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The Role of Accreditation in Promoting Quality Assurance of Technical Education*

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This paper first examines the nature and scope of quality, and the different perceptions about quality, particularly as it applies to engineering education. The factors promoting quality in technical institutions are briefly reviewed, and the requirements of and expectations from engineers and engineering administrators in order to face the challenges of the next millennium are enumerated. Beginning with the pioneering efforts of ABET, USA, accreditation has established itself worldwide as the principal mechanism for quality assurance in technical education, and more and more countries are coming under the umbrella of the Washington Accord. The major differences between accreditation and recognition, in the Indian context, are brought out. Accreditation involves a two-stage process, self-assessment and peer evaluation; the essential characteristics of each are highlighted. Some recent ABET initiatives and Indian experiences are discussed.

INTRODUCTION

WHILE QUALITY assurance has always been a matter of concern and significance in education, in general, and in professional education such as technical education in particular, the recent quantitative expansion of an unprecedented nature, in India, has caused educators to devote careful attention to the quality aspect. There already exist several regulatory mechanisms for ensuring minimum standards before an institution is started. However quality assurance entails an assessment of the performance of the institution in delivering Education of the prescribed quality.

THE NATURE AND SCOPE OF QUALITY

The corporate sector has universally recognized the importance of quality in their products and services for achieving and sustaining competitiveness. The engineering education sector has been slow to act. We must recognize the role of quality in achieving our identified mission and vision.

What quality is and what it is not

- Quality is very specific; it involves continuous improvement; it can be achieved by prevention; it implies zero defects or errors; it includes correction of errors.
- Quality is not something vague; not something achieved by inspection, testing and checking; nor acceptable quality levels.
- The scope of quality includes manufacturing activities, business processes, and services, and focuses on the needs of both external and internal customers.

Perceptions of quality in higher education

Quality perceptions depend to a large extent on the particular sector or group that is considered. Three such perceptions are indicated below:

- *National Funding Agencies:* education for largest number at minimum cost
- *Educational Administrators:* image and reputation of their institutions
- *Faculty:* student learning and satisfaction

Barnett's classification

Barnett has classified quality perceptions into three groups:

- *Objectivist perception:* identification and quantification of inputs and outputs. Inputs: faculty, physical resources, students, funds; outputs: student learning, failure rates, results, employment patterns, PG education, R&D.
- *Relativist perception:* examination of 'fitness for purpose'. Different stakeholders have different foci: students—educational process; employers—work output of graduates; professors—research.
- *Development perception:* exists within the institution, not imposed from outside. TQM culture promotes achievement of quality through this approach

Characteristics of quality applicable to services

The major developments in quality control and assurance have taken place in the context of the manufacturing sector. Recently, these concepts have also been made applicable to the service sector, which includes the education sub-sector. Some of the characteristics of quality applicable to the service sector are:

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- responsiveness to customer;
- cost-sensitivity;
- volume-sensitivity;
- ethical considerations;
- energetic and enthusiastic approach;
- openness to experiment;
- goal/results focus;
- errors can not be hidden;
- skill- not capital-intensive nature;
- heavy investment in training.

Implications of TQM for engineering education of the future

The US National Science Foundation (NSF) task force on TQM has come up with the following definition of Quality Engineering Education:

- 'Quality Engineering Education is the development of intellectual skills and knowledge that will equip graduates to contribute to society through productive and satisfying engineering careers as innovators, decision-makers and leaders in the global economy of the twenty-first century.'
- 'Quality Engineering Education demands a process of continuous improvement of and dramatic innovation in student, employer and societal satisfaction by systematically and collectively evaluating and refining the system, practices and culture of engineering education institutions.'

The task force points out that TQM is not a destination, but rather a journey to improvement.

The task force has also examined the nature of the customer of engineering education. it preferred to deal with the concept of 'stakeholders', which could vary widely depending on an institution's mission, goals, strategies and tactics. The stakeholders include suppliers, such as high schools, and receivers, such as employers and students.

Some indicators of academic quality

Table I summarizes some salient indicators of student, faculty and institutional quality.

Is academic quality quantifiable?

There have been several discussions on this fundamental question. It is widely believed that academic quality, like beauty, for example, is an elusive characteristic. Robert Pirsig [1] has resorted to much verbal gymnastics in coming to terms with quality:

> 'Quality, you know what it is, yet you don't know what it is. But that is self-contradictory. But some things are better than others; that is, they have more quality. But when you try to say what the quality is, apart from the things that have it, it all goes poof.'

A Mafatlal ad proclaimed: 'Quality needs no definition, you recognize it when you see IT'. Quality is a complex, multidimensional entity, no doubt; but so are many other things of significance, and we have to deal with them; such as, for example, development, growth, excellence, democracy, religion.

Two quotations are given below to bring out the need for quantification, and simultaneously the limitations of this approach:

- Lord Kelvin: 'When you can measure what you are speaking about, and express it in numbers, you know something about it; and when you cannot measure it in numbers, your knowledge is of a meager and unsatisfactory kind.'
- G. N. Lewis: 'I have no patience with attempts to identify Science with measurements, which is but one of its tools, or with any definition which would exclude a Darwin, a Pasteur or a Kekule.'

Table 1. Indicators of student, faculty and institutional quality

Indicators of student quality	Indicators of faculty quality	Indicators of institutional quality
Number of applications per seat	Number of applications for faculty position, at different levels	The utilization of strategic planning processes
Diverse preparation and background of entering students	Academic quality, in terms of publications, honors, awards, patents, sponsored projects and consultancy.	Interaction with the environment—industry, profession, community.
Number completing degree	Retention success; turn-over	Mobilization of resources for institutional development
Time to complete degree	Teaching quality, innovative initiatives	Diversity of external financial support
Proportion undertaking practical training	Publication records	Demand from outside agencies for R & D and continuing education
Proportion participating in research and development	Sponsored research, consultancy and continuing education activities	Adjunct appointments with Industry
Employment profiles and salaries on graduation	Professional society and public service involvement	Inter-disciplinary activities
Number taking up post-graduate studies	Ability to mobilize resources for department and institution	Self-assessment and accreditation processes
Satisfaction levels of students and employees	Internal and external (national and international) honors and awards	Alumni involvement
Perceived reputation of graduates and alumni, nationally and internationally	Quantum of practical experience	Perceived reputation, nationally and internationally
Proportion of foreign students	Effectiveness of student counseling	Use by national agencies as think tanks and for technology development
Number becoming entrepreneurs	Faculty career satisfaction levels.	Leadership in education and research

The subjective considerations in assessment of quality

There are several human activities where quality assessment is necessary and inevitable, but the techniques employed are quite subjective, and depend to a large extent on the human sensory perceptions:

- sight—beauty contests
- sound—music
- taste—tea, wine
- touch—comfort levels in air conditioning;
- smell—perfumes.

It is also as well to recognize that we do not have unequivocal measures for many things in life:

- feelings—love, compassion
- intellect—IQ is an attempt
- emotion—EQ is an attempt.

SOME CRITERIA ADOPTED FOR RANKING ACADEMIC QUALITY

There are several agencies and magazines that undertake the task of ranking academic institutions—country-wise, region-wise and globally. Most of these published rankings indicate the criteria employed; they assign weighting factors to the different criteria and come up with a single composite numerical score. Some of these criteria are:

- depth and nature of coursework
- student/faculty ratio
- selectivity or acceptance rate: number of applications per seat
- number of enrolled students who graduate ('retention')
- students' later achievements
- library facilities
- laboratory facilities
- computing facilities
- reputation/prestige
- quality of faculty members
- performance in competitive exams (GATE, CAT, GRE, GMAT, etc.)
- accomplishments of alumni
- endowments
- institutional resources
- perception of employers
- productivity—research, consultancy.

Webster makes the following recommendations in order to ensure that the rankings reflect a valid indication of relative academic quality:

- The assessment must be multidimensional; based on many measurable aspects.
- Measures should be based on achievements of majority of faculty and students.
- Must be based on per capita figures; not aggregate numbers.
- A technique must be devised to measure how much students learn; the value addition achieved.

In a very recent ranking of universities and technical institutions in the Asia-Pacific region published by *Asiaweek*, the following criteria were employed:

academic reputation
student selectivity
faculty resources
research output
financial resources.

No system of quality assessment is perfect; the following are some of the criticisms of commonly employed criteria:

- Number of Ph.D. holders on faculty: not every Ph.D. holder is a good teacher; senior professors may not teach UG classes at all.
- Number of enrolled students who graduate: college may screen out low-performers.
- Number of research papers: assumes all papers are of equal importance; focus should be on quality, not quantity.
- Productivity—in terms of research, consultancy, sponsored research.
- How to quantify student counseling, good teaching, etc.
- Reputation rankings: perceptions of quality are highly subjective.

THE NATURE AND SCOPE OF ACCREDITATION

The dictionary meanings of accreditation are:

official recognition
guarantee of quality
general acceptance.

The primary purpose of accreditation is to ensure quality control and quality assurance, commonly with reference to a certification system in the areas of education, training, testing, etc.

In some countries, this function is performed by an agency of the Ministry of Education, while in several industrialized countries it is undertaken by a confederation of voluntary agencies or professional societies. In our country, we do not yet have an umbrella organization confederating a majority of professional societies. There are several quality control mechanisms (inspection), however, in place; such as, for example, university affiliation, recognition by professional societies, such as the Institution of Engineers, AICTE approval for starting and continuing programs. However, there are several differences between the functions of inspection and accreditation; these are brought out in Table 2.

The basic process inherent in accreditation is evaluation or assessment of the different subsystems and component processes. There are two

Table 2. Some differences between recognition and accreditation processes

Recognition	Accreditation
Performed before an institution is to be started	Performed after two batches have graduated
Fulfillment of initial conditions	Fulfillment of minimum norms of achievements and results
Assessment of promise	Assessment of performance
Largely based on physical, financial, and infrastructure resources	Includes availability and quality of human resources, in addition
Based on Project Report	Based on information in self-assessment questionnaires which demand a clear articulation of mission and goals, and a SWOT analysis
Essentially a 'quantity' assessment	Essentially a 'quality' assessment
Reasonably straightforward	Much more complex
Decision: yes or no	Decision: grading into three classes
Not a new concept	A new concept in the Indian higher and professional education scene.

parts to it: critical self-assessment and external peer review, The former is performed by the faculty as a part of the support materials, and, if carefully and effectively done, can be a valuable strategic tool. Apart from collection and analysis of the data, the following questions should be posed and answered [2]:

- 'What are our goals, aims and objectives? Are they clearly stated? Are they useful? Why do we do what we are doing? Does consensus exist on the interpretation of goals, aims and objectives?
- Is the program designed in the context of the realization of the goals?
- Is the program functioning properly? Are we monitoring and controlling the input, the process and the output?
- Do we have the right performance indicators?
- The outcome of the self-assessment must lead to improvements, and, if necessary, to reformulation of the goals.

THE PIONEERING WORK OF ABET

The Accreditation Board for Engineering and Technology, ABET, has been the pioneer in designing and implementing the accreditation of engineering and engineering technology programs in the US. Several countries world-wide have followed closely the ABET processes. The Indian initiative, through the establishment of the National Board of Accreditation in 1994, has derived inspiration from the rich experience of ABET, but has introduced several modifications appropriately to take local conditions into account.

A companion paper in this *IJEE* Special Issue traces the history and evolution of ABET, and its recent articulation of *Engineering Criteria 2000*

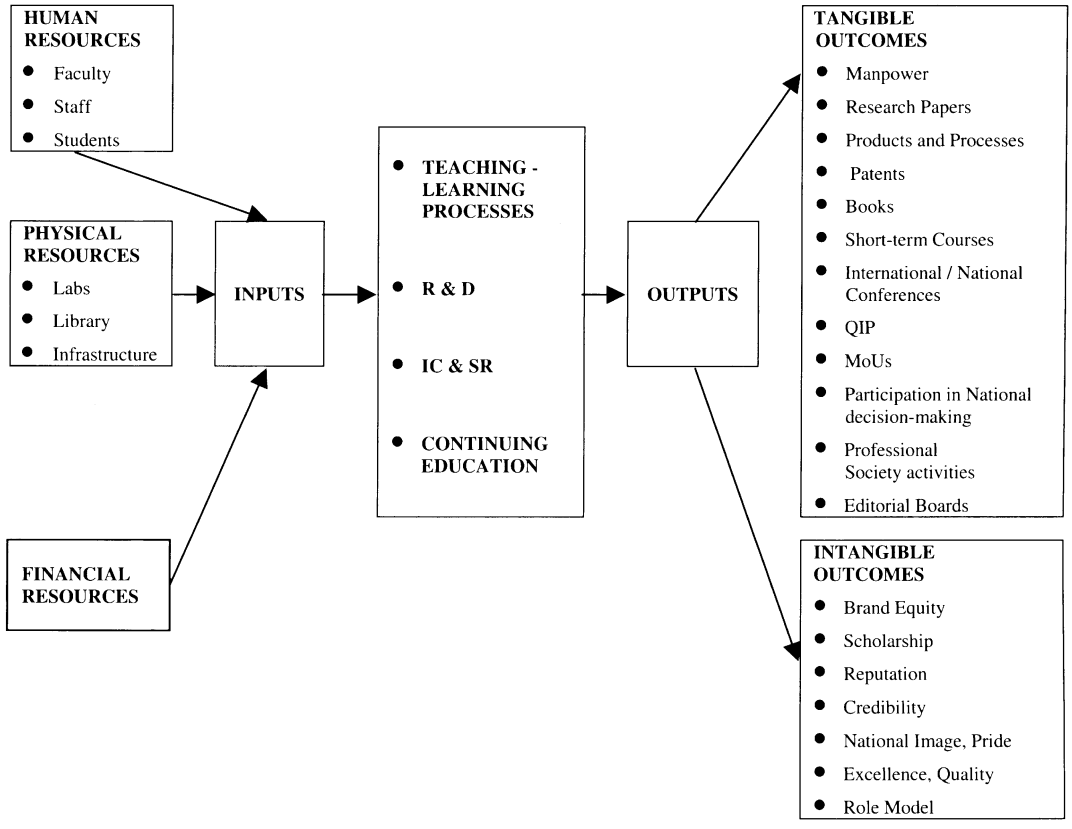

Fig. 1. The IIT system.

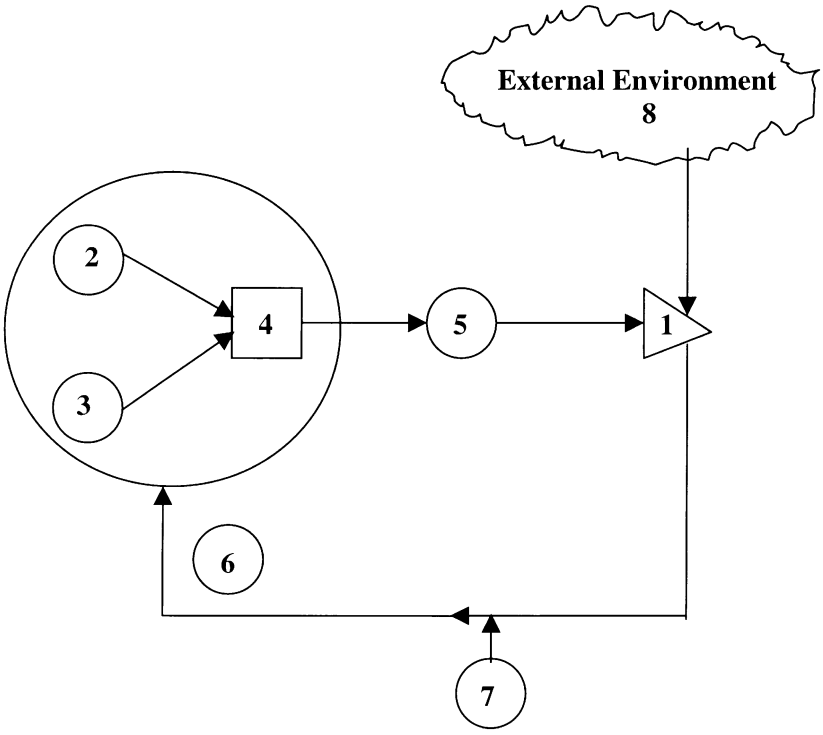

Fig. 2. Strategy for planning an engineering education system.

(EC 2000), which represent the result of a comprehensive study of the existing system and introspection, through the Accreditation Process Review Committee set up in 1992 to help outline 'a quality-oriented, flexible accreditation system that encourages diversity and does not inhibit innovations in an engineering system'. ABET has also mounted a massive national effort, along with NSF and industry leaders, in order to develop knowledgeable program evaluators.

THE ANATOMY OF A TYPICAL TECHNICAL INSTITUTION

It is instructive to adopt the systems approach to describe the anatomy of a typical technical institution (The IIT system, for example). Figure 1 shows the processes that constitute the core activities of such a system, the three major classes of inputs, and the two major classes of outcomes.

Figure 2 shows a block diagram expressing the strategic intent of an engineering education system, and the interconnections between the different elements:

1. Overall mission and direction.
2. Organization and management.
3. Effective deployment of resources.
4. Activities based on core competencies: education, research, consultancy (technical and educational), continuing education, training.
5. Measurement of outcomes: identification of measures, and methods to measure them.
6. Feedback: comparison with overall mission.
7. Benchmarking.
8. External Environment

In the modern corporate scenario, 'customer is king', and one of the principal measures of success and performance is customer satisfaction or customer delight. Many management experts and consultants prefer to employ the notion of stakeholders. Figure 3 shows the stakeholder relationships in the engineering education system.

SELF-ASSESSMENT

Self-assessment is often performed through a SWOT analysis. SWOT is an acronym for Strengths, Weaknesses, Opportunities and Threats; it refers to the internal strengths and weaknesses of an organization or institution, and the environmental opportunities and threats facing the organization. SWOT analysis involves a systematic identification of these factors and the strategy that reflects the best match between them. It is based on the premise that an effective strategy maximizes an institution's strengths and opportunities, but at the same time minimizes its weaknesses and threats. Strengths and weaknesses are internal to the institution and are within its control; they may be manipulated to suit a particular situation. Ideally, an institution should build on its strengths, dilute its weaknesses, exploit the opportunities, and avoid the threats.

A strength is a resource, skill or other advantage relative to competitors; it is a distinctive competence that gives the institution a comparative

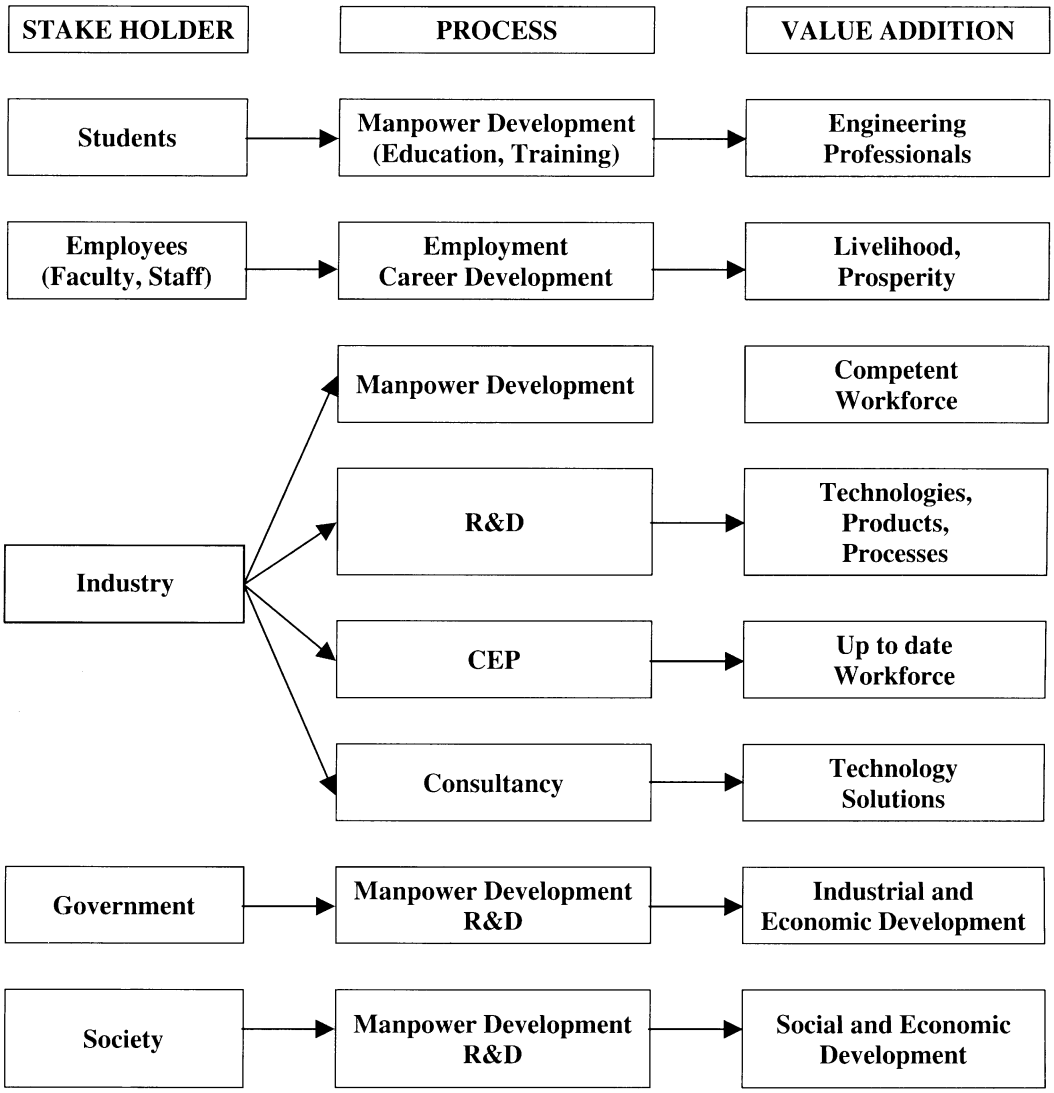

Fig. 3. Stakeholder relationships in the engineering education system.

advantage, such as image, financial/physical/human resources, etc. A weakness is a limitation or deficiency in resources, skills, and capabilities that seriously impedes effective performance. An opportunity is a major favorable situation in the Institution's environment. A threat is a major unfavorable situation in the institution's environment.

SWOT analysis may be used in different ways in strategic choice decisions:

- Systematic SWOT analysis spans all aspects of an Institution's status, and provides a dynamic and useful framework for choosing a strategy.
- Key external opportunities and threats are systematically compared to internal strengths and weaknesses in a structured approach, with the objective of identifying one of four distinct patterns in the match between the Institution's internal and external situations. Pearce and Robinson [3] label the quadrant between strengths and opportunities as 'aggressive strategy', that between opportunities and weaknesses as 'turnaround–centered strategy', that between weaknesses and threats as 'defensive strategy', and that between threats and strengths as 'diversification strategy'.

A major challenge in using SWOT analysis is in identifying the position the Institution actually is in. The value of the analysis does not rest solely on careful placement of an Institution in one particular cell. The SWOT analysis helps resolve one fundamental concern in selecting a strategy: What will be the principal purpose of the grand strategy? Is it to take advantage of a strong position or to overcome a weak one?

Pearce and Robinson [3] also provide an extended SWOT analysis, termed the 'strategic wedge analysis'. It reveals sources of risk and opportunity for the organization or institution. The quality of the strategy and the realism of the implementation plan will be directly related to the quality of the 'wedge' analysis: 'quality' in terms of clarity of focus, concentration on the significant, the depth of insight, vision and lateral

Table 3. SWOT analysis of a traditional engineer

Strengths	**Weaknesses**
Analytical capabilities	Ability to work in a team
Design capabilities: ability to handle open-ended problems; ability to handle poorly-defined problems; creativity and innovation	Inter-disciplinary knowledge
	Practical orientation (academics)
	Commercial orientation
Decision-making, including problem-solving	Introspective nature, modesty
Graphical communication skills	Oral and written communication skills
Discipline, work ethic.	Integrative skills
	Ability to employ IT
	Obsolescence (remedy: continuing education)
	Inter-personal skills
	Public perception and recognition
Opportunities	**Threats**
Most real-life problems require contributions from Engineers	Competition from scientists, economists, financial experts, administrators in high-level decision-making bodies.
National policies recognize role of S & T	
Business recognizes role of technology	Quantitative expansion in technical education without simultaneous quality assurance
Ambition of bright youth to become Engineers	
Globalization offers opportunities for acquisition of state-of-the art technologies	Industrial development entails depletion of natural resources and environment degradation—engineers held responsible for these.

thinking, multi-disciplined perspective and objective challenge.

THE GENERIC ATTRIBUTES OF AN ENGINEERING GRADUATE

The main purpose of accreditation is to certify the quality of engineering education provided by technical institutions, which is reflected in the knowledge, skills and attitudes acquired by the engineering graduates which enable them to practice their profession with competence and confidence. This has been the subject of studies and reports in several countries; for example, the Grinter ASEE Goals Report (USA), and the Finniston Report (UK).

Table 3 provides a SWOT analysis of a traditional engineer. Table 4 includes the desirable attributes of an engineer—both the traditional traits and those required for facing the challenges of the twenty-first century. Apart from the faculty, who are at the heart of the engineering education system as far as the teaching-learning processes are concerned, engineering educators and administrators have the responsibility for the planning, design, implementation and monitoring of the system. Table 5 lists the traditional as well as strategic functions and areas of concern of engineering educators.

In a recent report, the Institution of Engineers, Australia, has outlined the generic attributes of an engineering graduate. Graduates from an accredited course should have the following attributes:

- ability to apply knowledge of basic sciences and engineering fundamentals;
- ability to communicate effectively, not only with engineers but also with the community at large;

Table 4. The desirable characteristics of twenty-first century engineers

Traditional attributes	**21st century attributes**
Problem-solving abilities	Learnability: learning to learn, on one's own
Analytical skills	Yen for life-long learning —continuous education
Communication skills: oral, written, graphic	Ability to muster knowledge from neighboring disciplines
Ability to relate to practical aspects of engineering.	Ability to work in a team
Inter-personal skills	Exposure to commercial disciplines
Management skills	Creativity and innovation
Decision-making skills	Integrative skills
	International outlook
	Ability to employ IT
	Ability to work at interfaces between traditional disciplines
	Commitment to sustainable development

Table 5. Educational planning and administration

Traditional concerns	**Future concerns**
Conformity	Resource mobilization
Curricular contents	Market Forces
Faculty development	User-oriented research
Uniformity/standardization	I P R
Extrapolation of past	Quality, excellence, relevance
Procedure-driven	Internationalization
Quantitative expansion	Education delivery systems
Command and control	Distance education
Resource crunch	Virtual university
Examinations	Digital libraries
	Continuing education
	Innovation
	Employment potential
	Autonomy
	Flexibility
	Strategic planning and management
	Articulation of mission, vision, objectives
	Continuous improvement
	Performance evaluation
	Educational technology
	Internet connectivity

- in depth technical competence in at least one engineering discipline;
- ability to undertake problem identification, formulation and solution;
- ability to utilize a systems approach to design and operational performance;
- ability to function effectively as an individual and in multidisciplinary and multicultural teams with the capacity to be a leader or manager as well as an effective team member;
- understanding of the social, cultural, global, environmental and business responsibilities (including an understanding of entrepreneurship and the process of innovation) of the professional engineer, and the need for and principles of sustainable development;
- understanding of and a commitment to professional and ethical responsibilities;
- in-depth technical competence in at least one engineering discipline;
- ability to undertake problem identification, formulation and solution; ability to utilize a systems approach to design and operational performance;
- and a capacity to undertake lifelong learning.

SOME FUTURE DIRECTIONS FOR ENGINEERING EDUCATION IMPACTING ON ACCREDITATION

Engineering practice today has changed dramatically and irreversibly, due to:

growing global competition, and the subsequent restructuring of industry;
shift from defense work to private enterprise as the major source of engineering employment;
explosion of information;
developments in IT.

Engineering success today requires more than up-to-the-minute technical capability:

ability to communicate;
ability to work in teams;
ability to think creatively;
ability to learn quickly;
ability to value diversity.

We need a new instructional paradigm with new standards, and new ways of assessing those standards. Internal or institutional assessment by itself does little to convince the public of an institution's ability to provide quality education. External accountability or accreditation can inform the general public and peers.

Some positive consequences of accreditation

There are several positive consequences of accreditation—for the institution, for the faculty, students and staff, for the parents of students, for the university administrators and for the general public. The accreditation criteria define the nature and scope of pre-requisites for institutions imparting technical education, and the profile of a good institution. For instance, since the criteria demand that every institution have a mission and goals, industry/institute interaction, and research and development, we have seen institutions strive to satisfy these requirements. Accreditation also promotes awareness and replication of good practices (as in the case of energy conservation and environmental protection).

THE MALCOLM BALDRIGE NATIONAL (US) QUALITY AWARD

The Malcolm Baldrige Award is a very prestigious national quality award in the US, which was instituted in order to promote quality in the corporate sector. It is an annual award to recognize US companies that excel in quality achievement and management. The initiative for instituting this award seems to have come from the then President, George Bush: 'The improvement of quality in products and the improvement of quality in service—these are national priorities as never before'.

The Foundation for the MBNQA was created to foster active partnership between the private sector and government. The management of the award program has been entrusted to the National Institute of Standards and Technology (NIST).

The award promotes:

- awareness of quality as an increasingly important element in competitiveness;
- understanding of the requirements for quality excellence;
- sharing of information on successful quality strategies and on the benefits derived from implementation of these strategies.

There are three eligible categories of the award: manufacturing companies, service companies and small businesses.

The key concepts in the award examination criteria are:

- Quality is defined by the customer.
- Senior leadership should create clear quality values and build the values into the way the company operates.
- Quality excellence derives from well-designed and well-executed systems and processes.
- Continuous improvement must be part of management of all systems and processes.
- Companies need to develop goals, and strategic and operational plans to achieve quality leadership.
- Shortening of response time of all operations and processes of companies to be part of the quality improvement effort.
- Operations and decisions of companies need to be based upon facts and data.
- All employees must be suitably trained and developed and involved in quality activities.

Table 6. MBNQA—examination categories

Leadership	100
Information and analysis	70
Strategic quality planning	60
Human resource utilization	150
Quality assurance of products and services	140
Quality results	180
Customer satisfaction	300
Total points	1000

- Design quality, and defect and error prevention should be major elements of the quality system.
- Companies need to communicate quality requirements to suppliers and work to elevate supplier quality performance.

Table 6 shows the seven examination categories and the points for each, amounting to a total of 1000 points. Table 7 shows the Indian National Board of Accreditation (NBA) accreditation criteria, under eight categories, amounting also to a total of 1000 points. While each scheme is designed keeping in mind the specific objectives of the two systems, human resources and their utilization is common to both; the focus of MBNQA is on quality and customer satisfaction, while that of NBA accreditation is on teaching/learning processes.

THE MBNQA EDUCATION CRITERIA FOR PERFORMANCE EXCELLENCE

President Clinton signed legislation into law on October 30, 1998, enabling education institutions and health care organizations to take full advantage of the Malcolm Baldrige National Quality Award in 1999. The award application process, as well as self-assessment against the criteria for performance excellence, provides a steady and proven course for education institutions to pursue performance excellence and maintain a leadership position in their communities. The criteria provide a valuable framework for performance excellence, and assist in assessing and measuring performance in a wide range of key institutional performance indicators: student/stakeholder, educational service and outcomes, operational and financial. Self-assessment permits the identification of strengths and targeting of opportunities for improvement on processes and results affecting all key stakeholders—including students, faculty, staff and community.

A listing of the education criteria for performance excellence is given below (1999 categories/items point values):

1 Leadership: 110
  1.1 Leadership System: 80
  1.2 Public Responsibility and Citizenship: 30
2 Strategic Planning: 80
  2.1 Strategy Development Process: 40
  2.2 School Strategy: 40

Table 7. NBA accreditation criteria

Criterion		Weightings U. G.	P. G.
I.	Mission, goals and organization	100	70
II.	Financial and physical resources and their utilization	100	80
III.	Human resources	200	200
IV.	Students	100	100
V.	Teaching—learning	350	250
VI.	Supplementary processes	50	50
VII.	Industry—institution interaction	70	100
VIII.	Research & development	30	150
	Total	1000	1000

3 Student and Stakeholder Focus: 80
  3.1 Knowledge of Student Needs and Expectations: 40
  3.2 Student and Stakeholder Satisfaction and Relationship Enhancement: 40
4 Information and Analysis 80:
  4.1 Selection and Use of Information and Data: 25
  4.2 Selection and Use of Comparative Information and Data: 15
  4.3 Analysis and Review of School Performance: 40
5 Faculty and Staff Focus: 100
  5.1 Work Systems: 40
  5.2 Faculty and Staff Education, Training, and Development: 30
  5.3 Faculty and Staff Well-Being and Satisfaction: 30
6 Educational and Support Process Management: 100
  6.1 Education Design and Delivery: 60
  6.2 Education Support Processes: 40
7 School Performance Results: 450
  7.1 Student Performance Results: 150
  7.2 Student and Stakeholder Satisfaction Results: 100
  7.3 Faculty and Staff Results: 100
  7.4 School-Specific Results: 100

TOTAL POINTS: 1000

Explanation of concepts

- *Measures and indicators.* Measures and indicators refer to numerical information that quantifies input, output, and performance dimensions of processes, products, services, and the overall outcomes; they can be simple (derived from one measurement) or composite. While the Criteria do not make a distinction between measures and indicators, some users of these terms prefer the term indicator: (i) when the measurement relates to performance, but is not a direct or exclusive measure of such performance (e.g., the number of complaints is an indicator of dissatisfaction, but not a direct measure of it); and (ii) when the measurement is a predictor (or leading indicator) of some significant performance.
- *Performance.* Performance refers to information on output results obtained from processes and

services that permits evaluation and comparison relative to goals, standards, past results, and other organizations. Performance might be expressed in financial or non-financial terms. Two types of performance are addressed in the criteria: (i) operational, referring to performance relative to effectiveness and efficiency measures and indicators; examples being productivity, and regulatory compliance. (ii) student and stakeholder-related, referring to performance relative to measures and indicators of student and stakeholder perceptions, reactions and behaviors.

- *Process.* Process refers to linked activities with the object of producing a product or service for a customer within or outside an organization. In knowledge work, such as teaching, strategic planning, R & D, and analysis, process does not necessarily imply formal sequences of steps; rather it implies general understanding regarding competent performance, such as timing, options to be included, evaluation, and reporting.
- *Productivity.* Productivity refers to measures of efficiency of the utilization of resources.

Explanation of criteria

- *Leadership system*. How senior leaders guide the institution in setting directions, and in developing and sustaining effective leadership throughout the organization.
- *Public responsibility and citizenship.* How the Institution addresses its responsibilities to the public, and how the Institution practices good citizenship.
- *Strategic planning.* This category examines how the institution sets strategic directions, and how it develops key action plans to support the directions; also how plans are deployed and how performance is tracked.
- *Knowledge of student needs and expectations.* Describes how the institution determines longer-term requirements, expectations, and preferences of present and future students; also describes how the institution employs this information to understand and anticipate needs, and to create an overall climate conducive to learning.
- *Analysis and review of school performance.* Describe how the Institution analyzes and reviews overall performance to assess progress relative to plans and goals, and to identify key opportunities for improvement.
- *Faculty and staff education, training.* Describe how the Institution's education and training support the accomplishment of key institution action plans and addresses institutions needs, including building knowledge, skills, and capabilities, and contributing to improved faculty and staff performance and development.
- *Faculty and staff well-being and satisfaction.* Describe how the institution maintains a work environment and work climate that support the well-being, satisfaction, and motivation of faculty and staff.
- *Education design and delivery.* Describe how educational programs and offerings are designed, implemented, and improved; also, how delivery processes are designed, implemented, managed and improved.

Core values, concepts and framework

The education criteria are built upon a set of core values and concepts, which are the foundation for developing and integrating all requirements within a results-oriented framework.

These core values include learning-centered education which places the focus of education on learning and the real needs of students. Such needs derive from the requirements of the marketplace and the responsibility of citizenship. Rapid changes in technology and in the national and global economies are creating increasing demands on employees to become knowledge workers and problem-solvers, keeping pace with the rapid changes in the marketplace. A learning-centered Institution needs to fully understand and translate marketplace and citizenship requirements into appropriate curricula. Education offerings need to be built around learning effectiveness. Teaching effectiveness needs to stress the promotion of learning and achievement.

MBNQA AS AN ENGINE FOR CONTINUOUS IMPROVEMENT

The MBNQA seeks to improve national competitiveness by building active partnerships in the private sector, and between the private sector and all levels of government. The National Institute of Standards and Technology (NIST) promotes US economic growth by working with industry to develop and deliver high-quality measurement tools, data, and services necessary for the nation's technology infrastructure.

For more than a decade, the Baldrige Criteria for Performance Excellence have been a significant tool used by thousands of US companies to assess and then improve performance on the critical factors that drive their overall success. In the most competitive business sectors, organizations with world-class results are able to achieve a score above 700 on the 1000-point Baldridge Scale. Even if an organization does not win the Award, submitting an application in itself has valuable benefits. Every applicant receives a detailed feedback report—based on an independent external assessment conducted by a panel of specially trained and recognized experts—outlining the strengths and opportunities for improvement.

Many recipients indicate that their greatest rate of improvement occurs the year after receiving the award. There is only one requirement of recipients: that they share information from their application summary, and participate in the Quest for Excel-

lence Conference, the next year, so that the others might learn from their success. The award itself is traditionally presented by the President of the US at a special ceremony in Washington, D. C.

THE STRATEGIC PLANNING AND QUALITY ASSURANCE INITIATIVES AT IIT MADRAS

Beginning in 1996, IIT-Madras has embarked on two initiatives, one for the evolution of a Strategic Plan and the other of ISO-9001 certification, essentially of the support services. In this process, a quality policy for the institute activities has been generated, essentially through a bottoms-up decentralized approach:

- Impart quality education in technology and science for professional excellence and instill commitment to sustainable development.
- Perform world class research to advance the frontiers of knowledge.
- Provide innovative solutions through research, consultancy and continuing education for satisfying current and future industrial and R&D needs.
- Extend expertise towards improvement in the quality of technical education.
- Achieve excellence in the support services of the institute through continuous improvement and teamwork.

At the moment the strategic plan is getting ready and the mission statement for the institute is being evolved, again through institute-wide participation.

SOME RECENT ISSUES AND CONCERNS

The Indian National Board of Accreditation was established in September 1994, and has managed to accomplish a number of things—such as the definition of criteria and weighting therefor, the preparation of a set of four documents, including manuals and Questionnaires, organization of training programs for accreditors, and accreditation of over 400 programs, covering both UG and PG levels.

Some recent issues and concerns are highlighted here:

- There are a large number of programs of engineering colleges and polytechnics which are waiting to be accredited; there is an acute shortage of competent assessors, particularly from industry.
- There are multiple inspection agencies, such as the University Grants Commission (UGC), the All India Council for Technical Education (AICTE), universities, often with overlapping jurisdiction.
- The visiting teams are handicapped by lack of secretarial support, particularly if the chairman and assessors are retired professors.
- In the affiliating system prevailing in India, the individual institutions are not in control of the curricula, as would be the case for autonomous institutions.
- It is not yet decided how the accreditation results would be utilized.

CONCLUDING REMARKS

As in manufacturing and service industries, quality is the hallmark of excellence and effectiveness in engineering education. Every engineering college and polytechnic should define their quality policy and articulate their commitment to achieve quality in all their activities and implement the policies energetically. It might mean the difference between survival, and success and failure.

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