The Plausible Direction of Engineering Education: A Futuristic Estimation for Accreditation under Outcome based Framework

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ABSTRACT

The paper presents an approach to identify plausible future direction of engineering education in the Country in view of changing trend in global perspective and integrate few parameters annexing the same in the present outcome based accreditation framework with sole objective of sustainability of the discipline and the offered programs. The underlying idea of this proposal is guided by the fact that the Regulatory Bodies are always an inspirational factor to the Institutions consistently complying accreditation process and thus ensuring basic minimum quality. Quality assurance is done through accreditation by two autonomous bodies under MHRD, the National Board of Accreditation (NBA), which undertakes program-level accreditation, and the National Assessment and Accreditation Council (NAAC), which accredits institutions as a whole.

The motivation behind this proposal is to formulate remedial measures for the weaker/challenged institution, their disciplines and programs and what role the regulatory bodies can play with higher level of responsibility/accountability to provide a support-system to those. It has been observed that, even some accreditation compliant Institutions are also facing sustainability challenges mainly due to two reasons. One is to adapt to the changing trends in the disciplines and the other is to prepare its students to comply with the expanding employability needs. The objective of this proposal is to make an effort so as to ensure a minimal sustainable quality for the accredited institutions within the purview of the accreditation process.

The remedial sustainability plan mainly deals with educational as well as financial measure. This has been presented in the following sections in an illustrious way due to space limit. The full concept paper supplemented by a case study may be produced on demand.

Keywords: Self Appraisal Report (SAR), Self Study Report (SSR), Massive Open Online Recruitment (MOOR).

INTRODUCTION

Broadly, the evaluation and assessment at SAR/SSR in quality aspects has been made in the following main criterions in Tier I accreditation of the Program in NBA and overall Institutional accreditation under NAAC:

Table 1: Accreditation Criterion

<table>
<tr><td colspan="1">*NBA SAR for Program*</td></tr>
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NBA SAR for Program	*NAAC SSR for Institution*
Vision, Mission and Program Educational Objectives	Curricular Aspect
Program Outcomes	Teaching, Learning and Evaluation
Program Curriculum	Research, Consultancy and Extension
Students' Performance	Infrastructure and Learning Resources
Faculty Contributions	Student Support and Progression
Facilities and Technical Support	Governance, Leadership and Management
Teaching-Learning Process	Innovations and Best Practices
Governance, Institutional Support and Financial Resources	
Continuous Improvement	

There is obvious concurrency in terms of criterions in both of the above. In the following, an effort has been made to address the issues mentioned in the last paragraph of the abstract. The adaptability to the changes in a particular trade/discipline is first taken into consideration.

The sustainability of a disciplines, and thereby institutions, largely depends on its adapting to the changes w.r.t. global and national perspective. These changes emerge from the societal needs in a bottom up approach approving the idiom "necessity is the mother of invention". However, sometime this may be top-down when a strong concept emerged on that trade/discipline (viz. Mobile communication may be considered as a revolution that complemented the growing societal need for user –friendly communication). Several concepts emerge at various points of time, but the life of the concept depends on its societal acceptance through number of intermediate steps viz. research community acceptance of the concept, transition of concept to process or product, patenting of the same and commercialization of the product.

Two different and mutually exclusive dimensions in terms of stake-holders' satisfaction have been taken into consideration in order to adapting the trends in the engineering education. One is student-community who determines the acceptance of changing trends. A department is deserted only when students lose interest. However, if there are societal needs, then the department is never in dearth of students. In this context, perhaps the most important stake-holder is student's Employer. Societal needs transformed to creation of employment inspire the changing trends in a disciplines to survive provided employability matches with the supply chain management of employment. This is where the quality factor plays principal role. Here comes the scope of accreditation process so as to measure the department/disciplines ability to survive to the changing trends. Following is few illustrations of changing trends in various academic departments of engineering study. It is followed by a proposal in a parametric measurable form to adapt to these changes.

Observation 1: Electrical Engineering – is a most wanted engineering trade, trusted and tested throughout the previous century and ongoing decades of the present century. Its two major components Power Systems and Control Systems remain as relevant today as earlier. However,

survival strategy of the electrical engineering largely depends on its research and sustainability in renewable and non-conventional energy based on the eternal need of consumable energy in the globe.

Observation 2: Mechanical Engineering- This major branch of mother engineering has its research on Strength of Material, Machine Design, Applied Thermodynamics, Fluid Mechanics are almost saturated. Its hands on trend on foundry, smithy or forging shop is also so. Most importantly the World has almost migrated from empirical heavy engineering to smart technologies/soft-engineering. Hence large scale devices are gradually been deserted by most nations. On the other hand, its soft component Mechatronics and Autonomous Robotics, Unmanned vehicles and use of them security segment/surveillance mechanism is gradually expanding.

Observation 3: Civil Engineering- By following the previous statement that world has gradually been migrating from heavy engineering to soft engineering, because of the gradual decay of natural resources, the Civil Engineering will till expand its scope in the architecture/structural design front. Due to emerging uncertainties in weather largely due to global warming the Environment Engineering may be prioritized, however, Aerospace Engineering/Avionics will face stiff challenges. There is also a scope of expansion of high speed surface transport in the forthcoming days in a multi storied fashion. At least in-country surface transport will emerge to be more acceptable than both air and water.

Observation 4: The Soft Engineering/Technology are mainly having two major components: Electronics and allied disciplines and Computer Science and Engineering (including Information Technology). The Country's Vision 2020 is largely depends on success in this front. The changing trend in this front of study has been shifting from manual to automated, automated to interactive, interactive to autonomous, and autonomous to intelligent process, devices and products. The hardware front is taken care by the Electronics department whereas Software is the priority of Computer Science and Engineering and other branches. In a surface level observation, the large volume of automation since last seven decades won't be migrated to manual process again. Hence this segment is going to survive amidst the uncertainties in job markets. But since these courses are comparatively low-investment course and moreover, opportunities are much higher in these trades in contrast to core, the possibility of sustainability is more. A vast cyber-world of internet technology and Mobile Technology will only increase its scope however with a caution of congestion.

The proposal here is to identify and address this changing parameters in accreditation process of both Tier I/Tier II since the extinction threat to the departments doesn't distinguish autonomous/affiliated Institutions.

It has been observed in the recent past that even an accredited and funded department has been facing challenges of extinction not due to obsolescence of the trade but due to adaptability and quality compliance. So the proposal here is to incorporate a Section separately in Ties I/II accreditation process relating to sustainability of the Program offered by the Department.

Some parameters has been mentioned in the following Table 2, however, a substantial formula can be mined (like other formula mentioned in different section of the accreditation format) after a rigorous survey.

Table 2: Domain Specific Changes

Changing Trend

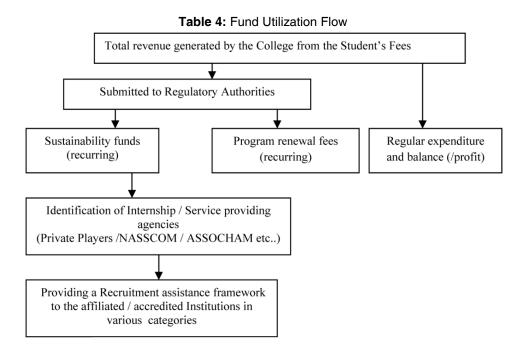|	*Change Parameter 1*	*Change Parameter 2*	*Change Parameter 3*	....
Program: B. Tech./B.E. Computer Science & Engg	PC Computing (C/C++) to Mobile Computing(Android)	Multi-User Environment to Service Oriented Architecture (viz. Cloud)	Automated Systems to Intelligent Systems	.... .
Program: B. Tech./B.E. Electrical Engineering	Manual Control to Intelligent Control	Power utilization to fuzzified Power Optimization	Energy optimization to Non-conventional Energy	
Program: B. Tech./B.E. Mechanical Engineering	Robotics to Aerobatics – Amphibionics	Machine design to Design Automation	Fluid mechanics Nano-mechanics	
………………	……………..	……………	………..	

Then in both of the accreditation criterions, it has to be measured that which criterions are affected (direct/indirect) by the above changes as in the following Table 3.

Table 3: Parametric Assessment

	Change Parameter 1	*Change Parameter 2*	*Change Parameter 3*	…	…
Computer Science and Engineering	PC Computing (C/C++) to Mobile Computing(Android)	Multi-User Environment to Service Oriented Architecture (viz. Cloud)	Automated Systems to Intelligent Systems		
NBA criterions					
Vision, Mission and PEO	Direct (computing objective changes)	Indirect (environment change)	Direct (change in perception)		
Program Outcomes	Direct	Direct	Direct		
Program Curriculum	Direct (new content to be introduced)	Direct (new course to be introduced)	Direct (onus more on Laboratory works)		
Students' Performance	Direct	Direct	Direct		
	(all changes are subject to evaluation/assessment)				
Faculty Contributions	Direct	Direct	Direct		
	(whether enough expertise available to address the change of content)				
Facilities and Technical Support	Indirect (min. additional resource reqd)	Direct (Service CCSP required)	Indirect (simulation level efficiency reqd.)		
Teaching-Learning Process	Direct (Demonstrative teaching)	Direct (Demonstrative teaching)	Direct (more analytic ability)		
Governance, Institutional Support and Financial Resources	…..	Direct (recurring service cost)	Not applicable		
Continuous Improvement	…..	…..	…..		

Similarly for the Institutional SSR for NAAC in a linear combination of criterion values from the each departments. The formula can then be constructed as has been the case for the other criterions viz. student performance etc.

Other important dimension i.e. sustainability in terms of financial aspects has been presented in the following which might be of immense significance and relevance for Private self-financed Institution. This is largely motivated by the Four fund concept (Corpus Fund etc..) of TEQIP solely aimed towards sustainability. The Regulatory Body has to take a lead role in this compliance of financial criterion by the affiliated/accredited institution and expected to work as pivot providing life-line to the challenged Institution in terms of revenue largely due to student's admission. Obviously, the Institute should identify a survival strategy within this time period. In general, Campus Recruitment Drive on completion of a course is a leading factor that comes as an outcome of Teaching-Learning Process motivating the admission. However, at the same time there are ability issues in this recruitment drives in which knowledge of the students is one vital parameter. The idea here is to provide a centralized support in a decentralized framework through massive open online recruitment (MOOR). To provide placement-assistance framework against a non-refundable security deposit through the agencies. The same has been represented pictorially in the following Table 4.

Table 4: Fund Utilization Flow

It has been observed through gap analysis that there are challenges in knowledge transfer mechanism with quality teaching-learning process; however, the absence of a strong recruitment setup is far more stiff challenge in the Engineering Institutions nation-wide. So one nation-wide framework (with placement sharing through Massive Open Online Recruitment) may escalate sustainability though hand-shaking/hand holding among this Institutions. Obviously, the categorization of the Institution is important, but, the concept of institutional networking already exists.

CONCLUSION

It is expected that sustainability factor can be strengthened through appropriate adaptive mechanisms and sustainability fund benefitting number of Institutions in the Country. Mining appropriate formula in above aspect has been kept as a future scope of study.

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