Chapter VI

EVOLUTION OF AN OPEN HIGHER EDUCATION MODEL
BASED ON SOA PRINCIPLES

“When you have eliminated the impossible, whatever remains, however improbable, must be the truth”

- Sir Arthur Conan Doyle
Chapter VI

Evolution of an Open Higher Education model based on SOA principles

6.1 OVERVIEW

Based on the study and analyses in the preceding chapters, there is an articulation of the need for a complete framework or architecture of learning with the preferences, choices and features that have been detailed in the previous chapter. World over, as also to some extent in India, a large number of such ‘Open Education’ efforts are being undertaken. This is indeed a healthy, welcome development. The concluding chapter of the book “Opening up Education” states, “We urge that in the future, the energies and resources of initiatives, institutions, organizations, and foundations involved in educational strategy-setting be directed toward addressing these opportunities that may recast the role of the university and formal education in light of an open world.” It is against this background and the specific context of countries like India that the model has been developed. If these initiatives are to really serve the huge demand and unmet need that plagues India, such efforts would need some structuring, rule-setting and scaffolding.

6.1a SAKSHAT – the portal of the National Mission on Education through Information and Communication Technology (NMEICT)

In the eleventh plan, a major stride has been taken in the form of the National Mission on Education through ICT. With a total cost of Rs.4,200

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1 ‘Opening Up Education: The Collective Advancement of Education through Open Technology, Open Content, and Open Knowledge’ Edited by Toru Iiyoshi and M. S. Vijay Kumar The MIT Press, Cambridge, Massachusetts
Crores, this is a major program of the Ministry of Human Resource Development, which aims at addressing issues of e-learning across the entire spectrum of education in a systematic manner.

The central part of this mission is the portal, Sakshat\(^1\), which is a one-stop education portal. Among the various aims and objectives, it also seeks to be an enhancement tool for the value and quality of those students who may not have obtained admission into the top schools of the country.

As described in detail in the mission document, the objectives of Sakshat are stated\(^2\) as follows:

‘In order to bolster our knowledge resources, to obtain and maintain the competitive edge in the world, we require a system of identification and nurturing of talent and lifelong learning. Knowledge modules based on the personalized needs of the learner would need to be delivered to him / her at the right time with the right content interactively to take care of his / her aspirations. In due course of time there would be a need to develop and maintain the knowledge and capability profile of every individual learner / worker. Such a system would have to be developed in a cost effective manner over a period of time, integrating, inter-alia the following objectives:

1. Effective utilization of intellectual resources, minimizing wastage of time in scouting for opportunities or desired items of knowledge appropriate to the requirement,

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\(^1\) http://www.sakshat.ac.in/ viewed on 20\(^{th}\) July, 2011.

2. Certification of attainments of any kind at any level acquired through formal or non formal means in conventional or non conventional fields,
3. Any-time availability of desired knowledge at appropriate levels of comprehension to all for self paced learning,
4. Platform for sharing of ideas and techniques and pooling of knowledge resources.
5. Systematically building a huge database of the capabilities of every individual human resource over a period of time,
6. Scholarship / Talent management including identification, nurturing and disbursement electronically.
7. Nurturing of scholars and learners.
8. Support to all the learners / workers for any of their perceived learning needs,
9. Extensive leveraging of the advancements in the field of ICT for taking the knowledge resources to the door steps of the learner,
10. Capability to handle the user base which would ultimately be expected to cross 50 crore in the long term.
11. Use e-learning as an effort multiplier for providing access, quality and equality in the sphere of providing education to every learner in the country.
12. Provide for Connectivity & access devices, content generation, personalization & mentoring, testing & certification and encouragement of talent.
13. Bringing efforts of different interested agencies working in the field of e-learning under one umbrella and establishing logical linkages between various activities.
14. Capacity building in this sphere and utilizing dormant capacities of various organizations. Creating infrastructural facilities for long term utilization and making sustained efforts for content generation & connectivity including access devices production.

15. Encouraging research in **spheres covered by Mission activities**.
Creating a large number of networks of experts in various fields to carry forward the gigantic vision under this Mission.

16. Providing e-books & e-journals, utilizing the repository of contents generated so far and the automation of evaluation processes. Creating a high impact brand for e-Journals in leading disciplines with a provision for good incentive-based payment to the researchers publishing their high quality papers in these e-Journals.

17. Spreading Digital Literacy for teacher empowerment and encouraging teachers to be available on the net to guide the learners.

18. Multi-lingual content development for the learners more comfortable in those languages.

19. Voice support for educational material delivery and interactivity for the content on the portal.

20. Development of interfaces for other cognitive faculties which would also help physically challenged learners. These efforts may cut across all the content generation activities.

21. Conversion of existing educational tapes into indexed formats compliant with the internationally accepted standards such as **SCORM (Sharable Content Object Reference Model)**.

22. Launching a national movement for content and question generation.
23. Development of GIS (Geographical Information System) based resource inventory as a knowledge base (for subjects and skills where ever possible / feasible) for educational and planning purposes.

24. Improving teachers' training and course curriculum.

25. Providing **Digital/Information Literacy** for teacher empowerment.

26. Creating a clearinghouse cum rating agency for various web based learning contents for guiding Indian learners.

27. Establishing a credible rating institution for knowledge content available on the Internet utilizing the large expert base, which would get collaboratively networked through one of the sub Missions of this National Mission.

28. Preparation of metadata and timed index preparation for educational video / audio content on tape or other media.

29. Credit based flexible module formulation for openness to qualifications and easy transfer of credits from one programme / course to another.

30. ERP (Enterprise Resource Package) and e-Governance for education.

31. Development of pedagogical techniques based on edutainment.

32. Customisation of Open Source Tools etc.

33. Development of robust models of networking to encourage community participation at local levels.

34. Content delivery through EduSAT and narrowcasting of TV signals. Providing 1000 DTH (Direct to Home) channels on 40 transponders [to be availed through the Department. of Space] so
that a separate DTH channel is available for every subject for every class in various languages to the extent possible.
35. Development of DTH platform for EduSAT and cheaper equipments for two way connectivity through satellites.
36. Providing e-Learning support to every higher education institution for technology assisted learning.
37. Setting up virtual labs and lab centers and finishing schools for quality enhancement.
38. Development of cheap access devices to make them affordable for every individual.
40. Developing reliable identification systems for learners and examiners and also developing model testing centers to test the learners under controlled environment.
41. Developing very low cost, low power consuming wireless mesh [Institution of Electrical and Electronics Engineering (IEEE) 802.11 standard or better] or point to point long range communication [IEEE 802.16 standard or better] capable robust video servers to act as communication and computational hubs at educational institutions.
42. Development of devices for achieving convergence among connectivity technologies.
43. Standardisation & Quality Assurance of e-Content.
44. Facilitating development and deployment of ultra low cost physical tool kits for engineering and science students to encourage project and design based learning complementary to the e-learning.
45. Deriving lessons from our ancient knowledge base.
47. Guidance to learners through various psychological / personality tests.
48. Coordination and synergisation of knowledge related activities of different Ministries and organizations.

This is a very exhaustive list of objectives. While such delineation is very heartening, the question of how many of these would be actually taken up for implementation is a question to be addressed. This is specifically in the context of the NMEICT. A mission usually has a specific set of objectives and deliverables with a specific period for the implementation.

Nevertheless, this is a list of various areas related to e-Governance and specifically e-learning which would need intervention by the mission and other means, over time.

The main components of the Mission include the education portal, connectivity related work, collaboration related activities, wherein all Institutions of repute in the country would be directed to collaborate, mapping of human resources and skill gaps and development of content in the local, vernacular language.

The mission document lays down details and the strategy for the fulfilment of its objectives in detail. Of these, this research is specifically focused on the NPTEL program with its deliverables, components, financial implications and road map. While the vision has been articulated with clarity, the actual mechanism for delivering these e-Governance services are to be detailed. This research actually takes this specific niche area, studies the implementation of the NPTEL and other e-content program across Gujarat and also seeks the inputs, preferences, choice and feedback of students of such programs. Based on the study
and feedback, various analyses have been attempted in the subsequent chapters. This has also culminated in the evolution of a model based on the SOA design for actually carrying out some of the deliverables of NPTEL as articulated in this document and as indicated by the students and faculty members as a part of this current study.

The main components of Sakshat are described in the following paragraphs as detailed in the mission document.

1. The education portal or Sakshat, a one-stop shop for educational content would also address issues such as the scholarship programme of the Ministry of Human Resource Development and ensure disbursement of Scholarship electronically. It would promote multi-institutional involvement for research activities and dissemination of quality awareness. Setting up of virtual laboratories, lab centers and finishing schools would be encouraged and facilitated by the Mission, so that the learners in the distance education system and those in remotely located educationally backward areas can reap the benefit of quality and relevant education, through ICT.

The Mission would work and extend support for building the knowledge network among the institutions of higher education and seamlessly integrate with the integrated National Knowledge Network in the country in order to ensure free availability of the above mentioned knowledge – e-content to all users / learners throughout the country using all possible channels such as internet, intranet, EduSAT or narrow casting TV signals, Direct to Home (DTH) platform. To ensure access of the knowledge e-material to students, the Mission shall work for providing access devices
(computers) and broadband connectivity to all educational institutions of higher learning.

2. Connectivity related work: In order to provide unfettered access to existing educational institutions, they all should be connected through MPLS VPN (multi protocol label switching - virtual private network). In this VPN, hundred premier institutes and universities should be connected via 1 Gbps access links (equivalent to 2000 number of 512 kbps VPN endpoint). All other 18000 educational institutions and colleges should be connected through 10 Mbps access links (equivalent to 20 number of 512 kbps VPN endpoints). These access links will also provide internet access to the participating institutes. Also, 10 free DTH TV channels will be setup for continuous broadcast of educational video content generated in the past and during this Mission. Also, multicast based IPTV streaming of video content shall be made through Edusat. For this purpose, SITs (Satellite Interactive Terminals) will be placed at all the institutes. In order to enable the up-linking of the IPTV content to satellite, there will be six up-linking hubs to six national beam transponders. In order to make the effective utilization of all the above infrastructure, PCs need to be made available at all the institutes. There will be up to 18,00,000 PCs provisioned with 50:50 cost sharing basis at all these institutes. As the up-linking hubs and SITs for Edusat will be operational fully by the end of three years, one will use Ipstar type of satellite to begin with. The Ipstar will be discontinued with full Edusat infrastructure in place with 45Gbps capacity. The terrestrial connectivity would be obtained on a rental model from the Department of Telecommunications so as to ensure seamless
integration as and when iNKN expands and covers all the Higher Education Institutions.

3. The National Project on Technology Enhanced Learning (NPTEL) is nearing completion and it would be generating a vast pool of learning modules for various branches of Engineering / Technology. These resources would also be delivered through this portal. The Mission shall provide financial and technical support to a designated Government agency for establishment of a National Testing Service (NTS). The Mission shall be free to move for the establishment of a separate body to act as a National Testing Service in order to fulfill its objective to certify the competence and skills acquired by the individual through formal or non-formal means of education and/or training in different disciplines/professions.

4. NPTEL Project Deliverables:

1. Conversion of NPTEL phase I video courses, in streaming video lecture format and setting up a distributed national video server for delivering lectures on demand.

2. Creation of 1 500 additional web and video courses in all major branches of engineering, physical sciences at the undergraduate and postgraduate levels and in the management courses at the postgraduate level.

3. Integration of College curricula in engineering education with NPTEL content through a large number of course specific workshops and interaction with Colleges in India for
improving TEL (Technology Enhanced Learning) infrastructure.

4. Creation of discussion forum for each course created under the NPTEL using a grid of computer servers and setting up FAQ’s for each course.

5. Indexing of all video and web courses and setting up powerful search engines to enable content and keyword search on all topics in science and engineering developed under NPTEL.

6. Major outcome of a project of this dimension would be formation of teams, groups, and institutes that would continue to contribute to the knowledge economy of our education system.

7. Interconnectivity among the universities and colleges will not only facilitate exchange of courses, seminar, conferences and specialized lectures by national and international experts but also enable resource sharing.

8. Knowledge available around the country and internationally would be available as usable packages.


10. Virtual Institute / university would be a reality at the end of the Mission.

11. Trained manpower in the emerging areas

12. Single window for primary to post-graduate education

Each Subject has 12 papers in an annual format equivalent to $12 \times 2 = 24$ Courses in a Semester System.

Hence, assuming the NPTEL standard of Rs. 7 lacs per semester course, for 1 Subject, $24 \times 7 = Rs. 168$ lacs would be required.

For 80 Subjects, the requirement would be $80 \times 1.68$ crores = Rs. 134.40 crores.

It is proposed to spend Rs. 35 crores during the first year covering nearly 20 subjects and the e-content generation for the rest of the subjects would be spread over the other 4 years of the 11th Plan. In case, a number of subjects still remain uncovered, then they could spill over to the 12th Plan period.

A major problem that the students face is the lack of guidance in the projects that form a part of College curricula. Web based advising systems, capable of bringing in mentors and students together, possibly from different parts of the Country, are a solution, which would have to be attempted’. This is another aspect that is posed as a question to both students and faculty alike. The unequivocal need and preference for this is observed in the findings.

The mission goes on to delve on laboratories and teaching resources too. ‘Virtual Labs will be effective as an instructional tool as well as a self-learning tool. The facility of ‘Talk to a Teacher’ online for interacting
with him / her off-line has been active on SAKSHAT: One Stop Education Portal w.e.f. 26th January, 2007.'

'The need of dedicated change agents, motivators, guides, troubleshooters and independent referees has to be much higher if the programme is to transform into a mass movement. They could also serve as our eyes and ears for various segments of our National Mission such as imparting Digital Literacy to the masses through Non-Governmental Organizations (NGOs) or volunteers.

In the initial phase, a proper awareness campaign would also have to be launched through TV, radio and print media so that the target groups of learners are sensitized and empowered to use the facilities.

We also know that research in a particular area moves rapidly only when there is a critical mass of Professors, researchers and students in that area working in close coordination, even though physically not very proximate. Such groups act as research output multipliers when one path breaking research encourages the other researchers in that area to join hands with the spearheading group.' These issues of awareness, enrolment and empanelment of resource persons to drive these programs are also addressed in this research. The need to augment research and provide mentors and a forum for the sharing of knowledge are some of the key areas that have been studied in this research.

'Given the current state of scattering of resources and experts among various institutions of higher learning in the country, a strong communication network would be able to forge a strong bond between various groups working in similar areas.

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It is proposed to transform the 100 Central Educational & Research Institutions into hubs for the creation and dissemination of knowledge for every learner in the country. They have also been visualized as the repositories of knowledge generated / acquired either in text, audio-visual or any other form and to serve as models of National Classrooms, in their respective areas of excellence.

The mission document delineates the structure of the mission with the constituent committees, organogram and the management instruments. This is as per the diagram that follows:
Finally, the evaluation of the Mission is also addressed in the Sakshat mission document. In fact, this research is an effort in this direction. Based on a critical study and evaluation of a specific component of the mission, viz. NPTEL across selected Government Colleges of Gujarat, some of the detailed structures and modalities have been evolved.
6.2 NEED EMERGENCE FROM THE STUDY

The study carried out clearly articulates the need for a standalone program which can offer the complete and full course cycle from registration all the way to examination and certification. Especially as has emerged from the factor analyses carried out in section 5.2.3.2 and 5.2.7 of chapter V the preferences of the respondents are brought out clearly. To recapitulate, these include standardised choices of courses from e-content, demand for e-content with simulated and actual laboratory experience, comprehensive evaluation facilities to be integrated in e-content, interactive e-content with students and employers, e-content that provides for faculty development; compensation by mentoring, extension by students and active, academic and administrative services.

Further, the study shows that there is an articulation of the need for integrated, humane graduates as described in section 5.2.4, with the education covering all dimensions of life ranging from the physical, ethical, spiritual and aesthetic aspects. Another clear preference that emerges is the need for various modes of learning ranging from animation, multimedia presentations, films, dramas etc. and not merely the ‘chalk and talk’ mode.

An innovative input that emerges is the willingness on the part of both students and faculty to collaborate in an online mode for research, which could be a part of the curriculum as found in Questions 8.1 and 8.2 of the questionnaire. Similarly, the willingness of students to mentor and teach other students online for a compensation, mainly ‘in lieu of credits’ is well brought out. This corresponds to question 8.3 for which the mean value of the answer is 4.07, which clearly corresponds to the response ‘agree’ and more.
Finally, there is an unequivocal articulation of the need for 'on demand on line examination' and certification for the courses provided online. This is seen in question 9.1 and the mean value of the response is 4.05, which is a clear articulation for the need for such examinations.
6.3 THE NEED FOR A NEW FRAMEWORK

The word framework or architecture is deliberately used above. Only a structured, somewhat tightly bound, standardised, sustainable system or framework with load bearing structures will be able to make 'open education' a sustainable, dependable, solid and accessible paradigm, especially in the context of a country like India. Such a comprehensive offering housed in a well structured architecture could be a substitute for formal education or could be increasingly used in the blended or completely online mode.

The idea of what constitutes a University is now increasingly understood as an institution that is engaged in Education, Research, Extension and Training. In the dimension of education, a University offers degree programs in different disciplines. The choice based credit system or CBCS in higher education, which is currently being talked about across states of India, including Gujarat, is cast in a 'scaffolding' that offers some choices in respect of the core courses, electives and the foundation courses. While the CBCS offers horizontal choices in terms of the spread of subjects and a vertical choice in terms of the degree of depth of the subject as offered by each University in question individually, the needs of students may be even more heterogeneous and differentiated; they may need many more choices of subject spread, depth and even specific flavours, nuances and niche areas.

As articulated in the following sentences\textsuperscript{85}, "a conversation with a faculty member of the IIM\textsuperscript{86} comes to my mind. Sitting at his Barber's, he recalled the Barber's son coming to meet him. Eyes lit up with a dream and aspiration, he asked the Professor how his son could make it to the

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\textsuperscript{85} Excerpts from a key note address delivered by Smt. Jayanti S.Ravi at the International Conference on Management dedicated to the theme of Management Education in 2020: Issues, Challenges and Opportunities held at IIM, Ahmedabad on January 1\textsuperscript{st}, 2011.

\textsuperscript{86} Indian Institute of Management, Ahmedabad.
portals of this world renowned Institute. Given the highly competitive nature of the entrance test, it seemed almost impossible that he would make it to the IIM but this conversation got me thinking..... On a similar note, in an Industrial cluster of dyes and chemicals located fairly close to this campus, as a program of innovations and quality improvement is being rolled out with support from IFC, my interaction with a technical expert educated me of the great need for MBAs for that sector. MBAs who could work as the 2-I-C or the second in command, taking care of production, marketing and financial issues of these units as the CEO is freed of some of these tasks. The Entrepreneur CEO can then be able to engage seriously with innovations, hone her vision to be able to move to a new orbit of practices, profits, growth and so on. There are differentiated, unmet needs, ranging from certification to short term courses, diplomas to full fledged degrees in management covering a wide range of skills to address the local needs of various sectors including Industry. This can simultaneously cater to the demand of students from economically weaker or marginalised sections, rural areas and mofussil centres belonging to minority groups and disadvantaged sections of the population. This refers to the dimension of equity.”

Another fact to be appreciated is that unlike the case of many OER efforts across the world like OCW of MIT and OLI of CMU, NPTEL is not the effort of just one institution such as IIT, Chennai. On the contrary, this is a collaborative effort\textsuperscript{87} of more than 1500 faculty members, in all, drawn from about 48 institutions of the country, which includes the IITs.

The processes for carrying out such collaborative work are, thus, in place. This has come to be a time tested process too, as it has been operational

\footnotesize{\textsuperscript{87} Based on inputs from Prof. Mangal Sundar, IIT, Chennai}
for nearly seven years now. NPTEL is on the threshold of formulating and designing the next phase and plans of becoming a virtual university.

In this context, drawing on the track record of NPTEL and its quality findings of this study, the model proposed in the following pages attempts to make the supply side much more extensive by enabling a very large number of HEI to join in the offering. The proposed model also builds in many innovative features to tide with shortages of teachers, classrooms, infrastructure and researchers by leveraging online mentors, services and facilities. And, most importantly, this framework is not meant to be a mere supportive accessory but will actually be involved in the complete cycle from registration to certification and even beyond.

6.4 THE MULTIVERSITY MODEL

The model is outlined in the following sections with the constituent components, building blocks, inter-linkages, processes and features.

6.4.1 Vision: Access, Quality and Equity in education - a new system of higher education based on Open Education Resources and Services (OERS) which enables the development of professional and human excellence.

6.4.2 Mission: To create and implement a new educational architecture of a multiversity; to facilitate the sustainable sharing and extensive usage of diverse OERS through the multiversity; create and nurture a special ambience conducive to the creation of a huge pool of high quality, humane professionals at the ground level.

6.4.3 Components of the model: The following paragraphs outline the details of the model. The model has five main components which are the National Knowledge Network or NKN, Multiversity, National Programs

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88 Placement, possibilities of neo graduate working again as a mentor if he or she is found suitable in the national, online selection for Parivrajakas and Upa Parivrajakas.
or NP, constituent or Member Higher Education Institutions or MHEI and Halls of Culture and Training or HCT.

1. The **Multiversity** is the heart of the model. The Multiversity, which includes a gateway or portal would, in turn, be collating and making available Open Education Resources and Services (OERS) from various ‘constituent’ MHEIs. The ‘multiversity’, a virtual entity will have a full fledged presence on the web. Needless to say, it will need a complete back office to carry out all the work that happens to make the OERS offerings possible.

2. **NKN** is the agency which is overall responsible for the running of the Multiversity and will have the necessary powers and authority to do so.

3. Seven **National Programs** covering areas ranging from content provision, research, extension, examination, telecast of live lectures, teacher readiness and educational governance or management, will be rolled out by the Multiversity. These are described in detail in the following sections.

4. The participant Universities, Colleges, individuals and Institutions which are constituent members of the multiversity and have their rich asset base of educational resources, services and legacy systems are contributors to the OERS. They constitute the third part of the model. These members of the Multiversity are designated as MHEI's.

5. Halls of Culture and Training (HCT) as the points of access would be located at district and metro places across the country. These HCTs would be able to access the standardised Open Education Resources and Services (OERS) through an access gateway or a

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89 Member Higher Education Institution.
portal called the Multiversity.

These five components work in unison as detailed in the following pages.

6.4.3.1 The Multiversity

To address these diverse needs, if there is a possibility of offering the set of courses that are offered by not just a university but a number of universities and institutions, the choices can truly multiply.

There are models of online private Universities like the Phoenix University\(^90\) which has a large number of students and the effort of the Apollo Group\(^91\). However, what can be done at the pan national level with a special concern for equity, as was understood in the various definitions of governance is to create a collaborative network of many traditional brick and mortar universities, which can collectively make all their offerings in the form of OER ‘through’ the multiversity.

The different nuances and contexts of a course of Management, Psychology or Chemical Engineering, for example, as offered by Patna University or Pune University now become available. This becomes the multiversity, instead of a university as students can now choose courses from different universities. This becomes possible in a setting where the OER of different Universities and Colleges are all made available on a common portal or Multiversity for students from different geographical areas and backgrounds to choose from. They can appear for the examination and even get a degree or certificate based on the credits earned and sewn together as per the prescribed or allowed distribution

\(^{90}\) http://www.phoenix.edu

\(^{91}\) Page no 39, E and Y, EDGE 2011 Report.
requirement as given by the qualification framework to be set or prescribed by the NKN\textsuperscript{92}. This is further elaborated in the following sections.

6.4.3.1.1 Open Education Resource and Services (OERS)

As the name and label of Open Education Resources and Services (OERS) suggests, the idea of ICT and OER is to liberate learning and education from the confines of a classroom and make it available and accessible to anyone, the only qualification being the willingness and readiness to learn. In that sense, these resources are available anywhere, anytime in the 24X7 mode, as has become the current day norm for many services and utilities.

These OERS would be available after following built-in processes of ensuring standards in terms of consistency, portability and most importantly quality. These would then all get metamorphosed into Open Education Services (OES). These services would be available for real time integration, would be reusable and loosely coupled with different operating systems and platforms. The independent services and resources, created, owned and controlled by respective owners are all supported with a common scaffolding or architecture. These services are all neatly tied together using a Service Oriented Architecture (SOA) framework.

6.4.3.2 National Knowledge Network

The NKN runs the Multiversity and is responsible for its smooth running. The NKN could, in turn, play a key role in constituting the task forces and laying down basic standards for various tasks. In order to prime the demand side, the NKN could mandate through policy interventions that the content services provided through the multiversity be benchmarked according to the needs for standard competitive examinations like the

\textsuperscript{92} National Knowledge Network, as detailed in the model in figure ----
UPSC and PSC examinations such as IES, GATE, NET/SLET, GRE, GMAT, BSRB. In addition preparatory material could be made available for corporate tests such as the NASSCOM Assessment of Competency (NAC) Tests etc. The detailed roles and functions of each of these National Programs are enumerated in section 6.4.3.3.

The NKN is a body constituted by the government. As mentioned earlier, the government or the NKN need not get into offering courses exactly in a virtual University mode, like the Phoenix University, etc. However, government can leverage its strength to orchestrate all such offerings by various Universities in the country. The USP of the NKN will be to draw from the authority it has and ensure that it puts in place sturdy mechanisms for:

- Standards
- Inter-operability
- Consistency
- Sustainability
- Regulation along various dimensions
- Grant of degrees, diplomas and Certificates
- Spawning or initiating the idea
- Credibility.

6.4.3.2.1 Roles, powers and functions of NKN: NKN will be empowered and be responsible for the overall implementation and running of these projects. It would operate directly, through task forces or through organisations selected for Public-Private- Participation or PPP, which will be

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93 Of services and various features across various National and International bodies like equivalence with UNESCO etc.
suitably authorized and empowered. In respect of each of the functions, it
would lay down the architecture and standards of these components in terms
of the deliverables, time frames, teams, funding, resources and processes.
These standards will be adhered to as the minimum prescribed for that
activity or dimension. The NKN will also constitute the task forces listed
below and ensure smooth co-ordination and conflict resolution across these.
The roles of NKN will include the following:

- Address all issues of technology choices, decisions and standards
  by constituting a Technology Task Force.
- Constitute the task forces for the seven different programs
  mentioned above, viz., NPTEL, NPTEAETT, NPTER, NPTEE,
  NPODOLE, NLeCP and NPTEG.
- Lay down the Standards for the various Task Forces
- Formulate and publish the Common Indian Qualification
  Framework of Reference (CIQFR).
- Grievance Redressal and Monitoring
- Design of the Halls of Culture and Training
- Fund allocation and appropriation.

NKN will also be responsible for and empowered to:

1. Finalize the detailed Perspective Plan, which in turn subsumes the
detailed plans of the various National Programs. Such plans
include respective objectives, aims, plans with deliverables, time
lines and financial allocation, monitoring processes.

2. Co-ordinate across various programs

3. Monitor and evaluate progress
4. Institute awards and rewards for good performances

The NKN will be the final authority in case of any dispute or disagreement.

6.4.3.2.2 Technology Task Force:

The Technology Task Force (TTF) constituted by the NKN in turn, could do the following:

1. Formulate the basic SOA architecture plan which would comprise the Hardware, networking equipment, computers, the software, the OER standards, including all the detailing of the network configuration, hardware and software configuration for fulfilling the objectives. The type design for the IT configuration for each of the 1000 HCTs would have to be detailed as a type design, with needed flexibility for local customization. Issues of sustainability, training for troubleshooting and maintenance would also have to be addressed as a part of the detailed blue print.

2. Standards, deliverables and performance norms for each of the technological services which would be procured in a PPP mode or by agencification would have to be formulated and clearly laid down.

3. Provide Broadband connectivity across the country to each of the 1000 Halls of Training.

4. Provision of basic Hardware and software to hold the broad band at 1GB/node, which could be scaled to 1TB/node eventually. Setting up and installation followed by maintenance of these would also be included.

5. Setting up and maintaining the computer training laboratories with fifty computers in a networked mode at 1000 centres, with the provision of two scanners, a copier, an LCD projector and four printers.
6. To set standards and set up a solid, robust, Highway or the Enterprise Service Bus (ESB) for the various services and e-resources to be provided and maintained.

7. To set standards and ‘empanel’ learning tools and LMSs such as moodle to be made available in the SOA framework.

6.4.3.2.3 PROCESSES of the NKN

- The basic tenets and principles of Governance like Participation, fairness, decency, accountability, transparency and efficiency would have to be adhered to by the NKN in its functioning and processes.

- It is proposed that for the various task forces and National Programs proposed, a consistent set of standards would have to be developed and laid down, which could be revisited at a certain periodicity. These would be based on the objectives to be fulfilled.

- Given that the context of most of these activities is in the States and UTs, these standards and CIQFR could be periodically discussed with the State representatives to ensure consensus and factor in local constraints and diversities.

- Transparency has to be a basic principle of the entire framework and hence, dissemination of these norms and standards on the web site would be done strictly.

- Wherever task forces are to be constituted, they would consist of a minimum of three experts and a maximum of five experts chosen by the NKN. These could be continued for a term of about three years.

- Task Forces constituted by the NKN will be empowered to carry out the tasks entrusted to them, after putting together a detailed blue print and discussing this with the NKN for consistency, interoperability and
scalability. They will have financial allocations and be given the required autonomy with the required accountability.

- Funding and facilities apportioning would be done at a minimum base level for all centres in the different States and UTs to begin with. This could then be revisited every six months based on the usage, demand, performance of the legacy systems and the new systems.

- The processes would have to merit based focused on access, quality, equity with autonomy and accountability.

6.4.3.3 National Programs

Seven National Programs will be rolled out by the multiversity and all of these will be held together in place by the National Knowledge Network, which would be the apex body, which will be overall responsible for running and executing this model. Common, generic features of all the seven National Programs are given below:

- Each program to solicit the participation and involvement of existing Colleges, Institutions and Universities of the country in contributing to the OERS in standardised forms that render them usable.

- This compiles the OERS from all the constituent institutions, standardises them from the ‘credit framework’ or such other point of view and renders them ready to consume.

- A menu of wide choice of standard, assured quality is, thus, laid for the learners in languages of their choice. The National Translation Mission could provide these translation services.

- These resources to be complied by the different National Programs

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94 These would facilitate the local students and could be built in gradually.
95 [www.ntm.org.in](http://www.ntm.org.in)
will be inter-connected and include:

- course outline
- objectives of the course
- lectures, notes, animation and presentations
- projects
- quiz, assessment tools and assignments
- provision of simulated laboratories
- internet access to real labs using OES like ilabs\(^{96}\) of MIT
- online mentors
- online collaborators for research projects
- provision of an on-line on-demand examination

  - This would, inter-alia, test knowledge, understanding, skills, application, higher order thinking skills (HOTS) and a viva.

- Provide for final certification, which could lead to the award of degrees, diplomas and certificates depending on the credit equivalence framework which would be finalised by NKN.

Each such program will have a compulsory credit earning in foundation courses such as ‘life enrichment’, ICT, English, Basic law and Environment.

Most importantly, all this will be set in a medium and context of integral learning and constantly facilitate the growth of each learner for the highest aspirations and self knowledge.

\(^{96}\) [http://icampus.mit.edu/ilabs/](http://icampus.mit.edu/ilabs/)
It also enrolls each of these and the HCTs as points of disseminating learning for complete online or a blended mode.

The main areas that need organisation and planning as backend processes for the smooth running of the multiversity and the HCTs along with the corresponding National Program that has been proposed are now listed:

Table 6.1 Seven National Programs with Corresponding Areas

<table>
<thead>
<tr>
<th>Content Creation</th>
<th>National Program of Technology Enhanced Learning (NPTEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher empanelment, assessment and training</td>
<td>National Program of Technology Enhanced Empanelment Assessment, and Training of Teachers (NPTEAETT)</td>
</tr>
<tr>
<td>Research</td>
<td>National Program of Technology Enhanced Research (NPTER)</td>
</tr>
<tr>
<td>Extension</td>
<td>National Program of Technology Enhanced Extension (NPTEE)</td>
</tr>
<tr>
<td>Online On-demand examination</td>
<td>National Program of On-Demand On-line Examination (NPODOLE)</td>
</tr>
<tr>
<td>Streaming of live lectures</td>
<td>National Integrated e-Classroom Program (NIeCP)</td>
</tr>
<tr>
<td>Governance and Educational services</td>
<td>National Program of Technology Enhanced Governance (NPTEG)</td>
</tr>
</tbody>
</table>

Each of the seven National Programs will have to perform two generic kinds of roles:

1. Creation of content, protocols etc for various programs
2. Invoking this content and using or deploying the content or resources.

The NPs could directly (through mass emails, newspaper advertisements and announcements) solicit inputs for various programs from various Universities, Departments, Colleges or individual faculty members and experts. The content would have to be compiled together using an SOA framework to facilitate maximum participation of various services, resources and tools in a loosely coupled manner. Once the framework is ready, the content and inputs would be submitted by the contributors; for e.g., if there is a course in philosophy that a professor of, say, Mysore University wants to upload, he could submit it. The SOA standards framework checks if this is in conformity with laid down standards such as “is whether this course is already being offered by a University in India which is accredited to NAAC at B and above” and so on.

The task force can, in turn, constitute subject wise groups (subject review experts for NPTEL) drawn from among the best scholars of the subject. These can be co-opted into this model in an online mode, without physically having to relocate. They may be trained in an online as well as a few face to face sessions, on the ‘how’ and why of the course contours and can ensure that the courses uploaded are of high quality standards. This would be done with complete transparency and fairness. Any such matter that is vetted after submission and found up to the minimum standard is then cleared for posting on NPTEL. This is not unlike the blinded review that happens in the case of papers written for international journals. This ensures that the good governance principle of participation is completely followed.
These seven national programs could all be neatly held together in the Multiversity. This multiversity, in turn, is accountable to and works under the direction and supervision of National Knowledge Network (NKN), the apex body at the national level, which could be empowered for this by an Act of Parliament that creates the multiversity.

6.4.3.3.1 NPTEL

Pooled generation of OERS

This is the basic activity that has been accomplished to a great extent by programs like the NPTEL. It is about generating content for courses. The National Program of Technology Enhanced Learning (NPTEL) can be further extended and strengthened to include content and courses related to various technical, science and humanities disciplines.

The need for this clearly emerges from the questions 3.5, 3.6, 3.7, 4.2, 4.3, 4.4 and 4.9 of the research study questionnaire. An analysis of the mean values of the responses to these questions clearly indicates a need indicated by students for the various features that are now built into the NPTEL program.

Content creation ranging from course outline to unit wise lectures, animations, films, simulated laboratory facilities, internet based access of real laboratories, provision of practice questions, question banks and provision of reference material in the form of a bibliography and 'web'liography with a variety of material on the course can be compiled and updated periodically. This program could draw on the rich resource of various IITs, IISc, Universities and Colleges in the preparation and compilation of content. A task force for this work could be constituted with about five members.

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97 Universities in India are either set up by an Act of Parliament or the State Legislatures.

http://www.ugc.ac.in/new_initiatives/hisp.html viewed on 30th April, 2011.
representing Academia related to technical and liberal subjects, Industry, Government to design and implement the entire program. This group could be selected with great care choosing people with demonstrated leadership qualities, integrity and academic excellence.

As regards the Course content, details ranging from the objectives of the course, course outline, lesson plans, class wise or week wise lectures totalling to about forty hours of lectures, presentations, films, videos, text books, notes, projects, assignments, tests and practise questions, all these could be made available for each of the courses that are offered as a part of the multiversity. A standard template that lists out each of these components would be prescribed and laid down by the NKN. For a course to be accepted and posted as a part of the multiversity it should have all these components and they should be found satisfactory in terms of quality by a committee of subject experts constituted by the NPTEL for this vetting. Such a mechanism with both automated and human services could also be available as a part of the SOA framework, with the software or human experts checking and validating the quality of the OER online, through video interviews and conference calls with the Principal Course Co-ordinator (PCC) offering the course.

6.4.3.3.2 NPTEATT and Teaching Resources of the model

This program also called the National Program of Technology Enhanced Assessment, Empanelment and Training of Teachers (NPTEAETT) could be started to address the training and capability building needs of teachers with their assessment and rating as well. This could also facilitate the empanelment of teachers from the open market and facilitate the creation of a bank of teachers, both serving and non-serving, both retired and fresh.
The study posed questions (8.3, 8.4) relating to the coaching /mentoring of students by peer group students for. There is a clear indication of the willingness to undertake peer coaching and teaching- These responses are factored into the model in the form of the NPTEATT.

Similarly, a question on the rating of the faculty and the need for testing and training of faculty was also posed to students (Q9.2, 9.3) Based on the responses, this NPTEATT has been designed. This program would have to put in place a full-fledged faculty training calendar in a mission mode and work independently but in collaboration with the other wings to roll out a training program which could have both on line and face to face components followed by testing and assessment or rating of faculty.

Eventually, at steady state, it is planned that each teacher working in the technical education sector of the country goes through at least one session of mandatory training per year. Such modules would comprise of a minimum of about 42 hours or approximately 1 week duration each year which would cover the technical contents, administrative issues and integral education. This work would be carried out by a task force of three members who would work with resource persons and trainers that can be pooled from across the country.

Another specific area of this program would be to empanel a huge pool of about a thousand ‘Parivrajakas’ or visiting educational experts, who could also be designated as National Fellows of the National Knowledge Network. These could typically be people of great eminence and leadership from various fields ranging from Academics to Industry to Administration and the Army and such other sectors. These would be selected by a very transparent, all India selection process and designated
to be the chief of each of the HCTs across the country for a minimum period of three years.

In addition, the NPTEATT would also select as many as three thousand “Upa-Parivrajaka” or the assistants to the Parivrajaks. These would be especially selected graduates and students from the third year of degree and engineering colleges, who can choose to work at the HCTs for a period of one year, during which they can continue to study in the blended mode and also earn up to 25% of the credits required for course completion by successfully performing the duties assigned to them, as they work with the Parivrajaka at the HCTs. They could be designated as National Young Fellows of the NKN.

In addition, another three thousand young students of this profile would be selected through a National level transparent, merit based process for being on line young tutors and mentors (e-upa parivrajaka) for the students studying in the thousand HCTs set up across the country to begin with. These can be compensated by waiving the credit equivalent to one course on successful completion of this assignment or they could be given a special Certificate of Honour at the end of their studies. Such an arrangement, it is proposed, will trigger the process of learning by Constructionism for the teacher as well the student, as explained earlier.

This task force can also make projections of the need for teachers in different disciplines and build awareness and the environment for more and more bright, young people to take up teaching.

Once the material is posted on the multiversity portal, as discussed earlier, students who have completed that course as a part of their previous semester work could opt to be an online teaching fellowship or online course assistantship. Students opting for such online teaching and
mentoring would be all interviewed and empanelled online by a transparent process which evaluates their subject competence as well as their clarity, communication and interpersonal skills for teaching.

On selection and deployment, the work performed by them could be evaluated based on their rating by the client students and their performance as well as a log of the quantity of time spent in teaching, tutoring and checking assignments. These e-tutors would also have scheduled online office hours during which they would be available for clarifying doubts and questions by students in a synchronous mode. In addition, they could also answer questions and doubts in an asynchronous mode.

6.4.3.3 NPTER Research

The model will include a National Program of Technology Enhanced Research (NPTER). Most studies have lamented on the slow and tardy progress of Research across the country.

In response to question 4.6, 8.1 and 8.2 related to inclusion of research topics in the curriculum as well as student and faculty participation in online research projects as a part of curriculum, the current study indicates a clear preference by a mean score of 4.07, 3.49 and 3.25 on a scale of 5, 4 and 4 respectively. Based on this, the NPTER has been developed.

This program will work at two levels. Through a specially created task force for this purpose, which will be suitably empowered and enabled, a repository of discipline-wise researchers will be made by contacting Universities and soliciting such experts with standard, authentic credentials.
About five hundred such researchers could be empanelled to begin with and they could be designated as National Research Scholars. Now, based on the areas of research and their willingness to collaborate with students across the country, a shelf of research projects can be made available.

Now, students studying at conventional colleges, Universities and the HCTs could opt for carrying out one research project as a part of their credit earning for course completion. All such students could be selected using an all India merit test and following an e-interview with their respective National Research Scholars. This will be done with complete transparency and fairness.

On successful completion of their research, they could be awarded credits in lieu of the research work done or a Young Researcher Certificate of Honour. Such a movement with careful nurture and mentoring can help charge and transform the research scene in the country.

There could, for example, be a scenario where a student from a HCT in a tribal pocket of Chattisgarh could be working in a frontier area with a leading Researcher from Physics of IIT, Kanpur along with students from Bombay and Kerala. As these groups immerse themselves and learn and advance with each other, the processes and the outcomes can both be very enriching and stimulating for all. Such interactions can hone their behaviour and lead them from separate behaviour to connected and constructed behaviour, which are explained in Chapter IV.

6.4.3.3.4 NPTEE or Extension

This aspect of education is addressed by a program called the National Program of Technology Enhanced Extension (NPTEE). Extension here refers to two categories of engagement: One with the local community in the
vicinity and neighbourhood of the HCTs and the other with a very important constituency, the prospective employers, including Industry, services, Governments, NGOs and markets.

A task force could be constituted to carry out this work, comprising of not more than five eminent people representing the various constituencies referred to above. The current education often comes in for a lot of criticism for not enabling a connection with the local communities and their needs. Similarly, the fact that most learning happens in a constructivist and constructionist mode is acknowledged here too. Students can opt for the equivalence of one course either for research or extension every year as a part of the CIQFR.

In response to questions 4.12, 9.4 and 9.6 related to inclusion of industry module and CSR (Corporate Social Responsibility) project in the curriculum as well as internships of student, the current study indicates a clear preference by a mean score of 4.09, 3.85 and 3.90 on a scale of 5. Based on this, the NPTEE has been developed.

This program will enable the survey of the local community and identify a set of projects or interventions that are needed. These could range from a social audit of the MGNREGA to participatory irrigation management, a specific health intervention or the development of a value added co-operative agro industry unit with the local community.

The Parivrajaka at the HCT will be available for consultation to guide the students and local community members to develop this. All such projects or the shelf of such projects can be posted on the web site for students to choose and opt for community level work on the lines of ASR or academic social responsibility like CSR.
They would, again, be selected on an all India merit based system and work in a structured way, under the guidance of suitable agencies of NGOs, at such projects in a location of their choice, based on merit. On successful completion of the course, they would be given a credit in lieu of the work and learning and a Young Social Entrepreneur Certificate of Honour in Extension Services.

6.4.3.3.5 NPODOLE -Examination and evaluation

The National Program of On-Demand On-line Examination (NPODOLE) would be another important component of this model. In response to questions 4.10 and 9.1 related to on-demand on-line mode of examination, there was a willingness among students to bundle the on demand exam with e-content. This was revealed with a clear preference by a mean score of 3.95 and 4.05 on a scale of 5. Based on this, the NPODOLE has been developed.

The third important part of the multiversity tasks relates to examination and evaluation. Students would be at liberty to appear for an examination when they are ready or even choose not to. A question bank for each of the courses would have to be readied which would be prepared and populated by the Principal course co-ordinator or PCC.

These questions would cover the entire course and be of various types ranging from multiple choice questions to short answer questions to long answer questions as well as essays and project works. These questions would be framed in a manner that tests the knowledge, understanding, skills, application and Higher Order Thinking Skills (HOTS) of students.

Similarly, the difficulty level of the question paper could be such that even an ordinary student should be able to reasonably attend about fifty percent of the paper. Another 30% of the paper could have a greater
difficulty level, which could only be addressed by about thirty percent of the students. Ten percent of paper could be even more tough and the final ten percent of the paper could be so tough that a very small percent of students that are really bright can successfully answer the remaining ten percent.

Blue prints for the examination would be prepared by the PCC. The PCC could load these questions to the ODOLE service of their choice by using the SOA portal. The multiversity could lay the standards and protocols for standard on-demand on-line examination services, which draw out questions as a different permutation according to the blueprint each time it is invoked, the multiversity could offer a series of tools for the conduct of the online examination in the SOA framework that can be found and invoked by the learners.

Another feature that the conventional system has been unable to offer can be attempted in this multiversity model. Every student could also schedule a time slot for a live, online, video viva or (LOVV). The PCC or the team of e-TFs and e-CAs would be available using a calendar and scheduler service. The student can be tested in addition to the ODOLE through a live conversation, which can be recorded end to end, and the student awarded grades on the basis of this performance too. Such an effort will hone the communication skills, confidence and clarity of the student. Those students with good knowledge and yet endowed with poor writing skills can also get a fair assessment and thus, benefit in the process. The emphasis in this new paradigm is on learning but students could enroll themselves when they are ready to take the examination on an on-line basis.

The HCTs could also double up as an assessment centre for a month in each semester and for three hours daily for one more month in each semester, say, from 6am to 9am for those wanting to take the exam. A task force of about
three eminent, competent people with expertise in the conduct of examinations with the required empowerment and enabling can be constituted.

6.4.3.3.6 National Integrated Classroom Program or NIeCP (NIeCP)
Under this program, eminent speakers and personalities in various fields would be scheduled for giving their talks as per a pre scheduled calendar which would be streamed live to each of the HCT from a centralized location.

As a part of the study, the respondents were asked to indicate their preference for various modes of learning (Questions 7.2 and 7.3). Interestingly, there is a fairly high weightage given to conversations and dialogues with eminent people. Similarly, on life stories of outstanding people and their struggles, accomplishments, beliefs, faith and achievements was posed as a part of question 7.4, 7.5 and 7.6.

There is a fairly high need articulated in favour of these. Specifically, they seem to want autobiographical sketches of Scientists, Sportspersons, Technocrats and thinkers or philosophers. In order to get regular sessions with such eminent personalities, the NIeCP would be a good channel. A task force for NIeCP would have some eminent educational media experts with academicians and some eminent leader of thought. This task force could work towards producing such programs on a regular basis and also make them interesting and fun.

6.4.3.3.7 National Program of Technology Enhanced Governance (NPTEG)
This will automate nearly all the applications related to students, faculty members and all aspects of the Colleges and institutions belonging to Higher and Technical Education.
In response to questions 10.1 and 10.2 related to use of ICT (information Communication Technology) for various applications and administration, the current study indicates a clear preference by a mean score of 3.94 and 4.10 on a scale of 5. Based on this, the NPTEG has been developed.

A standardized portal which can cater to students from all the States and UTs, whether they belong to the HCTs, Government, grant-in-aid or self financed Institutions may be in order. This could be made mandatory by organisations like the AICTE, UGC, NBA and NAAC to ensure that all organisations do update their information and use these applications. This can take care of various applications like admissions, enrolment, credit transfer, registration in the conventional and blended mode, scholarships, issuance of transcripts, fee payment, enrolment for examinations, college transfer and a host of other applications.

This will bring in a great deal of convenience, transparency and accountability to the system. One of the main concerns of the Times Higher Education Report (THE) was the management issue of student services in large campuses like that of Bombay University.

Such a program from the All India level would help set standards and benchmarks and also allow for a multiplicity of agencies to offer such services with various bells and whistles in addition to a plain vanilla version, which can be offered for a very nominal cost using standards that the Service Oriented Architecture (SOA) framework could provide as detailed in Chapter II. Another important purpose of this program is to generate reports with valuable data and information related to statistics and Macro level snapshots and pictures for the country and the States.
6.4.3.3a Understanding educational space design to lead to the new model

It is increasingly acknowledged\(^1\) that while designing educational spaces, one would need to start with the program of study and elements of learning to lead to alternate visions and then arrive at the physical layout, design or even changes in existing learning spaces. The design of learning spaces is primarily about fostering learning and education and not just architecture. The types of interactions, learning modes and practices that are desired should, therefore, lead to the evolution of the spaces, resources and environments\(^2\). This is what Torin Monahan\(^3\) calls the 'built pedagogy', the educational vision to underpin the design principles for the learning environment. However, the term pedagogy or androgogy is, itself, still based on prevalent premises of relationships and ways of learning, which may themselves need to be challenged.

Immediate relevant aspects, including links and collaboration for extension with the local communities, incorporating local culture and practices into the space design and most importantly, being able to break away from the current methods of teacher centric, passive teaching are very important. Equally important is the openness and active nurturance of methods and processes of transacting the learning and interaction with other students and co-learners to lead to an expansion of knowledge, understanding, creative and critical thinking abilities. Learning as well as

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\(^1\) Dr Betty Despenza-Green, Director, National High School Initiative- Despenza-Green, B. Director, National High School Initiative at the Small Schools Workshop based at the University of Illinois at Chicago, quoted in 'Innovative School Design for Small Learning Communities'.


the spaces designed for learning would have to connect to the reality and context on ground.

As dealt with in this study in the earlier chapters, it is equally important to question the old premises and understand basic questions afresh such as... 'What is to be learnt?', 'How is the learning to happen?', 'who are the partners in the learning?', 'what are the relationships across learners in different geographic places and the local community?', etc. Until these questions are addressed, learning spaces for the future will not evolve, but will actually only provide more comfortable versions of what are existing schools, referred to as ‘warehouses’ by Prakash Nair⁴, who writes, “The truth of the matter is that school buildings have been and continue to be places to warehouse children. New schools just do it in more comfortable settings.” This is, perhaps, equally relevant for higher education.

A thrust in the context of the findings in the earlier chapters is the clearly articulated need for choices of subjects, pace of learning and depth of learning. In other words, students can be empowered with educational spaces that facilitate personalized learning pathways and learning contracts that fit their individual needs rather than a uniform set of courses in a ‘one size fits all’ mode. The design spaces would also have to facilitate and provide for active learning as against passive teaching that typically happens in many class rooms. It would also have to provide space and provision for interactions that could be of an informal kind for group work, projects and such other methods of learning. Schooling for

⁴ Nair, P 'But Are They Learning? School Buildings – The Important Unasked Questions' www.designshare.com/Research/Nair/Are_They_Learning.htm
Tomorrow\textsuperscript{5} group identified several dynamics that need to be taken into account when considering alternative models of learning and school systems. While many of these references to learning spaces talk of schools, these are equally relevant for higher education institutions and higher education.

The new models would have to facilitate learning and collaboration within and across institutions and the possibility of a very heterogeneous group of learners ranging from the fresh entrants to higher education straight from school to those who are employed and are seeking further education as well as local community members who could be recipients of new practices and research findings as a part of extension work. Yet, these spaces should make the students and learners feel welcome, comfortable and provide the ambiance that they are culturally used to.

Most of all, the aim of education, which refers to developing a person who is well integrated across all dimensions, must be facilitated by the architectural spaces and design. The space should provide for the development of the physical dimension in the form of spaces for outdoor sports, games etc, which is emerging as one of the clear needs from the study. Such facilities and spaces also bring the learners closer and ‘enroll’ more and more students into learning as an interesting activity that they like. The dimensions of aesthetics, including creative pursuits such as music, dance, dramatics, art, craft and fine arts should also be nurtured in the architectural designs that are adopted. This will help students develop the emotional dimension too, particularly since this is the age where students have hormonal changes accompanied by various emotional

\footnote{www.oecd.org/topic/0,2686,en_2649_34859774_1_1_1_1_1_37455,00.html}

266-3
outbreaks, etc. Similarly, the design of education spaces must factor in provision for intellectual activity of a very high quality with the active utilization of computers and technology. Finally, if all rounded human beings who are both creative and compassionate are to be created in these institutions, there must be adequate spaces for quietude, silence, introspection and reflection. However, as Lippman⁶ argues, to date, learning environments have principally been developed for “short term information mastery goals” where we largely see: “...a single adult interacting with many in relatively impersonal social relations in which the social rules, principles, and guidelines govern the activity settings... Furthermore, as learning has been structured around individual activity, the school setting has been organized to control behaviour. Schools, like prisons, have been designed with classrooms adjacent to one another along either single or double loaded corridors. This arrangement limits the types of activities that can occur and symbolically reinforces for children that they have little power to make changes in their daily lives, affect their environment, or opportunities to examine alternative ways of living.” His ideas are equally applicable for schools and colleges. Lippman further contends that in considering future learning space designs there is a need to move away from the notion that such places need to be organised for moving from one activity or subject setting to another, but rather as places which support knowledge and action so that learning extends across and between settings. These inputs have been factored into the educational spaces which have been evolved in the following sections of this chapter.

As laid down in the previous chapters of this study, there is a greater clarity now on what could constitute true education and true learning in the 21st century. Freedom of the learner both in the content and methods of learning is of paramount importance, which, in turn, translates to corresponding sensitivity to learning spaces and designs, which would facilitate interactions across learners and those across learners and teachers.

‘As Van Note Chism⁷ argues, there is now greater emphasis on learners actively constructing knowledge in stimulating environments that encourage the exchange of information, recognise the importance of building on prior knowledge, and offer opportunities for rehearsal and feedback. She further contends that, from a social constructivist perspective, the social setting greatly influences learning and that traditional classrooms tend to be designed on the basis of, “transmission theory whose built pedagogy says that one person will ‘transfer’ information to others who will ‘take it in’ at the same rate by focusing on the person at the front of the room”. Alternatively, it is possible to design spaces that promote collaboration, innovation and knowledge co-construction, challenging existing assumptions about how learning occurs, thus providing crucial components for 21st century learning. Bickford and Wright⁸ use the example of a classroom that has embedded some of the design principles that can foster community and collaboration. These include the absence of ‘symbolic’ teacher-focused tools, such as lecterns or desks, positioned at the front of the class, the use

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of plasma screens connected to various audiovisual sources and different presentation options, as well as a clear emphasis on learner collaboration and making the space appear ‘open’ and inviting\textsuperscript{9}.

Fielding (2006)\textsuperscript{10} outlines six ‘essential elements’ that should help define the design of educational spaces, based on evidence from best practice examples. These are that spaces should:

- support teaching and learning
- maximise physical comfort and well-being
- demonstrate environmental responsibility
- serve the community
- establish design principles that make buildings (or spaces) work better, last longer, cost less to renovate and maintain, and inspire and adapt to changing needs
- apply open, transparent and collaborative processes that allow the school and community to assume ownership of planning and design.

Lackney\textsuperscript{11} (2003), in turn, focuses on more practical aspects and lays down 33 principles based on research and practice in the field. Whilst not

\textsuperscript{9} Re-imagining learning spaces- future lab ‘what-if...’ report-2006.
all are directly applicable to outdoor spaces, they provide a valuable checklist and source of inspiration for thinking differently about design.

These principles of educational design are:

1. Maximise collaboration in school planning and design

2. Build a proactive facility management program

3. Plan schools as neighbourhood-scaled community learning centres

4. Plan for learning to take place directly in the community

5. Create smaller schools

6. Respect contextual compatibility while providing design diversity

7. Consider home as a template for school

8. Meander circulation while ensuring supervision

9. Design for safe schools

10. Cluster instructional areas

11. Provide space for sharing instructional resources

12. Design for a variety of learning groups and spaces

13. Keep class sizes small

14. Provide resource-rich well-defined activity pockets

15. Integrate early childhood education into the community school

16. Provide a home base for every learner

17. Regard teachers as professionals
18. Provide studios to support project-based learning

19. Encourage administrative leadership by decentralising administrative space

20. Establish a community forum

21. Allow for community conferencing space

22. Create privacy niches

23. Weave together virtual and physical learning space

24. Provide opportunities for job training

25. Provide parent information centres

26. Provide health care service centres

27. Design places with respect for scale and developmental need

28. Maximise natural and full-spectrum lighting

29. Design healthy buildings

30. Design for appropriate acoustics

31. Allow for transitional spaces between indoor and outdoor spaces

32. Establish a variety of outdoor learning environments

33. Separate children and pedestrians from vehicles and services

While all of these ideas cannot be transplanted into the current, Indian context, some salient points and features can be adopted into the design of learning spaces that can be used in the present context of our country.
Based on these inputs and the needs of the higher education sector in the country, which is plagued by low GER rates and relatively lower literacy rates in rural and backward areas, this study now leads to the concept of learning spaces for both learning and assessment, which are referred to as Halls of Culture and Training in the following section.
6.4.3.4 Halls of culture and Training

The study has shown that there is a need for all the various features which have been built into the model. But, in a country like India, where the GER is as low as 11% and where access is a major concern, the model must make a provision for citizens to easily reach the multiversity in an ambience that is conducive to learning. Providing the multiversity gateway with the best of OERS alone is only strengthening the supply side. However good this is, unless the demand side is primed and access is easy, the twain may not actually meet!

It has been seen that even if the quality of OER is very high as emerges from this study in respect of NPTEL, the usage typically is quite low. Hence, a great deal of efforts would have to be taken to create awareness of the multiversity. The cost of setting up a thousand new colleges with all the capital costs and recurring costs would require a huge allocation. Further, with an acute shortage of teachers even in the current scenario, new colleges cannot get adequate teachers. These will need new, innovative ways of addressing these gaps. If this were to be done at a fraction of the cost, without diluting the quality, the concept of the Halls of Culture and Training could be adopted, as proposed.

6.4.3.4.1 Location and Spread of HCTs

At the ground level, it is proposed to set up centres which are labelled as Halls of Culture and Training at district and ward locations.

The word culture in the context of the Hall of Culture and Training is used to connote the context of ‘immersion’ that is needed for sustainable and fruitful learning. The word culture\(^\text{98}\) is defined variously as ‘development or

\(^{98}\) Another definition is ‘the quality in a person or society that arises from a concern for what is regarded as excellent in arts, letters, manners, scholarly pursuits, etc’. Further, the figurative sense of
improvement of the mind by education or training', 'the total of the inherited ideas, beliefs, values, and knowledge, which constitute the shared bases of social action'. This helps create a social and sustainable culture of learning as against fragile, dysfunctional processes of 'learning'.

So, an HCT would be the place where the model touches the ground and provides actual access to students and learners from across the country. It is proposed to start with about 1000 HCTs initially, which may then be ramped up or otherwise, depending on their efficacy and performance.

A Hall of Culture and Training is proposed in each District and about 4 HCTs per Municipal Corporation, to begin with, which could then be taken up to the taluka level and eventually the village level. The possibility of their collocation with an existing Institution such as a College or a school with sufficient space is also to be explored.

6.4.3.4.2 Design and Layout of the Hall of culture and Training

It is felt that for learning to happen, the features of the learning spaces would have to be thought through. They would have to be visualised and designed to create spaces where OER touches the ground or the learner. For ensuring that the right ambience and educational ergonomics99 are available for assimilation, absorption and internalisation of knowledge, it is proposed that specially designed learning spaces in the form of HCT would be created. Besides, in a country like India, the computer density and penetration is still not as high and evenly spread.

98 This term has been coined as the right ambience, features, facilities and spaces that are conducive to learning. 'Ergonomics, also known as human factors, is the scientific discipline that seeks to understand and improve human interactions with products, equipment, environments and systems. Drawing upon human biology, psychology, engineering and design, ergonomics aims to develop and apply knowledge and techniques to optimise system performance, whilst protecting the health, safety and well-being of individuals involved. The attention of ergonomics extends across work, leisure and other aspects of our daily lives.' From http://www.tandf.co.uk/journals/titles/00140139.asp viewed on 30th April, 2011.

99 "cultivation through education" is first attested c.1500 as viewed on 23rd April, 2011 http://dictionary.reference.com/browse/culture.
The learning space is configured as the Hall of Culture and Training (HCT). A model type design and layout of such a Hall of Culture and training is given below.

Each hall of culture has a central quadrangle for formal assembly, informal learning and group interactions in an open ambience. This hall has a library of books, films and e material or resources to supplement the OER. This is flanked by two lecture rooms, one of which functions also as the satcom reception room or Integrated e-Class room (IeCR). This room equipped with a dish antenna can receive live streaming of lectures that are telecast centrally by experts in various disciplines and other eminent personalities through the Integrated e-Classroom program.
(JeCP). A store room holds all the materials and equipment that the students and learners use in activities such as exhibitions and projects.

A laboratory facility would also be set up in some selected HCTs which will have a basic laboratory that is designed by the NPTEL team which can serve the overlapping needs of most disciplines. In addition to the physical laboratory, online simulated laboratories would be available for conducting experiments related to various disciplines as a part of the OER.

The other lecture room is for lectures or seminars by visiting scholars, learners or local community members. A creativity room provides for the resources and equipment for nurture of the various dimensions of the personality related to music, dance, fine arts, craft, poetry, dramatics, etc.

The silence room, an integral part of the Hall of culture, is a room for students to sit in silence and reflect or contemplate. This could be sound proofed with a glass brick opening at the top to allow some sun light to enter the room.

A separate room for the Parivrajaka\textsuperscript{100} in charge of the centre would be available, as shown. The HCT would be provided with the toilet block, drinking water fountain and cafeteria for use by students and run by them. The center would have on the outside, a vocational skills cafeteria, which would house equipment, resources and instruments needed for skills like carpentry, plumbing, electrical wiring, computer repairing, leather crafts etc. These could also be based on the local expertise and weather.

The hall of training will house 50 computers connected with a LAN, having internet connectivity. These will be connected to a common printer, copier, scanner and also have provision of headphones and microphones.

\textsuperscript{100} The Parivrajaka would be the Person heading the HCT. This is detailed in the subsequent paragraphs.
A community room for activity and extension work related to the local community would be available too. This entire building could be 'bordered' by a running track which also has the provision of a basic gymnasium. The complex would also have some gardens on all sides with local varieties of plants that can be tended by the students and local community members. This is not necessarily exhaustive or final and would need some more detailing.

Such spaces and configurations provide the ambience and setting for complete education. The statement by the renowned twentieth-century Swiss architect Le Corbusier, in reference to his Modular system of proportions, captures the general purpose of design 101: “Architects everywhere have recognized in it, not a mystique, but a tool which may be put in the hands of creators of form, with the simple, aim . . .of ‘making the bad difficult and the good easy’” (Le Corbusier, 1966, p. 5).

A great deal of care and attention is needed for detailing the spaces and configuration of these HCTs. This is not necessarily reflected as a mere increase in the costs and outlays but would certainly reflect on the aspirations, efforts and attention to details to make every nook and corner of the complex glow and be a perfect space for learning, becoming and being.

6.4.3.4.3 Learning Processes in the HCT

The learning in the HCTs would happen through several modes. Students would have the option of choosing from an online lecture mode, interaction with online mentors, discussions with other students and mentors in the HCT such as the Parivrajaka and Upa Parovrajakas.

101 Designing Open Educational Technology by David Kahle, Opening up Education.
A basic book and CD, DVD library of the different E-content can be made available in the HCT. The preference is for online streaming of OER which can, no doubt, be updated at source. But, given issues of bandwidth, which might still be a bottleneck in the initial five to ten years, it may be a good idea to provide for the offline OER banks too in the HCT. These OER could include films, dramas, interviews with experts, virtual study tours of facilities and places, multimedia presentations, e books etc.

They can learn by silent reflection in the silent room, which is especially designed as a part of the HCT. In addition, the students can interact with their co-learners on the multiversity net. Lectures on various disciplines and topics would be neatly catalogued and available online. In addition, everyday, there would be a packed schedule of talks and lectures by the most eminent minds that will be telecast through the Integrated e-Classroom facility that each HCT has.

The learning that happens in the HCTs would be very different from the passive teaching paradigms presently found in most colleges. Instead the entire emphasis in this paradigm, including the design of the HCT is to stimulate constructivism, constructionism, social constructivism and self education.

The idea of the HCT or for that matter, a college, is not to build a structure to merely listen to lectures. On the other hand, the HCT is meant to initiate and nurture and accelerate the process of self education; to encourage oneself to learn more and more and develop the searching mind. The ideal climate and environment ought to be one that brings forth various questions and answers and raises the consciousness to be able to find the answers with quietude and an inner enquiry at a leisurely pace.

**6.4.3.4.4 Provision of Integral Education**
What could be the other specific tasks or action taken in this direction of providing integral education? Given the fairly high importance accorded to development of different dimensions of life other than the professional dimension alone, this assumes great importance. Intrinsic values such as truth, hard work, sincerity, intelligence and character that have been selected by respondents can be developed through some of the methods outlined below.

6.4.3.4.4.1 Stories related to Intrinsic Values

One such action could relate to the narration or provision of stories of truth, beauty and goodness. These could be drawn and compiled from various contexts and cultures of the world and be a central, core part of the OER that would be offered to the learners. A repository of about a hundred stories could be built and these could be further expanded.

Inspiring stories of the freedom struggle of India and the values that inspired the National leaders could be presented to the students. This could be using OERs through lectures, dramas, screening of films and conversations with eminent people using the multiversity portal.

As the survey reflects the need of students for education in various dimensions, these are provided variously in the HCT. The very ambience and culture at the HCT, the OER and the attitude of the Parivrajakas and the biographies, stories and monographs referred to in the next section would also explicitly promote the dimensions of life related to ethical and aesthetic dimensions.

6.4.3.4.4.2 Inspiring Biographies and Monographs

Material related to knowledge of the inner self could be compiled and presented to students. Monographs and books related to the values of illumination, heroism and harmony could be presented to students.
through OER. The study shows that there is a fairly high articulation of the need for inspiring life stories with details of the struggles, accomplishments, beliefs, faith and achievements. These would have to be prepared as multimedia presentations as demanded by respondents of this study. A possible list of such material is presented in annexure II.

6.4.3.4.4.3 Education related to the Physical Dimension

The jogging track and the basic gymnasium in the HCT would facilitate physical education. Integral education should include education of the physical dimension. The study shows that there has been maximum preference for this dimension to be emphasised. This relates to health, sports and longevity. In addition to actual physical exercise, sports and games, rich multimedia presentations on concepts related to the Beauty and Excellence of the Human Body\(^\text{102}\) could be included.

6.4.3.4.4.4 Education related to the Inner Self

A study and practice of the theme of consciousness through a variety of methods could be provided for students to choose from. This could range from provision of inspiring books, some of which are listed in annexure II to provision for quiet reflection and mentoring by online mentors and experts.

Provision for meditation through guided multi-media OER could be an integral part of this effort. The provision of the silence room in the HCT could play a very important role in providing the space for such reflection and quiet contact with the inner self. The Parivrajakas and the Upa-Parivrajakas could be oriented for such training through example, instruction and inspiration.

\(^{102}\) Details of this book given in Annexure II

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6.4.3.4.5 Parivrajakas

The Hall of Culture and Training would have three key functionaries to initiate the work and start the open learning process. These are a Parivrajaka and two assistants called upa-Parivrajakas. The centre will be headed by the Parivrajaka.

The Parivrajaka, as explained in the NPTEATT, need not be a specialist in any of the domains of knowledge but should be able to coach and mentor the students and be their friend, philosopher and guide. He or she would have to stay in the HCT complex in the residence block provided. The overall maintenance, development of the HCT and education of the learners that come to the HCT would all be taken care of by the Parivrajakas. For a smooth running, some detailing of the daily functions, the financial budgets and listing of tasks and roles would be made available by the NKN for each HCT. The Upa-Parivrajakas would be interns and would assist the Parivrajakas and also take up specific responsibilities in the smooth running of the HCT and the process of integral learning.

Given that this entire paradigm is one of a new education in a networked age, which requires a new culture of learning, the Parivrajakas would have to be sensitive to the implications. The modes of learning, mentoring, coaching and interaction would have to support the inevitability of informal learning. The HCT should have its distinct culture and emphasis on physical exercise, all round development, learning interaction through the OER, e-interactions of the NPs, interactions in the Hall of Culture and practise of silent enquiry in the silence room and the learning spaces of the HCT.

The Parivrajaka would have to be a new kind of teacher, who understands all this and is a patient teacher who guides and enables the full
manifestation of the abilities of the student, in an atmosphere of freedom, respect and harmony. Discipline would be a core principle of this arrangement but one that has the willing sanction of the students as partners in the process of discovery, learning and scaling new heights, within and without.

The overall model, to recapitulate, will consist of the Multiversity, the NKN, the seven National Programs, the member Higher Education Institutions and the HCTs.

6.4.4 Configuration at State level

It is proposed that each State have a node, which, in turn, links all the HCTs and other institutions in the State. This node could be at the Knowledge Consortium of the State. Such an outfit could provide a platform for co-ordination, consultation and collaboration with the various representatives of Higher and Technical education in the state such as VCs, Directors of Centres of Scientific and Technical excellence and National, International Institutions.

6.4.4.1 Corresponding State Programs

As the model gets started and matures, if the load on the NPs is very high and, more importantly, once the organisation culture of the NPs is sufficiently developed, it may be a good idea to spawn a corresponding State Program in respect of each of the areas to solicit more inputs and to slowly lead to a culture of decentralisation and participation. In any case, the States and UTs would be invited to form their Knowledge Consortia, which would be the corresponding nodal agencies at the State for consultation, environment building and soliciting inputs.

These broad strokes depict the overall model with its components, processes and methods. The next section ties up various tiers of the model.
6.4.4.2 Three tiered Structure

The seven national programs at the national level will be rolling out the compiled and standardised OER. The NPs will also sustain these by funding and support on a transparent basis. They would directly interact with the Colleges and Universities for soliciting their OER. However, for dissemination and consultation at the State level, the NPs could engage with the Knowledge Consortia of different States (KCSX) and Knowledge Consortia of homogenous National Institutions like the IITs (KCIIT and Sc), IISc and IISERs, IIMs (KCIIMs), Central Universities (KCCUs) and so on. After the model gains maturity, different KCs could also be involved for compilation of OERS. This will be to facilitate the compilation of OER, vetting of OER and so on. There is a tier at the ground level at the HCTs. Thus there are broadly three tiers, at the National, State and local levels. Tiers at the District level, cluster and college could also be developed in future as shown in the figure below, if
the mechanism at the State level is inadequate for compilation of all the material and state level reports of the HCTs.

Fig. No. : 6.3 Multi-tier diagram of OHE model
6.4.5 Academic and Administrative Audit (AAA)

Another important component of the model is the mechanism for the Academic and Administrative Audit (AAA). This will put in place a rubric to ensure that the principles of good governance, viz., participation, fairness, transparency, decency, accountability and efficiency are followed both at the supply side and the demand side.

This is planned as an independent program to be carried out by a task force specially constituted for the purpose. A sub group of the AAA task force could work on grievance Redressal and conflict resolution mechanisms by mentoring and counselling, in keeping with the spirit of integral education.

AAA agency would comprise financial experts and academic experts who would put in place a complete protocol for the maintenance of quality by conducting periodic assessments of various component programs, the OER, the HCTs and all other processes that are a part of the model. Teams of experts can be drawn from various organisations after being selected, empanelled and trained. These need not be full time team members although a core team of about five to seven people may be needed for the AAA core team, which can assist and work as per directions of the task force.

6.4.6 Financial and Resource Implications

The finer details of the costs and implications would have to be worked out. This will require detailed working out but it is presumed that each HCT could be built at a cost of about 3 Crores. This includes the cost of building, computers, furniture and all associated infrastructure. This assumes that Government land is available on a cost free basis or the HCTs are collocated in existing educational campuses which have some land that can be used.
The cost of engaging as many as 2000 National level scholars would come to about 240 Crores, if they are compensated at the rate of about 12 lakhs per annum. Similarly, the cost of the National Youth Fellows at the rate of about 1 lakh Rupees per annum will totally come to about 60 Crores. The cost of the task forces and their programs would have to be calculated, which could be overall in the range of about 10 Crores per National Program task force to begin with. This would not include the cost of creation content which would have to be on the lines of Sakshat and the present form of NPTEL.

Given that the outlay\textsuperscript{103} for the National Mission of Education through ICT has been in the range of about Rs 4,612 Crores for the period from 2008 to 2012, the cost detailing for rolling out the model after working out the details does seem a possibility.

6.5 THE SOA BASIS

Service Oriented Architecture (SOA) model for ‘OHE model and Multiversity’ has been described in the following paragraphs:

The SOA model will enable the provision of search of various OERs and Open education tools by the users. They can find, bind and invoke the services that are all available with well defined standards, yet available in a loosely coupled mode. The providers of various services would be the constituent Universities, Colleges and Institutions of the multiversity as well as private service providers who may wish to provide services for a cost.

\textsuperscript{103} http://www.sakshat.ac.in/PDF/Missiondocument.pdf
6.5.1 SOA Components of the Model

The model would broadly consist of the following parts:

1. Hall of Culture and Training at the local level. This part could also be represented as the access point in a college. The access to the Multiversity gateway, would, needless to say, be available from any internet access point such as a cybercafé or even an office or home.

2. The access to the Multiversity is through its Access Gateway or the Portal, which is run by the NKN or the National Knowledge Network.

3. The next layer is the Applications layer which has the Business
processes such as the NPTEL application for creating OER and
managing these, NPTER application or Business process for
facilitating Research, NPTEEATT for faculty empanelment and
training, NPODOLE for conduct of assessment and examinations,
the NPTER for Research applications, NPTEE for extension
applications, NPTEG for Administration and Management
Applications as well as the NICP for various live Lecture, teaching
and mentoring applications. These represent various ‘services
which are bundled together into a logical flow’ (orchestration or
choreography\textsuperscript{104}) to some sort of an end-to-end business process.

4. The next layer is the services layer which is a set of capabilities from
the constituent enterprises. The description of these services, QoS
(Quality of Services) and SLAs (Service Level Agreement) are all laid
down clearly and accompany the services in this layer. An application
or a Business process such as On-Demand-On-line Examination
Process would, in turn, comprise of several services such as the
registration service, verification of eligibility service, scheduler service
for the date and place of examination, assessment service, Viva
service, provision of mark sheet service, to name a few.

5. The Enterprise Component layer is used to realise specific functions
and this layer is responsible for the ultimate execution of the request
from the multiversity gateway or human-machine interface layer.

6. The layer of operational resources represents the legacy enterprises
with the systems and functions performed by the constituent
Universities and Colleges. These resources relate to the existing
systems, databases and resource persons for course creation, course

\textsuperscript{104} \textit{Page 9, SOA field Guide for Executives} by Kyle Gabhart and Bibhas Bhattacharya
offering, conduct of examination, recruitment of teaching resources, timetable scheduling for class room lectures and laboratories as well as the various services and registration/enrolment. The services that the SOA multiversity offers would leverage these existing resources and uncover new opportunities for utilising these assets within the context of a larger enterprise\textsuperscript{105}.

7. Other Infrastructure elements that are the key for the Multiversity to truly develop and fulfil its mission include the Business rules engine, Enterprise Service Bus, Policy Server, Process engine, Service Manager and Registry or Repository of services.

6.5.2 Key SOA features of the model

In the proposed model, the NKN Agency constituted by the Government of India acts as the initiator and catalyst, which gives both policy and regulatory support. The key infrastructure elements of the Multiversity are given below\textsuperscript{106}.

- The NKN, for example, use the Business rules engine to tweak and throttle key variables that drive the Business processes of the NPs. The standards finalised by the NKN will used for this.

- The Enterprise Service Bus is often considered the quintessential SOA infrastructure element. This is used to broker service transactions, route traffic to appropriate services. For instance, the users wanting to take an ODOLE will be routed through this to the various services such as the registration service, scheduling service, written examination service, viva service etc.

\textsuperscript{105}Page 9, SOA field Guide for Executives by Kyle Gabhart and Bibhas Bhattacharya
\textsuperscript{106}The concepts articulated in 'Pages 10 and 11 of SOA field Guide for Executives by Kyle Gabhart and Bibhas Bhattacharya' are transposed on the Multiversity model.
• Policy Server: This is very crucial and it is through this that the definition and implementation of policies is done. This includes issues of the use of service data, performance standards, security and reliability norms of the ODOLE application, for example.

• Service container: This is where the services actually live. For example, the Blue prints and the question Banks of the ODOLE would be pooled through intelligent caching on this application server.

• A process engine supports the definition of the various services that are orchestrated into a process and invokes various services to complete the process.

• Service manager is responsible for service life cycle management and monitoring its health and performance. It could, for example, ensure that the ODOLE is carried out and the mark sheets and results given within the stipulated period. There should also be provisions for soliciting feedback, grievances and suggestions on various aspects of the services to ensure course correction. The various task forces under each application will give their set of performance norms to be adhered by the service manager.

• Service registry or repository is an essential part of every SOA. It serves as the directory that describes the services along with interfaces and other descriptors.

The SOA based model of the multiversity could initially be a framework that only includes OER, which are at no cost to the multiversity. However, these could be offered to the end users for a pre-decided tariff list for various applications and services.
These payments would have to be made through a payment gateway, which would also be another composed service invoked by the Process or Application that is related to ‘Administration’ or Governance under the NPTEG. The rates for registration, enrolment, getting transcripts, examination fees, mentor fees, use of HCT fee etc. would be published on the portal. These would be fairly nominal costs to ensure access by the users and yet give it seriousness and value.

Over time, depending upon the stability of the model and with a view to making it sustainable, the NKN could take a decision on whether the multiversity should include private service providers who may have e-content and online tools for learning provided for a cost which could be regulated.

The diagram below details the components such as the Enterprise Service Bus (ESB), Curriculum Providers, Teaching Resources, Research Providers and the Learning cum Assessment Centres-Halls of culture and Training or HCT(Point of Presence). Connectivity for the HCTs and the constituent academic institutions is provided by the NKN. The technology task force will be responsible for this.
Thus, the learning spaces, programs, processes, standards and most importantly, the people and teams will all be well orchestrated into the model. Resources and Processes at HCT, Research and assessment through HCT and the SOA as well as the Teaching and mentoring through the Parivrajakas will finally constitute the model of the multiversity with HCTs that are suffused with learning and living.

6.6 INTEGRATION WITH CSCs OF NEGAP

On another note, as many as one lakh Community Service Centres (CSC) have been set up by the Government of India under the National E-
Governance Action Plan (NEGAP). These CSCs could also be given special access to avail of these services at a prescribed, marginally lower cost. The difference could be the legitimate service cost that the CSC can charge. This will help the viability and sustainability of the CSCs and make available a large presence of the multiversity even in remote villages and locations.

6.7 THE STEADY STATE

The earlier sections were focused on creating or setting up the multiversity with the collaboration of the various centres of excellence of the country as well as interested institutions of higher and technical education. As described in chapter III, the maturity model (SOA MM which was detailed in Annexure I) defines five levels of maturity over time with respect to SOA adoption in the OHE model. At each level, the model identifies progressive benefits that the NKN will be able to realize. The five maturity levels and key educational process impacts relate to initial services of the seven national programs (functionality), architected services (cost effectiveness), national programs and collaborative services (responsiveness), measured services of national programs (transformation) and optimized services of the national programs (optimization).

Depending upon the need and the level of maturity of the programs, as indicated before, corresponding State level programs to complement the National programs may be initiated and the aims and objectives of these can be suitably defined to complement the roles of the NPs at the State level. Similarly, the roles and functions of task forces constituted for the State level programs could be suitably defined on the lines of the NPs. The task forces would be sufficiently empowered and enabled to ensure success of the mission, aims and objectives that have been already stated.
Once the model is created and the multiversity is set up, the task forces created for the various National Programs could be empowered to facilitate the smooth sustainable, running of these programs as well as the HCTs through the multiversity. At the end of every three years, a complete relook at the reports of the performance, the success, drawbacks could all be studied and changes incorporated. The reports of the Academic and Administrative Audit as well as independent reviews and evaluations could be carried out to make course corrections. A systematic, objective way of measuring the quantity and quality of the talent pool thus created would have to be gauged every year. Systems of feedback collection, evaluation studies and analysis of this data would have to be an essential part of the SOA model.