A Design for Quality Improvement in Remote Higher Educational Institutions using Technology and Knowledge Management – an Indian Experience

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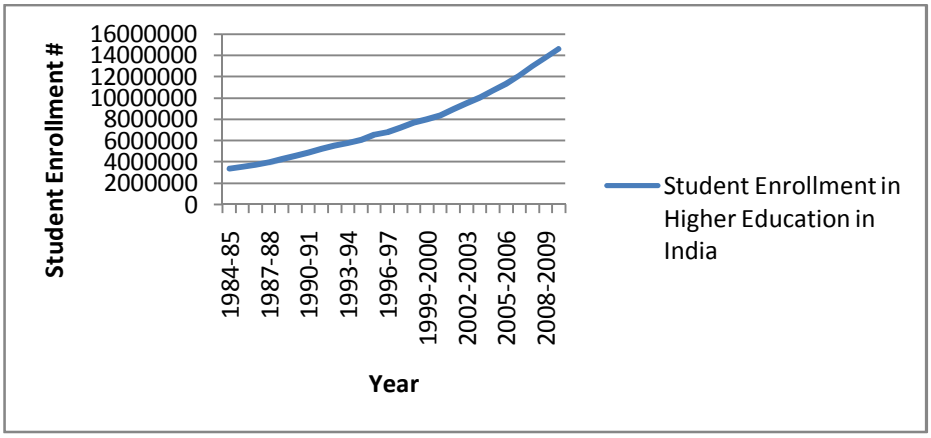
Abstract

The current requirements for learning in developing nations like India are posed with the challenges of quality, quantity and equity. As we have not yet equipped ourselves enough, to cater to these increasing demands, there is an increasing gap in quality between the desired and the actual. This requires a system level solution, with appropriate combination of people, processes and technology. Architecting the solution empowered by technology and accelerated by Knowledge Management (KM) is a key requirement which is the focus of this work. Based on a comprehensive study of the KM best practices across three learning related application domains and deep analysis of the requirements of educational institutions facing these challenges, we present our KM conceptual design and the roadmap towards implementation. We have designed this for a group of engineering institutions located in a remote area which has large demand for quality education but without adequate local expertise to address it, which is the critical challenge of Indian education system today and to a large extent that of the developing world.

1. Introduction

Having seen the correlation between educational qualifications and the economic rewards, there has been a natural upsurge in the aspirations of citizenry of developing nations like India, which has resulted in a nonlinear increase in the enrollment in higher educational institutions. Figure 1 gives the plot based on statistics available in the University Grants Commission Report [1]. While it may be gratifying to see these numbers and its trends and a lot of efforts being taken to significantly improve the Gross Enrollment Ratio (GER), there is a serious concern when we see the quality of education offered. The poor status of the quality in Indian Universities is quantified in another UGC Report [2]. A much more recent survey [3] on the employability of the students from Indian Engineering institutions has reported that less than 18% are employable in the Information Technology (IT) services sector and less than 3% in IT product companies. Though IT employability is not the main goal of an educational institution, these data gives us some basis to validate the subjective opinions of experts in the system, which is also on similar lines. The report also states that the employability of the students decreases logarithmically with the increase in the number of engineering institutions. While increase in GER is important in the growing knowledge era and the economy, it is equally vital to keep up the quality of the system and its outcome. Now that the system has not been planned or implemented adequately enough to this large growth in the learning requirements, there is a challenge to the quality of the number-wise growing educational sector.

Figure 1 – Student Enrollment in Higher Education in India

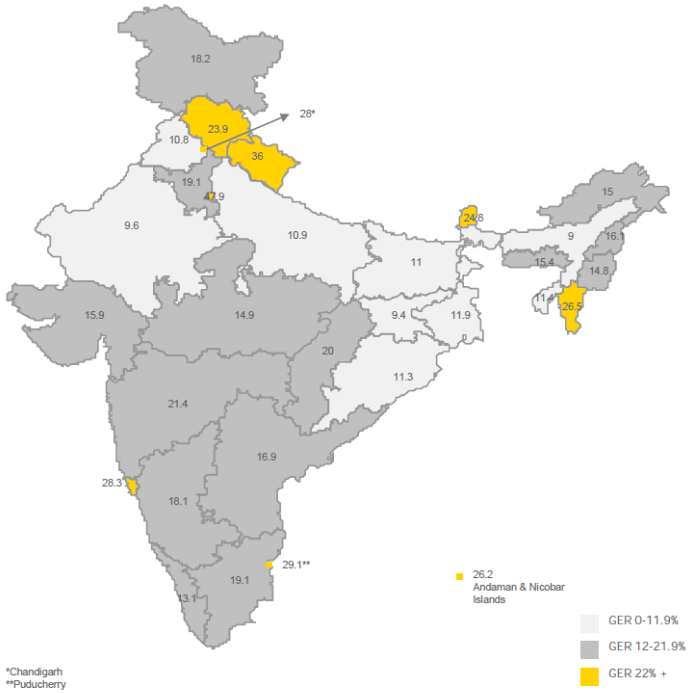


Source: University Grants Commission Report [1]

1.1 Challenges for Quality Higher Education in India

Federation of Indian Chambers of Commerce and Industry (FICCI) Education summit's deliberations on Higher Education in India: 12th Five Year Plan and beyond, have reported[1] [4] the following challenges.

Figure 2 - Gross Enrollment Ratios of Indian States – 2010 [4]



Source: FICCI Higher Education Summit 2012 Report [4]

[1] The data inputs have come from many UGC reports, Ministry of Human Resource Department, further compiled by Ernst and Young at the behest of FICCI and Planning Commission of India.

- Expansion
  - India's GER of 16% is far less than the world average of 27% (2010)
- Equity
  - Wide disparity in GER across states (47.9% in Delhi vs. 9% in Assam)
  - Gross Attendance Ratio (30% in Urban and 11.1% in Rural Areas)
  - Differences across communities and gender
- Excellence
  - 40% and 35% shortage of faculty in state and central universities, respectively
  - 51% of Professor positions lying vacant in central universities
  - National Assessment and Accreditation Council (NAAC) 2010 statistics report 62% of universities and 90% of colleges are either average or below average.
  - The citation impact of publications from India is half the world average.

Our responses to these challenges are presented in this work as follows. Section 2 describes the growing technological reach. Section 3 introduces Learning and Knowledge Management. Section 4 provides our KM conceptual solution. Section 5 describes our roadmap for quality improvement. Section 6 presents further challenges and what we are looking for, Section 7 summarizes this work, Section 8 concludes this paper and Section 9 lists the References.

2. The Technology Environment

Table 1 gives the snapshot of the statistics of Indians using Internet. Given the current penetration and the rate at which it is growing, we can see that the internet platform is opening up huge possibilities.

Table 1

Internet Usage Statistics India 2012			
Description	**Quantity**		**Source**
Population	1205	Million	Internet World Stats
Internet Users	137	Million	Internet World Stats
% of Internet Penetration	11	%	Internet World Stats
% of world users	5.7	%	Internet World Stats
Mobile Subscribers	904	Million	IAMAI & IMRB /TRAI
Mobile Users	78.7	Million	IAMAI & IMRB /TRAI
Age Group 15+	62.6	Million	Comscore
% of Youth (15 to 35 Age) of 15+	75	%	Comscore
% of Yearly Growth	41	%	Comscore

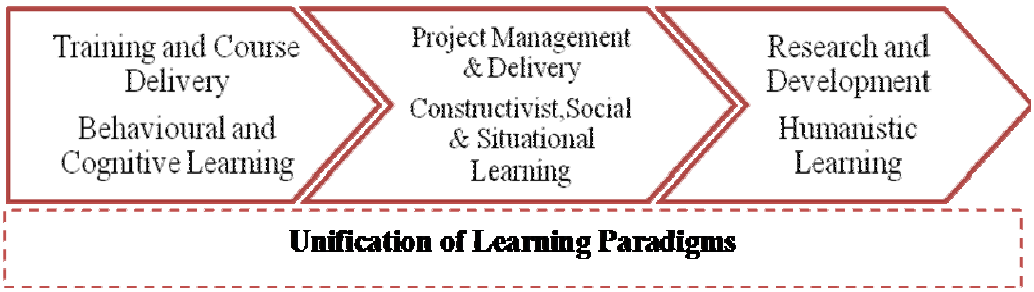
The large percentage of the youth users is noteworthy, when we are looking for new avenues for higher education. These users are agile, technology savvy, willing and are ideal for experimenting with and adopting new learning paradigms.

Even among the employed workforce, a recent survey [8] reports that India today consists of a highly motivated and self-reliant workforce aspiring for appropriate training. Another trend worth noting is that while 79% have taken up classroom training, 58% of people have *also* experienced online training. The Cegos Asia Pacific survey also reports that India is the greatest user of smart phones for learning. This suggests that while classroom training is still preferred, there is a significant scope for usage of technology for learning.

3. Learning and Knowledge Management:

As educational institutions are to systematize learning, we look at Knowledge Management (KM) as an effective accelerator for maximizing learning with the appropriate use of people, processes, structures and technology. The research thesis [9] studies the literature on diverse orientations to learning and arranges the varying learning paradigms to different stages of learning and maps them to appropriate domains whose characteristics matches with each learning stage. In order to address learning comprehensively, this work, structures the major learning paradigms into three phases. Learning which affects the behavior and cognition at the first phase is the main objective of the training and course delivery environment. The next phase focused on constructivism, social and situationalism is predominant in the project management and delivery environment. Humanistic Learning, which is predominant in the Research and Development environment, happens at the third phase. These orientations of learning appear diverse if perceived in isolation. In the effort to systematically place them with respect to the natural evolution of the learning process in the learner, each of them get placed appropriately in different phases or stages, depending mainly on the objective and the current position of the learner. Thus the underlying unity in the diverse learning paradigms has been illustrated in this work.

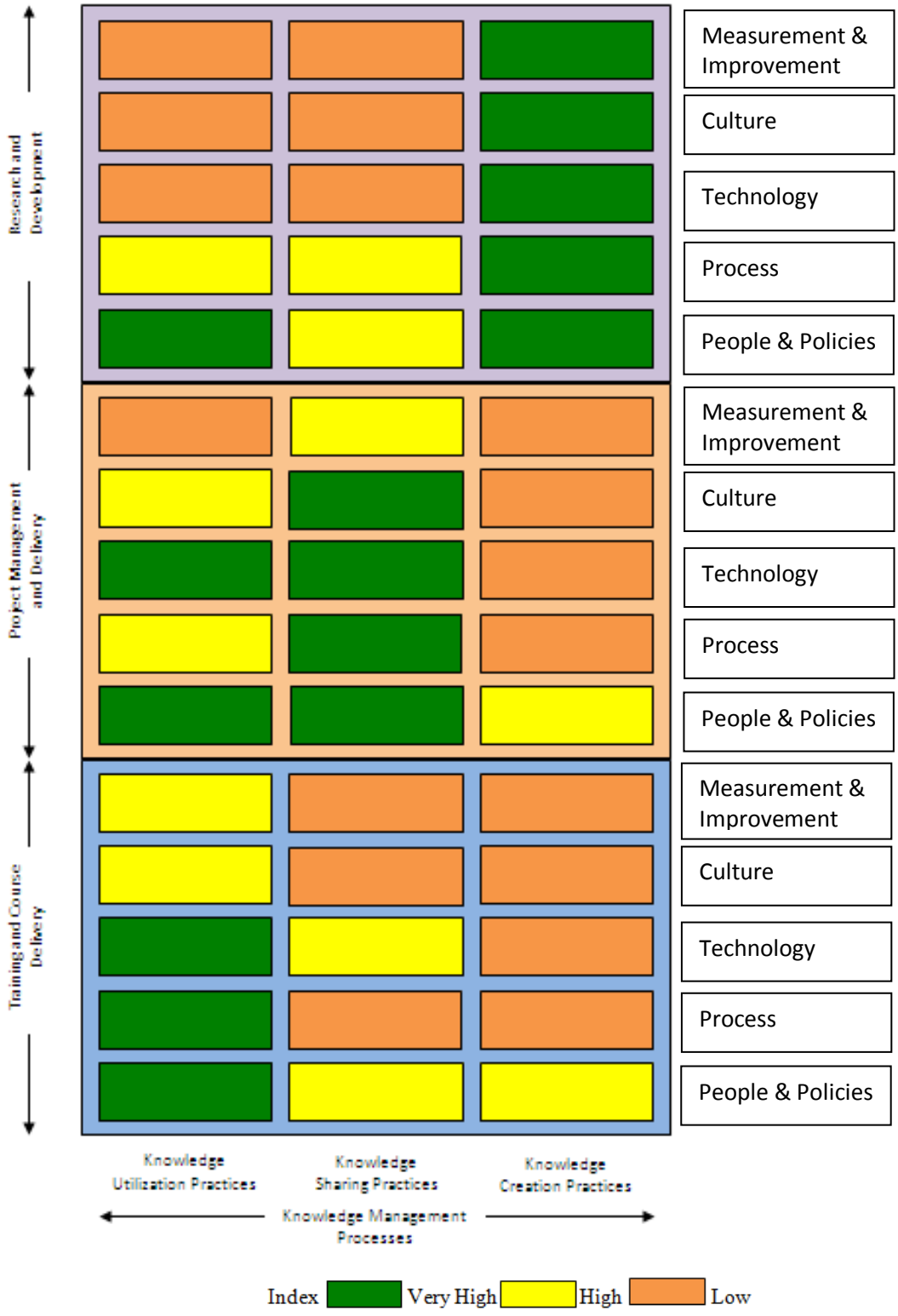
Figure 3 Learning Unified



Extensive analysis (surveys, focus group study, content analysis and in-depth interviews) of the issues in the current learning ecosystem (University, affiliated engineering colleges and educational media organizations) resulted in pointing out the strong presence of KM drivers and low to moderate presence of enabling conditions. Hence as the next logical step, the KM best practices in each of the three environments were studied using case study, grounded theory and secondary research data.

The three environments / KM application domains studied in this work and the findings are: Educational Media catering to Training and Course delivery is strong for Knowledge Capture and Dissemination; IT Services Industry catering to Project Management and delivery is strong for Knowledge Sharing and Application; and R and D Institutions catering to Innovation and Research is strong for Knowledge Creation and Utilization. The study also resulted in yielding out the KM best practices (Figure 4) with respect to three major life cycle processes of Knowledge Utilization, Knowledge Sharing and Knowledge Creation.

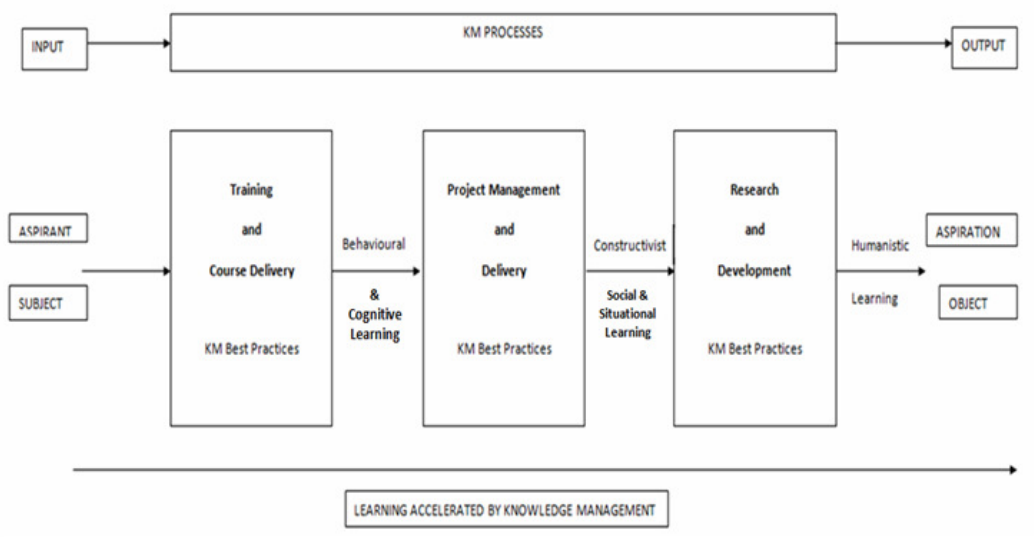
Figure 4 - KM best practices



4. Solution Design

Integration of the KM best practices in these three application domains and mapping them with the appropriate learning stage is the foundation on which this design has been built as is shown in Figure 5.

Figure 5 – Conceptual Design



Accordingly we plan to make use of the best practices detailed in [9], a few of which are captured in Table 2; of knowledge capture and dissemination from various educational initiatives; Knowledge Sharing from IT Industry; Knowledge Creation from Research and Development institutions. We need all these KM lifecycle processes and best practices for building and sustaining a holistic learning environment in educational institutions.

Table 2 – Knowledge Management Best Practices

Knowledge Dissemination Practices From Educational Media	*Knowledge Sharing Practices From IT service Industry*	*Knowledge Creation Practices From R&D Organizations*
Prominent Subject Matter Experts Identification facilitates easy high quality content generation and distribution	Committed leadership to drive Knowledge Sharing initiatives. Cleary defined KM roles and structures	Thought Leadership, driven by intellectual pursuit and peer recognition – recognized by publications, awards and other Intellectual Property Rights
Wide variety of distribution mechanisms empowered by technology for access	Leadership demonstration of commitment & competence, open communication, conversations in common language	Policies and practices to partner with premium institutions and colleagues across regions
Servers with mirror sites and advanced search options for structured and unstructured	Distributed model of creating knowledge – crowd sourcing, encouragement to seek and	Periodic informal team meetings and variety of brainstorming formats

knowledge	share, transparency	
Availability of tools to do easy content / document management and distribution of knowledge	KM seen as potential enabler of every function of the organization	Allocation of adequate funds for long term new research domains, that does not warrant immediate results
Relatively high centralization enables easy monitoring, measurement, control and continual improvement	Encouragement for collaboration, organizational KM campaigns – awareness, promotional activities and recognition	Sponsorship and encouragement for higher studies, conferences / seminars, sabbaticals, visits to other R&D organizations etc...
Open and free content	Heavy adoption of interactive technologies including web2.0, pulling together to achieve shared objectives	High degree of flexibility, support for learning from mistakes
Ensuring quality of content	Periodic analysis and reporting of trends	Culture facilitating innovation and supporting co-creation.

5. Roadmap for Implementation

Having arrived at the design, in order to realize KM effectiveness, there is a need for Knowledge Management System (KMS) road map. Towards this, a prescriptive framework, derived from the existing descriptive frameworks (APO 2009[10], ISO 9001:2008[11]), and the results and inferences from the study [9], are presented as follows:

It starts with core People (Leadership), specifying the Policies. In accordance with the directions specified in the Policy, the Processes and supporting Procedures and Guidelines have to be defined. The necessary Technology has to be either acquired or developed. Training has to be provided to the entire Team and the users to ensure that all the stakeholders understand all aspects of the KMS including the use of Technology. Continuous Practice of this results in internalization of the KM Practice as KM Culture. As with any quality process, the effectiveness of the KMPs has to be measured by using appropriate Metrics. The measurements go as feedback to the periodic Knowledge Management Review Meeting for necessary corrective / preventive actions, review of the Policies and Objectives for Continual Improvement. As KMPs sustain their momentum in this stage and beyond, the performance of the KMS results in the seamless achievement of the KMSs objective of bringing the learner and his object of learning together.

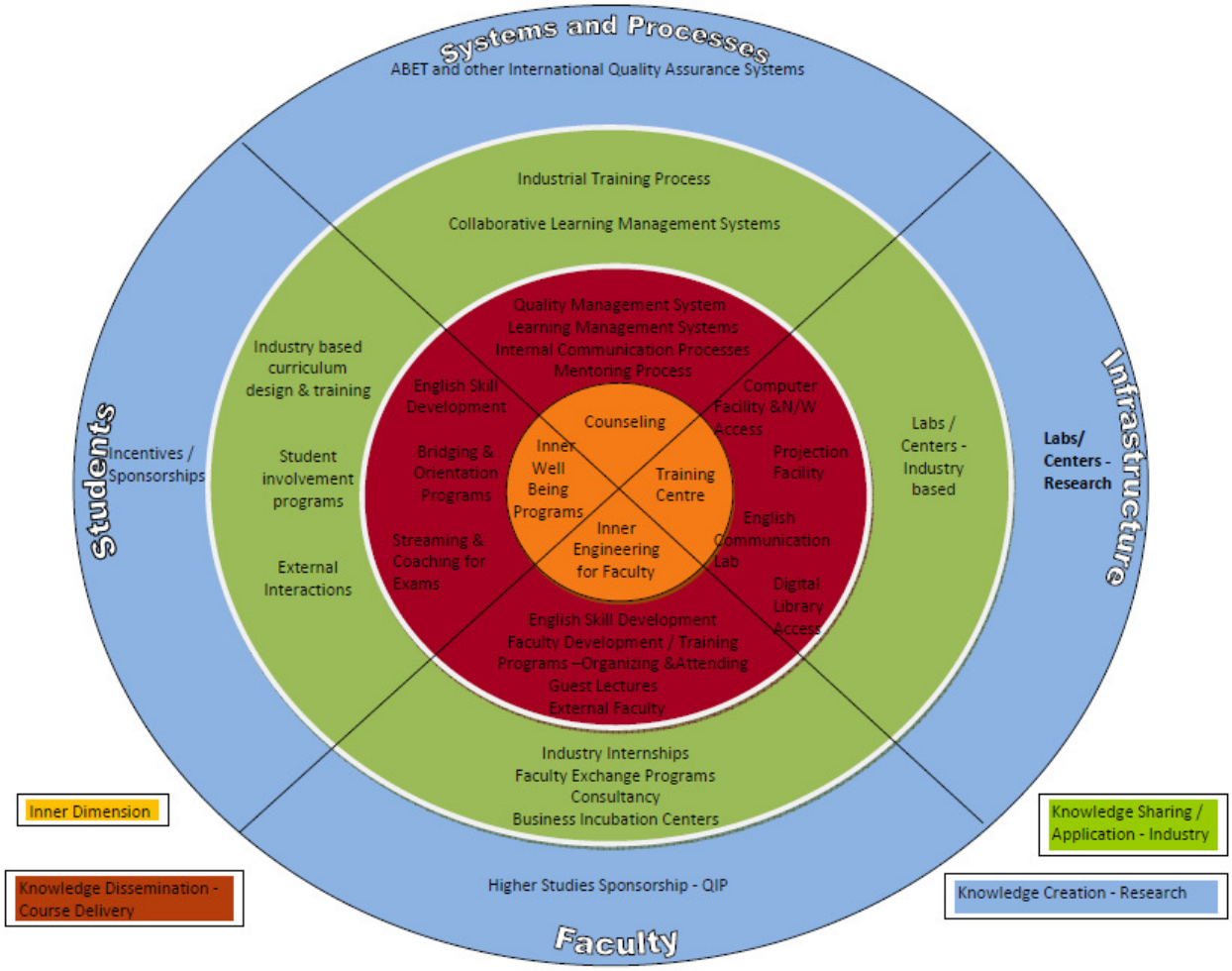
5.1 Quality Improvement Plan – A Specific Case

In this section, we present the plan for the initial phase of interventions for improving academic quality of a group of engineering institutions, which form our immediate focus. The group has five engineering colleges with a total of around 7300 students and 484 faculty members, in the Salem – Tiruchengode region of Tamilnadu, India. One campus is near Salem, another near Tiruchengode and the remaining three are located on the road from Salem to Tiruchengode. The students and faculty are largely from Namakkal, Salem districts of Tamilnadu. These colleges are all affiliated to Anna University and together offer 7 undergraduate engineering programs, 5 postgraduate engineering programs and Masters Programs in Business Administration and Computer Applications.

Our objectives have been to continually enhance the learning ambience in each of the following dimensions:

- Inner (Dimension) Way / Isha Yoga for Inner well being [16]
- Course Delivery / Knowledge Dissemination
- Industry Practices / Knowledge Sharing and Application
- Research and Development / Knowledge Creation

Figure 6 – Quality Improvement Plan



To meet the Quality Objectives for each of the four stated domains, quality improvement processes have been defined for each of the following aspects and are being continually improved:

a. Faculty
b. Students
c. Systems and Processes
d. Infrastructure

Figure 6 highlights variety of phase one interventions planned (from center- outwards) spanning the aspects defined above. These have been arrived after a deep study of the existing status, the environment, the availability of resources, and the objectives of the various stakeholders of the institution. It should also be pointed out that there are 520 engineering colleges affiliated to Anna University of Tamilnadu, India following the same curriculum and the examination system. The design of the KM based learning solution presented in this paper, can easily find applications in any of them and the broader framework can be applied to any learning based organization. However the specifics (proportions and combinations) of interventions will have to be customized to each institution depending on its current state, its environment and its objectives.

5.2 Technology Based Interventions

As technology forms a special focus of this paper, we would like to present further details on the same. As presented in Section 2, there is a prevailing technology infrastructure, which provides us the opportunity to roll out our KM dissemination and sharing solutions. In the institution where we have planned the implementation, for example, we have a phased availability of tablet computers to all students, wifi enabled campus and adequate multimedia servers. We have identified a service provider who has consolidated, categorized much of the educational video content available from MIT [12], NPTEL [13], Khan Academy [14] etc… The same service provider also registers the students and pushes the content to a variety of end devices available with the students. All these above services are for free to the institution and the students. The service provider gets his revenue from the usage statistics of the students. These statistics about students with various profiles of learning are passed on to their potential employers, who provide for the income of this service provider. The active student also gets an employment avenue, while he benefits from technology based learning facilitated by this service provider. There are also service providers who provide content for improving employability, who will also collect and use statistics of the registered students for the same purpose. In addition there are online service providers who administer employability and other aptitude tests, to test and measure the skill sets of the students. The results could be used to do SWOT analysis, to offer bridging courses, and to offer career guidance.

While the service just described will only satisfy large scale dissemination of content from one to many, it may not serve for much interactivity, networking, collaboration, sharing and problem solving. This would require a different level of a knowledge sharing platform, which would allow for identifying the right set of people, to see posts on a certain topic, identify domain experts, connect to them, post queries and have conversations. This same platform can also be used for posting a problem, so that the entire audience (crowd) will come with innovative

solutions for the same. In this way the technology can provide the platform for knowledge sharing and creation. We have also identified a tool [15] which has been successfully used in the IT service industry for a similar purpose of leveraging the wisdom of the experts across different geographical locations and the crowd for solving business problems. We have planned to use this tool for connecting experts in the academia and the industry with students and faculty of the target educational institutions for special training, project work and for facilitating the people connections for joint research. The same tool can be used for program managing our interventions across multiple campuses.

6. Challenges and Future Work:

While we have reasonably addressed the technology aspects of the solution, challenges remain in the process and people front. The standard processes with respect to learning and KM require customizations to the specific environment. Hence the time required for understanding the learning and KM requirement and tuning our processes (including pedagogical changes that will be required) and technology, is the next step. People aspect of the solution, however, remains the biggest and the most critical challenge in this endeavor. As our objective is to take the faculty, system and the students together with us in this exercise, we have taken a multipronged approach involving all stakeholders. Given the technology savvy and agile nature of the students, it should find easy adoption with them. Convincing the top leadership on the benefits of the solution, should get the necessary support for causing the changes in the system. There is a significant new requirement in the transformation of the role of faculty. A large percentage of faculty time and effort has been conventionally, on knowledge delivery. Now that much of it, over a period of time (initial overheads would be there), could be handled by technology on/off line, the faculty will be required to take up multiple new roles. At the lowest level of intervention, the faculty might have to just facilitate the learning. He might have to then pose innovative problems and methods of solving them. He might have to trigger curiosity in the students and inspire them for their self- learning using the existing learning resources. To initiate, orient, train and systematize such transformation in the faculty require more subtle work, which is the challenge that we are looking forward to handle.

7. Summary

This work started with a deep analysis of the requirements of higher education in India, identified its critical challenges and presented the changing technology landscape which opens up unprecedented opportunities to meet out the challenges. In the search for solutions to variety of learning requirements, we unified the existing learning paradigms - hitherto seen as diverse, mapped the main KM lifecycle processes with each stage of learning, integrated the KM best practices and applied it to develop a quality improvement plan for a typical higher education institution - facing these challenges. An implementation roadmap that has appropriate people, processes and technology based solutions, has been laid out. We presented details of technology based interventions, further challenges and our broad approaches in resolving them, and concluded with the critical requirement of pedagogical changes and faculty role transformations required in this context. We look forward for learning (including its application) various methods of catalyzing this phenomenon in institutions of higher learning.

8. Conclusion

Technology has connected us like never before, and is going to be increasingly so in the future. Any student in any corner of the world will soon have the opportunity to listen, watch and may be - take up a course from the best of the faculty of the world. Technology however has its limitations. What is designed for one type of an educational system from where the content is mainly generated, may not as such suit the requirements of the rest of the world, where there is a very large audience. Large scale customizations are needed to suit different types and stages of the educational systems of the world. This will require adoption of conscious KM program in all its key life cycle processes of creation, sharing and utilization. Such processes have to be followed by all the entities involved; benevolent institutions generating the content, service providers and users. It does not matter how much level of sophistication we reach at, given that each student is unique, there is no easy way for technology and processes alone to satisfy the learning requirement of a learner effectively without human intervention. A faculty would always be required to do that for varieties of students. He will be required to kindle the curiosity, show the way, help solve the problems, and inspire the learner towards the cherished objectives. This role requires continual adaptation based on the state of the student, learning objective, technology and that of the system. As in computer science, this non determinism is where our most critical challenges remain and will keep us driving this continual process.

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