Design of the Organizational Framework for Accreditation of Engineering Institutions

R. NATARAJAN

Professor of Mechanical Engineering, IIT, Madras, 600036 India

While there have been informal mechanisms for ensuring the quality of engineering education in the country, the National Policy on Education (1986) formulated guidelines for planning, formulation and maintenance of norms and standards for quality control and quality assurance through the statutory agencies of the AICTE and the UGC. A National Board of Accreditation has been set up, drawing inspiration from the objectives and organization of ABET in the USA. This paper discusses the details of the envisaged structure and policies of the NBA, the method of evaluation of institutions and programmes, and the accreditation action and its implications. The major issues in the Indian context are discussed. It is hoped that the system will evolve into a fine-tuned instrument for the monitoring and control of quality in the spheres of engineering and higher education.

THE PRIMARY PURPOSE OF ACCREDITATION

THE PRIMARY purpose of accreditation is to ensure quality control and quality assurance in the field of education, engineering or technical education in the present context. In some countries, it is the responsibility of the Ministry of Education; in some (as in the US and the UK), it is performed by a confederation of voluntary agencies representative of the profession. In India, there is no umbrella organization confederating a majority of the professional societies, nor do there exist professional societies with the necessary strength and credibility to inject quality into the technical education system. It is in this context that the National Policy on Education (1986) has been concerned about the mushrooming of a large number of institutions within a short span without appropriate facilities.

The dictionary definitions of 'accreditation' are:

- official recognition;
- guarantee of quality;
- general acceptance.

POLICY INITIATIVES FOR INTRODUCING ACCREDITATION OF ENGINEERING INSTITUTIONS

In the section on technical and management education, the National Policy on Education (1986) stated that:

The All India Council for Technical Education (AICTE) will be vested with statutory authority for planning, formulation and maintenance of

norms and standards, accreditation, funding of priority areas, monitoring and evaluation, maintaining parity of certification, and awards and ensuring the coordinated and integrated development of technical and management education. Mandatory periodic evaluation will be carried out by a duly constituted Accreditation Board.

As a follow-up to this policy statement, the AICTE bill was framed to provide for the establishment of the AICTE vested with statutory authority. The bill was passed by both houses of Parliament and became Act No. 52 of 1987. The AICTE Act came into effect on 28 March 1988.

The portions of the AICTE Act that have a direct bearing on accreditation are as follows:

It shall be the duty of the Council to take all such steps as it may think fit for ensuring coordinated and integrated development of technical education and maintenance of standards and for the purposes of performing its functions under this Act, the Council may—

- (i) lay down norms and standards for courses, curricula, physical and instructional facilities, staff patterns, staff qualifications, quality instructions, assessment and examinations;
- (ii) set up a National Board of Accreditation to periodically conduct evaluation of technical institutions or programmes on the basis of guidelines, norms and standards specified by it and to make recommendations to it, or to the Council, or to the Commission or to other bodies, regarding recognition or derecognition of the institution or the programme.

In pursuance of this function, the AICTE is to constitute the National Board of Accreditation.

Stated objectives of accreditation [1]

Accreditation is a process of quality assurance, whereby an approved institution or programme is critically appraised at intervals, not exceeding six years, by a group of external peers as to whether an institution or a programme meets the norms and standards prescribed by the Council from time to time. Accreditation does not seek to replace the system of award of degrees and diplomas by Universities and Boards of Technical Education. Accreditation is intended to accomplish the following objectives:

- To assist the public, prospective students, educational institutions, professional societies, potential employees and government agencies, in identifying those institutions and their specific programmes which meet the minimum norms and standards prescribed by the Council.
- To provide guidance for the improvement of the existing institutions and programmes and also for development of new programmes.
- To stimulate the process of bringing about, continually, improvement in Technical Education in the Country.

Stated purposes of the Board [1]

The National Board of Accreditation is the agency to ensure that the objectives of accreditation are met and will have the following purposes:

 to evaluate in a comprehensive manner, the academic programmes and the institutional environment in which these programmes are conducted for purposes of accreditation and also to advise institutions, Universities and Boards of Technical Education in planning and organising the programmes and improving the institutional environment, if required;

 to advise the Council in evolving and reviewing norms and standards for accreditation of

institutions as well as programmes;

 to assist the Council on matters pertaining to approval, recognition, inspection and funding so gathered as feedback information to educators and administrators for the purpose of applying necessary adjustments and corrections to practices and procedures in the educational process;

 to evolve new methods and techniques for evaluation of institutions and their program-

mes.

Stated responsibilities of the Board [1] The Board shall be responsible:

 to establish in advance, policies, procedures and guidelines for accreditation consistent with the norms and standards prescribed by the Council and continually review the same;

 to administer the accreditation process based on the norms and standards prescribed and guidelines laid down by it;

• to make decisions on the accreditation of

institutions and programmes;

 to receive applications for review of decisions on accreditation and take appropriate action;

to widely disseminate information on accreditation process and to advise institutions,
Universities and Boards of Technical Education on commendable and innovative practices for promotion of excellence.

Stated role of the Board [1]

The Board is the sole agency responsible for performing the statutory function of accrediting institutions and programmes and it is expected that this role will be appreciated by the public, prospective student, educational institutions, professional societies, potential employers, statutory bodies and governmental agencies.

The Programme of Action (POA), which followed the National Policy on Education, stated under the heading 'Accreditation and Promotion of Excellence':

The AICTE will set up a Board of Accreditation to make recommendations to it on accreditation of programmes and institutions. The Board, with the active involvement of Professional Bodies, both at the Centre and State levels, will prescribe guidelines and norms for the purpose. The Board will also constitute accreditation panels at the State level, for different levels of technical and management education on the basis of the prescribed guidelines.

A BRIEF NOTE ON THE ACCREDITATION INITIATIVES IN OTHER COUNTRIES

There are significant differences in the system of engineering education in different countries—in admission criteria, admission procedures, curricula, delivery systems, industry involvement, societal expectations and demands, funding patterns, administration and management of the engineering institutions, political perceptions, role of professional societies, etc. The differences are especially significant between developed and developing countries; and even within each of these groups. The following discussion reflects these differences in the approach to accreditation by the US and UK, and raises some questions in the Indian context.

The US experience

The US appears to be the first country to have introduced 'accreditation'. It was originally performed under the auspices of the Engineers' Council for Professional Development (ECPD),

which was established in 1932, as a result of the studies leading to the Wickenden Reports. It consisted of 14 participating bodies, including the American Society for Engineering Education

(ASEE).

The main objective of accreditation was related to the need to be responsive to the needs of the engineering profession, industry, the educational community and the public at large. The principal concerns of the ECPD included ethics, professional development, career guidance and accreditation.

Whereas in most other countries, the quality control function in education rests with the Ministry of Education, the US has delegated the responsibility of accreditation to voluntary agencies. Their concern or fear was that they did not want an educational system in which the same group determines both the truth searched for, and

interprets the truth that is found'.

The first voluntary agency was the National Commission on Accreditation (NCA) set up in 1949. A second agency, the Federation of Regional Accrediting Commissions of Higher Education (FRACHE), was also established in 1949. The US Office of Education (USOE), a government agency, has assumed an increasing role in recognizing accrediting agencies.

The Accreditation and Institutional Eligibility Branch of the USOE was created in 1968 to ensure that federal funds were going to institutions of high quality. The criteria required by the USOE were

that the accrediting agency must:

 foster ethical practices among the institutions or programmes it accredits, including nondiscriminating practices in admissions and employment, and fair and equitable student tuition refunds.

 list the current accredited status of institutions or programmes, and the date of the next currently scheduled review or reconsideration

of accreditation.

 furnish a preliminary written report to the institution, and provide the Chief Executive with an opportunity to comment on the report, before the agency takes action on the report.

In 1972, the NCA also began accrediting advanced engineering programmes leading to the master's degree. The efforts at accreditation of postgraduate programmes have not been an unqualified success. The American Institute of Aeronautics and Astronautics (AIAA), the American Institute of Chemical Engineers (AIChE) and the American Institute of Minerals, Metals and Materials (AIME) withdrew their support for accreditation of postgraduate programmes. The main problem was concerned with the confidentiality of the supplied information. The solution lies in stringent requirements, including guarantees, limitation on number of copies that can be duplicated and filed, etc. Accreditation, in its broad sense, implies constraints, and accreditation of specialized professional programmes implies additional constraints.

The NCA and the FRACHE merged on 1 January 1975, to form the Council of Post-secondary Accreditation (COPA). Its main objective was to lend greater assurance to both the educational community and the public at large that the institutions are delivering educational offerings of high

quality.

Currently, the accreditation function in engineering education rests with the Accreditation Board for Engineering and Technology (ABET). It has a large number of reputed professional societies, covering all branches and disciplines of engineering and technology, as the participating bodies, and has established an Engineering Accreditation Commission (EAC). It has laid out in great detail the objectives, structure, criteria, evaluation procedure, contents of questionnaires for review of the entire institution and of the individual programmes, and expenditure norms.

ABET has many constituencies; but ultimately it derives its standing from its parentage—the

engineering community:

 It serves the public interest on behalf of the engineering community.

It derives its expertise from the engineering

community.

 It nurtures its vitality and technical currency from the continuing support of the engineering community.

Other countries, e.g. Canada and Australia, have also based their systems on the US experience. ABET has also initiated moves for international co-operation in the area of accreditation of engineering programmes. Already Canada, Australia, UK, Hong Kong, and Singapore are in dialogue with ABET.

Some excerpts from recent statistics from ABET (1988)

The figures showed a marked improvement in quality. The EAC took actions on 391 programmes at 97 institutions during 1987–88: 35% (135 programmes) received the maximum six-year term of accreditation, while 43% received three-year accreditation, 2% (7 programmes) were not accredited, and 5% were in the show-cause category (why accreditation should not be terminated).

All the above figures were better than in 1987. The most commonly noted deficiencies related to faculty size, adequacy of the advising process, coverage of engineering design, institution's long-range plans for maintenance and replacement of laboratory equipment, human quality factors related to faculty, and allocation of financial resources.

It should be noted that ABET's accreditation programme is a quality measure based on minimum criteria: programmes that meet or surpass these criteria get accredited. The system does not

measure the standing or ranking of programmes or institutions.

The UK Experience—with special reference to mechanical engineering

In 1982, the Institution of Mechanical Engineers (IMechE) began reviewing all UK degree courses in mechanical engineering and closely related subjects. The plan was to review regularly on a nominal five-year basis. The formulation of the proforma for eliciting information took 18 months to develop. It was found desirable to articulate a formal statement on the desirable course content.

The IMechE found it necessary to define the criteria relating to core syllabus content against which the accreditation of such courses are to be carried out by the institutions. The purpose is twofold:

 To offer a rationale of the needs of professional mechanical engineers, related to the development of the engineer's role in industry and society, through the 1980s and 1990s.

 To develop from this rationale a framework for the education of professional mechanical engineers which may guide current and future course development.

The IMechE felt that one of its functions was to evaluate and accredit those engineering degree courses which are able to provide a sound education for practising mechanical engineers. It was the Institution's responsibility to ensure that a young engineer was equipped to assume the demands of a progressive career, and is able to provide the engineering leadership and co-ordination required in all branches of industry.

According to the IMechE, the following rationale had to be borne in mind when formulating or reviewing engineering degree courses:

 In the preparation for a career in engineering, the degree courses should show evidence of a progressive shift of emphasis from fundamental scientific principles and techniques in the early stages towards real application and practice.

The education of mechanical engineers generally should provide the broad academic function and rigour to prepare for careers in a wide spectrum of industry, with sufficient knowledge of allied disciplines, to co-ordinate, communicate, and to play a leading role in decision making.

 The interests of the majority of young engineers will be best served by this broad academic function, which is more relevant to the needs of industry than courses which seek premature specialization in narrow fields of science and technology.

 Industry and society need engineers who are able to identify the value and appropriateness of their engineering education in the solution of industrial, social and ecological problems. The purpose of accreditation, according to the IMechE, is to meet certain standards which aim to advance the quality and effectiveness of engineering curricula, but in no way to enforce a rigid pattern of conformity in course structure. The value of the diversity of the courses, related to the market needs for mechanical engineers, is recognized and maintained. The process of accreditation by the IMechE seeks to review:

- the syllabus content and rigour;
- the balance of theoretical and practical studies;
- · the control of standards for entry;
- year-by-year progress, and degree awards.

It was also important to ascertain that the resources of the establishment are adequate to enable the above functions to be implemented, and the stated aims of the courses to be achieved. Ultimately, however, the onus rests with the academic institution to ensure that standards are maintained, and that no degree will be awarded to a candidate, whose performance is demonstrably below professional potential.

THE ISTE INITIATIVE

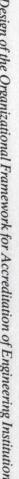
The Indian Society for Technical Education (ISTE), which is a professional society with membership comprising teachers of engineering colleges and polytechnics, and also serves as a Programme Unit of the MHRD, initiated the work of preparing a detailed document on accreditation, on behalf of the MHRD, even before the formulation of the National Education Policy. The pioneering work on accreditation has been done in the US. In this effort, therefore, rather than start *ab initio*, the enormous experience gathered in the US relating to engineering and technology, which is directed by ABET, was utilized as guidance, and was suitably adapted to suit Indian needs.

Separate exercises were undertaken for degreelevel and diploma-level institutions. In each case, four documents were prepared:

- Objectives, structure and criteria.
- Manual of evaluation procedure.
- Questionnaires for review of engineering programmes (Vol. I for the entire Institution; Vol. II for the individual programmes).

The documents were discussed at a few regional workshops, to elicit feedback from different sectors of technical education.

The accreditation agency has been variously called the National Accreditation Board for Engineering and Technology (NABET), the National Accreditation Board for Technical Education (NABTE), the National Accreditation Board for Engineering (NABE), and is currently called the National Board of Accreditation (NBA)—India. It has also been decided to have separate boards for degree-level and diploma-level technical education.



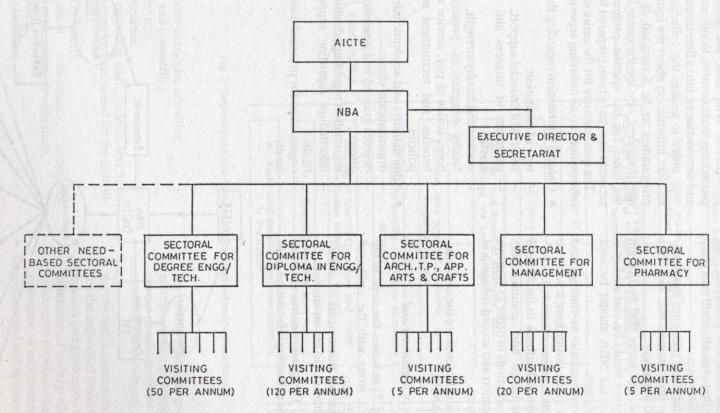


Fig. 1. Organizational chart of the NBA.

Accreditation policies

 To undertake evaluation of approved institutions and programmes at regular intervals not exceeding six years.

 To undertake evaluation of unapproved institutions and programmes, if requisitioned by the

AICTE.

 At least two batches must have graduated from the institution; the first evaluation will take place on completion of five years.

 Accreditation of full-time/part-time/sandwich/ distance learning programmes will be done

independently and separately.

 Accreditation does not imply that curriculum development activities would be curtailed; it is only required that the NBA should be kept informed of any changes.

 The NBA will communicate its findings and recommendations to the institutions; it will also give reasons for action taken or intended.

 The NBA will provide feedback to institutions on innovative activities and commendable achievements of institutions in order to improve the quality of education and accord recognition for good performance.

Figures 1 and 2 provide details of the organizational structure of the NBA.

Method of evaluation of institutions and programmes

The flowchart (Fig. 3) indicates the steps in the accreditation process, along with the estimated time required for each step.

There are two principal instruments of assessment: (i) the questionnaires; (ii) the on-site visit.

The questionnaire. The questionnaires are basically an instrument for extracting information from

the institution to serve as the basis for discussions and evaluation. They should ask for all the information which is essential for arriving at valid decisions; they should not ask for information which would not be used in the accreditation process. The questionnaires should be comprehensive in eliciting information, and should be amenable to computerization. With time, the questionnaires and procedures would evolve, to suit our special needs and circumstances, into a fine-tuned instrument.

In order to enable the collection of as much relevant information about the institution and the programmes to be accredited as possible, two questionnaires, one for the entire institution, and the other for the specific programmes seeking accreditation, have been prepared for NBA-India.

The questionnaire for the entire institution seeks information on the following aspects:

- General information regarding the institution:
 - type of institution;

sources of financial support;

statement of finances and physical plant assets;

student and faculty strength;

- faculty designations, prescribed qualifications, scales of pay, service and retirement benefits, and recruitment and promotion policies.
- Administrative and academic information:

organizational chart;

- degrees granted and academic programmes offered;
- information regarding administrators;
- information regarding supporting departments:
- organization for practical training and placement;

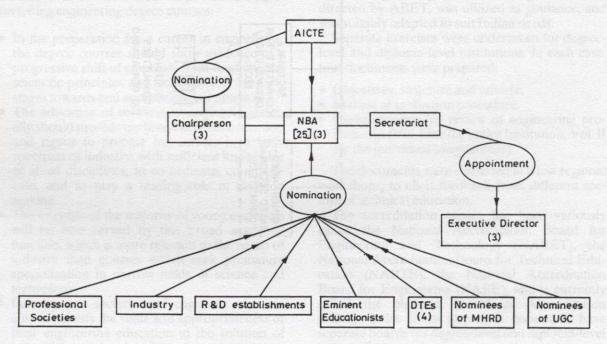


Fig. 2. Organization of the NBA.

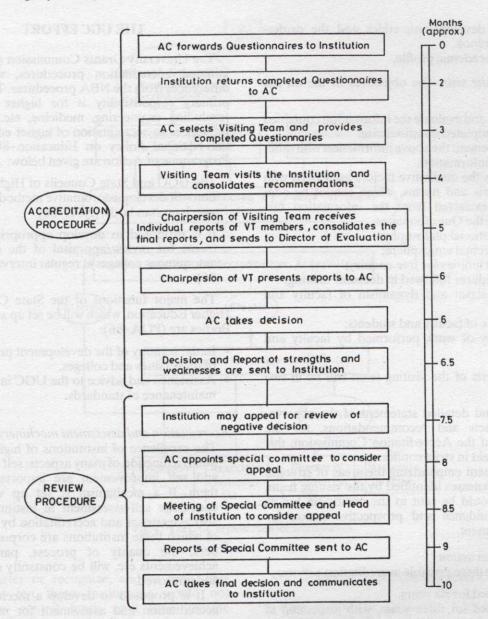


Fig. 3. Sequence and time-frame of accreditation and review procedures.

- co- and extra-curricular activities;
- guidance and counselling;
- student services
- faculty amenities.
- Information regarding staff, students and finances—for the entire institution and for the individual departments.
- Emoluments of faculty.
- Policies toward consultancy, sponsored research and professional development.
- Support facilities:
 - computer facilities;
 - library;
 - other central support facilities.
- Educational development activities:
 - curriculum development;
 - laboratory development;
 - educational technology;
 - interaction with industry;

- continuing education programmes;
- entrepreneurship development;
- special programmes for weaker sections.
- Information on enrolment and degrees conferred:
 - for the entire institution;
 - for the individual departments.
- Admission and graduation requirements:
 - admission of undergraduate students;
 - graduation requirements;
 - collection of information regarding alumni.
- Objectives and self-appraisal.

The questionnaire for the individual programme seeks the following information:

- Objectives and self-appraisal.
- · Course requirements.
- Laboratories associated with the programme.

- Student development, ethics and the professional outlook.
- · Faculty academic profile.

The on-site visit. The objectives of the on-site visit are:

- To study and evaluate the information contained in the completed questionnaire.
- To supplement the above information with other relevant information.
- To assess the qualitative factors associated with the criteria and norms, which cannot be adequately extracted from the information furnished in the Questionnaires:
 - institutional philosophy;
 - intellectual atmosphere;
 - opportunities for free enquiry;
 - procedures followed in decision-making;
- enthusiasm and dynamism of faculty and students;
 - calibre of faculty and students;
- quality of work performed by faculty and students.

The reports of the visiting team will be in two parts:

- A full and detailed statement of the observations, facts and recommendations, for the benefit of the Accreditation Commission; this will be held in strict confidence.
- A statement emphasizing the areas of strength and weaknesses identified by the visiting team, which would be sent to the institution for its future guidance and prospective action for improvement.

Accreditation action

There are three possible accreditation actions:

- Accredited for six years.
- Accredited for three years, with inspection at the end of this period.
- Not accredited.

Factors that would limit the term of accreditation include:

- need for additions or improvements in faculty, staff or equipment;
- uncertainty of financial resources;
- uncertainty due to nature of the administrative organization;
- · a new or changing curriculum;
- undue dependence upon a single individual;
- management-related factors.

The Secretariat will prepare and publish annually a list of programmes and institutions that have been accredited.

Provision has also been incorporated for appeal by the institutions and review. The institutions are also required to keep the Accreditation Board informed of any major changes in staffing, administration, curricula, etc., during the period of validity of accreditation.

THE UGC EFFORT

The University Grants Commission (UGC) has initiated accreditation procedures, with some differences from the NBA procedures. The UGC's primary responsibility is for higher education (excluding engineering, medicine, etc.), and the references to accreditation of higher education in the National Policy on Education–86 and the Programme of Action are given below:

The UGC and State Councils of Higher Education will develop coordinative methods to keep a watch on standards. (NPE-86)

It is proposed to develop appropriate instruments for review/appraisal of the scheme of autonomous colleges at regular intervals. (POA-86)

The major functions of the State Councils of Higher Education, which will be set up as Statutory Bodies are (POA-86):

- Initial scrutiny of the development programmes of universities and colleges.
- Assistance and advice to the UGC in respect of maintenance of standards.

Accreditation and assessment machinery

The excellence of institutions of higher education is a function of many aspects; self evaluation and self improvement are important among them. If a mechanism is set up which will encourage self-assessment in institutions, and also assessment and accreditation by a Council of which these institutions are corporate members, the quality of process, participation, achievements etc. will be constantly monitored and improved.

It is proposed to develop a mechanism for accreditation and assessment for maintaining and raising the quality of institutions of higher education. As a part of its responsibility for the maintenance and promotion of standards of education, the UGC will, to begin with, take the initiative to establish Accreditation and Assessment Council as an autonomous body. It will evolve its own criteria and methodology for accreditation and assessment. Its main functions will be catalytic; it will not be enforcing any given norms and standards. It will analyse and evaluate institutions and their performance to facilitate self-improvement. This Council will be supported by a professional secretariat in the performance of its functions.

Figure 4 shows the UGC organizational structure for accreditation.

Implications of UGC accreditation decisions

It is envisaged that within five years of the setting up of the Accreditation Council, only accredited institutions would be eligible for central government funding. State governments would be free to

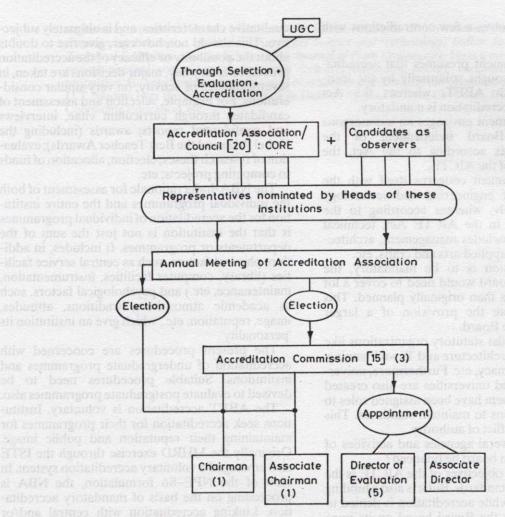


Fig. 4. The UGC organization for accreditation.

found, charter or recognize, and to fund, new institutions, but these institutions would not receive any central funds until they become accredited. Furthermore, funding, development or support of as-yet unaccredited state institutions would be entirely the concern of the states.

For the funding of a new central institution, separate funds would be allocated to sustain it until it gets accreditation, and planning for the new institution would be undertaken with the requirements of candidature in mind. If a central institution fails to win accreditation, even after a reasonable period of time and investment of funds, the Accreditation Council will recommend its closure.

As far as existing affiliated colleges are concerned, after the system of accreditation is in place, the colleges would be in a position to obtain a complete degree of autonomy, through the conferment of 'deemed university' status from the UGC, which is a possibility envisioned by the UGC guidelines and also by the NPE-86.

SOME ISSUES IN THE INDIAN CONTEXT

- Who should be given the responsibility for carrying out the accreditation function: the Ministry or an independent umbrella organization representing professional societies, as in the US or individual professional societies for individual disciplines, as in the UK or the ISTE or the UGC, or a newly established body?
- How to ensure that institutions would want to be accredited. In other words, how to motivate them, in terms of establishment of credibility and significance of the procedure, to want to be accredited.
- How to keep out vested interests and their interference.
- How to use the process of quality control to weed out the undesirable ones among the current explosion of engineering institutions.
- How to disseminate the information to those who need it.
- How to guard the confidentiality of the information collected and processed.

The ISTE exercise, based heavily on the ABET system, and finalized before the AICTE Act came

into existence, involves a few contradictions with respect to the Act:

 The ISTE document presumes that accreditation would be sought voluntarily by the institutions, as with ABET, whereas the Act stipulates that accreditation is mandatory.

 The ISTE document envisages an autonomous Accreditation Board independent of the AICTE, whereas according to the Act, the

Board is a part of the AICTE.

 The ISTE document concerns itself with the accreditation of engineering and technology programmes only, whereas according to the definition given in the AICTE Act, technical education also includes management, architecture, pharmacy, applied arts and crafts, etc.

 Since accreditation is to be mandatory, the Accreditation Board would need to cover a lot more institutions than originally planned. This would necessitate the provision of a larger

Secretariat of the Board.

 There already exist statutory organizations like the Council of Architecture and Town Planning, Council of Pharmacy, etc. Furthermore, universities and deemed universities are also created by Acts. All of them have been assigned roles to inspect institutions to maintain standards. This may create a conflict of authority.

· How will the several agencies and activities of

the Accreditation board be financed?

 One of the main objectives of the AICTE is the maintenance of standards. But it is also a funding agency. Hence, while accreditation is denied to an institution by the Board based on its poor performance, should there be a mechanism to provide financial support to an institution to enable it to come up to acceptable standards?

These issues were discussed at a workshop at IIT Delhi, 10–12 January 1989, and the original ISTE document on accreditation was modified so as to make it consistent with the provisions in the AICTE Act.

CONCLUDING REMARKS

It can be seen that the overall evaluation procedure is based on both quantitative and

qualitative characteristics, and is ultimately subjective. This should not, however, give rise to doubts about the possibility or efficacy of the accreditation processes. Every day, major decisions are taken, in several spheres of activity, on very similar considerations. For example, selection and assessment of candidates through curriculum vitae, interviews and confidential reports; awards (including the Nobel Prize and the Best Teacher Awards); evaluation of research theses; election; allocation of funds to competing projects; etc.

The NBA-India rationale for assessment of both the individual programmes and the entire institution for the accreditation of individual programmes is that the institution is not just the sum of the departments or programmes. It includes, in addition, physical factors, such as central service facilities (library, computer facilities, instrumentation, maintenance, etc.) and psychological factors, such as academic atmosphere, traditions, attitudes, image, reputation, etc., which give an institution its

'personality'.

The present procedures are concerned with accreditation of undergraduate programmes and institutions. Suitable procedures need to be devised to evaluate postgraduate programmes also.

The ABET accreditation is voluntary. Institutions seek accreditation for their programmes for maintaining their reputation and public image. Originally the MHRD exercise through the ISTE also envisaged a voluntary accreditation system. In view of the NPE-86 formulation, the NBA is proceeding on the basis of mandatory accreditation. Linking accreditation with central and/or state funding is not envisaged at the present moment. The aims are to tone up existing institutions and also to curtail the mushrooming of poorquality institutions. The UGC concept proposes to use accreditation as a necessary qualification for eligibility to receive government funds.

Figures 1, 2 and 4 show the differences in the organizational structures of the NBA and UGC proposals. Also, while the NBA will be an organ of the AICTE, the Accreditation Association of the UGC is envisaged to be a registered society.

BIBLIOGRAPHY

 National Board of Accreditation (NBA-India) Documents on Objectives, Structure and Criteria; Manual of Evaluation Procedure; Questionnaire for Review of Entire Institution; Questionnaire for Review of Individual Programme; Details of Expenditure, All India Council for Technical Education, Ministry of Human Resource Development, Government of India (1989).

Professor R. Natarajan is currently Professor and Chairman, Department of Mechanical Engineering at the Indian Institute of Technology, Madras, India. He obtained his Ph.D. from the University of Waterloo, Canada for research in the area of combustion. He has published several papers in the area of combustion, propulsion, energy, transport phenomena and

engineering education. He is a Member of the Editorial Boards of International Journal of Engineering Education, Fuel (London), Fuel Science and Technology, Indian Journal of Technical Education, and the Editor of the Journal of Plant Engineering. He is a member of several national committees dealing with technical education, energy, combustion and propulsion. He has shouldered a wide range of academic and administrative responsibilities at I.I.T. Madras over the past 24 years, such as Dean of Student Affairs, Chairman, Centre for Continuing Education, etc.