ENGINEERING FOR ENGINEERING EDUCATION : TOWARDS A UNIFIED ROLE FOR PRIVATE AGENCIES

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ABSTRACT

India claims to have the third largest repository of Scientists and Technologies in the world; yet it imports technology even for making tooth-brush bristles. It adumbrates on the need to have more and superior technical education yet it bureaucratises and inhibits creative efforts to do so.

It is in this situation that one has to look at higher education, the role of private agencies, and the coordinated efforts needed to raise engineering education towards its envisaged goals. These issues are taken up in this paper under these heads.

1. *The Paradox of Education*
2. *The Fundamental Issues*
3. *The Chain of Events*
4. *The Task for Private Agencies.*

The first section explains the paradox within which one has to operate, the second explores the main questions in engineering education, the third sequences the present situation, and the last elaborates on the role of private agencies and the things that they have to do.

1.0 PARADOXES OF EDUCATION :

One is already familiar with the three-cornered struggle between knowledge, education, and wisdom from the 'Panchatantra' tale of the brothers resurrecting a dead lion. The three main paradoxes of higher education (including Engineering education) are given here. One can begin with the doubt whether higher education is indeed higher (as building- blocks) when one sees that (i) degree-obtaining seems easier than passing in +2 examinations and that (ii) many post-graduate do not call for prerequisite undergraduate courses !

1.1 PARADOX OF PURPOSE :

Those seeking Higher Education

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and those who supply it have goals in conflict.

The seekers – parents, students other influencers – are after these goals : (i) to become degree-holders, (ii) to display proof of "competence" by gaining admission into Engineering, Medicine, and Management, (iii) to overcome the stigma of poor scores in an earlier course (So a second M.A. ?), (iv) to participate in Union activities (any course to continue to be on the rolls - often LL.B.), (v) to get higher dowry, (vi) to improve job prospects (an MBA after a BE or an M.Com.) and or (vii) to gain knowledge for its own sake, (viii) to kill time while waiting (a) for jobs as M.E. dropout shows, (b) for professional education (so a B.Sc. trying to get into M.B.B.S.), (c) for preparing for Services examinations (witness : JNU, for example), (d) for inexpensive boarding and lodging (a bane of big city Post graduations, including IIT/Delhi), and (e) for marriage (Ask the parents of girls).

The suppliers – pedagogues, administration, government – visualize differently : (i) some of the above goals but in different order of priority, (ii) statistically satisfying successes (for example, percentage of passes), and (iii) platitudes (like moral values, character building, good citizenry, and such other convocational stuff).

If the seekers and the suppliers have such differences, the following questions arise : (1) Whose views should prevail ? (2) How are differing views to be corrected ? and (3) How to balance the views in a productive manner ?

1.2 PARADOX OF AVAILABILITY :

A welfare government wants education to be good and job-oriented but does not take determined steps to provide it.

Policy makers and educationists reiterate the importance of "purposeful" education, one that is job-oriented (if not job-creating) and socially responsible. The right to education is promised along these lines. Yet, they all know.

(a) that demand for such education exceeds supply (due to growing population, economy, social status, etc.),

(b) that government funds and facilities are inadequate to cope with the rising demand institutions, fund allocation, and administrating bodies being what they are), and

(c) that criteria to allocate the limited resources and seats would make many into competent ineligibles (as quotas are based on birth, location, physique, relationships, etc.)

Note only this. Two unfair attempts to break this impasse have been made :

(a) Delinking degrees from jobs – a method to do away with expertise from all jobs, and

(b) Offering unsuitable courses through Correspondence – allotrope : Distance Education – as when one obtains an M.Sc. in Chemistry with a week's practicals ! Does the university have credibility?

Why then the platitudes ? When the lauded education is not made available to all, why frustrate by eulogising it ?

1.3 PARADOX OF CRITICISM :

Evaluators insist on standards but cannot bear scrutiny if the same standards are applied to them. "Do unto others what you would have them do unto you", is an unsafe biblical credo.

Here are some examples :

1. Quality-marking institution lacking its own standards,
2. Management Institute / Departments have mercenaries,
3. Messy Universities send Expert teams to Colleges for possible affiliation,
4. Banks in the red expect good performance from borrowers,
5. UGC expects scientific management but is unable to explain many of its actions,
6. AICTE is unable to sort out anomolies in revised scales or in nomenclature,
7. DTE wants engineering education to improve but has not even standardised titles (Are these the same : B.E., B. Tech., and B.Sc. - Engg ?),
8. Pedagogues are selected on the basis of nonpedagogic skills (papers, doctorates, but not teaching ability?),
9. Teachers who panegyrise for academic excellence maneuver for administrative posts,
10. Capitation fee-paying parents make unsavoury remarks about their wards' Colleges,
11. DST says it stands for improvement in Science and Technology but refuses to fund crucial projects (such as : (a) development of productivity yardsticks for universities and R & D units, and (b) fate of Gold Medalists),
12. Industry sneers at Indian higher education but seeks sops from government to escape competition from abroad,
13. Indian pride is "seen" in admiring foreign degrees,
14. Vice-chancellors who condemn political interference are appointed by politicians,
15. Politicians wax eloquent about the noble profession of teachers but do show that they mean what they say.

And the list goes on.

True, one does have to be good to be eligible to fault others. But, shouldn't physicians heal themselves ?

These paradoxes, in the context of engineering education, need serious introspection and careful coping strategies. But what is this context of engineering education ?

2.0 FUNDAMENTAL ISSUES :

The core questions that arise are :

1. What are the goals of Engineering education ?
2. How should its inputs be selected ?
3. Who should operate the Educational system ?
4. How should the system be operated ?

The following section searchers for answers.

2.1 Goals of Engineering Education :

Today, engineering education

should satisfy these goals –

1. Improve the productivity of operating systems
2. Develop relevant new technology
3. Build scientific temper as an attitude
4. Instill national pride, and
5. Create job-generation along with job-orientation

Degree-level engineering education should be -

1. Added-one rather than different from I.T.I or Polytechnic streams (without commenting on Polytechnics in U. K. becoming Universities through a fiat). For example, an Electrical engineer who cannot repair a switch cannot claim to be superior to an Electrician.
2. Visualizing, Anticipating, and Solving of Problems rather than being merely numerical-oriented and numbers-crunching. A calculator can do the latter just as well.
3. More than a stepping stone to non-engineering higher education (like MBA) or non-engineering jobs !

These are possible only if (i) one studies the nature of the jobs likely to be available and the extent of engineering knowledge required as one moves up the hierarchy, and (ii) match the goals fine-tuned with the results.

Let us elaborate. The first goal, Improvement of Productivity, would require knowledge of present systems, state of art in developments, constraints, and process of tackling various implementational issues. Are the courses or teachers geared to these ? One of the reasons for emigrating, IIT alumni claim, is the IIT knowledge is too advance for India. If this true, IITs have failed. The second goal seeks innovations and inventions in products and processes than in lots of research papers. As transfer of technology becomes more difficult and costlier, this goal gains prominence. The third goal is the capacity to overcome prejudices and not to shy away from engineering occupations, salaries and status permitting. This remark because so many engineers are into Finance and Marketing after gaining MBA degrees. Overcoming cynicism and developing national pride to invent and fabricate is the next goal. Creating employment opportunities (rather than being employees to others) lays stress on the balance theory and practice.

There are two options with these goals. One could try to ensure that the goals are realised, or one could alter the goals.

2.2 Selection of Inputs :

If the goals are accepted, then the selection of inputs is severely restrictive.

For instance, consider the manner in which students are selected.

1. It assesses knowledge of Physics, Chemistry, and Mathematics (and a modicum of English and General Knowledge) but leaves out APTITUDE – the most important component. Result : Many "First Class" engineers have no inclination for engineering.
2. It uses the same techniques for all branches of Engineering (and, worse, for Architecture too) Result : We have Architects without an

aesthetic sense.

3. It goes by marks obtained in previous examinations. Result : Past (and not suitability is used as yardstick.
4. It permit inter-branch mobility as seats fall vacant. Result : Availability, not suitability, determines branch allotment.
5. It is based on birth, location, physique, sex, etc. Result : Perpetuation of reverse discrimination while rigidifying obnoxious social stratification.
6. It offers a Hobsen's choice of "this branch of nothing" Result : An asthmatic studies Mining because he could not get Electronics.
7. It gives seats on the ability to mobilise financial resources. Result : Entry of incompetents with capitation fees.
8. It enables operators to peddle influence. Result : Unpleasant quid pro quos in exchange for seats.

The scene for **Teachers** is no better. Common features include Low qualifications (to ensure loyalty), Contractual appointment (to ensure industry), Heavy burden of multiple classes (to economise), low total pay despite standard scales (to cut costs and have younger-age pliant faculty), and promotion without competition. And the quotas.

Administrators, often, are far removed from education. They hold the purse-strings, discourage academically enriching functions (preferring student functions to academic seminars), practice benevolent dictatorship, often are retired persons from mainstream (this keeps costs down, and improves lobbying contacts), voiceless in Board meeting, who pontificate without practising.

Government of Private, most inputs are along the lines as described.

Even it there are limitations, there is a correct way to doing things.

2.3 Students :

1. Counseling at +2 stage, if not earlier, to determine options and develop an aptitude for engineering. And the type and the level of engineering (ITI, Polytechnic or College).
2. Educational enlightenment in knowing that other branches of knowledge are not "inferior". This could avoid crowding.
3. There must be an entrance examination where earlier scores (+2 or others) should be considered only as ceteris paribus.
4. In addition to Physics, Chemistry, Mathematics, Language and General Awareness) which is the ability to explain phenomena, rather than recall of coins and capitals alone), a heavily weighted aptitude test must be given. In spite the burden of doing so, excellence should not be short-circuited for the sake of convenience.
5. There must be a clear policy on quota. Perhaps soft loans, coaching centres, minimal cutoff scores, etc. should be used. These can be applied for those who can afford to pay too.

2.4 Faculty :

1. Reasonable minimal standards must be adhered to.
2. They should be more ideas-persons than formula-memorizers. Perhaps a balance is called for.
3. A motivating, enriching environment should be made available.
4. Exploitative work or salaries are avoidable (as these could lower efficiency)
5. Periodic evaluation should be compulsory.

2.5 Management :

1. The Director must have ideas more than an engineering degree.
2. Reasonable autonomy for Director and his team.
3. Students too, can be entrusted with work on a selective basis.
4. Role of funding and approving bodies should be clearly delineated (akin Articles of Association, Memorandum of Association of the corporate world).

Despite the handicaps of the environment, if one is able to ensure a modicum of quality, it would reflect well on the institution.

2.6 Operators of the System :

Undeniably, it is the government which should set the course of a nation's development strategies and the role of engineering educations therein. To the extent that government funds such education (fully of partially) or provides the sought-after recognition, it has a right to expect its guidelines to be followed. Where, then, is the catch ? It is in the composition of the decision making team.

1. Politicians for whom Education is not a "power-yielding" portfolio.
2. Policy makers who extrapolate the past rather than "zerobase" realities and trends.
3. Bureaucrats who find safety in established procedures than to "rock the boat".
4. "Educationists" who must have taught eons ago, tow the line in exchange for the opportunity to be in Committees.
5. Teachers who seek out shortcuts to teaching and syllabus, who cling to pet prejudices, who lament that they being evaluated on non-pedagogical bases (so that papers and Ph.D. overrule good marks or sound teaching), and who despair to get into non-research, non-teaching administrative positions (which, sadly, pay more).
6. Alumni who are indifferent, if not supercilious.
7. Society which generally does not wish to take up issues except when it becomes a mob.

Yet all these are necessary constituents. It is only that the proportion needs to be revised, with the young-at-heart getting to play a more vigorous role.

1. A key Committee must comprise all of the above and also employers specialised organizations, and related institutions.
2. Members must be suitable – not perennial members and mutual admirers. Publicity to invite member-

ship would not hurt.

3. There must be a greater representation for Industry and Alumni.
4. Participation in meetings should be on an equal footing rather than by bemusement or tolerance.

2.7 The Task of the Committee should be five-fold :

1. To organize brainstorming sessions in colleges and related forums on the future of engineering education – trends, approaches, numbers, courses, delivery, etc.
2. To consolidate the generated views and suggestions for the Centre.
3. To follow-up with the Centre to collect similar profiles from all areas and consolidate these into a Master Plan.
4. To dovetail the concepts of the Master Plan into National effort and
5. To prepare plans, guidelines, and syllabus so that engineering education serves both the nation as well as individuals.

The State, the Nation, however, does not have the wherewithal to cope with the demand for the special features of engineering educations or to tackle all the problems associated with the education.

It would be useful, at this stage, to have an aside on the chain of events that have led to a role for Private agencies.

3.0 CHAIN OF EVENTS :

There have taken place in this sequence :

1. Demand for professional education – including engineering education – exceeds Supply.
2. Social trails of strength and government policies being what they are, quotas and reservations would increase in the years to come. Perhaps a cutoff percentage (so that ridiculous scores do not get in, competing within their own categories), Coaching centre, etc. might improve the quality of this input.. (It is not clear nevertheless, as to why "committed" leaders do not insist on reserved – category persons as their personal doctors or contractors). Over a period of time, more or less 80% of the seats are likely to be reserved.
3. Naturally, there would be fierce competition for the remaining 20 (?)% of the seats.
4. This fierceness could lead to these situations :

(a) engineering could lose some of its charm on return on investment criterion (that is, cost and effort put in as against the benefits), OR

(b) greater tenacity would be shown to get into engineering courses, so that seats would be sought through (a) Hefty payments and / or (b) Unfair means.

5. such a situation would lead to the establishment of more private institutions for engineering education in order

(a) to operate as a business venture (which is quite a fair approach

(b) to get appropriately trained personnel (like lease and buyback

schemes)

(c) to spread superior engineering education.

6. As the number of institutions increase, competition would oscillate between individuals and institutions – on issues such as funding, approving, affiliating and between institutions.

7. As lobbying seems to carry more weight than competence - witness, or example, the manner in which UGC selects persons for the various foreign Scheme like Commonwealth scheme - institutions are likely to focus attention on this aspect so that they could

(a) increase their funds through more seats and greater autonomy for funds management

(b) improve their market value by also emphasising many non-academic attributes (such as location, boarding and lodging, extracurricular, placement, linkages, etc.).

8. Underhand deals of a few institutions, often, jeopardize the reputation of all.

In the light of the chain of events, the following issues are to be faced by private agencies :

1. Preliminary bureaucratic obstacles – approval, permission, accreditation, affiliation, etc.

2. Intake criteria – quotas for government management, alumni, faculty, etc.

3. Autonomy to run the institutions differently though inhibited by government, funding bodies, social/local/market forces.

4. Limitation of funds for high cost education

5. Developing, upgrading, and maintaining high standards

6. Teacher motivation, as well as their academic and social enrichment

7. Obstacles to development and to stringent standards

8. Acceptable image in industry, government, and public (Because they are all government institutions, it does not seem to matter if all universities do not have the same reputation or image. REC's and IITs can be ranked differently)

Given these portents, how are private agencies to operate ? How are they to face the challenges ?

4.0 TASK BEFORE PRIVATE AGENCIES :

The more important matters that must be taken up by Private agencies severally as well as in a unified manner are given below :

1. Establish a legitimate forum of Private Engineering colleges to take up their causes as well as to provide constructive inputs.

2. **Decide on the fundamental question :** Should the courses need recognition of educational system (AICTE and universities) or of market forces ? The former tends to subordinate autonomy and subjugates innovation. Harvard University has not cared to get itself accredited.

3. **Define the strategy to be**

employed :

(a) to provide similar and substitutable engineering education – conventional education that is approved and confirming to requirement, Or

(b) to provide unique and innovative education that depends on the approval and acceptance in the job market. For instance, will the automobile engineers be able to repair his car without having to call the mechanic ?

While the former may facilitate activities, the latter is beset with initial hurdles of social acceptance, recognition for higher studies and government jobs.

4. Establish oneself in any of these forms :

(a) Trust or Society for education

(b) Business venture

(c) "Subsidiary" activity to an R & D unit

(d) Ancillary wing to main business. Many U.S. firms, including IBM, have their own educational institutions

(e) Consortium created by a group of businesses.

5. Decide on the funding sources and the legal form for the same.

(a) Float shares for education. (GV Films have done it for films, haven't they ?)

(b) Link it as an incentive to a bond/ debenture floatation

(c) Study loans

(d) Differential - rate fees

(e) Educational endowment (with interest being put to use).

(f) Subsides

(g) Alumni funds

(h) Industry-created activities

(i) Industry-creating activities (institution makes and supplies things)

(j) International grants

(k) Institutional linkages with international ones

(l) Self Finance : (i) Lump sum, (ii) Installment, (iii) Refundable lump sum, (iv) Shramdan (Free labour) to institution, (v) Contract to work (for a specified organization).

6. Mobilise support to convince government so that it

(a) offers tax incentives

(b) declares professional education as an industry

(c) allows NRI investment

(d) facilitates collaboration

(e) permits quotas for donors

7. Carefully operate cost-effective systems.

(a) Zero-base budgeting and activities

(b) Image building

(c) Self-supporting activities (like Seminars)

(d) Avail low-cost developmental activities (like Summer-Winter Schools, QIP, etc.)

(e) Provide industrial exposure to faculty by rotation, (while the others share the load of the deputed)

(f) Allocate adequately for academic growth and motivation

(g) Utilize students many things. This would (i) economise, (ii) build en-

thusiasm, (iii) provide learning opportunities

(h) Fabricate as many items as possible. Many mechanical and electrical items would turn out to be cheaper and provide laboratory experience as student projects.

(i) Linkup with industries and competent alumni (i) to organize special sessions and (ii) for industrial visits.

(j) Institute social and technical awards to keep institution in limelight

(k) Create a Board of governors comprising eminent and useful persons

(l) Establish a consortium of engineering colleges :

(1) to organize inter-college self-improvement programmes

(2) to make group purchases

(3) to have sent adjustments and barter

(4) to share facilities (like special labs, expert visits, etc.)

(5) to operate shift-system for special facilities

(6) to update syllabus, intake, and evaluations processes

(7) to organize coordinated field visits

(8) to rotate organizing / participation vis-a-vis ISTE

(9) to optimize benefits from AICTE, ISTE, DST, DTE, etc. Attempts to economise, however, must not stifle productivity. Indifference and turnover could follow.

8. Generate activities that indicate social responsibility of the institution.

(a) Offer a few seats to the underprivileged : (i) % on standard selection, (ii) loan facilities to the deserving poor, (iii) % for government allotment, etc.

(b) Linkup with educational, social private and government organizations.

(c) Symbiosis with ITI and Polytechnic to teach and to gain hands-on experience for students.

(d) Participate in sincere development work (rather than condescending ones like NSS)

9. Attain and Maintain high standards

(a) High Standards should mean :

1. Market image
2. University results
3. Job opportunities

(b) Indicators of poor maintenance are :

1. High staff turnover (as in BITS, Pilani)
2. High dropout to get into other institutions
3. Vacant seats (dates extended, readvertised, etc.)
4. High failure in national tests (GATE, ME, etc.)
5. Drop in Image (after a crisis)
6. Education "unrelated" to market opportunities
7. Overwhelmingly theoretical, "pure" courses.

(c) Maintenance is possible through :

1. Incentive schemes at all levels
2. Superior feed forward planning systems

3. Image-improving social activities
4. Dissociation from sleazy institutions
5. Positive attitude.
10. Lobby to limit the roles of the following :

(a) Centre : to manpower planning and broad guidelines

(b) State : to indicate needs, and follow-up

(Centre-State issues are not raked up here !)

(c) University : to approve, affiliate, assist

(d) AICTE : to recognize, accredit.

One of the blemishers of the system is the unacademic decree : that evaluation should flow unidirectionally. AICTE, UGC, IMC, et al are prompt in evaluating others but will be unable to bear scrutiny under the same set of criteria. So also Universities which (with their many unattractive, wasteful courses and with poor performance of its students at NET and GATE) pontificate through their inspection-team "experts". Colleges must dismantle this unilateral advantage. After all, it is these hallowed institutions that play more with the taxpayers' funds. And all that one seeks are opportunities for the rupee to run farther in gainful higher engineering education.

5.0 RECAPITULATION :

Private agencies must realize that their forays into education must be based on (i) the extent to which they depend on current governmental and educational systems to gain legitimacy for their outputs, and (ii) the manner in which they propose to gear themselves but dissociate from wrong deeds and institutions. In the present scene, when liberalization and privatisation are no more taboo-words, and when shortage of resources inhibit various activities, private agencies have the opportunity to come into their own. This paper, after examining the scene and with its diagnosis of problems, has endeavoured to enumerate suggestions for consideration. It is the contention of this paper that, in the ultimate analysis, engineering of education should precede engineering education.

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