

7. HIGHER TECHNICAL EDUCATION: SOME CONSIDERATIONS FOR TECHNICAL UNIVERSITIES

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Preamble

Since independence in 1947, technical education system in India has grown into a fairly large sized system, offering opportunities for education and training in a wide variety of trades and disciplines at certificate, diploma, degree, post graduate degree and doctoral levels in institute all over the country. In 1947, country had 38 degree level institutes with an intake capacity of 2500. Today we are having more than 1800 engineering institutes (not including IITS/NITs/) with an intake capacity of more than 600,000 students. .

We are witnessing an urgent need for modernization and internationalization of engineering education. Rapid technological development, together with economic globalization, tends to increase the gap between the needs of the industrial world on one hand, and the "products" of engineering education on the other hand. India is no exception to this. Industry is faced to successive waves of change due to deregulation and global competition, but new technologies as well, which have caused considerable upheaval in the industrial environment, particularly in the fields of information technology (IT).

The Higher Technical Education System (HTES) in India comprises of various types of institutes. These include: IITs /IISc/IITs/IISERs at the top level (Tier-1), NITs/CFIs(Centrally Funded Institutes) at the middle level (Tier-2)

and various government/private engineering institutes/colleges at the bottom level(Tier-3). The objective of HTES is to help support improvement in engineering education system of the country. HTES must impart and develop the skills of engineers to meet the needs of 21st century India and its globally competitive firms.

The higher technical education system in India has undergone several changes. These changes include:

- The last few years have witnessed unprecedented challenges and opportunities for HTES arising from the effect of changing economic policy of liberalization and globalization. The economic policy has opened wider options for not only the investment for the Indian industry but has brought in the realization that only the best can survive in the world market and that only quality in products and manpower is the key to success.
- Knowledge is increasingly recognized as the main force behind economic growth and development in the contest of global economy coupled with information and communications revolution, the emergence of world wide labor market leading to significant changes in the global sociopolitical environment across the world. The Indian economy is helped greatly with

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availability of strong talent in IT. Since IT is all pervasive and India being the hub in this arena, the present situation has created larger avenues of education and training. IITs/IITM were created to meet manpower needs in these areas.

- MHRD has taken initiatives to improve GER (Gross Enrolment Ratio). As a result new IITs, IIMs, IIITs, IISERS, Central universities, and world class universities are being established. It is envisaged that these institutes will help in providing high quality manpower in various sectors. However, the expansion is also beset with certain challenges.
- The expectations of industry/academia/R&D laboratories and institutes have also changed. The lifecycle of technology has shortened coupled with a very demanding set of customers. This has definitely put a severe constraint on curriculum and content delivery.

Each tier above has a definite role to play in the entire HTES of India. In tier-3, there are many institutes/colleges. These colleges are either autonomous or affiliated to some other university, not necessarily a technical one. On this background, it is necessary to reflect on certain issues and challenges faced by the higher technical education system.

Issues: -

1. **Quality:** The issue of quality is very important. While HTES is on a rising mode as far as quantity is concerned, the issue of quality is at stake. Unfortunately, the regulatory bodies such as AICTE/ NAAC etc. have failed in controlling the quality of HTES. In the process, there is a huge gap between the quantity and quality. The process of accreditation has not served the intended purpose. Instead of focusing on quality of teaching-learning process, these regulatory bodies have focused on infrastructure issues which today are redundant. There

has to be a body of professionals who can deliberate, discuss and evolve mechanisms to develop quality education system. NGOs and international certification bodies/ professional societies need to be involved in addressing quality related issues. These may include: quality of teaching learning process, quality of curriculum, quality of faculty, quality of students and quality of staff who are the major stakeholders in delivering the message of quality.

The quality of education and training being imparted in HTES varies from excellent to poor with some institutes (few IITs) comparing favorably with the best in the world and many others suffer from different degrees of handicaps, such as faculty shortage, infrastructural deficiencies, curricula obsolescence, lack of autonomy in academic/financial/administrative and managerial matters, poor involvement in knowledge creation and dissemination and poor interaction with community and economy.

Multiple control mechanisms and controlling regulations have stifled initiatives in recruitment of faculty, admission of students, curricula revision and up gradation and financial management of most of the tier-2/tier-3 institutes.

- b. **Faculty Shortage:** The issue of faculty shortage is very acute one. On an average there is shortage of about 20-25 % of faculty in IITs/IISc/IITs etc. Unfortunately, HTES is not geared for rapid expansion. Old IITs are finding it difficult to fill faculty vacancies. New IITs are struggling to get the threshold faculty strength. These new IITs are being mentored by the old IITs which themselves are in acute shortages of faculty. This has increased the faculty teaching load tremendously. Because of large numbers, the quality of instruction has definitely suffered. Faculty in IITs are finding little time to devote to research and technology development/technology transfer. Most of

the productive time is spent on UG teaching only. This has severely constrained already loaded faculty resources. A definite faculty succession plan does not seem to be in place. Significant efforts are needed to plug the gap between demand and supply of quality faculty.

A large number of teachers are under qualified in tier-3 institutes. Existing teachers both in government and institutes are not exposed to modern pedagogy. Similarly, there is no regular exposure to advances in their field of specialization for these teachers.

Failure to attract and retain good quality faculty due to archaic recruitment and promotion procedures, absence of incentives for quality performance and non-existent staff development policies are very common in most institutes at tier-2/tier-3 levels.

- c) Research focus: There seems to be lack of focus in pursuing thrust research areas across TUs. The research efforts in these universities seem to be in a fragmented manner. There does not seem a coordinated set of efforts to align the research in line with the mission and long term vision of the country.

There is a need for enhancing interaction with industry for working on research projects of mutual benefits. This will help in focusing on research projects of relevancy.

Role of Technical University

A technical university can play a significant role in addressing the above issues. TU such as UPTU is playing a significant role in managing various engineering colleges / management institutes affiliated to it. Similar examples can be quoted from states such as Madhya Pradesh (Rajiv Gandhi Technical University) Andhra Pradesh (JNTU) etc. (Table 1).

Table 1: Select List of Technical Universities in India

S. No.	State	Name of the University	Year of Estb.
1.	Andhra Pradesh	Jawaharlal Nehru Technical University	2008
2.	Madhya Pradesh	Rajiv Gandhi Technical University	1998
3.	Orissa	Biju Patnaik University of Technology	2002
4.	Uttar Pradesh	Gautam Budhh Technical University	2000
5.	Rajasthan	Rajasthan Technical University	2005
6.	Punjab	Punjab Technical University	

The following are some of the advantages of such Technical Universities (TU):-

- a) Governance: A TU will be able to control and monitor various institutes/colleges attached to it with a proper governance mechanism such as Vice Chancellor, Registrar and necessary infrastructure required for the functioning of TU.
- b) Watchdog: A TU can act as a watchdog in controlling the quality of affiliating colleges/institutes. The governance mechanisms can be established for this purpose.
- c) Centralization of Vital academic functions: A TU can exercise much better control in centralizing various academic functions. These may include:

- i) Centralized admission - For example UPTU conducts its own entrance examination for entry into various affiliated colleges of the university.
- ii) Faculty selection- Being a university, faculty selection at the centralized level will assure quality of the faculty.
- iii) Academic calendar- TU can design an academic calendar which can be administered uniformly across the state. This will ensure uniformity in adherence to schedule and indirectly will also enhance quality.
- iv) Curriculum Design- TU through its structure can administer a uniform curriculum across all the participating institutes. This will ensure same syllabus being followed across the state.
- v) Administration of Examination – This is one of the most significant advantage that TU can administer the examination at one go through the necessary infrastructure and manpower available at its end.

Action Plan for Technical Universities

Based on the issues identified above, the following action plan is proposed for a TU. It must be noted that a hierarchical action agenda is needed to address the issues. The tier-2 / tier-3 institutes must make attempts via a TU to evolve a comprehensive improvement of engineering education to teach relevant hands-on, problem-based, project-based, learning-to-learn, critical - thinking, cutting edge entrepreneurial, team and communication skills.

Quality

Q.1 Quality can be improved by having a standardized curriculum across all the institutes. Various TUs can interact with each other and form a centralized body for uniform curriculum. Today IT can play a major role making such network of TUs realizable.

Q.2 Adopting National initiatives such as NPTEL and MHRD's National Educational Mission on ICT will also help enhancing quality.

Q.3 Regular Faculty Development Programmes through lead initiatives from TU will help in upgrading the knowledge base of the faculty which in turn will help in enhancement of quality.

Q.4 Quality also relates to installation of good performance measurement system. Key performance indicators (KPIs) need to be defined separately at each tier. These KPIs could include: outturn of graduates/postgraduates, number of publications, Patents, technology transfers, service to society etc. These indicators will help in defining quality of HTES. Based on the pre-defined KPIs, a system of Monitoring & Evaluation (M&E) need to be in place. A good M&E system should be able to provide timely, accurate and relevant information to various stakeholders (the stakeholders include but not limited to : Institute, alumni, funding agencies, etc.) to assess the efficiency and effectiveness with which each tier institute is working. Both the quantity and quality parameters need to be monitored properly. The system should also be able to provide a good feedback so that mid term corrections can be done besides suggesting relevant mechanisms for the same. The system could be web enabled and can be made transparent and objective. This will also encourage a sense of accountability and ownership amongst HTES institutes.

Q.5 Innovation, intellectual competition and entrepreneurship are almost totally absent in many good tier-2 institutes as these are not considered integral part of the curriculum and training of young graduates and post graduates. Innovation demands intellectual challenge. Even conversion of a research result to a useful product needs specialized skills that require not only nurturing and fostering but also training and repeated exposures to learn from failures. Institutional mechanisms need to be developed to convert innovative ideas generated by

outgoing students into useful products. This will also help in shifting the focus of student community from employment /package based approach to more mature entrepreneurial approach. TUs can help establish such incubation and innovation centres.

Faculty Shortage

F.1 TU must produce more number of PhDs to meet the shortfall of faculty, especially in areas such as computer science, energy, environment and other thrust areas. TUs can collaborate with IITs/NITs in that area to make this feasible.

There is a need to build demand for PhDs . Industry and R&D centres (such as CSIR, DRDO etc.) can come forward in this exercise. Suitable methodologies for attracting industry in joint PhD programme need to be evolved. The TU can enter into a medium term contracts with industry within the region for this purpose. Sufficient faculty time for R&D and PhD guidance need to be committed by the participating institutes who have matured- Cross-departmental collaboration in Tier-1/Tier-2 institutes need to be promoted.

F.2 A systematic training need analysis programme is to be evolved for faculty development of such TUs. IITs and NITs can come forward in designing such programme. The delivery can be by tier -2 institutes such as NITs for the benefit and up-gradation of skills the faculty of tier-3 institutes of TUs..

There is a need to have specialized national level institutes for faculty development responsible for training, development of pedagogical skills and academic management. These institutes (one in each region- South, North, West East, and Central) will also be responsible for manpower planning and suggest ways and mechanisms in which Tier-1/Tier-2 could assist in faculty development.

F.3 Tier-3 institutes of TU's must engage in production of high quality engineers by

increasing learning outcomes , up-gradation of faculty qualifications, enhancement in industry interaction, periodic curriculum revision, capacity building . IITs/NITs can extend their support to TUs in such endeavors.

F.4 Though it is clear that a country of India's size needs high quality technical manpower, there is a huge gap between supply and demand. According to NASSCOM survey, only about 25 % of output from engineering colleges in the disciplines of IT/Computer science/Electricals is employable! The skills which are expected from graduate engineers are simply not forthcoming from HTES. This requires serious attention. There has to be a nation wide exercise involving experts from academia/industry to draw up a long term manpower plan, especially for indentifying needed faculty vis-à-vis their expertise in line with our S&T policy and Technology policy statement .

Research Focus

R.1 Align R&D with economic needs (power, water management, IT-KPO, environment management, heavy manufacturing, agriculture technology/bio technology etc). Certain incentive schemes for promoting R&D can be evolved in these institutes. An interface body needs to be developed which will act as a bridge between end users(such as DRDO, ISRO, BHEL etc.) and the technology developers Academic institutes, Industry/Industry associations and Government must be jointly involved in developing such an interface body. This interface body will comprise of experts / executives from user industry , government departments /ministry, and faculty members from tier-1 institutes. This body will actively interact with tier-1 institutes to understand their capabilities based on faculty competence, infrastructure and equipment /machines/ software available with these institutes. For this purpose a database of expertise available with tier-1 institutes along with the track record of

projects handled by these institutes need to be documented and made available to the user industries/sectors. On the other hand, professional bodies/industry associations like CII, FICCI, and Automobile Associations etc will periodically gather requirements of the user industries. Once the supply and demand side requirements are articulated, the interface body may meet quarterly to allocate projects which are triggered by the users and which are likely to be designed/developed and delivered by the tier-1 institutes. Tier-3 institutes affiliated to a TU in turn will involve their student base along with scientific project staff to deliver the project outcomes. One can envisage the following benefits from such a mechanism—

- i) Tier-2/3 institutes will be aligned with the end user requirements,
- ii) R&D activity will get more focused ,
- iii) Students will get satisfaction of working on live projects and,
- iv) huge infrastructure at both the ends will be actively utilized.

R.2 Informal or non-formal sector occupies major share in our economy. TU must also engage a part of their research efforts on addressing the issues of this important sector. These issues may include: quality

enhancement. standardization of production/delivery systems. The development of technical manpower for such sector can be delegated to tier-2 /tier-3 institutes.

R.3 Industry interactions for tier-2/tier-3 institutes can be enhanced with initiatives such as offering continuing education programme, undertaking problem solving projects and consultancies on industrial products, services and processes. Testing and calibration facilities can be established at TU in collaboration with industry. Organizations such as DRDO, Railways, BSNL, need to have a formal collaboration with institutes in tier-2.

Conclusions

Technical Education System in our country has grown phenomenally in recent years. A number of colleges/institutes have been established. Looking at the present scenario, some of the states have established technical universities. These universities offer a number of advantages including good governance, centralization of various academic and administrative functions etc.

Technical Universities can play a significant role in addressing the issues of quality, faculty shortage and research focus. Various initiatives are suggested to address these issues.

