational training system are totally inadequate.

The annual budget (1999-2000) of Karnataka Government for Vocational Training is given In Table 1 below.

Table 1: 1999-2000 Budget for Vocational Training in Karnataka (Rs.lakhs).

	Non-recurring	Recurring	**Total**
Plan	329.90	769.75	**1099.65**
Non-Plan	539.36	1258.52	**1787.88**
Total	**869.26**	**2028.27**	**2887.53**

b. The ITIs in Karnataka are not designed to generate their own resources either through student funding or through other income generating schemes like continuing education and training and production activities. The programmes in government ITIs are heavily subsidized and the fee levels in private ITIs are too low to generate

own resources to meet the recurring expenditure. The staff salaries constitute a major portion of the recurring costs leaving very little for development and quality improvement.

Therefore there is a need for generating income in the ITIs by optimum utilization of the its resources to reduce the burden on the government funding.

11.16 National Policy on Vocational Training

The National Policy on Vocational Training 1999 calls for certain radical reforms to make our vocational training system respond to the changes that are taking place in national and international economic orders. Important ones among these are:

- Planning and executing demand-driven and competency-based pre-service, in-service, non-formal and flexible vocational training programs of quality satisfying the skilled workforce needs of primary, secondary and tertiary sectors of our economy;
- Transforming the current vocational training system into a decentralized system accountable to the users;
- Sharing managing and financing responsibilities with all the stakeholders in the system
- Planning and executing vocational training for the physically disabled.

11.17 Development Project

It is believed that DET, GOK is planning to undertake the development of vocational training under the second phase of World Bank Assistance. It is suggested that the strategies described above may be incorporated in detailing the proposed project. The project should contain the components as shown in Figure 34.

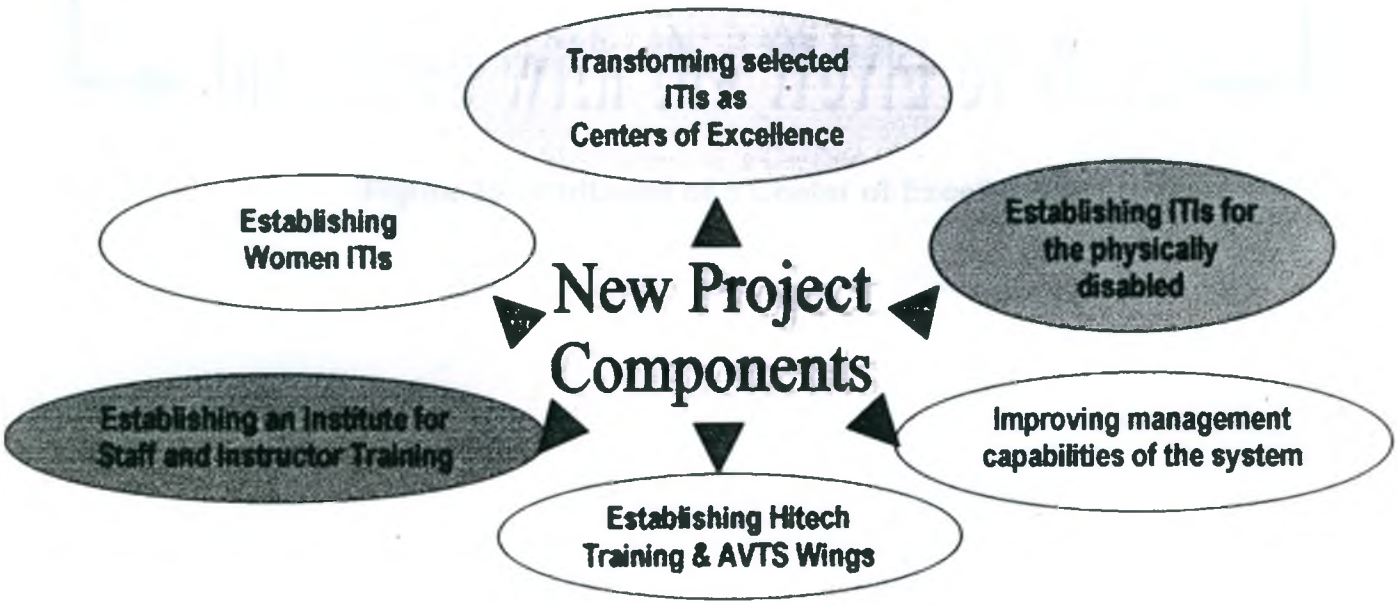


Figure 34: Project Components

The main attributes of a Center of Excellence are shown in Figure 35.

Figure 35: Attributes of a Center of Excellence

12. STRATEGIES FOR IMPROVEMENT

12.1 Capacity Expansion

Government should not invest in capacity expansion of technical education at degree and diploma levels due to underutilization of existing capacity, poor quality of education and training in a majority of institutions, satisfactory engineering manpower supply position and current unemployment situation. Private sector should be free to make investment in capacity expansion of existing programmes with associated risk and in starting new programmes with well-established manpower demand.

12.2 IT Education and Training

12.2.1 State Level Coordination

The State IT Department may convene a workshop to:

- Avoid swaying different institutions by the *"IT Mantra"* on collision course;
- Train the right kind of manpower required by the IT industry in ITIs, Polytechnics, Engineering Colleges at skill, technician and engineer levels following the NASSCOM-Mc Kinsey Study;
- Recommend the IT knowledge and skill areas to be handled by different types of institutes both in the formal sector and the non-formal and continuing education sector

Chairman IT Education Board, Director of Technical Education, Director of Employment and Training, IT industry professionals, a NASSCOM representative, Director IIIT and selected engineering colleges, polytechnics and ITIs may participate in this workshop.

Time Frame - June 2001

12.2.2 IT manpower

Computer science accounts for 18% of the total intake in degree (4787) and diploma (6082) courses. Adding the outputs from MCA institutes, universities and private institutes, the annual supply of IT manpower may workout to about 15000. The projected demand of IT manpower at the national level by 2008 is 2,367,000. In view of the fact that major IT industries are situated in Karnataka (Bangalore being considered as the Silicon Valley of India), the supply side could be improved by increasing the intake and starting new institutions if necessary. KREC Nodal Centre and NASSCOM should collaborate to project the IT manpower requirements in Karnataka annually and recommend measures to meet the demand at least a year in advance of the additional needs.

Time Frame - December 2001

12.2.3 Feasibility Study for Establishing a Virtual Technological University Campus

In view of the pre-eminent position of Karnataka in the IT map of the world, and the revolutionary developments taking place in computer mediated communication technologies in education GOK may examine the feasibility of establishing and operating a virtual technological university campus in the state. This campus may be a part of VTU or a separate deemed university with facilities for the following.

a. Post-graduate studies in engineering/ technology, and business studies using the on-line learning technology

b. Continuing education programmes for working personnel engineering/technology and business studies using the on-line learning technology

c. Teacher education and training programmes for polytechnic and engineering college teachers

12.2.4 Domain Specific IT Education and Training

To make the courses in branches of engineering other than IT/Computer Science & Engineering more attractive and motivating to the students and faculty:

a. VTU should hold a State Level Conference in collaboration with the Indian Institute of Science and leading IT Companies in which selected teachers from Engineering Colleges will discuss the extent to which IT Applications in teaching design, drafting, production/construction/process planning and quality control using industry standard software can be undertaken, equipment required (HW, SW), student assignments conforming to industry needs;

b. VTU should organize and conduct a Faculty Development Programme to train the teachers;

c. VTU should introduce the necessary changes in the curriculum;

d. As a short-term measure bridge programmes in IT may be introduced for the benefit of non-IT graduates and diploma holders.

Similar exercise should be undertaken at the polytechnic level. TTTI Chennai may be requested to redesign the curriculum of all diploma courses incorporating the required IT content and training teachers.

Time Frame - December 2003

12.2.5 Work-at-Home IT Education for Women

IT Department and DTE GOK, in consultation with IT industry, should support and strengthen Women's Polytechnics in Karnataka to design and offer IT training to educated women to enable them to undertake part-time and flexi-time jobs for IT-enabled services.

Time Frame - December 2001

12.2.6 IT Training Vouchers for Unemployed Engineering Graduates and Diploma Holders

IT Department and DTE GOK, in consultation with private IT institutes may be issue IT training vouchers to unemployed engineering graduates and diploma holders through employment exchanges to enable them to get IT training in private institutes thus improving their chances of employment.

Time Frame - December 2001

12.2.7 Supporting Teachers to Prepare and Tryout Computer-based Learning Materials

Every engineering college and polytechnic should encourage teachers to prepare and tryout computer assisted learning materials like CBT, CD-ROM, WWW using the facilities available in the computer laboratories/ centres. Every teacher in engineering colleges and polytechnics should be provided with a PC + Internet Connection.

12.2.8 Study on Non-formal IT Education and Training

A separate study should be undertaken of the non-formal sector of IT education and training with the following objectives.

a. To assess the contribution made by the non-formal sector towards IT education and training

b. To identify new areas in which non-formal sector should concentrate on providing IT education and training based on manpower requirements.

c. To develop program specifications conforming to global standards and a mechanism to ensure their compliance

d. To establish mobility between formal and non-formal programs through multi-point entry based on credits earned.

e. *To identify successful quality and costing practices in the non-formal sector with a view to introduce them the formal sector.*

12.3 Towards firing the Educational Innovation Engine

Directorate of Technical Education should become an agency to plan, implement and evaluate innovatory approaches in all aspects related to polytechnic education and training. VTU should plan, implement and evaluate innovatory approaches in all aspects related to engineering/ technology education and training at degree level and above. Principals and Department Heads in Polytechnics and Engineering Colleges in the age group 40-45 years should be trained in a Management Development Programme covering the following areas.

- Innovatory approaches to re-engineer technical education for high-growth economy;
- Concepts, strategies and methodologies for developing a demand driven technical education system including design of competency-based education and training;
- Developing a quality assurance model for technical education and training;
- Planning and executing internal resource generation activities and attracting alternative funding;
- Concepts related to autonomy and accountability of polytechnics and engineering colleges and management of autonomous institutions; Ensuring transparency and accountability;
- Developing co-operative and collaborative relationships and programmes with industries and employers.
- Performance evaluation of programmes, departments and institutions (not based only on the examination results but based on employability, entrepreneurial quality, quality of student projects/assignments, R & D output translated to IPR, faculty involvement in consultancy;

The innovatory efforts should be aimed at changing the situation shown in Figure 36 to that shown in Figure 37.

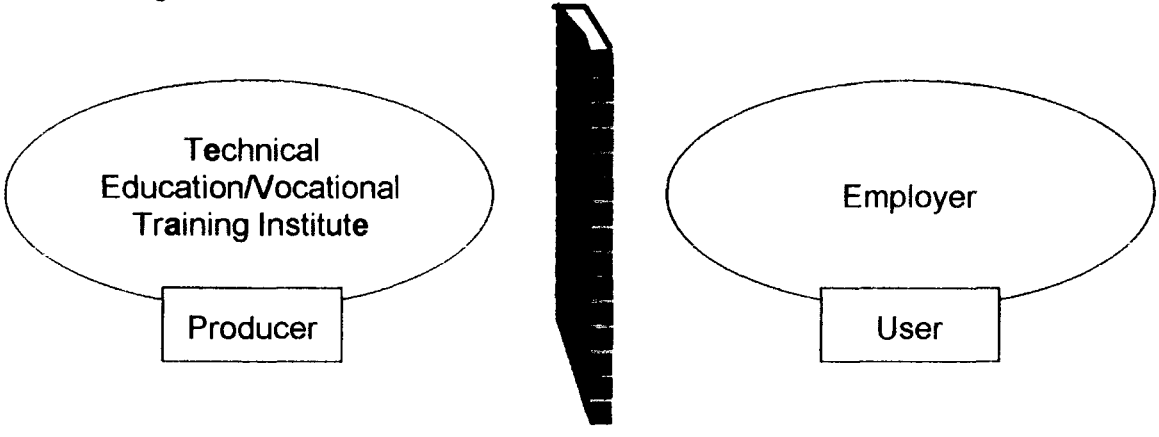


Figure 36: Current State

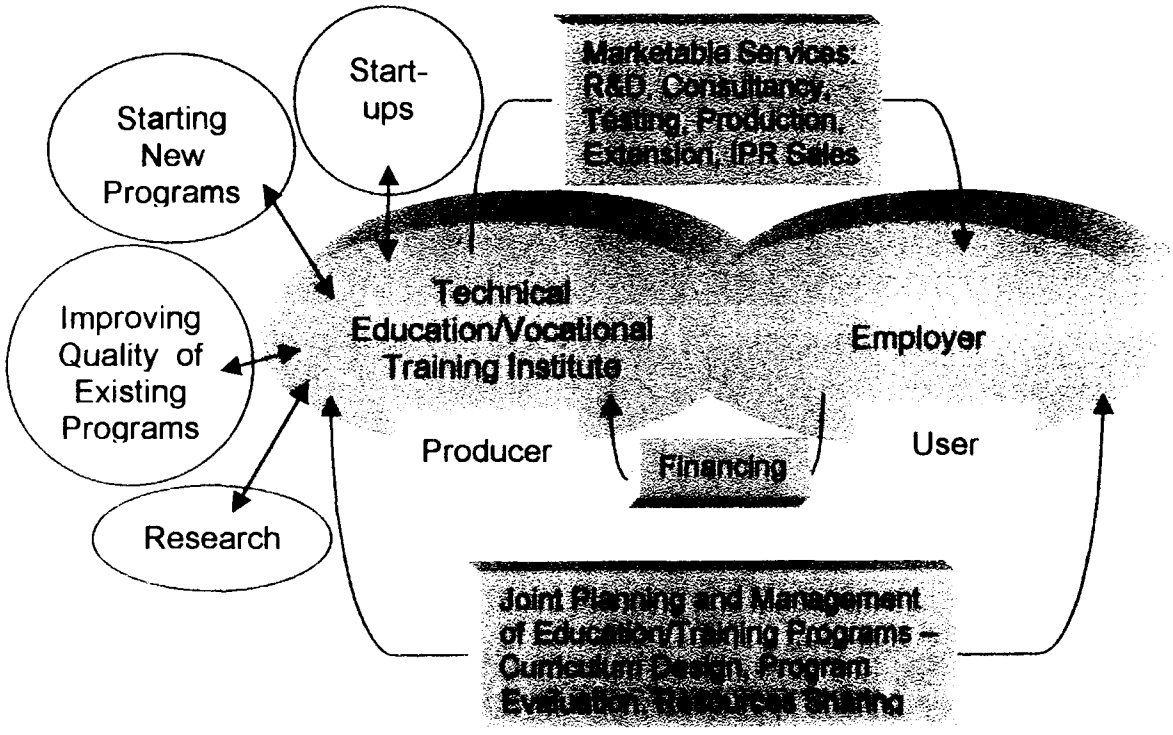


Figure 37: Desired State

Time Frame March 2001

12.4 Quality Management - State Level

- VTU and NBA may jointly formulate a calendar for accreditation of all engineering colleges in the state by the NBA. All those engineering colleges (existing for more than five years), that have not got their programmes accredited by NBA, must get the accreditation for at least the undergraduate programmes.
- VTU must ensure that all curricula for degree programmes are competency-based. Benchmark statements for measuring the attainments of students (as in QAA) should be formulated. Flexibility should be built into the curriculum so that a student can complete the programme successfully anywhere between four or five years. A student who completes the programme successfully in five years should get the same degree as a student who does it in four years. The student based on his/her interest, aptitude and achievement should have flexibility in the choice of courses.
- The concept of awarding a major degree and a minor degree (as introduced in IIT Kharagpur) - for example a major degree in mechanical engineering and a minor degree in computer engineering.
- IT applications in branches of engineering/ technology other than IT courses should be introduced immediately in the curriculum like the computer-aided design, computer-aided drafting, computer-aided manufacturing, computer-aided production/process planning, computer-aided quality control through use of industry-standard software.

Time Frame - 2003

- DTE should revitalize the KSBTE as the state agency for quality assurance of programmes offered by polytechnics. DTE/KSBTE, in consultation with AICTE, must formulate a quality assurance model for polytechnic education based on the perceptions

of its quality by teachers, administrators, and industry experts (including TQM/ISO 9000 organizations/experts). Based on this model, all polytechnics in Karnataka must be assessed for the quality of programmes offered by them during the next five years.

- DTE must ensure that all curricula for diploma programmes are competency-based. To make the polytechnic programmes relevant to needs of industry, ultimately all of them must be offered as cooperative/sandwich programmes. To begin with programmes offered by polytechnics located in industrial cities and towns should be on this pattern. State Government may enter into an MOU with CII/FKCCI incorporating a schedule for introducing such programmes..

Time Frame 2004

12.5 Quality Management - Institution Level

- Quality Circles should be setup at institution and departmental levels to improve quality systems and processes.
- Colleges obtaining A for all its programmes through the accreditation process by NBA should be awarded a development grant of Rs. 25 lakhs as an incentive by the State Government to enable the college to further improve the quality of programmes offered.
- Polytechnics obtaining ISO 9000 certification for the programmes offered should be awarded a development grant of Rs.15 lakhs as an incentive by the State Government to enable the polytechnic to further improve the quality of programmes offered.

Time Frame 2005

12.6 Quality Management - Teacher Level

- Teachers should set out intended learning outcomes of the programme they are going to teach, teaching/learning methods that enable the students to achieve the intended outcomes and assessment methods (including the criteria for judgement) used to demonstrate their achievements in the beginning of a semester. The intended learning outcomes should cover knowledge and understanding, intellectual abilities, practical skills, IT skills, social skills, communication skills, creative problem solving, design (creativity and innovation), business context, engineering practice and teamwork as appropriate.
- All students should be informed of the intended learning outcomes, assessment regulations and the strategies to achieve the outcomes. In addition to lectures, tutorials, practical/laboratory sessions, there should be seminars and discussions, project work preferably an industrial project and educational communication through computers like e-mail, chat sessions, learning through the internet etc.,
- Teachers should establish benchmark statements for student attainments and use them as the basis of assessing the learning outcomes. Evaluation of student's performance should be continuous with provision for open-book and take-home examinations. They must test essentially the creative problem-solving abilities of students and not the information-reproduction ability.
- Teachers should be encouraged to form E-groups with faculty in other countries through E-mail for exchanging views on content, methods of teaching and evaluation.
- "Outstanding Teacher" awards may be instituted at college and polytechnic levels to encourage excellence, creativity and innovation in the teaching-learning process.

Time Frame 2004

12.7 Autonomy

GOK and VTU may jointly formulate a policy framework for according functional autonomy in academic, administrative and financial matters to all the engineering

colleges in Karnataka, which are in existence for more than ten years. The features of such a framework could be a sustainable institutional environment that is able to:

- Formulate, implement and evaluate strategic plan for institutional development;
- Raise and spend resources from the industry and community for performance-based management;
- Set-up institute-specific management committees with industry heading such committees, programme-specific advisory committees to advice on curriculum, equipment and staff;
- Generate income from non-formal/continuing education and training programmes, testing, consultancy, production work , sponsored research & development and donations and use such income for institutional development;
- Plan and implement education and training programmes suiting to requirements of market and community.
- Gradual switching over to output-based funding government/aided institutions;
- Attract investment from industry by availing the tax exemptions;
- A formula to relate tuition fee to unit cost of training;
- Continuous quality improvement of programmes through revision of curricula, staff development, replacement of equipment in partnership with industry;
- Intra-institutional networking for optimum utilization of resources;
- Ensuring financial transparency and accountability by the institution to its stakeholders;
- Government control and intervention only if necessary.

- Management Development Programmes to train teachers and administrators to enable them to run autonomous institutions should be planned and executed - by VTU for engineering colleges and DTE for polytechnics.
- All the engineering colleges should achieve a status of becoming deemed universities during the next ten years. Quality institutions will come up to expectations and the others will wind up.
- DTE should initiate steps to accord functional autonomy to all polytechnics during the next five years.

Time Frame -
Management Development Programmes: 2001

Deemed University Status to Colleges 2010

Autonomy to polytechnics 2005

12.8 Providing Educational Service Support to Teachers and Students

Technical education means learning how to apply science in industry and commerce. Therefore every course must be developed to teach theory with application. VTU must provide educational service support as outlined below.

- Laboratory course materials in engineering/ technology should be developed to provide opportunities to plan and execute open-ended project type and investigative assignments by students emphasizing hands-on-experience instead of verification type and stereotype laboratory experiments. The laboratory courses should enable the student to plan, setup and carryout experiments; select measurement techniques and procedure to be used for validation of data. Model laboratories may be set up in selected colleges to be replicated by others.
- Courses like Introduction to Engineering and Technology, Creativity in Problem Solving, Introduction to Engineering Design, Orientation/ Exposure to industry should be developed and introduced in the early semesters to enable the student to appreciate

engineering methods and to facilitate understanding courses in later semesters. The laboratory and workshop component of such courses should include exercises for the student to tinker with materials and gadgets like bicycles, scooters, sewing machines, typewriters, toasters, fuses, refrigerators, airconditioners, furniture, domestic electric appliances, concrete mix preparation, brick testing, cement testing, electronic instruments, PCs and so on.

- Workshop practice courses should be developed aimed at making the student aware of the manufacturing/ production/ construction/ fabrication processes, tools and machines used, factors that decide process selection and identifying his/ her and others' role in the team.
- Professional and design courses should be developed with emphasis on creativity and projects to enable the student to experience the ways in which scientific knowledge can be put to use in the development and design of useful devices, products, structures and processes involving consideration of economic, social, environmental, legal and political factors. Engineering method should be emphasized rather than engineering content in these courses.
- Management courses should be developed as case study - based courses and should enable the student to assess the impact of technology innovations and total quality management in business/ industry and convert technology packages into industrial ventures including process planning, production/ construction scheduling/ resources scheduling. These courses should include achievement motivation training and entrepreneurial development inputs. Courses in attitude building to work as a team member should be developed and introduced.
- Teacher's Manuals should be developed for all the courses to incorporate the principles of learning like motivation, participation practice, feedback, flexibility and transfer of learning while planning, delivering and evaluating instruction. Technologies available for making educational communication interesting, meaningful and student-friendly like computer-based instruction, multimedia learning packages, video and audio instructional materials should be developed.
- Students' Manuals should be developed for all the courses so that during the instructional process, student is encouraged to learn from experience, face uncertainties and take risks, negotiate critical situations instead of avoiding them and work as a member of the team.
- To promote and implement IT-enabled teaching, arrangements may be entered into with software companies to produce/ market multimedia CD ROMs on concepts and engineering practices that are difficult to understand through class lectures and books.
- Currently available educational materials from IITs, CDCs and other agencies (for example The International Illustration Bank of Unesco) may be reviewed before taking the steps listed above.

VTU may set up and operate an Educational Services Center to provide the educational service support as outlined above.

Time Frame: Establishing the ESC-2001

Offering the Services - Should begin by 2002

DTE should continue to utilize the facilities and expertise of TTTI Chennai and its Bangalore Extension Center for the development of polytechnic education.

12.9 Faculty Development

12.9.1 Review of existing schemes

All the current faculty development programmes like the QIP, Short-term Courses, Continuing Education Programmes, Summer & Winter Schools should be reviewed so that they may be redesigned catering to the needs of institutions rather than individuals. The functions of technical teacher should include teaching theory, laboratory and practical courses; evaluation of

students; curriculum development & evaluation; setting-up laboratories; research & development; consulting and developing interaction between the institute and industry/employers. Faculty development programmes should be designed accordingly.

Engineering research carried out in post-graduate and Ph.D. programmes should end up in inventing new materials/products/processes and innovating to improve existing materials/products/processes. QIP for teachers should include a compulsory project on developing and testing a new course of study or improving teaching & evaluation of an existing course of study. Creativity, commercialization of new technological findings/innovations, starting up new companies should be built into postgraduate and Ph.D. programmes.

Acquiring the B.Tech (Ed) offered by TTTI Chennai should be made compulsory for all serving polytechnic teachers who are less than 50 years of age and who have not yet availed the opportunity. TTTI Chennai may be requested to build in a minimum of 3 months in-industry training in the B.Tech (Ed).

All polytechnic teachers possessing B.Tech (Ed) should be given an opportunity to acquire industry-oriented postgraduate degree/diploma in engineering/technology on a roster basis under the QIP.

The service conditions attached to the revised AICTE Pay Scales should strictly enforced so that the faculty are fully involved in the development in the institution of which teaching is one function though an important one.

12.9.2 Crash Programme on IT applications

VTU should plan and conduct a crash programme for all teachers of engineering colleges on IT applications in different branches of engineering. DTE and TTTI Chennai should plan and conduct similar programmes for all polytechnic teachers., DTE and AICTE should jointly finance these programmes.

Time Frame: December 2001

12.9.3 Support Staff Development

DTE and TTTI Chennai should plan and conduct need-based training for the support staff of engineering colleges and polytechnics aimed improving their performance. DTE and AICTE should jointly finance these programmes.

Time Frame: December 2002

12.9.4 Attracting the best talent for teaching & research

GOK may constitute a committee of experts from the field of technical education and industry to devise a scheme for attracting the best talent for teaching and R & D work in engineering colleges and polytechnics. The committee may consider the following aspects.

a. Attracting young graduates & postgraduates and offering them compensation packages on par with industry and in addition providing them with R & D grants and opportunities for higher studies in India and abroad.

b. Attracting executives from industry with rich professional experience in design, R & D and management and offering them compensation packages not less than what they are earning in industry and in addition providing them with R & D grants and allowing them to start-up new companies.

c. Attracting NRIs willing to return from industrially advanced countries and take up faculty positions by offering them residence, schooling for their children and attractive compensation packages.

d. Identifying talented students during the undergraduate studies who have potential to become good teachers and offering them industry-standard compensation packages during the 6th, 7th and 8th semesters, sponsoring them to acquire a specially designed postgraduate degree in engineering/technology and technical teaching in IIT/IISc after their successful

completion of undergraduate programme with distinction with 25% annual increase in compensation, recruiting them as teachers in engineering colleges/polytechnics for 3 years, sponsoring them for Ph.D. programme, continuing them as teachers for 3 years after their Ph.D. allowing the do post-doctoral research abroad if they wish to for 2 years and continuing them as teachers subsequently with built in mechanism of promotion subject to performance.

12.10 Marketing Technical Education

Karnataka has made significant contribution to the growth and development of technical education in the country. Feasibility of establishing a Technical Education Consultancy Organization on lines similar to EdCIL of the Government of India may be examined for the purpose of marketing the expertise and services in the field of technical education to other states in India and Overseas. Such a company should work as a corporate entity with stakeholding by GOK, Industry, Financial Institutions and Technical Education Institutions.

12.11 Financing

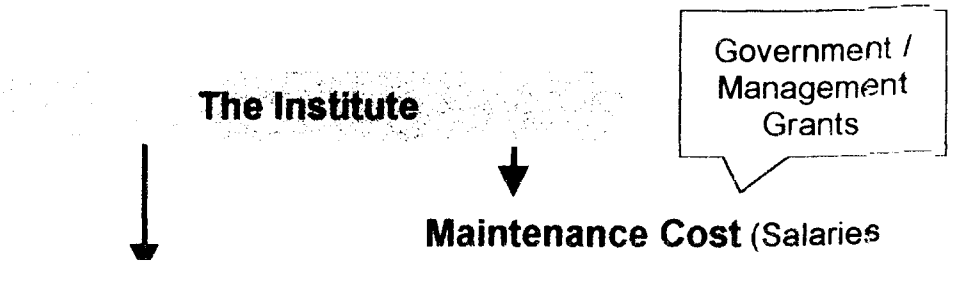
A balanced approach to financing technical education should be adopted wherein the GOK, private sector and industry share their respective responsibilities of policy formulation, and effective and efficient implementation of such policies. Public investment in technical education should be essentially earmarked for Quality Improvement, R & D and Entrepreneurship Development. Private investment should aim at capacity expansion including establishment of new institutions.

12.11.1 Technical Education Development Bank initiative by GOK

The demand for technical education in Karnataka by all sections of people is an indicator of the fact that it not only benefits individuals but also enriches society at large. Therefore there is a substantial overlap between private and public interests. The hitherto understood notion that higher education in general and technical education in particular has high private rates of return and low social rate does not hold good. While private sector has come forward in establishing and running a majority of engineering colleges and polytechnics in the state, public spending is necessary to launch a reforms programme aimed at quality improvement, R & D and faculty development in these institutions. GOK may establish a Technical Education Development Bank with an initial capital of Rs.100 crores. All the engineering colleges, polytechnics and other technical/vocational institutes should be invited to be the shareholders in the bank amounting to at least 10% of the total shareholdings. Leading banks should be entitled for 25% of the shareholdings. Each institute should be able to draw upon the resources of the bank for meeting its expenditure for development activities on easy repayment terms.

12.11.2 Internal Resource Generation

MHRD Block Grants System (a frozen grant for a 4 year period) is recommended for government and aided institutions. The institute should be asked to create a corpus/endowment fund to finance its development projects by contributing savings from the government/ management grants and income earned through various income-generating activities to which a matching grant is added by the government/ management as shown in Figure 38. It is well known that all institutions cannot generate income by resorting to all the activities shown.



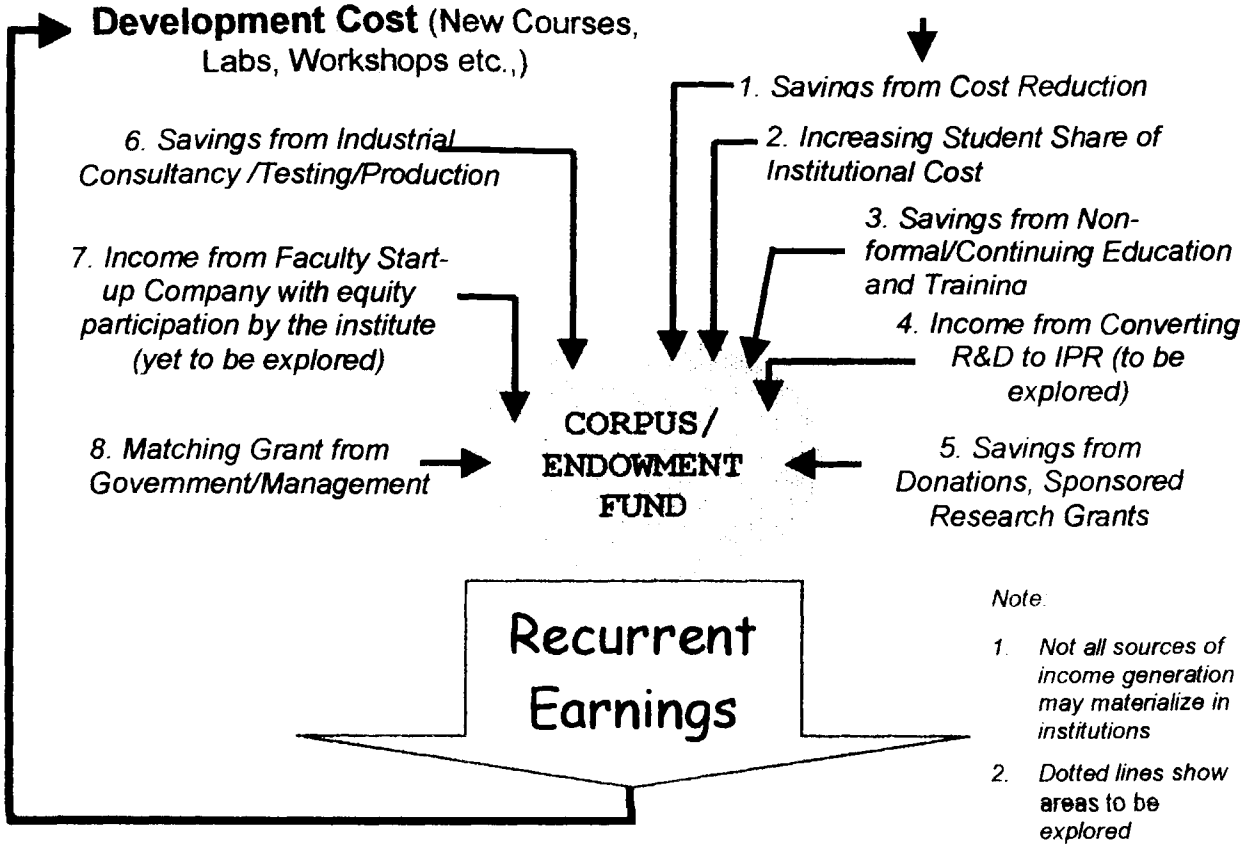


Figure 38: A model to meet development expenditure

Private institutions should venture into development of their institutions if they have to survive on along-term basis and start generating income from sources other than student fees.

GOK should reimburse atleast 50% of the expenditure on institutional development to any engineering college/ polytechnic, which formulates, implements and evaluates strategic plan resulting in generating resources to meet the developmental needs of the institute.

Time Frame: Internal Resource Generation in:

Engineering Colleges to the extent of 10% of Annual Recurring Expenditure by 2002, 25% by 2005 and 75% by 2010;

Polytechnics to the extent of 10% of Annual Recurring Expenditure by 2002, 25% by 2005 and 50% by 2010

12.12 Developing VTU as a Technological University of Global Standards

Feasibility of developing VTU as a Technological University meeting International Standards of Education, Research & Development and Extension Services in cooperation and participation with TIE (The Indus Entrepreneurs of USA) and University of California should be explored.

While undergraduate engineering education should be the responsibility of the respective colleges, VTU should develop and offer innovative post-graduate programmes not only in emerging areas of engineering and technology but also in areas that can fuel the economic development of Karnataka through entrepreneurship development, commercialization of technology and incubation facilities for start-ups

R & D in engineering and technology of relevance to the state and in areas relevant to the development of high quality technological education with innovative curriculum

models, innovative teaching through projects and innovative methods of assessing student performance should be an integral component of post-graduate education leading to M.Tech and Ph.D.

Time Frame: 2010

12.13 Research and Development

"Innovate or perish" should be the 'mantra' for all engineering colleges and polytechnics. R & D should be regarded as an essential function of engineering colleges and a technical teacher must develop R & D as a habit. Identifying and solving problems faced by industrial establishments and rural/urban communities should be encouraged by institutions and undertaken by the faculty

In addition to seeking R & D grants from AICTE, an R & D Seed Fund may be set up by the VTU. Faculty members of engineering colleges and polytechnics coming out with proposals for undertaking worthwhile research projects should be supported financially and organizationally from the fund. Projects with participation by industry should receive the first priority.

A suitable mechanism must be devised by each institute to monitor and evaluate R & D including accountability for the utilization of the fund.

12.14 Continuing Education

VTU and AICTE should jointly assess the impact of the current programmes offered by several agencies on improving the performance of participants in their job environments.

Engineering colleges should offer continuing education programmes, which emphasize design methodology and skills using computer as a tool.

Polytechnics should offer continuing training programmes, which emphasize practical and operational skills in hitech areas.

Continuing education and training programmes should be designed as modules. A participant successfully completing a set of modules should be eligible to acquire a certificate/degree/diploma.

At least half the number of continuing education programmes offered by an institute in a year should be sponsored by industry.

12.15 Industry-Institute Interaction

12.15.1 Learning Factories

With the problems by the Indian industry due to globalization and its lukewarm attitude towards technical education, it is difficult to set any deadline to develop a healthy and symbiotic partnership between technical institutions and industry. While the current efforts should continue, it is well established that industry will look to technical institutions provided they can be of help in training and supplying high quality manpower and improving their profits by introducing new technologies. This again emphasizes the need for offering competency-based education and training and undertaking R & D by technical institutions. The laboratories, workshops, computer centres and other physical facilities in engineering colleges need to be redesigned as *learning factories* to create industrial situation for learning in the institute as far as possible.

12.15.2 Involving industry in the institute management

Institute-specific management committees should be set up by involving industries in such committees as chairpersons. Programme Advisory Committees should be set up for each programme offered by the institute in which industries have a major say. GOK may take up the

issue with CII, FKCCI and KASSIA so that each institute may enter into an MOU with a nearby industries association or a group of industries on staff training, students, training, sharing facilities and expertise, consultancy, testing, production and R & D.

12.16 Equity

12.16.1 Attention to SC/ST admission

Admission of SC and ST in private institutions is about 5% of the total in degree programmes (probably in the payment category) and 8% of the total in diploma programmes. Private institutions should launch a special drive in the form of newspaper advertisements, TV commercials and counseling in PU Colleges to attract deserving candidates for admission to degree and diploma programmes.

12.16.2 Minimizing Geographic Imbalances

Polytechnics should launch special drives like counseling in Schools and PU Colleges, TV Commercials and newspaper campaigns about the scope of the diploma courses to increase the capacity utilization in polytechnics.

12.17 Technical Education Development Projects

After reviewing the impact of technical education development projects already undertaken, an expert group may be set up to prepare project proposals for development of technical education in the state on the basis of which GOK may explore obtaining international donor assistance aimed at improving:

- *Educational infrastructure including classrooms, libraries, multimedia laboratories, on-line learning facilities, new laboratories, hostels, equipment and institutional networking;*
- *The design, testing, and implementation of new curricula and academic programmes including cooperative programmes;*
- *The recruitment, retention, motivation, and long-term development of well-trained faculty;*
- *The quality of programmes offered by engineering colleges and polytechnics on a continuous basis leading to ISO 9000 certification;*
- *The current governance in technical institutions to an autonomous, multidimensional (research, consultancy, testing, continuing education, start-ups etc.,) enterprise operated by entrepreneurial professionals accountable to stakeholders in the system.*
- *The credibility of technical institutions in the eyes of financial institutions and banks for borrowing money for technical education development;*

The World Bank Assisted Sub-sector Development Program for Technical Education should be redesigned by incorporating the improvement strategies suggested above.

12.18 Role of Central and State Governments

12.18.1 State Government

The strategies suggested in 12.1, 12.2 (12.2.1 to 12.2.8), 12.3, 12.4, 12.5, and 12.8, 12.9.2, 12.9.3, 12.10, 12.11, 12.12, 12.13, 12.14, 12.15, 12.16 and 12.17 should be initiated at the State Government Level.

The strategy suggested in 12.6 should be initiated at the institution level.

12.18.2 Central and State Government

The strategy suggested in 12.7 and 12.9.1 should be initiated by the State and the Central Government through AICTE.

12.18.3 Balanced Approach

- *Balancing institutional freedom for innovation and providing educational service of international standards at competitive price*
- *Creating a climate for designing and offering demand-driven programmes*
- *Freedom to specify input quality*
- *Accountability for output quality*
- *Minimum standards of institutional performance*

should be the approach in regulation of technical education institutions.