

6. STATE-LEVEL TECHNOLOGICAL UNIVERSITY TO PROVIDE GLOBALLY COMPETITIVE MANPOWER - THE NEED OF THE HOUR

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Abstract

The higher education scene in India has undergone serious and fundamental changes over the past 15 years or so. Quality of engineering education for India is a key priority, but it has been dwindling at the state level with mushrooming of Institutes and there is a dire need to revive it. This article addresses the issue and describes the personal views which have evolved over the length of our career as a teacher and researcher in the education and the industrial sectors. We have proposed the guiding principles, design and architecture of a State Level Technological University (STU) to be established by incorporating best practices of all Universities across the state. We have further explained, how it will impact future quality of engineers and thereby provide globally competitive manpower which is the need of the hour.

1. Introduction

Education and specifically technical education should be seen as a long-term investment by a society in its own human resources for the purpose of ensuring its own survival, stability, and well-being[1]. Today, there is a need to fuel the national economy by producing leaders in all sectors of academia, business, industry and government through perpetual innovation on products and processes [2]. The role played by engineers and engineering activities is extremely crucial in the context of economic and industrial development and its impact on society [3]. Tertiary education (technical and engineering) is critical to realize the Indian dream of becoming a competitive player in the global knowledge economy [4].

Time is opportune for India to make its transition to the knowledge economy which creates, disseminates, and uses knowledge to enhance its growth and development. If India plays the cards right, it can become by 2020, the world's number one knowledge production center creating not only valuable private goods but also much needed public goods which will help the growing population suffer less and live better. The 'if' statement is and will be a major condition for success.

Until recently, India was winning the 21st century knowledge race among emerging economies. It has a large pool of individuals who are English speaking as primary language, it has the world's third largest higher education sector which enjoys academic freedom and

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boasts of world renowned centers of learnings [5]. China has closed the gap by achieving near literacy and investing heavily on higher learning to create a select number of world class research universities. Hence India needs to address these issues in terms of both quality and quantity. The higher education scene in India has undergone serious and fundamental changes over the past 15 years or so. University is an institution devoted both to production of new knowledge and its dissemination through teaching of students will in the long run foster economic development and growth. This integral role of a technical University in economic development is illustrated in figure 1.

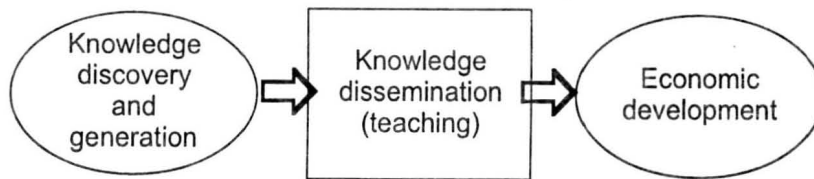


Fig. 1: Role of a University in economic development

A good technical university builds an Engineer who is a professional, has gone through a planned system of learning and training which enables a specific body of knowledge, necessary to solve a host of engineering problems. Today, engineering is a preferred choice for good students at 10+2 level. Competition is intense, resulting in increased demand and hence mushrooming of a large number of engineering colleges [6]. In the last two decades, the higher education scene in India has undergone serious fundamental change as per the reforms recommended by the Knowledge Commission and Yashpal Committee. These reforms were focused on projecting India as a sure shot key to becoming a knowledge society. In 2010, AICTE and NBA has stepped forward with a demand for creating an online database of Institutional level details from existing and new applicants for approvals. It is evident that now information given by Institutes will be authentic;

thus, we can look forward to improved quality of engineering education.

Quality of engineering education for India is a key priority. This must be achieved keeping in mind issues of relevance, costs, equity and international standards [7]. How do we promote quality? What kind of leadership is required at the state level to achieve this quality? Individual stakeholders play a very important role in creating cultures of quality. There is a call to give clear cut directives to the staff so that they are motivated to align themselves to the institute, university and the state goals and give their best. There is a need for monitoring and

evaluation to be a part of all processes, systems and sub systems of the Institution. It is required that all university affiliated colleges, reflect on its practice and commit to a continuous quest for excellence. There is a need to move from relying on best practices, to what C K Prahalad calls, next practices. It is advisable to follow not just the best practices but to develop next practices to blaze a trail and stay ahead of the pack. Quality is a philosophy, it is a journey and it is, what we practice. Technology is forcing change on the roles and models of higher education.

In spite of so many engineers graduating across the country, industry complains of absence of trained quality engineers. Today, even teachers, researchers, academicians and citizens are disturbed by the present state of the technical education system [8]. Measures are needed to enhance the quality and relevance of higher education; so it is more

demand driven and quality conscious. A University needs to form plan to retain highly qualified people. There is, hence, a need for strategic intervention, to create uniformity among Universities and increase industry academia interactions to strengthen engineering education in the state.

This article addresses the issue and describes the personal views which have evolved over length of our career as a teacher and researcher in the education and the industrial sectors. We have tried to maintain neutrality to bring out the essence of the problem as objectively as possible. The idea is to propose introspection into the current state of the technical education in the state and encourage, the well wishers of the academic community to propose a plan of action which is in tune with the state government and central government technical education policies of the eleventh plan. This, in turn, will result in widespread and far reaching corrective measures in salvaging the existing technical education system in the state.

Let us first get a quick feel of current scenario of technical education in the state and the motivation for writing this article, followed by, why we need to make a quality conscious decision at this point in time. We then present the guiding principles which can be used to design a central technical university for the state. Next, we propose the design of a state level technical university along with an ontology based organizational structure followed by an implementation plan for technical education. We end this article with concluding remarks and directions for future. On a personal note, we are aware that our perspective may be limited and is shaped by where we stand as faculty in the University of Mumbai. But we believe that the situation across the state is not far different.

2. Motivation

Across the world, universities are finding themselves facing a new challenge: how not only to equip students with adequate technical

skills but to arm them with skills and knowledge required for leveraging technology effectively in the work place [9]. These are the facets of learning processes, a long term character in personal and social spheres and not training which is geared towards a specific niche skill set. Over the past few decades, many of our universities have remained highly static, resistant to change, unwilling to evolve in pace with real time and focused primarily on their advancement of abstract knowledge.

The number of engineering colleges and universities at the State level is huge and complex. We have been able to overcome issues of fair access and affordable participation by all, to some extent to allow individual potential to be fulfilled. Thus, more state level graduates have got opportunities for employment and to compete in the international arena. There are significant changes in supply and demand of engineers which make it important to ensure that all universities and affiliated colleges are effectively and efficiently governed and managed to meet the needs of the industry and society. Countrywide policies have continued to identify this, as a key to delivery of these national needs to improve quality of learning and teaching output and outcomes.

Many of the Universities in the state of Maharashtra have been looking after a large portfolio of disciplines namely: Science, Commerce, Law, Technology, Medicine, Humanities, Nursing etc. all under one roof. This has resulted in dilution of focus in the area of technology leading to degrading quality or output. In Maharashtra, many colleges have mushroomed, churning out four year undergraduates in engineering disciplines in large numbers, but quality wise poor. Today, technical education in the state of Maharashtra is delivered by various Universities which include IIT, Mumbai, VJTI, NMIMS, Bhartiya Vidyapeeth, D. Y. Patil, Dr. Babasaheb Technological University, University of Mumbai, Nagpur, Pune University, Shivaji University,

SNDT University, Sholapur University, Swami Ramanand Teerth Marathawada University. Many of these Universities follow slightly different admission norms, curriculum, semester pattern, evaluation schemes etc. Each of these universities has best practices in place but may also have some lacuna.

The failure of many of our universities can be seen in every aspect of its operation, and on all four counts; namely, purpose, vision, governance and accountability. Academic stagnation, rigidity of procedures, academicians have no say in the decision making process because of outdated statutes and acts. The most alarming symptom is the declining quality of manpower (academic and otherwise) also the system's inability to attract and retain quality manpower. Another lapse is the number of PhDs required to teach these undergraduates, leading to small numbers of innovations in terms of products and applications. There is absence of dynamism in curriculum design and introduction of new subjects; syllabus is designed by faculty who may not be subject experts and for their own name sake are not willing to take advice from industry experts. Often the syllabus is designed with topics and subtopics ditto from a single book, resulting in providing a very narrow perspective to the subject. It is no surprise that the ultimate sufferers are the students, academicians and hence, all academics as a whole. The need for academia is to act as proactive vigilant force and voice their opinion to shape the academic policies from time to time by having a mechanism of mature debates and process of consensus to guide the policy framework.

We cite a few scenarios here, which highlight the current state of affairs on the technical education front at the University level. Syllabus is set from a single book which a group of faculty may feel is okay without taking substantial inputs from the subject experts belonging to the academic or the industrial sector. Several times, University papers (semester exams) are set with duplicate

questions on the same page and silly/printing mistakes. It is surprising, how these mistakes are not eliminated in proof reading? Are the paper setters so busy that they can't just one single review? Finally, the students get away with getting full marks if they have attempted both the questions. University question papers are, many times, set with standard questions from the last three- five year's papers. Only last three years papers are sent to the paper setter and not the syllabus. How, in the world, does he/she understand the scope of the syllabus? Students find this in their comfort zone; they do not have to study anything except these standard question answers. Even a mediocre student finds this sufficient to pass and even score well. By chance if a paper contains one-two new questions which are not in the standard set, the entire university result will drop drastically. Papers are assessed by the size of the answers and not the content. One example cites where student had written a movie story and has secured four marks out of eight. Often examiners assess 60-80 papers per day. Is this not beyond the time required to read a paper? Once papers are corrected, it may go for reevaluation. Several instances are cited in which at least 60-70% student's marks are modified. What faith do students now have in the examination system at the first attempt of paper correction? One another rumour (?) was cited where an obsolete elective was introduced in a particular branch curriculum by bribing the syllabus committee to satisfy the financial thirst of people who thrive on teaching in classes. These are just a few examples, but there are many more.

Where is the education system heading? The university systems operation needs to be strongly focused on purpose, vision, governance and accountability. There is a need to undergo a major reorganization and physical change to meet the future needs of society [10]. Some lessons can be learnt from the Bologna process, Europe's higher education sector is undergoing the most sweeping reform programme. The 45 signatory governments are

committed to a radical restructuring of university teaching, and to creating what has been grandly described as a European Higher Education Area by the year 2010 [11]. If the reforms are successfully implemented, University teaching could become more efficient and cost-effective, and drop-out rates could fall. Keeping this in view, well thought long term corrective measures are needed to improve the dwindling quality of technical education in the state. Unless quick well defined actions are implemented we stand to lose a long way in the knowledge economy race. In all, it is better to revive the education system before it falls. To deliver high quality education across the entire state in a uniform manner there is a need to incorporate best practices of each University together to build and govern a single State Technical University (here onwards called as STU). It is a single largest state educational enterprise which has the potential for reaching out to the masses.

3. Guiding Principles for STU design

What should be the objective of STU? As quoted by John Gardner in Excellence, 1961, it is necessary to give critical qualities of the mind and durable qualities of character. Technology is changing by leaps and bounds. Today, there is no clear cut idea of the skills which are going to be required 25 years down

the line. So it is important to train undergraduates and post graduates in the fundamental fields of knowledge, inculcate an aptitude of independent learning and equip them to understand how to deal with change. STU shall hence have two mandates; (a) Education or teaching, and (b) technology transfer programs through publications [12]. The first mandate focuses on creating human resource cadre equipped with world class skills to serve the manufacturing sector or the services sector. Now how would do we teach or deliver education? Today students have a shorter learning curve so they have grown toggling multiple forms of media. Hence, there is a need to move away from traditional lectures to interactive mode. Today, students are more open to collaboration, and they are at ease for multi tasking but they also have limited experience in independent decision making. This need must be addressed.

The other mandate of STU is the dissemination of scholarship in the form of technology and to make the work public, by overcoming all technical, legal and economic barriers. Inculcating research culture among the human resource cadre will enable them to cater to design and produce knowledge based products and do systems development as illustrated in figure 2.

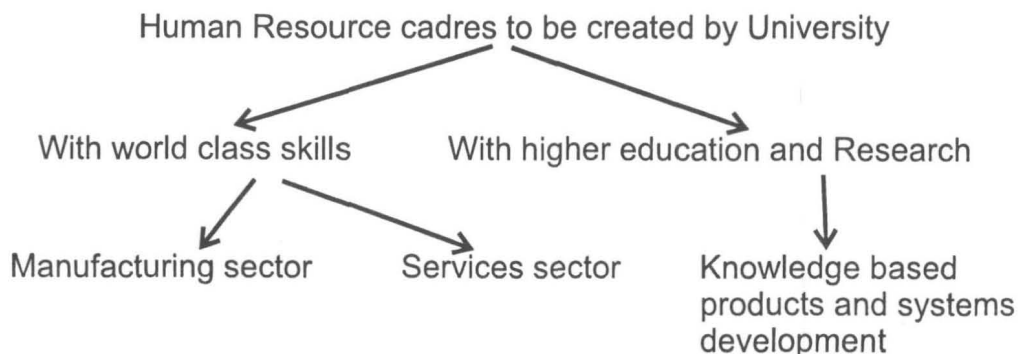


Fig 2: University output

The guiding principles which will gear STU towards becoming a university of excellence and is concerned about competencies and skills [13] are:

- Radical reorganization of the university structure of acts, statutes, and ordinances.
- To follow UGC/ AICTE norms as per say
- For smooth operation it must have an upper bound on size, financial autonomy as far as the affiliated institutes are concerned for the university campus
- No control or interference from the state government in terms of student entry, faculty or staff recruitment , promotions, assessment of faculty which may violate norms.
- Sanity mechanisms: internal and external for safeguarding accountability
- Academicians to control university

governance

- Conscious effort to bring in niche in the organization, young and fresh, capable, creative and dedicated minds which are capable of thinking differently.
- Altruism on the part of the industry/ corporate world. More vision from the government, greater social involvement from the NGOs, mass movements and some long term thinking by everybody. Corporate sector needs to move towards playing a more proactive role in shaping the education policy than just getting involved in skill set based trainings with immediate employability as the only guiding principle.

Overall STU needs to gleam into the future to set the path today with inputs and cooperation from its stakeholders. The main functional structure of STU is depicted in figure 3.

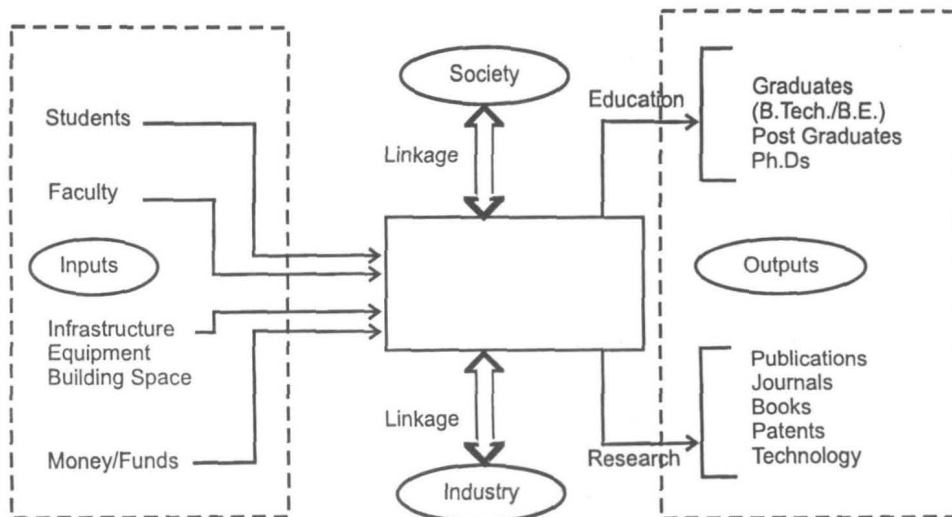


Fig 3: Functional structure of STU:

Clarity of the inputs, linkages and outputs will enable us to design the STU architecture. The inputs to the engineering education include students, faculty, infrastructure, funds. Linkages with industry and society enable STU to get regular feedback to update curriculum, understand market scenario and how placements are happening. The two major outputs of STU are education: graduates, post graduate and doctorates and through research function are publications, journals, books, patents and technology.

4. Proposed STU design

Excellent universities are built by excellent minds, but are not created overnight by just wishful thinking or vision statements alone. However maturation is needed. The specific prerequisites for a quality technical university are: quality faculty, excellent administration, support staff and support structure, and a need to strike a balance between university goals and personal growth of each individual member by creating, nurturing, sustaining an environment which respects human dignity and is conducive to personal growth and excellence. The universities role in education, research, and policy formation and information exchange is necessary to achieving these goals possible [14].

Structure of an education system to be delivered by STU must be prepared by satisfying the following criteria. The core value system of academics and research is to commit to pedagogy, authenticity, thoroughness, perseverance, and excellence to whatever extent possible with originality and creativity and this should not be compromised at all costs. Quality of manpower: academic and otherwise, needs to be maintained. Adhere to standard norms of Teacher student ratio for effective instruction. Optimal organization size (number of students, faculty, support staff etc.) is needed for a lean and efficient structure to enable it to respond immediately to the changing needs of society, technology and times. Adequate administration procedures are required to be

in place, which are geared to support quality academics in an efficient and proactive manner so that the academicians can focus on academics. Literature survey indicates that learning forums (TEQIP stakeholder groups) emphasized importance of working in partnerships and that overlapping interests can support more effective delivery of education to meet the needs of society and industry.

STU design should incorporate good governance mechanism namely which:

- Supports mission and purpose of the individual institutes under the flagship of STU. It needs to have a shared intent in purpose and delivery from all stakeholders. It creates sound, ethical and sustainable strategy which is acceptable to the Institute as a whole and to all its key stakeholders.
- Oversees implementation of This strategy through well considered processes and procedures in an open, transparent and honest manner.
- Governed by AICTE norms for requirements
- What has been mentioned above, is mandatory, not optional.

A single university-STU shall enable all stakeholders to implement and adhere to these guiding principles and standardize the quality of technical manpower development in the state. The STU shall have uniform entry level criteria, internetworking: resource sharing of subject experts and infrastructure; make efficient use of senior eminent faculty spread across the state and contribution for curricular development from industry and alumni. STU would be engaged in all key areas of the state, use a wide range of technology and communication channels with like- minded individuals, localities, colleges across the state. It draws upon faculty, student, administrators who are knowledgeable to adapt to this new paradigm who are willing to lead and cooperate at all levels.

The proposed architecture is as follows:

In this article we focus only on the part of the organization structure which we feel is required to govern the STU from the academic point of view. These are the first level of thoughts and will need more details prior to actual implementation. We explain the structure starting from the Dean level, called level 1 here. Each member in the team nominated from Institutes across the state for a two year full time period (June to May)

- a. Level 1 is proposed to have a separate Dean for each engineering discipline. All these Deans will meet periodically to prepare a plan of action and a reporting structure to align the university governance with the state policies for technical education.
- b. Level 2 is proposed to be the Dean's team which comprises of seven functional and technical experts (called FE here). The functions are listed below:
 - Education: regular monitoring and audits of the teaching learning process, faculty sharing among institutes in need
 - Curriculum development: regular inputs from Industry and alumni to keep pace with emerging technologies, increase usage of elearning and ICT
 - Evaluation: entire workflow from paper setting, paper evaluation, redressal to results analysis
 - Research: regular monitoring of research activity at institutes, encouraging internetworking and resource sharing, improving quality of projects, maintaining database of projects and updating at regular intervals

- Strategic planning: forward planning of department growth, faculty competency development
- Administration: regular administration and college record keeping

Liaison officer: to establish and maintain linkage with industries, alumni and parents, look at technology transfer- funding and community service.

- These FEs will strive to establish policies, processes and procedures to streamline activities in the Institutes to maintain uniformity among institutes.
- c. At level 3, the state geographical area is divided into four zones and each FE will have a representative from each zone. They will meet periodically to focus on standardization and monitoring the specific function at the zonal level.
- d. At level 4, the FE will in turn have a representative from each Institute (preferably Head of the Department) who will attend regular meetings and drive the policies in the Institute.

The proposed architecture is as illustrated in the figure 4, on page no. 61

STU is proposed to be an entity with ever growing and reciprocal linkages to other entities of equal growth potential across the state and will prove useful in aligning state level technical education goals with those of the individual institutes. To achieve academic quality the procedure of STU governance can be categorized into three levels as displayed in table 1:

Fig 4: STU architecture

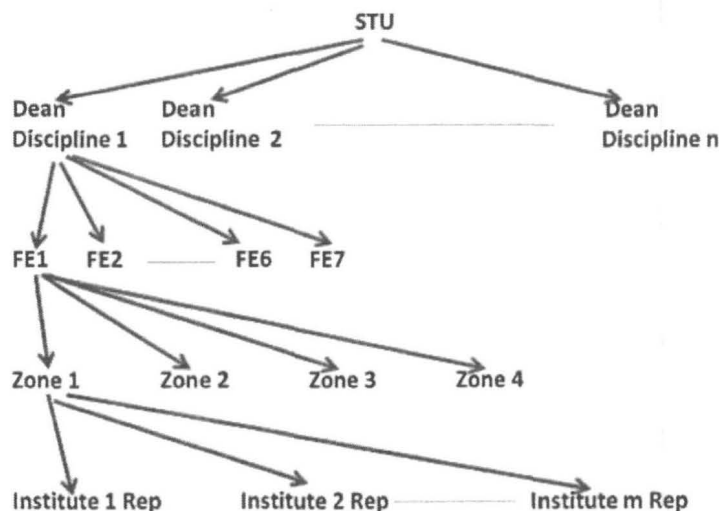


Table 1: STU governance

At the National level (AICTE/ NBA)	At University Level	At institute level (solely managed by Institute)
Well defined Accreditation norms	Policies for institutional governance, admission, staff recruitment, service Curriculum development and evaluation processes Academic monitoring R&D	Budgeting for infrastructure, facilities. Maintaining quality of learning process Placements Supplementary processes

We have presented the first level design but more efforts will be needed to pen down the details.

5. STU Implementation Plan

There is a need to conceptualize the legal foundation for this new model and then align all current universities to it. A common legal framework for governance will be required. Transition will not be an easy task. It requires a culture change among existing staff and students and an uncompromising commitment from all stakeholders. We discuss here, the impact of the transition on specific stakeholders and how we can exploit the change to our benefit.

Strategic planning at the state and institute level is required in terms of alignment with the higher end technical education of the state and the country. A few policies are earmarked here for perusal but there may be more which can be identified on second thoughts. These include:

- Common quality assurance policies and standards internationally benchmarked parameters
- Qualifications specifying knowledge and skills required for employment to establish credible national standards

- Curriculum framework/ subject benchmarks to guide curriculum development, evaluation guidelines
- Student assessment and QIP with institute
- Assessments and certification of skills and competencies obtained through industrial trainings
- Quality and accountability based on outcomes
- Policies and mechanisms for student mobility : intern, intra institute possible
- Framework for faculty appraisal/ faculty development schemes including training needs analysis and funding
- Policies and mechanisms for Industry. Academia collaboration
- Industry investment in education (in kind and funding)
- Industry experts serving as faculty / researchers and faculty serving in the industry
- Industry providing training for students
- Professional development for all staff: to increase capacity to assume higher responsibility in terms of quality assurance, curriculum development etc.
- Policies to define and encourage optimum utilization of resources: sharing of faculty, labs, library, use of technology for effective delivery of courses to support research
- Framework for technical assistance and mentoring for institutes which have lacuna of resources in specific areas
- Policy to tackle faculty shortage

All member teams should meet regularly and conduct themselves honestly, with integrity, lack of self interest and without engaging in corrupt self practices. They should exercise

their responsibilities in the best interests of the university as a whole rather than just the Institute or a personal gain or as a representative and narrow interest group. Deans should check their own effectiveness under regular review using key performance indicators and standard benchmarks.

As far as faculty is concerned, they represent deep reservoirs of knowledge and scholarship across a wide range of disciplines and fields of inquiry. We need to move from just traditional blackboard teaching to using these resources for effective learning in the classroom. No longer can educators hide behind theories, supposition, speculation, opinion or any other comfort zone. Today technology is forcing a change in roles and models of higher education. Nowadays there is ample availability of online resources: online library consortiums like INDEST, INFLIBNET, Lecture recordings by renowned IIT professors in online format: NPTEL and live telecasts by IIT professors: Eklavya channel. Also exhaustive amount of resources- teaching and for evaluation of the learning process are available on the WWW, the time has to come use them extensively instead for reinventing the wheel. Students have to be moved from passive to active behavior. On a lighter note: "The professor's role is evolving from instructor to mentor

"Homework, quizzes and projects will have to be designed in such a way as to require genuine thoughtfulness on the part of the student. That paradigm shift offers enormous potential for advancing educational quality."

There is a need to explore path for successful integration of technology in educational contexts. Gone are the days when it was strongly felt that nothing short of personal contact were a valid learning environment. Technology has forced teachers to focus on quality of curriculum and on the learner's needs. Hence there is a need to bring in content development as an important role of the teacher apart from teaching and we need to now move

from just being a campus based environment to an online learning environment.

Some pointers on the research function:

Today research in various university–colleges is scattered in silos; [15] there is a need to bring them together, integrate, consolidate information and carry out research on top of this information. Subject area hubs can be demarked as meeting points or locations across the states [16]. There is a need to move towards the University research function and broadly focus on three important aspects of research:

- Research and development: accumulation of ideas through convergent processes of learning and knowledge codification
- Research and teaching: research function to develop teaching material and enhancing skills of teaching staff
- Research and learning: apart from creating new ideas development of researcher's skills and knowledge

It is necessary to focus on projects quality improvement and learn from new research and foster evidence based projects and experimental work. It may be a good idea to build a repository of projects which are open for modification and in today's market context existing project enhancements- is the much required skill. The liaison officer can focus on the technology transfer function to identify commercial applications for discoveries made by university faculty to realize revenue in the process.

The challenges in STU implementation are fundamental and complex. But there is a sense of urgency and commitment to deliver these policies and practices pertaining to good governances.

6. Conclusion and Future Directions

In this article, we have presented a quick feel of current scenario of technical education

in the state and the motivation for writing this article followed by why we need to make a quality conscious decision at this point in time. We have then presented the guiding principles which can be used to design a State Level Technological University to build quality engineers. Next we have proposed the design of a state level technical university along with an ontology based organizational structure and the implementation plan. STU is one of the feasible solutions to improve the quality of technical education in the state by bringing in uniformity in policies, processes and governance to align the University goals to state level higher education goals. If STU is implemented and governed in the right spirit we shall be successful in achieving these goals. However STU design, architecture and implementation needs to be chalked out more in detail and transition can be planned phase wise for its success. We are sure that academicians and other stakeholders will look forward to this plan.

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