



Status of Undergraduate Engineering Education in India -An Analysis of Accredited Engineering Programmes

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Abstract

National Board of Accreditation (NBA), a body constituted by the All India Council for Technical Education (AICTE) is responsible for the accreditation of Technical education programmes in India. NBA evaluates the performance of engineering programmes quantitatively by assessing 70 variables grouped under a set of 8 predefined criteria, and qualitatively by observing the strength & weaknesses of the programme. The qualitative analysis of NBA reports during the period 2000 – 2005 is utilized in this paper for exploring the status of undergraduate engineering education in India. This paper also assesses the performance in terms of the total scores obtained by the UG engineering programmes in the NBA accreditation process during this period.

Keywords: Accreditation, Performance of engineering programmes, Engineering programmes in India, Qualitative analysis

1. Introduction

The system of technical education in India has become a formidable reservoir of technical expertise in terms of the magnitude of human resources and expertise available and of the physical facilities created over the last three decades. As of 2005, India has 1346 degree-level engineering institutions with a student intake of 4,39,689 (<http://www.aicte.ernet.in>). The quality of education received by the engineering students from these institutes will have a direct impact on how the companies, where they are employees compete in and contribute to the global economy. Moreover, in the new economy, technological innovation is central to wealth creation and economic growth (Bordogna, 1997). To sustain a competitive advantage, engineers must act as enablers to wealth creation rather than simply be a commodity on the global market (ABET, 2002).

Along with many success stories, there is a belief, and there are sufficient evidences and reasons to do so, that the science and technology is on the downward swing in India, and standards in Science & Technology education are deteriorating at a rapid pace while the intellectual level of the youngsters is rising (REE, 2003). As the growth rate of engineering institutions has been phenomenal, many problems associated with such fast growths are present in the Indian engineering education system. Some of these problems are inadequate supply of well-qualified and experienced faculty, too many colleges affiliated to a single university and location of many institutions far away from industry centers. An analysis of performance of the engineering programmes is of great interest in this situation, which could also help us in identifying some policy options to improve the quality of engineering education in India. This paper attempts for such an analysis by a search through the assessment reports of the National Board of Accreditation (NBA), a body constituted by the All India Council for Technical Education (AICTE), India for the accreditation of technical education programmes in India.

2. Framework of the study

National Board of Accreditation (NBA) is the agency responsible for the accreditation of Technical education programmes in India. NBA reports and score sheets can be treated as the basic source of information for the analysis of performance of engineering programmes in India. NBA uses a scoring system with a maximum score of 1000 points in terms of 70 variables for the assessment of quality of engineering programmes. The process has been reviewed from time to time to better its assessment capabilities. The reviewed process has been implemented with effect from January 2003, and further modified in January 2004. The grading systems and accreditation criteria for the three versions of NBA (Manual for NBA Accreditation, 2000,2003,2004) are depicted in Tables 1 and 2.

The first part of the study has been organized to analyze the impact of these revisions on the scoring pattern of the programmes. In addition to the assessed scores, the NBA score sheets include the qualitative judgments of the experts about the strengths and weaknesses of the programmes. In the second part of the study, these qualitative observations

are extracted for the analysis of the strengths and weaknesses of the UG engineering programmes in India.

3. Objectives

(1) To explore the scoring pattern of the UG Engineering programmes under each of the three versions of NBA assessment processes.

(2) To analyze the strength and weaknesses of the UG Engineering programmes that had undergone the accreditation process of NBA.

4. Data description

Both the studies are developed around the NBA criteria, score sheets and reports. NBA reports and scoring sheets connected with the accreditation visits to 240 UG engineering programmes from 13 states of India during the period 2000 - 2005 have been collected.

The scores obtained by the programmes are categorized in to three groups based on the periods 2000 – 02, 2003 and 2004 – 05 for the first study. The distributions of the scores obtained by the engineering programmes in the accreditation process of NBA in each of the three periods are found out separately for the analysis. These distributions are used for drawing conclusions about the performance of the programmes as well as the assessment process of NBA.

Previous studies (Viswanadhan et al, 2004, 2005) pointed out that the entire accreditation process of NBA could be summarized by 19 factors instead of 70 variables. The summary of these 19 factors is displayed in Table 3.

As the 12th factor, Student Intake (Table 3), is not mentioned anywhere in the NBA reports while listing the strengths and weaknesses of the programmes by the experts, this factor does not seem to be an important indicator of performance of the programmes. Hence this factor is not considered in the study. As the last four factors - Supplementary Processes, Industry Initiatives, Institute Initiative and R&D Activities are the supporting processes of the core process of any educational programme - the Teaching Learning Process; they are combined and named Supporting Processes. Hence sets of 15 factors (Quality Indicators) are considered for assessing the strengths and weaknesses of the programmes. The observations of the NBA experts about the strengths and weaknesses of the programmes are categorized under these 15 factors for the second study.

5. Results and discussions

5.1 Study 1 - Performance of programmes and the assessment process of NBA

The pattern of scores of the programmes during the three periods 2000 – 02, 2003 and 2004 – 05 are displayed in Table 4. A combined view of the scoring pattern during the three periods is given in Figure 1. Out of the 139 programmes accredited under the initial process of accreditation (before 2003), four programmes (3%) graded as 'Not Accredited' (Denied accreditation status), thirty five programmes (25 %) graded as 'C', seventy five programmes (54%) graded as 'B' and the remaining twenty five programmes (18 %) graded as 'A'. Under the 2003 revised process, out of 23 programmes applied for accreditation, fifteen programmes (65%) got 'Accredited for 3 years' and the remaining eight programmes (35%) got 'Accredited for 5 years'. Four programmes (5 %) got 'Not Accredited', sixty four programmes (82 %) got 'Accredited for 3 years' and ten programmes (13 %) graded as 'Accredited for 5 years' out of the 78 programmes during the period 2004 – 05 (Latest revisions).

A clustering of the programmes is visible around the minimum scores for accreditation in all the three periods (twenty one programmes (15 %) during the period 2000-2002, ten programmes (43 %) during 2003 and fifty programmes (64%) during the period 2004-05). This clustering is more noticeable with the revised processes (43% and 64%), where the grading system changed from three categories to two categories. A trend can be observed that most of the programmes that come forward for accreditation process are getting accredited through the revised accreditation processes. The reason for this phenomenon might be

- (1) The programmes satisfying the minimum requirements are only applying for accreditation
- (2) There is a tendency in the NBA expert teams to give accreditation status to all the applied programmes

5.2 Study 2 - Strengths and weaknesses of programmes

The status of the UG Engineering programmes in terms of the fifteen indicators of performance is analyzed from the qualitative observations mentioned in the NBA reports. The number of programmes judged as strong, weak and normally performing are listed in the Table 5. Performances of more than 25% (60 out of 240 programmes) of the programmes are judged as weak with respect to six indicators. These indicators are supporting processes, Student Performance, Performance Appraisal & Development, Faculty Adequacy, Supplementary Physical Resources and Participatory Management. Pie diagrams depicting the percentages of strong, weak and normally performing engineering programmes with respect to these six indicators are displayed in the Figures 2 through 7.

The commitment of the Managements that are seeking for accreditation is clear from the values of CA in Table 5 (only

1% of the programmes are weak). Main Physical Resources of the applied colleges are also very strong (96% rated as strong or average). It can be assumed that the colleges will assure the minimum standards at least in terms of the infrastructure before undergoing the accreditation process. Academic Calendar, which is almost common to all colleges affiliated to a University, is also intact in all the programmes (100% rated as strong or average).

The Supporting Processes, especially R & D activities and industry institute interaction, are the weakest components of accredited programmes. Inadequacy of faculty and lack of participatory management are the next weaknesses of the programmes. Performance appraisal mechanisms are not alive and student performance seemed to be poor in most of the programmes. It can be observed that managements of engineering institutes give less attention to the development of supplementary resources (hostels, transportation facilities, medical facilities etc).

6. Conclusions

An analysis, both quantitative and qualitative, of the performance of engineering programmes in India has been presented in this paper. It is observed that the programmes applied for accreditation are good in major physical resources and their managements are committed in achieving their intended goals. The major weaknesses of the programmes are the inadequate supporting processes and faculty members. A cautious review of these weaknesses will help in the improvement of quality of the programme, institute as well as the engineering education system of India.

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Table 1. Revisions of NBA accreditation processes - Grading system

Accreditation System	Total Points (Out of 1000)			
	<550	550-650	650-750	>750
Earlier System	Not Actd.	C	B	A
From 1-1-03	Not Actd.		Actd. for 3 yrs	Actd. for 5 yrs
From 1-1-04	Not Actd.		Actd. for 3 yrs	Actd. for 5 yrs

Table 2. Revisions of NBA accreditation processes - Criteria for Accreditation

Earlier System			Present System (Modified from 1-1-2004)		
Criterion Number	Criteria Earlier system	Wts	Criterion Number	Criteria From 1-1-2004 onwards	Wts
1	Mission, Goals and Organization	100	1	Organization and Governance	80
2	Financial & Physical Resources and their Utilization	100	2	Financial Resources, Allocation and Utilization	70
			3	Physical Resources (Central Facilities)	50
3	Human Resources: Faculty & Staff	200	4	Human Resources: Faculty & Staff	200
4	Human Resources: Students	100	5	Human Resources: Students	100
5	Teaching – Learning Processes	350	6	Teaching – Learning Processes	350
6	Supplementary Processes	50	7	Supplementary Processes	50
7	Industry – Institution interaction	70			
8	Research & Development	30	8	Research & Development and Interaction Effort	100
Total		1000	Total		1000

Table3. Summary of Criteria wise Factor Analyses on the NBA variables

Criteria -NBA	Variables (Parameters – NBA)	Factors Extracted
I Mission, Goals and Organization	Decentralization and Delegation, Involvement of faculty, Transparency	1. Participatory Management
	Leadership, Efficiency, Attitude, Motivation	2. Leadership Efficiency
	Mission & Goals, Commitment and Effectiveness	3. Commitment to achieve goals
	Planning & monitoring and incentives	4. Planning and Monitoring
II Financial & Physical Resources and their Utilization	Maintenance budget, Development resources and budget, Capital resources, Operational budget	5. Financial Resources
	Office equipment, Hostels, canteen, transportation and medical facilities,	6. Supplementary Physical Resources
	Land, Building and Support services – water, electricity communication	7. Main Physical Resources
III Human Resources: Faculty & Staff	Attitudes, Involvement, Commitment, Skill Up gradation, Workload, Performance appraisal.	8. Performance Appraisal & Development
	Recruitment procedures, Number, Qualifications/Skills	9. Supporting Staff Adequacy
	Recruitment procedures, number, qualification and development programmes.	10. Faculty Adequacy
IV Human Resources Students	Academic Results, Admission to Post Graduate Courses, Performance in competitive Examinations, Placements and Employer's Feedback	11. Student Performance
	Admission Criteria and number of admissions	12. Student Intake
V Teaching –Learning Processes	Syllabus, Implementation of the Instructional Programme, Library, Computing facilities, Laboratories, Workshops, Modernization and Budget for Consumables	13. Learning Facilities
	Instructional aides, Evaluation Procedures and feedback,	14. Instruction, Evaluation and feedback
	Working days, contact hours/ week, announcement and implementation of academic programmes.	15. Academic calendar
VI Supplementary Processes	Student Counseling and Guidance, Extra & Co-curricular Activities, Alumni Information, Professional Society Activities, Entrepreneurship Development	16. Supplementary Processes
VII Industry – Institution Interaction	Industry participation and curriculum planning, Consultancy, Continuing education and industrial internship for the faculty, Project Work	17. Institute initiatives
	Extension Lectures, Industrial Visits and Training, Placement	18. Industry Initiatives
VIII Research & Development	Institutional Budget for Research and Development, Academic/Sponsored/Industrial Research and Development, Publications and patents	19. R&D Activities

Table 4. Distribution NBA scores of undergraduate engineering programmes

NBA Scores Obtained by the programmes	Number of programmes		
	During 2000-02	In 2003	During 2004-05
< 450	2	0	0
450-500	2	0	0
500-550	0	0	0
550-600	21	0	0
600-650	14	0	4
650-700	44	10	50
700-750	31	5	14
750-800	20	8	10
800-850	5	0	0
850-900	0	0	0
900-950	0	0	0
950-1000	0	0	0
Total number of programmes	139	23	78

Table 5. Performance of programmes with respect to the 15 quality indicators

Sl.No.	Quality Indicators	Number of programmes rated as		
		Strong	Weak	Normal
1	Participatory Management (PM)	46	93	101
2	Planning and Monitoring (Pln)	48	31	161
3	Leadership Efficiency (LE)	18	23	199
4	Commitment to achieve goals (CA)	65	3	172
5	Main Physical Resources (MPR)	94	10	136
6	Supplementary Physical Resources (SPR)	71	78	91
7	Financial Resources (FR)	70	46	124
8	Faculty Adequacy (FA)	70	110	60
9	Performance Appraisal & Development (PAD)	33	66	141
10	Supporting Staff Adequacy (SSA)	49	30	161
11	Student Performance (StP)	47	83	110
12	Learning Facilities (LF)	12	19	209
13	Instruction, Evaluation and feedback (IEF)	48	35	157
14	Academic calendar (AC)	53	0	187
15	Supporting Processes (SP)	20	202	18

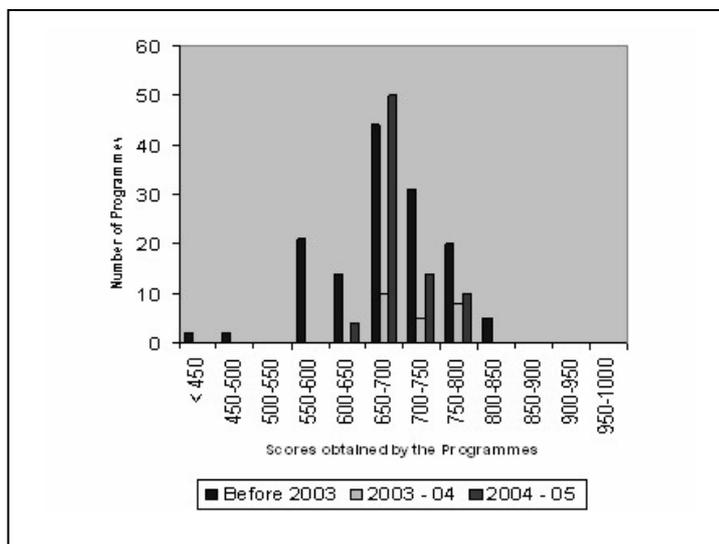


Figure 1. A combined view of distribution of NBA scores obtained by UG Engineering Programmes

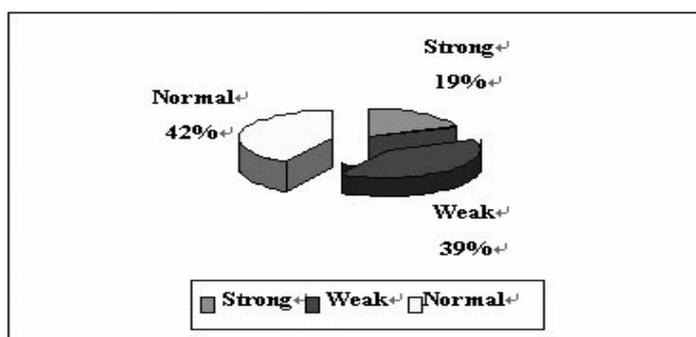


Figure 2. Participatory management of engineering programmes

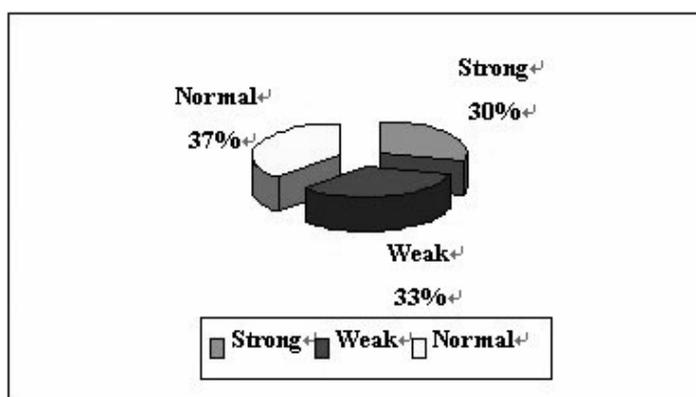


Figure 3. Supplementary physical resources of engineering programmes

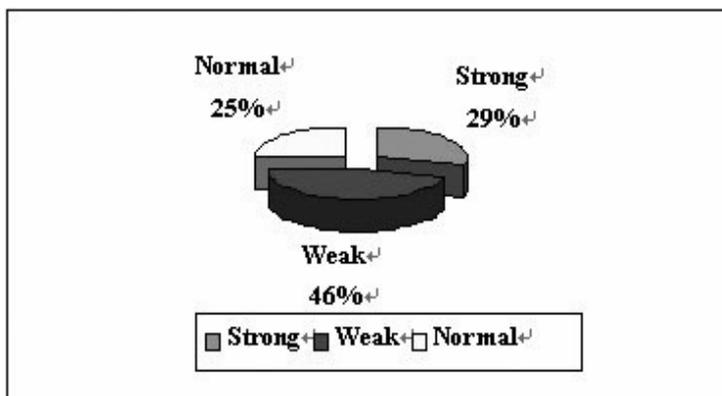


Figure 4. Faculty adequacy of engineering programmes

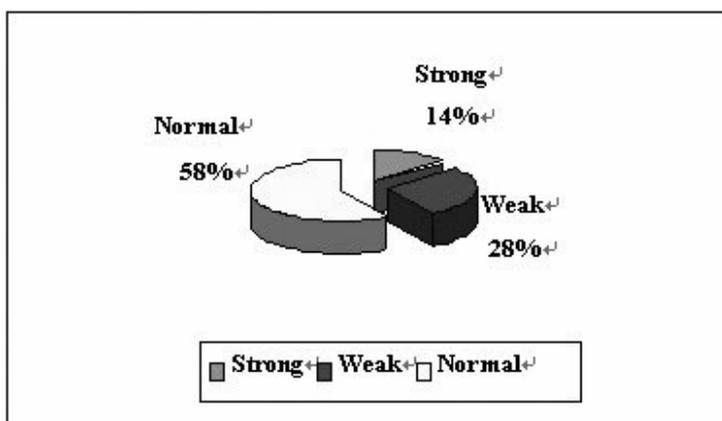


Figure 5. Performance appraisal and development of engineering programmes

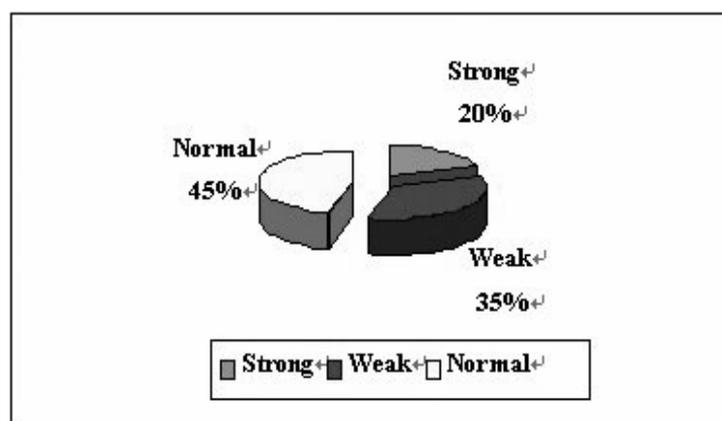


Figure 6. Student performance of engineering programmes

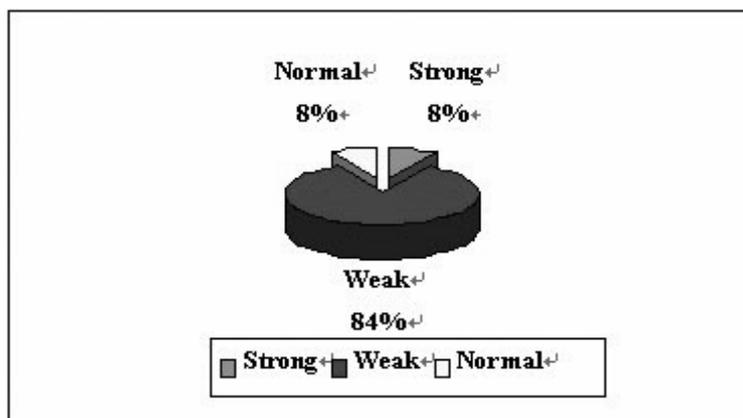


Figure 7. Supporting processes of engineering programme