REPORT OF THE COMMITTEE ON IT @ COLLEGES

THE KERALA STATE HIGHER EDUCATION COUNCIL

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INTRODUCTION

The functions and responsibilities of the Kerala State Higher Education Council include evolving "new concepts and programmes in higher education".

Quality in higher education derives from quality of infrastructure (laboratories, library, classrooms, amenities), curriculum, pedagogy, assessment and evaluation and the quality and commitment of personnel (teachers, administrators, facilitators and management). To deliver quality graduate and post graduate education, which will provide the students the edge in the competitive employment market, it is necessary that all elements of college and university level learning and teaching ecosystem embrace the best of today's educational technology and practices. As educationists world-wide have discovered and indeed endorsed, Information Technology provides some of the best tools and solutions to make this happen.

Kerala leads the nation when it comes to indices of literacy and quality of life of her people. Colleges and Universities need to be focused on making sure that students are ready for the careers that await them when they graduate and enter the workforce. KSHEC believes that Kerala students deserve indeed demand our best efforts to make this happen.

The Kerala State Higher Education Council (KSHEC) constituted a Committee named "IT @ Colleges Committee" on July 2013 with experts in IT field to study the available IT facilities in the Colleges in Kerala and also to ensure that every colleges in Kerala has the required infrastructure for use of technology for teaching and to develop content for the courses.

This report gives a brief idea about the current developments in the field of Information Technology and how we can make use of those facilities in the Colleges in Kerala. The field of Higher Education in Kerala can be improved by introducing the e-Learning facilities like Smart Classrooms, Virtual Labs, MOOCS etc. The report also discusses the IT facilities introduced by the Government of Kerala in the Colleges in Kerala. The opportunities and the challenges faced by the Government to implement e-Learning is also covered.

The details of the study conducted by KSHEC about the current availability of Systems and Equipments in Government and Aided colleges in Kerala is also included in this report. Based on the study, a cost estimate has been prepared by KSHEC to implement a Technology Enhanced Learning and Teaching Facility (TELT) at Colleges.

I would like to place on record my appreciation to the members of the Committee for their dedication and hard work.

Amb. (Rtd.)T.P. Sreenivasan
Chairman of the Committee

1.1 Gearing up for the 21st Century Campus

The meaning of "going to college" is changing. While higher education is more important than ever, the idea that the classroom or lecture hall serves as the primary educational venue is being uprooted. Technology is broadening the opportunity for learning, making every personally owned computer, smart phone, and tablet a potential academic resource.

To take advantage of this trend, and to match the expectations of a tech-savvy student body and make more of budgets, colleges and universities must explore new ways of virtualizing and sharing their resources like teaching collateral, learning modules, computational and storage hardware and software to deliver a consistent learning experiences, regardless of device or student location.

Traditional methods of learning and teaching – both are undergoing changes that are driven by developments in the field of Information Technology (IT). IT in education is now perceived as one of the important means of meeting the evolving needs of the students, faculty, Universities and Society as a whole. Developments in the field of Technology and Communication has facilitated e-learning.

Most Universities across the globe have adopted e-learning into their portfolio of offerings. This has become a necessity for global universities to enhance the overall education system and improve

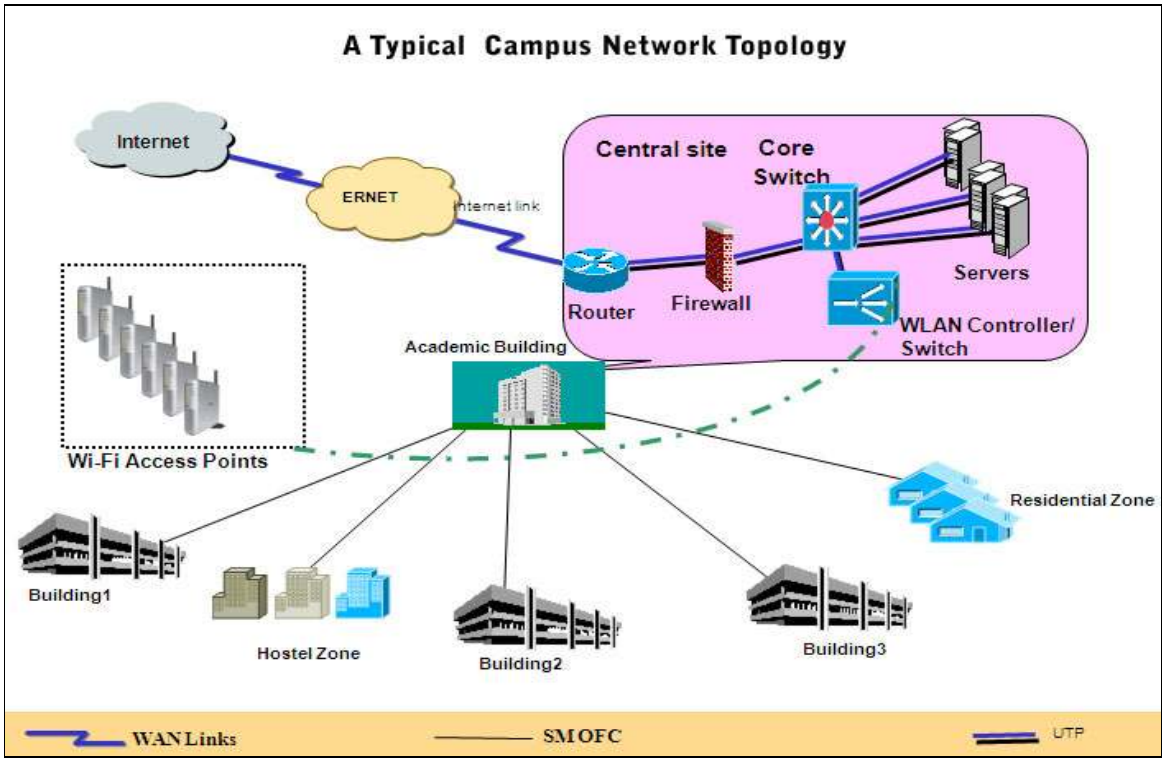
performance of their students. The field of Higher Education has been an area of focus for implementing E-learning.

The following technologies and initiatives can be considered as essential if the State is to IT-enable its graduate and postgraduate educational systems and aspire to be a national leader in the business of equipping her young people for a meaningful and fruitful professional and academic career:

1. Connected Campuses: WiFi and fibre-optic networking in every higher educational campus in the State
2. Server consolidation and desktop virtualization: To realize a cost effective, optimally utilized computing system
3. Smart Classrooms: Leveraging technologies like interactive boards, lecture capture, audio visual presentations
4. Virtual Labs: Harnessing computer technologies to bridge the gap created by insufficient experiment and "practical" infrastructure
5. Course Content: Harnessing massive Online Open course materials
6. Digital Archiving: building upon existing knowledge bases like Kbase and MGU Thesis archive.

1.2. Connected Campus

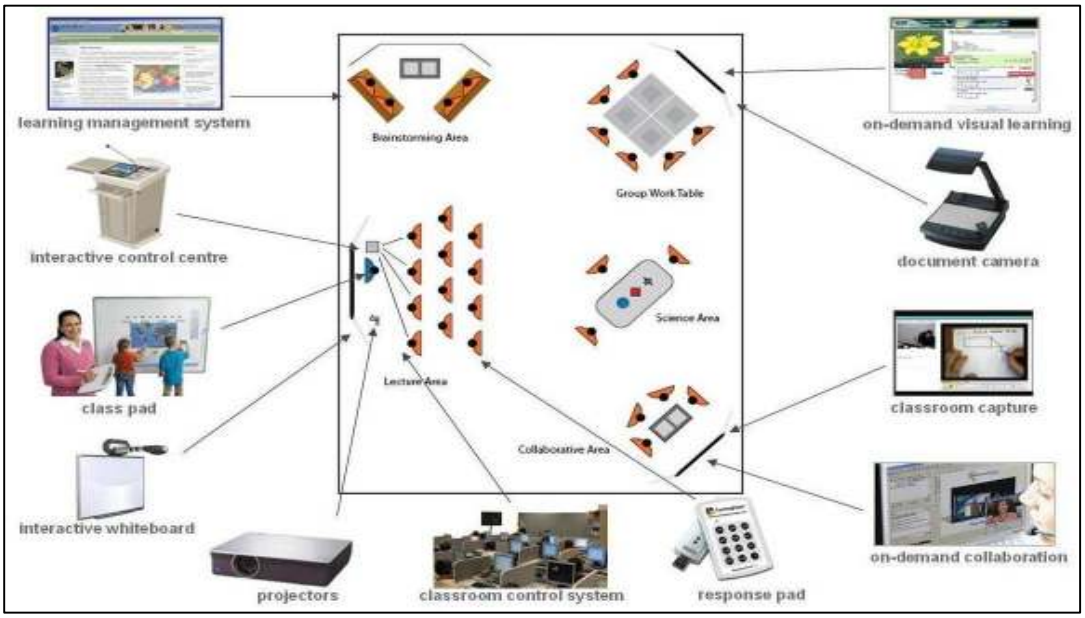
The first requisite for enabling any educational system is a connected campus. These days wireless has emerged as the cost effective way to go for Internet enabling small or large campuses. However a combination of wired (fibre-optic) gigabit ethernet and wireless (802.11b/g/n) often turns out to be a cost effective solution. In the case of colleges and other educational campuses, the network needs to include classrooms, laboratory, common areas like library, administrative offices as well as student residential areas (hostels), if any. Students today already come equipped with their own connected devices like smart phones or tablets. At the most, some might need assistance to equip them with an Internet-connected device. A campus wide Communication network is therefore both a necessary and sufficient piece of infrastructure to complete the connection between institution, teacher and student.



1.3 Server Consolidation and Desktop Virtualization

Virtualization on the server side ensures that server utilization is dynamic and based on demand -- switching applications across multiple servers for optimally exploiting their resources. The newest variant of this trend is cloud based servers, where individual institutions, which do not possess the knowhow or expertise to manage their own servers, harness such resources by tapping cloud-based servers on a use-based model. We believe this is particularly relevant to the Kerala educational environment, where the overwhelming majority of colleges have neither the experience nor the wherewithal to own and manage their computing resources. We believe however that a judicious mix of private cloud -- owned and centrally operated in the State by the higher education department or its trusted contractor -- and publicly owned server-as-a-service clouds for seasonal demand surges will be the best solution.

1.4 Smart Classrooms



A Smart Classroom is a traditional lecture style teaching space, which has available technological equipment that can be used to aid and enhance instruction of a course. This typically consists of computer and audiovisual equipment, internet access, projection system, and an interactive smart board. Individual student desks may or may not be equipped with PCs. However current thinking is that every student must have his or her own computing/communicating device -- no matter how basic – like tablet, smart phone or an iPad. This ensures the connected classroom is truly interactive and self paced -- as opposed to the unidirectional teaching methodology of traditional 'brick' classrooms.

Smart Classrooms also include an interactive learning software suite, which provides teachers with the essential tools to manage classrooms, assess students and encourage collaboration. Such software is designed to easily integrate with existing classroom technology and the institution's wireless or wired network. Instructors can easily transition between lesson creation, classroom management and student assessment. It reduces the time it takes to set up classroom technology, enabling greater focus on teaching and learning with instant assessment and classroom management.

In an environment that many of the courses conducted are repeated to multiple audiences either on or off campus, the modern Connected Smart classroom also needs the ability to:

a) Stream instruction to the classroom from outside sources including Web, YouTube type Internet video or stored and forwarded audio visual modules from wherever it is available

b) Capture the ongoing session in audio and video for later editing and reuse.

Lecture capture has now emerged as a useful adjunct of smart classrooms. It allows the lecture, often delivered by a highly paid guest or expert, to be preserved and reused at other institutions at minimal additional cost.

There are many elements to smart classrooms; not all of them will be relevant to every institution. But it is our understanding that every college must invest in at least one smart classroom if it is to exploit and harness the shared education resources that the State *in toto* will generate.

1.5 Virtual Labs

Virtual Laboratories are central to IT-enabled learning and significant cost saver that becomes very relevant in situations where institutions are challenged to provide traditional lab environments either through logistical problems or because of financial constraints. To a large extent, Virtual ie computer simulated, labs can serve as a substitute -- and the Virtual Labs initiative of the MHRD has brought together multiple Indian institutions into a common, collaborative space where they share the virtual labs created by them. http://www.vlab.co.in/

The aims are:

a) To provide remote-access to Labs in various disciplines of Science and Engineering. These Virtual Labs would cater to students at the undergraduate level, post graduate level as well as to research scholars.

b) To enthuse students to conduct experiments by arousing their curiosity. This would help them in learning basic and advanced concepts through remote experimentation.
c) To provide a complete Learning Management System around the Virtual Labs where the students can avail the various tools for learning, including additional web-resources, video-lectures, animated demonstrations and self evaluation.
d) To share costly equipment and resources, which are otherwise available to limited number of users due to constraints on time and geographical distances.

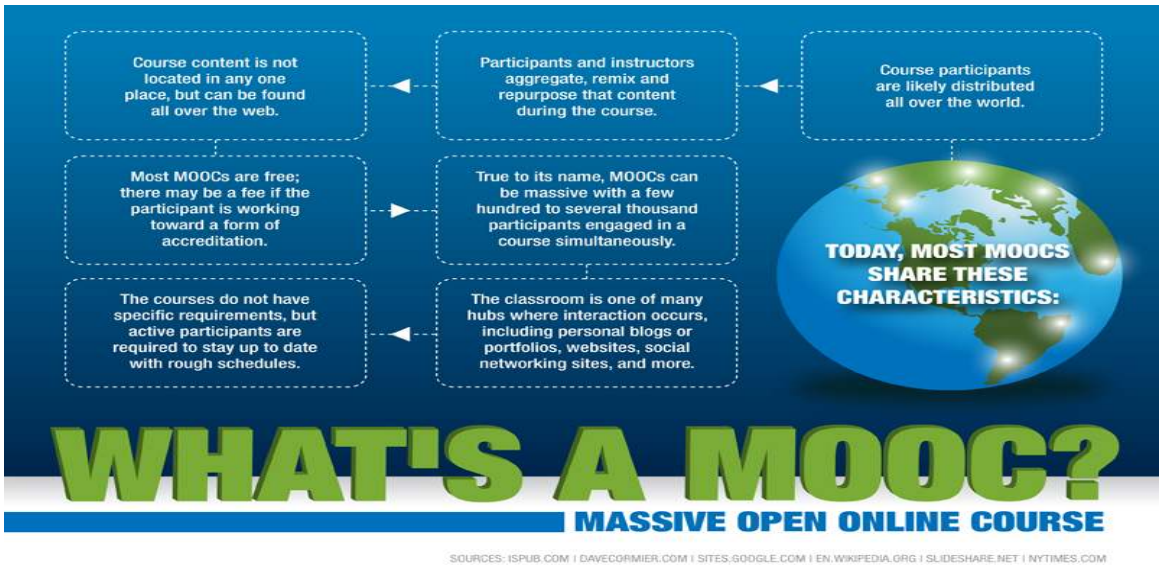
In the Kerala context, it is worth mentioning that the **V Labs** initiative of Amrita University is a partner in this consortium and has developed a suite of such Virtual Lab in Physical, Chemical and Engineering sciences http://vlab.amrita.edu/. They make use of technologies like animation, videos, simulations and remote trigger.

The Kerala Government's Centre for Development of Imaging Technology [C-DIT] has also created a few Virtual Lab tools, especially in the area of Electrical Machines. C-DIT has created a multimedia CD, which will help students "perform" the experiments, using the mouse to make electrical connections, switch circuits on and off slide rheostats, adjust and read meters exactly as they would do in a real lab. Pull-down windows provide the usual lab documentation: Aim, Apparatus, Principles, Diagram and Procedure, which the students can review before 'doing' the experiment with the visual tools provided. Experimental readings can be logged and tables of results created exactly as in real life. There is even a "viva voce" that the student can take at the end of the experiment with the sort of questions examiners like to ask. Some of the classical experiments like Swinburne's test for the efficiency of a DC motor; Hopkinson's test of the mechanical coupling of DC machines; the Scott connection to convert a 3-phase load into a 2-phase source, the open circuit characteristics of a DC motor may be performed.

1.6 Course Content: Harnessing MOOC

Even if the infrastructure constraints of IT-enabling are overcome by an institution, the challenge of is to find appropriate course content suitable for its programme. MOOCs (Massive Open Online Courses) is an online course aimed at unlimited participation and open access via the web. In addition to traditional course materials such as video lectures, readings, and problem sets, MOOCs provide interactive user forums to support community interactions between students, professors, and teaching assistants. They are similar to university courses, but do not tend to offer academic credit. A number of web-based platforms (initiatives) supported by top universities and colleges

offer MOOCs in a wide range of subjects. India is the second biggest market for MOOCs in the world, following the United States.



National Programme on Technology Enhanced Learning [NPTEL] is a joint initiative of the IITs and the IISc. NPTEL provides e-learning through online web and video courses in engineering, science and humanities streams. The mission of NPTEL is to enhance the quality of engineering education in the country by providing free online courseware.

The MOOC and NPTEL models may be customized to enhance the quality of teaching and learning in science and arts colleges in the State.

1.7 Digital Archiving: Creating a Knowledge Base

The digital archiving of all knowledge created within the higher educational system is considered to be an essential component of any ICT-enabled academic system. Kerala has been fortunate in that at least two such initiatives are already on the ground:

a) **Kbase** is the Digital Repository and the e-Learning System of the Directorate of Technical Education, Government of Kerala. An Institutional Repository along with an E-Learning System has been hosted at College of Engineering Trivandrum for all the Govt. Engineering Colleges and Govt. Polytechnics under the Directorate of Technical Education. The repository was established in 2010 to facilitate the deposit of digital content of a scholarly nature created by the faculty, staff and students and accessible to end users both within and outside the institution. This is intended to be shared amongst the departments as well as to preserve the valuable contents in a managed way. The

knowledge named "kbase" is an e-learning management system as well as an Institutional Repository which is an online locus for collecting, preserving, and disseminating, in digital form, the intellectual output of its various institutions. http://kbase.cet.ac.in/

b) **Thesis repository**: MG University, has created a free and open online archive of every doctoral thesis it has awarded –a first for an Indian University, and a significant academic archive in four languages that exceeds 350,000 pages. The university has completed the task of digitizing around 1100 of the 1250 theses in English, Malayalam, and Hindi accepted by the university during the last 25 years that is from 1983- 2008. MGU is the only one among 370 universities of India which has hosted such an archive. http://www.mgutheses.in/

Rather than 're-inventing the wheel', KSHEC proposes that these two initiatives may be extended, built upon and replicated across the higher educational system so that the valuable knowledge base within the system may be accessible to a larger public.

2. e-LEARNING

e-Learning is a powerful tool for the education sector that no Government can ignore. The social implications of transporting knowledge across a diverse society with all its demographic components (age, sex, earning capacity etc.) cannot be achieved effectively by the traditional class room and campus based methods alone. The benefits and cost advantages are too significant to be overlooked. A state like Kerala can effectively benefit from this environment given its head start it has in the field of literacy levels. In any case it cannot lose its advantage.

2.1 e-Learning in Various Segments

The e-learning market in India is a fragmented market as far as opportunity and solution providers are concerned. The provider side is led by players who offer Learning Management Systems (LMS) / technology platforms, content or assessment solutions. On the user side, there are opportunities in K-12, Higher Education (H.E.), professional courses, Skill Development, English language training, test prep (GMAT, GRE, TOEFL, IELTS, IIT-JEE, etc.) and MOOCs.

Higher Education

The size of the Indian education industry as a whole was pegged at INR 3,833.1 billion (CAD 708 billion) in 2012-13 by CARE Ratings, of which higher education is estimated to contribute nearly 60% and growing at 8.7%.

While 30% of higher education students worldwide take at least one course online, the Indian higher education system, which follows a fixed curriculum, does not allow students the choice of deciding which courses or the number of courses to be taken. However, by 2011 estimates, 26% of enrolments in the Indian higher education system (approx. 6 million) are still recorded under Distance Learning, which is a significant increase from the 20% recorded in 2001.

With students using their degrees to further employment prospects, certificate courses have higher acceptance over those that do not offer a certificate at the end of the course. The key challenge for international online offerings is the lack of recognition by the Indian government. For this reason alone, most of the students enrolled in e-learning programs offered by overseas institutions in India are mature, working professionals aiming for professional growth within their areas of work. See the section below on Corporate Training and Continuous Professional Development.

Opportunities in the higher education sector are strongest in the following areas:

- Providing certified e-learning modules that can be embedded into regular courses,
- Soft Skills programs that can be used to train college students preparing for job interviews and
- Joint Certification.

Challenges: The remuneration for delivering these courses would be relatively low.

Skills Development & Employment

With the government mandate to train a workforce of 500 million people by 2022, e-learning seems poised as the most viable means of reaching the masses.

To encourage the innovative use of technology and make skills development accessible across the country, the National Skills Development Corporation (NSDC) set up the "NSDC Innovation Fund" in 2013. It has already partnered with a range of organizations and piloted

twenty schemes (not all of them funded), ranging from English Language and Soft Skills, to mobile-based applications to help farmers.

Opportunity: Skills development is the most talked about segment in India today. Canadian companies could partner with the NSDC and/ or one of its training partners to deliver training in remote areas through e-learning. The new Companies Act 2013, mandates companies with a certain minimum income to spend up to 2% of their income on various Corporate Social Responsibility (CSR) activities, including education and training, and claim tax exemptions.

Challenge: Most training partners in this space at present deliver highly subsidized programs and are dependent on government funds for sustenance.

Very few sectors have the pull-factor that English Language Studies and Test Prep services offer in India. The presence of a large base of English language speakers is also the single largest reason for the boom in IT and outsourcing businesses in India. This boom has in turn fuelled an aspirational value amongst non-English speaking Indians who see English language proficiency as a ticket to economic improvement.

2.2 e-Learning - Challenges in India

Regulatory framework in India

After the dissolution of the Distance Education Council (DEC) in 2013, the power to govern the Open and Distance Learning (ODL) system has been vested in the University Grants Commission (UGC) and the All India Council for Technical Education (AICTE) for their respective domains.

The closest regulatory guideline that currently governs e-learning delivery is the same that covers "distance learning" in India. This is often referred to as "Gazette Notification No. 4477", which states that all qualifications awarded through distance learning by institutions established under the University Grants Commission (UGC) Act, 1956 will be recognized for the "purpose of employment" in government jobs in India.

However, no specific regulations have been laid down to date to govern either domestic or overseas institutions offering e-learning programs. As the Gazette notification states – only "for the purpose of employment to posts and services under the Central Government", qualifications must be recognized by the UGC. If students are not planning to work for the Central Government, the relevance of this regulation may be moot, but the allure of stable and highly respected employment with the government cannot be eliminated entirely. At the time of this writing, the new government has not yet achieved its first 100 days. The India

Trade Commissioner Education team and Edu-Canada will be closely monitoring any new developments.

Cost and Integration

The main barriers to widespread adoption of e-learning are 1) cost, 2) integration into the existing curriculum, and 3) setting up the required infrastructure at bricks and mortar institutions of learning. There is also a certain amount of resistance from faculty who is not computer literate and is intimidated by the prospect of e-learning. Without proper accreditation or recognition, students are also wary of taking up e-learning courses. Though international programs can and do charge a premium for their courses, the choice will always be between cost and volume.

2.3 e-Learning in India and Kerala

The Government of India's Ministry of Communications and IT has Department of Electronics and Information Technology (DeitY) that has been entrusted with the objective "to develop tools and technologies for e- learning".

In 2004, UGC set up the UGC-INFONET to provide electronic access to scholarly literature available over the internet in all areas of learning to the university sector in India. Teachers and College Professors are given regular ICT orientation programs through Academic Staff Colleges.

Brihaspati, an e- learning platform developed as open source software by IIT- Kharagpur in 2003, is being used in over 75 Universities / Institutes across India. This is being supported by Ministry of Communication and Information Technology.

NPTEL is a project to promote web based training and funded by Ministry of Human Resource Development.

2.4 Enhancing quality of education through Technology Augmented Learning And Education Environment Management (TALEEM) in the affiliating University -Colleges System

Technology Enhanced Learning (TEL) is much more than providing IT infrastructure and some IT applications. In the context of TEL, we need to address the following larger questions on how we ensure the new IT capabilities introduced in the colleges are put to effective use in transforming the

quality of education offered in the colleges and link the same to the socioeconomic progress of the entire state.

Q1: To practice Technology Enhanced Learning, the IT infrastructure needs to be well configured with relevant applications and services and running with good uptime. ***What support systems are needed to ensure for this effective maintenance, servicing and applications of the IT infrastructure?*** This should be seen in the light of many past IT infrastructure investments were made poor use of by the colleges and through depreciation lost their value. There needs to be ownership of maintenance and upgrade of the IT Infrastructure configurations, applications and services. We propose establishing 'ERLINK' (for Education and Research Integrated Library. Information, Networking and Knowledge) Services Centres - one in each district for all the colleges therein.

Q2: The largely mass exams-centric coaching type of system of education enforced by the universities severely dilutes the quality of education. This has weakened our universities and the colleges and distanced them from offering quality education. The universities are reduced to bureaucracies and administering admissions and examinations. Colleges are largely reduced to coaching centres. Our objective should be to impart knowledge and skills in the graduates to be globally employable, promote research, entrepreneurship, innovations and link education with socioeconomic development. ***Using the investments under the IT@ Colleges initiative and related others, how do we transform the present weak education system to one of quality education wherein courses are conducted with Outcome Based Education ? We propose the TALEEM Framework to address this.***

Q3: The biggest drag on socioeconomic development of Kerala/India is the disconnect and large gulf between education and the needs of development. This has also resulted in poor quality of education. How do we bridge this disconnect so that the vast energies of the youth, the knowledge and competencies of scholars and teachers of universities and colleges address the needs of socioeconomic progress in the light of the emerging knowledge society and economy?

Addressing Q1: Need for ERLINK Services

The first essential need is to ensure that the universities and colleges have effective and efficient support systems and services for the IT Infrastructure. We may refer to Fig. 1. The IT systems and processes we shall have runs at three levels: (1) The applications and processes that are cloud enabled and supported; (2) the applications and processes that run at colleges and university

infrastructure level; and (3) the IT applications and services accessed by students and teachers through access devices like laptops, tablets, IP-TV and smart phones.

The first essential requirement is that the universities, through their Boards of Studies should appoint empowered Subject Matter Experts (SMEs) (Block 4 in Fig.1) to assist the teachers and student in the colleges with lesson plans and expert assistance. This calls for enhancing the roles of Boards of Studies to oversee the creation, management and support for lesson plans We propose the system of TALEEM in the next section to effectively integrate IT enabled processes in each course conducted in the colleges

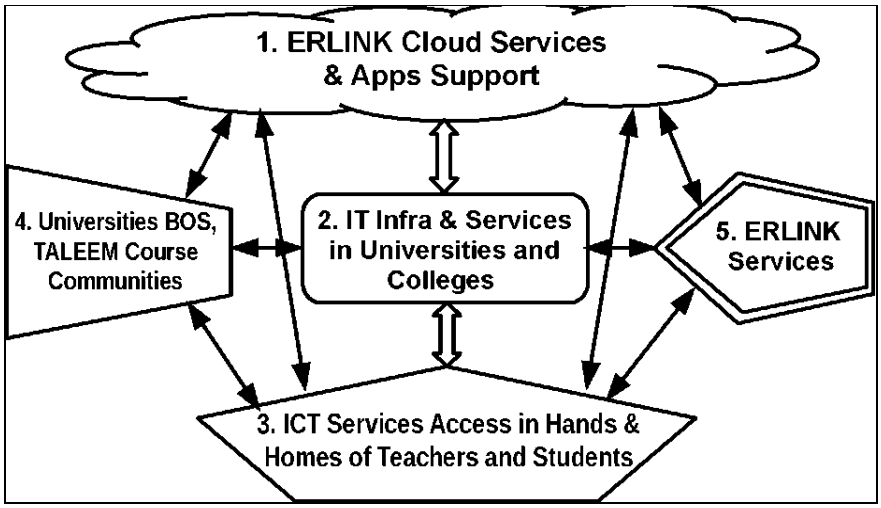


Fig. 1: ERLINK Supported TALEEM Services Framework

However for all these to work, we need very effective IT support for the TALEEM services Framework (explained in the next section). The colleges need College Internet Gateway systems, database systems of different kinds, Internet Security, WiFi hot spots, IPV6 LAN, Eduroam authentication services and more. It is over this ***managed IT infrastructure*** that we can run the educational processes, remote classrooms and so on. So we need to create at least one ERLINK (for Education and Research Integrated Library, Information, Networking and Knowledge) Services that may be shared by all colleges in each district. ***ERLINK Services is best run as a district (or university) level services centre with guidance from ERNET of DEITY.*** The broadband connectivity issues for universities is best sorted out under the NKN, NME-ICT and Digital India options provided under DEITY or MHRD. However this raw connectivity will require ERLINK Services support for ensuring the many applications and services that make its useful in academic environments.

Networked systems of education are complex and multi-tiered issue of applications, processes and their management. We need to create the requisite IT capabilities to manage them. Many are not going to be available from the narrow mix of applications and services available from the IT industry. So we need ERLINK. ERLINK will also ensure that complex applications like Virtual Labs, computations, Simulations and Visualizations environment are supported for competent academicians to build their research and applications over the same. ERLINK bridges the crucial gap between having IT and the ability to use it effectively in the support systems and processes that are required in education and research.

Addressing Q2: The TALEEM Framework

It is time that Indian universities grow out of being the bureaucracies that administer admissions and examinations. The present system has resulted in an enforced mediocrity of education reducing it mostly to coaching for patterned university examinations. It is time that our graduates meet globally acceptable quality of education. We need to respect the following three principles in assuring quality of education.

Principle 1: Outcome Based Education (OBE): Every course has clearly defined course objectives. Every student on completing the course shall achieve demonstrably the objectives stated in the course.

Principle 2: Scholar Attribute Profile (SAP): This is a generalization of the Graduate Attribute Profile as stated in the Washington Accord. SAP is achieved by the complete suite of courses and learning activities like projects, term papers and internship. SAP assures that on completion of the degree program the graduate is well equipped with knowledge of chosen specialization, capacity to apply the same in real world situations, modelling, professional judgement, capacity for team work, reporting and documentation,communication and presentation skills, sensitivity to society and fellow team members, ethics and character. SAP is achieved by a mix of courses each with OBE that span the mix of desired attributes as desired in the program design of the degree.

Principle 3: Organizational Learning Contract (OLC): OLC implies that every student entering a colleges enters implicitly into a 2-Party contract between herself/himself and the institution. The obligation of the student is to carry out the studies with the stipulated activities with due diligence, academic integrity, subjects to timely completion of assignments and assessment. The institution on its part assures that it will provide the student the necessary resources, ambiance, timely completion of learning and assessment activities and support with feedback for the student to acquire the stipulated knowledge and skills as stated in the course objectives and SAP of the program.

Together the OBE+SAP+OLC provide the total environment for effective completion of studies. What we propose here is the ***'Technology Augmented Learning and Education Environment Management', or TALEEM as a framework to effectively manage the OBE in the courses.*** Implicitly, TALEEM Framework also assist in achieving the SAP and supports the OLC. We illustrate in Fig. 2 the TALEEM Framework.

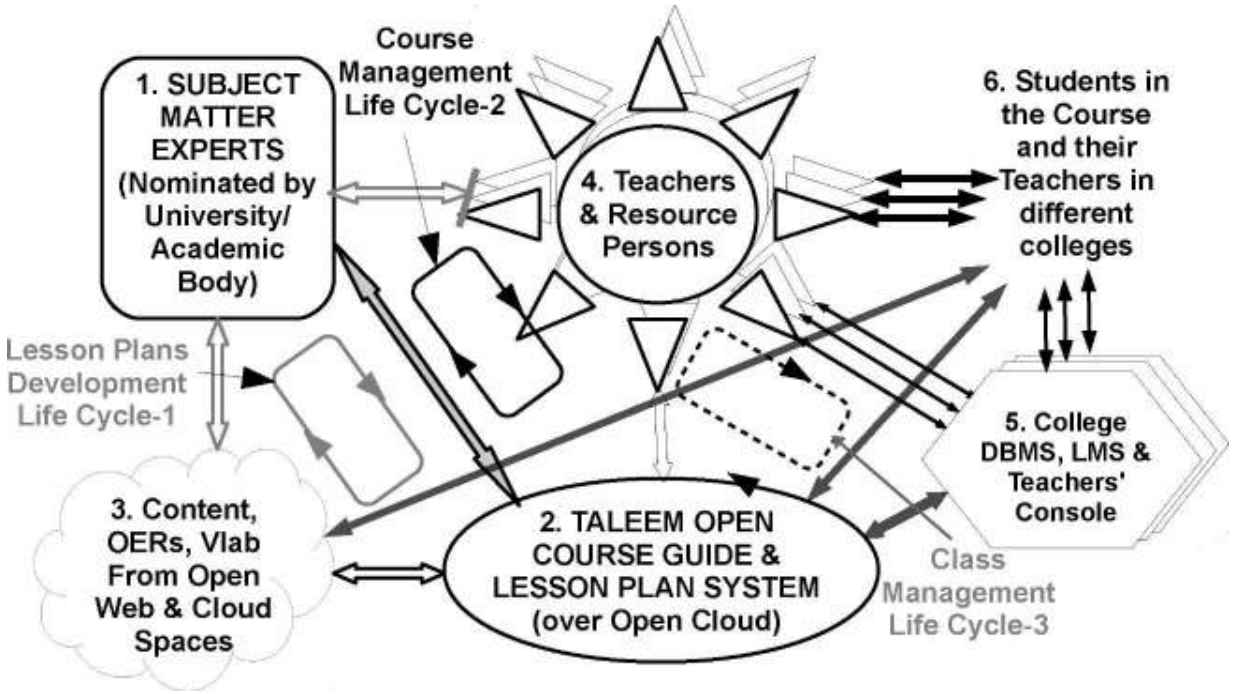


Fig. 2: TALEEM Framework for Courses

TALEEM Framework involves establishing and managing three life cycles as indicated in Fig. 2 and outlined below.

(1) Course Development Life Cycle (CDLC)

In TALEEM every course will have a detailed online curriculum as is being already done by the universities. The university's concerned Board of Studies should nominate at least two SMEs for each course in every degree program who will oversee the development and posting of the TALEEM Open Course Guide (OCG) and TALEEM Lesson Plans (TLP). An outline of these TLPs are given in the next section. The OCG and TLPs are published for open access in the university portal for all the teachers and colleges to use. CDLC must complete the development of OCG and TLPs before the course is launched. The SMEs in charge of the CDLC may also review annually and revise the OCG and TLPs.

(2) Course Management Life Cycle (CoMLC)

Once the OCG and TLPs are published for a course, our next concern is that all teachers in the different colleges teaching the subject are supported by one or two university nominated SMEs. These SMEs may be the same who oversaw the development of the OCG and TLPs, or different. The central functions under the CoMLC are twofold. First is that the university, through the SMEs associated with CMLC of the course will support orientation and capacity building of the teachers who are teaching the subject under the different colleges. Secondly, CoMLC will empower the teachers across the colleges and the associated SMEs to form a 'web-community' to assist them in their lectures and class management. With good networking, we may also add special lectures by the SMEs and seminars by invited experts in the subject to be multicast to the students in all the colleges.

(3) Class Management Life Cycle (CsMLC)

This is mostly confined to each college teacher and his/her class conducting the class related activities for the registered students as described in the TLPs and conforming to the OCG posted by the university for the course. Each college may use its own LMS and the class teacher, supported by assistants as necessary, carry out the class and students activities. Students across colleges may also participate through course community collaboration over the web and mobile. The college may use its own LMS and internal systems for computing and virtual learning environment that may be hosted in its premises or mounted over cloud servers. We propose in the next chapter the system of ERLINK Services to address technology related issues related to TALEEM.

There is a fourth course space also. It is that the collective of students and teachers in all the colleges under a university may form a course specific social networking, blogging, commenting on the course sharing their learning and connecting with web mentors. Each university should be supported to invest in the following activities.

(i) ***Preparing TALEEM Open Course Guide (OCG) and TALEEM Lesson Plans (TLP)*** for each of the course. This has to be done formally under the Board of Studies (BOS) nominated SMEs. We suggest that each university prepares the OCG and TLPs for the courses by asking the SMEs to conduct TALEEM Course Development Workshops with experienced teachers wherein the OCG and TLPs are finalized and recommended to the BOS for approval. This is then approved by the Academic Council. The OCG and TLPs provide links to respective online resources like NPTEL content and OERs that are recommended for use in the courses.

(ii) ***Orientation programs for teachers in the TALEEM Framework for each course:*** This will be conducted by the assigned SMEs. The university may also conduct the ***Proficiency Certification of Teachers*** in the concerned courses they teach as per the TALEEM Framework.

(iii) ***Online support for teachers of each course across the colleges (CoMLC):*** This will be valuable to ensure both quality and broad uniformity in the conduct of courses across colleges.

Addressing Q3: Assuring Quality of Education and Linking with Socioeconomic Development

TALEEM Framework will help the universities to transit from the present mass examination type of weak education system to one of OBE over a few years. As teachers get certified in proficiency, it will be possible to introduce assessment components that are better done by the teachers in colleges themselves. Colleges with good number of teachers with proficiency may be given greater functional autonomy. A greater percentage of marks may go into the continuous assessment system managed in the colleges. The present need for over-centralized examinations causing delays in Kerala's education system may be done away with. Instead the SMEs may be charged with setting up of term end examination papers on demand from groups of colleges. Many innovations become possible once we set up the TALEEM Framework.

There is another aspect of linking education with development. Courses of relevance to local development may be designed and each student should do at least one such course every year. In these courses they will take up real-world problems of importance to local development, do the modeling, design and analysis work leading to appropriate conclusions. Every College may depute part time students to work through the ERLINK services that connect with the needs of the local district. Such real-world problem solving courses will ensure that students education is connected with local developments as well. These may be projects oriented courses. Norms for conducting and guiding such courses may be published online.

Budget Requirements for TALEEM: We believe that there is a need to find the funds for manpower, workshops, proficiency certification of teachers, as recurring cost to effectively manage the TALEEM model of IT supported courses. We may need about Rs. 1000/= per student per year to run these services. With an estimated 500,000 students in the colleges, this will aggregate to Rs. 50 Crore per year for these ERLINK and TALEEM Framework services. 50% of this may be spent in the colleges themselves and the remaining 50% for the university related services.

HR for ERLINK and TALEEM Support Services: Every college will need at least two well trained IT professionals to support TALEEM. They need to be trained in hard IT skills, information management skills and media production services. In addition each district will need about 15 trained professionals under ERLINK Services supporting the colleges, cloud infrastructure and core applications. Such skills as required are not readily available from either educational institutions or the IT industry. ***IIITM-K may be charged with grooming such professionals as its ongoing advanced IT skills program.*** ERLINK itself may be positioned adjunct to the District Data Centre under the e-District or SWAN. In Fig. 3 we indicate the functional structure of typical District ERLINK services.

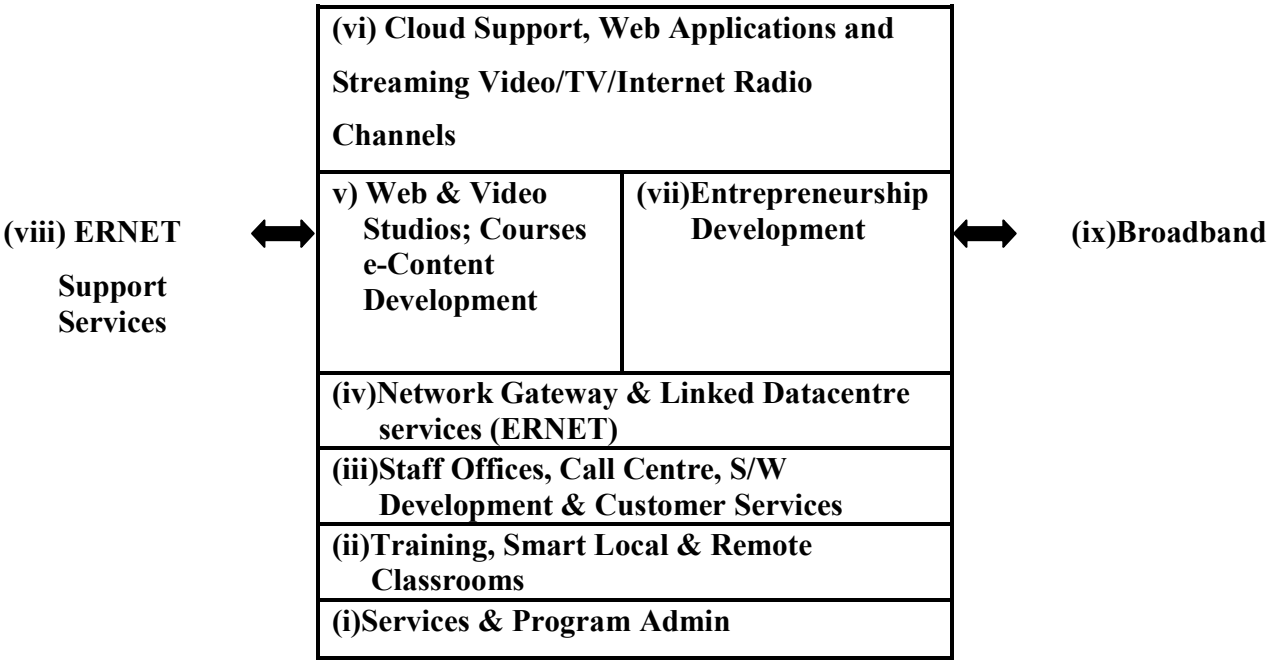


Fig. 3: Functional Structure of ERLINK Services Centre

A good number of problems that arise in the colleges for effective running of TEL in the courses and enabled by the IT@Colleges are effectively addressed by the ERLINK Services. There is one more issue in ensuring the establishment of ERLINK Services Centres in the districts with associated advanced skilling needs for its workforce. ***Towards this we propose establishing in IIITM-K the Centre for Advanced Research in Extensions Services (IIITM-K CARES) for effective execution of TALEEM Framework in the universities.*** This is effectively a modernized framework of the Kerala Education Grid that IIITM-K was executing in association with CET, CUSAT and NITC between 2003 and 2006.The initial capital funds for IIITM-K CARES may be asked in the form a proposal for central grant from DEITY under Digital India or such funds available from MHRD.

3. SUMMARY OF CURRENT AVAILABILITY OF SYSTEMS AND EQUIPMENTS IN GOVERNMENT AND AIDED COLLEGES IN KERALA

1. Attendance Method

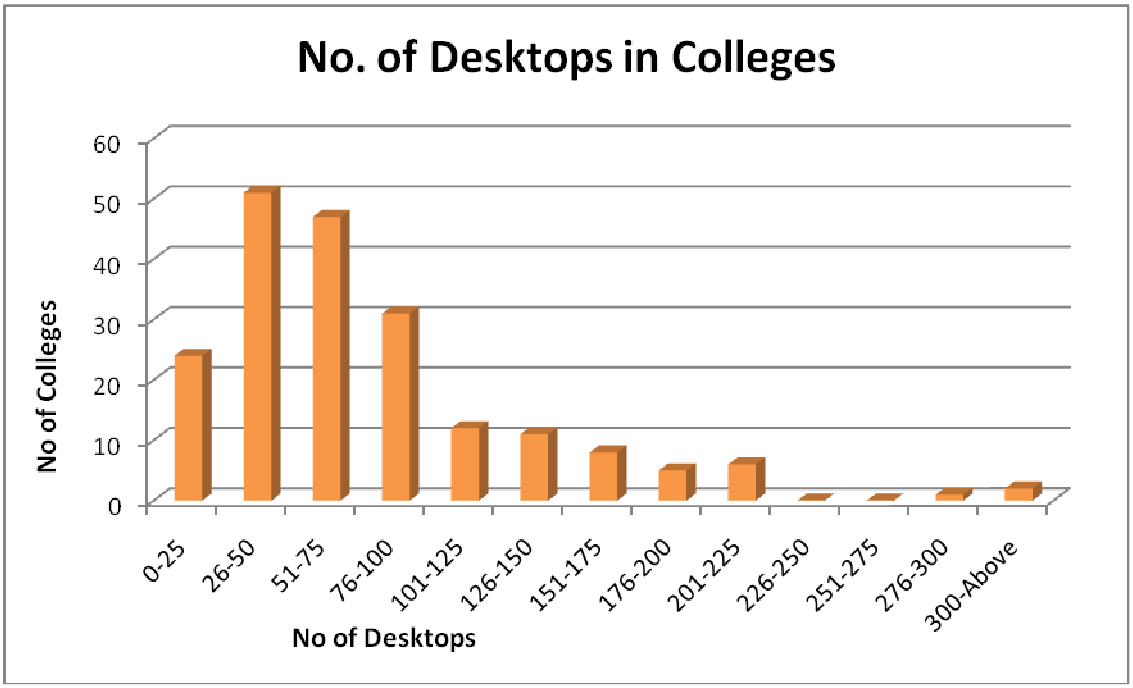
Only 4 colleges have physical biometrics and rest have manual method of capturing attendance of their staffs and students.

2. Desktop Computer:

All colleges are making use of computers in their office duties and computer labs. Some of the colleges have good number of desktop computers viz. St. Berchmans College Changanassery Kottayam has got 462 desktop computers, Nirmala College Muvattupuzha Ernakulam has got 345 desktop computers and Farook College Calicut has got 331 Desktop computers.

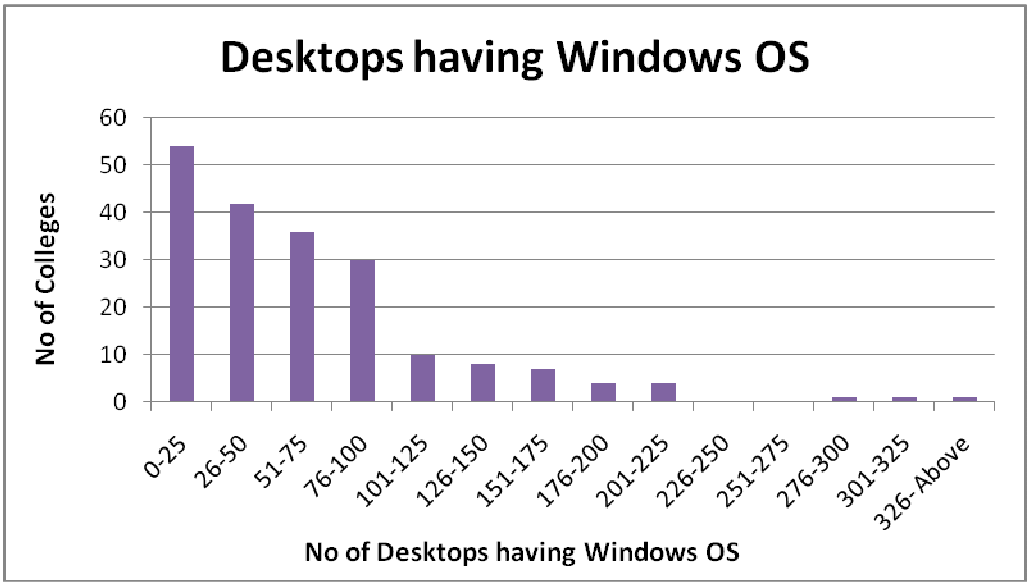
a) Number of Desktop Computers

No. of Desktop	No. of Colleges
0-25	23
26-50	51
51-75	47
76-100	31
101-125	12
126-150	11
151-175	8
176-200	5
201-225	6
226-250	0
251-275	0
276-300	1
300-Above	3



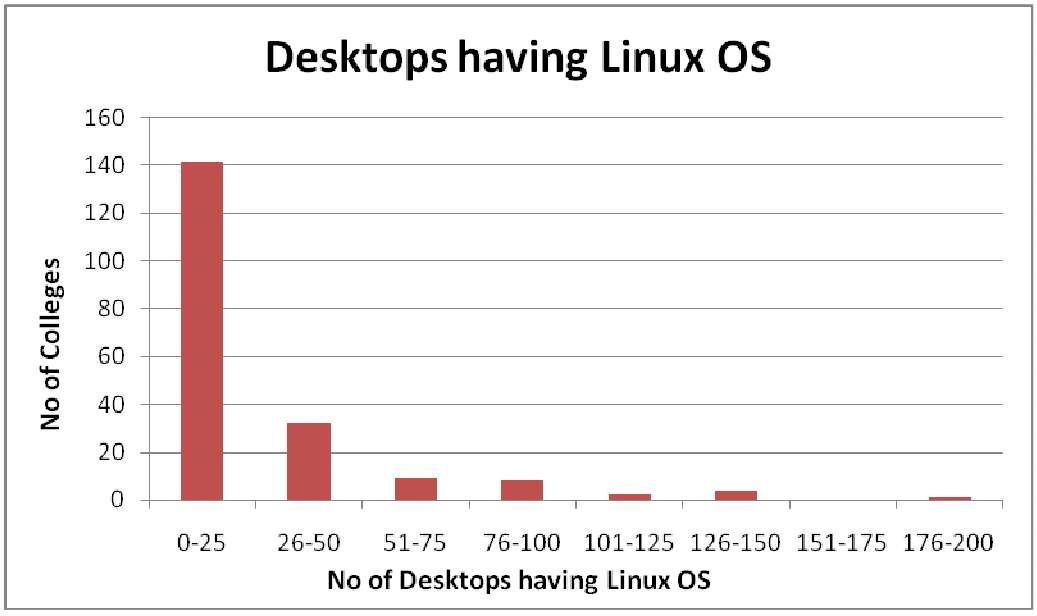
c) Windows Operating Systems for Desktop

No of desktop having Windows OS	No of colleges
0-25	54
26-50	42
51-75	36
76-100	30
101-125	10
126-150	8
151-175	7
176-200	4
201-225	4
226-250	0
251-275	0
276-300	1
301-325	1
326- Above	1



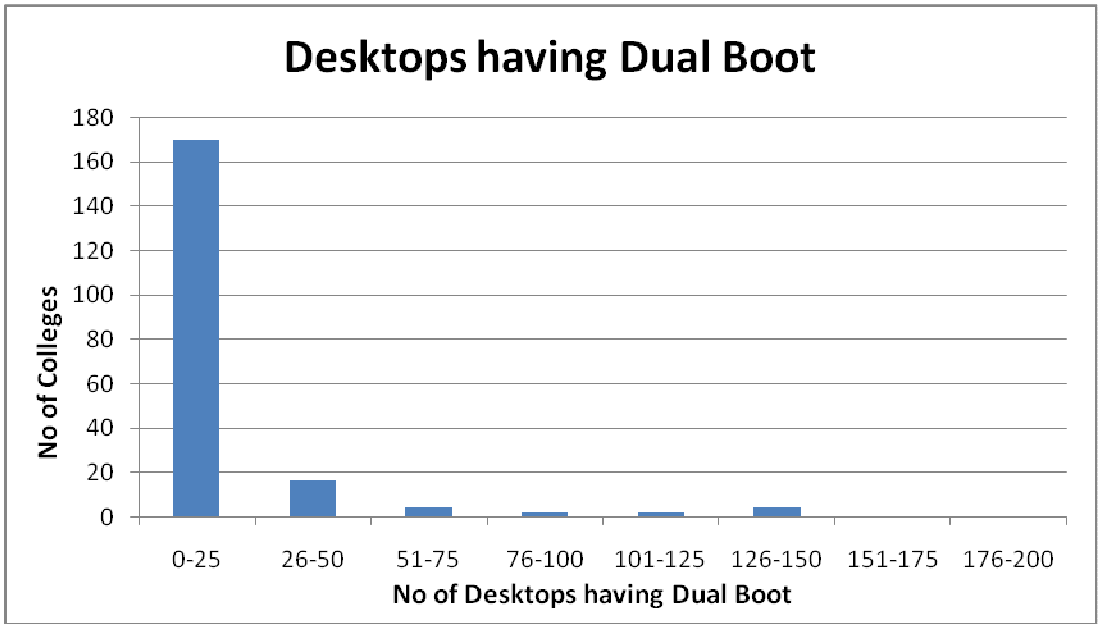
d) Linux Operating Systems for Desktop

No of desktop having Linux OS	No of colleges
0-25	142
26-50	32
51-75	9
76-100	8
101-125	2
126-150	4
151-175	0
176-200	1



e) Desktop Computers with Dual Boot Facility

No of Desktop with Dual Boot	No of colleges
0-25	170
26-50	16
51-75	4
76-100	2
101-125	2
126-150	4
151-175	0
176-200	0

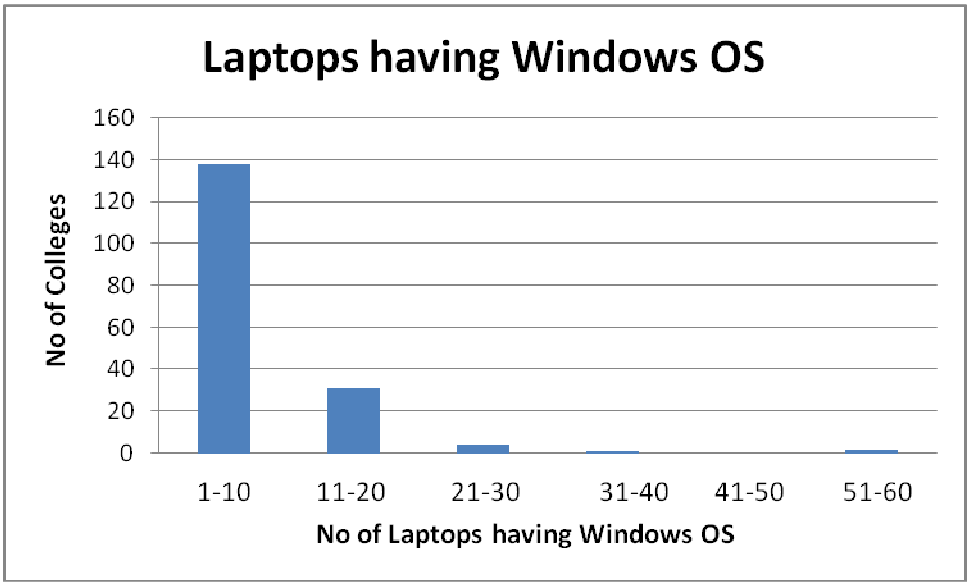


- Twenty one colleges use intel and AMD Athelon processor and rest of the colleges use only intel processor in their desktop computers.
- RAM size of desktop computer varies from 512 MB to 4 GB and HDD is upto 500 GB.

3. Laptop

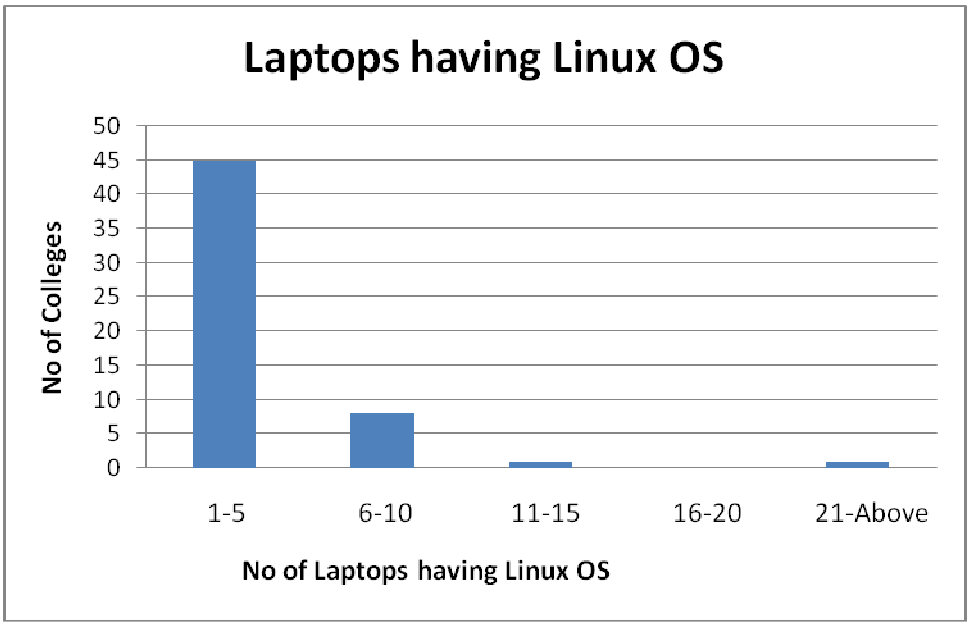
a) Windows Operating Systems for Laptop

No of Laptop having Windows OS	No of colleges
1-10	138
11-20	31
21-30	4
31-40	1
41-50	0
51-60	2



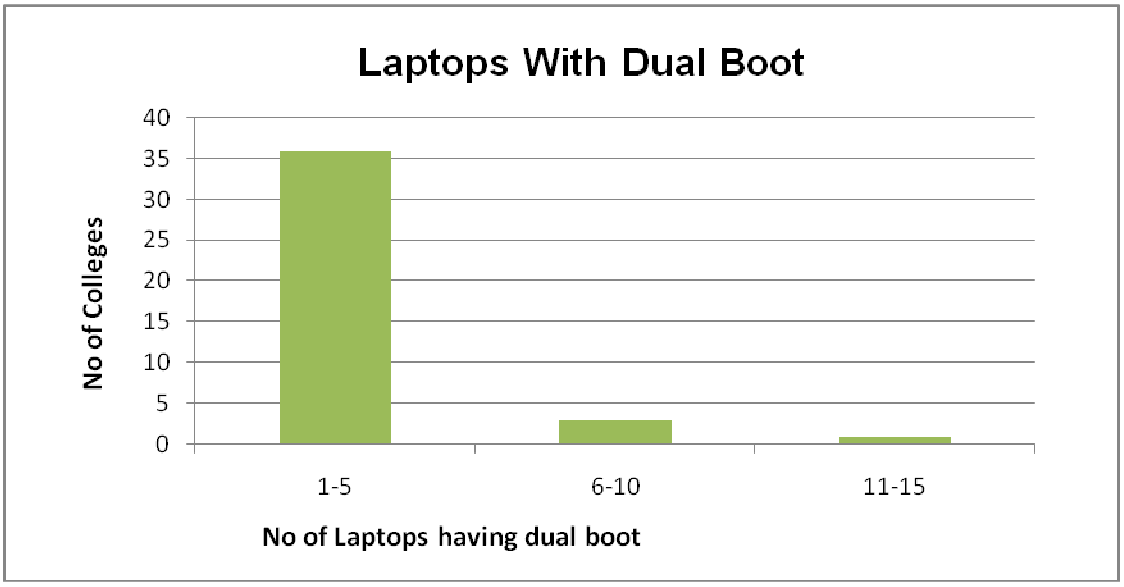
b) Linux Operating Systems for Laptop

No of Laptop having Linux OS	No of colleges
1-5	45
6-10	8
11-15	1
16-20	0
21-Above	1



c) Laptop with Dual Boot Facility

No of Laptop with Dual Boot	No of colleges
1-5	36
6-10	3
11-15	1



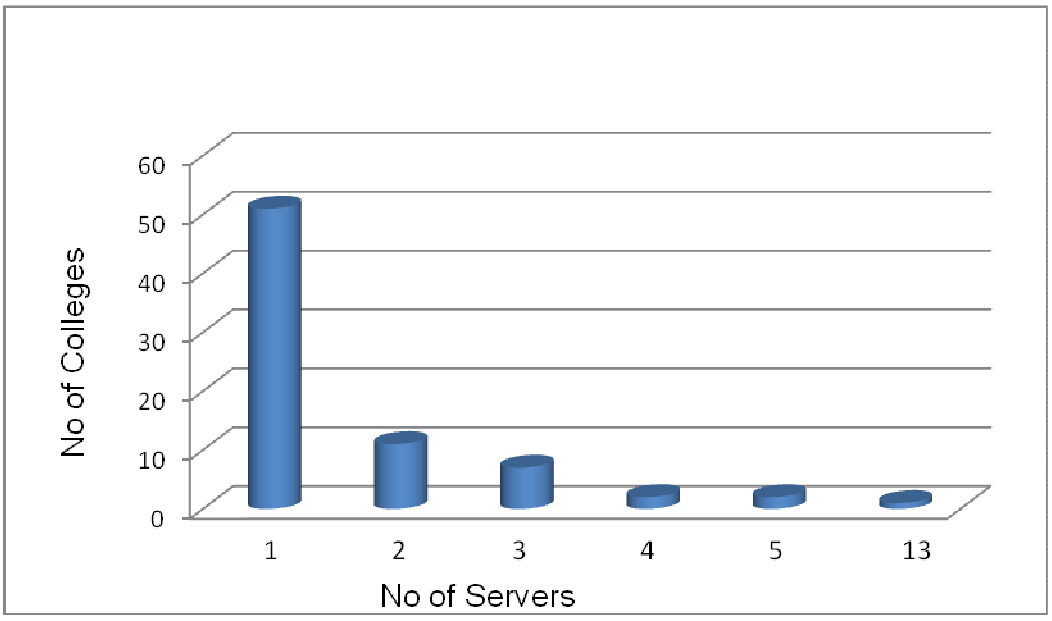
- All the colleges use Intel processor for Laptop.
- RAM size of laptop varies from 512MB to 4 GB and HDD is upto 500 GB.

4. **Tablet**: Twenty one colleges use tablet.

5. **Server Class Machine**

One hundred and twenty four colleges don't have any server class machine. Around 51 colleges have one server class machine. Sacred Heart College Chalakudy Thrissur has 13 server class machines, which is the highest among all colleges.

Number of Server	No of colleges
1	51
2	11
3	7
4	2
5	2
13	1



1. Nine colleges use AMD processor along with intel processor and the remaining seventy seven colleges use only intel processor for their server class machine.
2. RAM size of server class machine varies from 512MB to 16 GB and HDD is upto 500 GB.
3. Forty Eight colleges use windows OS, Nine colleges use linux OS and Sixteen colleges use both windows and linux OS in their server class machine.
4. Thirteen colleges use rack mounted server and remaining colleges use tower mounted server.
5. Twenty six colleges have configured RAID for their server.
6. It is also found that colleges have inadequate number of servers.

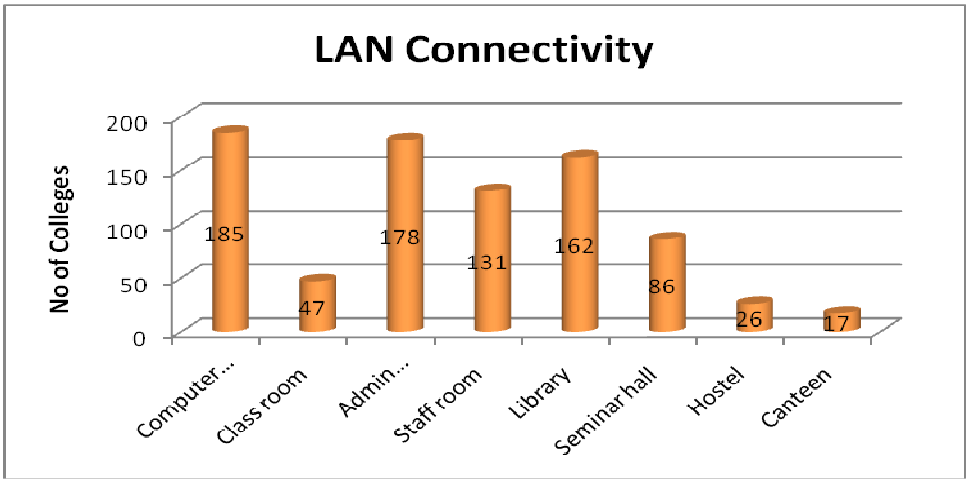
6. Antivirus

Fifteen colleges do not use any antivirus for their machines. Commonly used antivirus are AVG, MACAFEE, QUICK HEAL, KASPERSKEY, AVAST, NORTON, etc.

7. LAN connectivity

Most of the colleges have LAN connectivity in their computer lab, administrative office and library.

LAN connectivity	No of colleges
Computer Lab	185
Class room	47
Admin office	178
Staff room	131
Library	162
Seminar hall	86
Hostel	26
Canteen	17



8. Firewall

One hundred and twenty one colleges do not use any firewall and rest of the colleges use software firewall to manage internet traffic in colleges.

9. Internet Connection

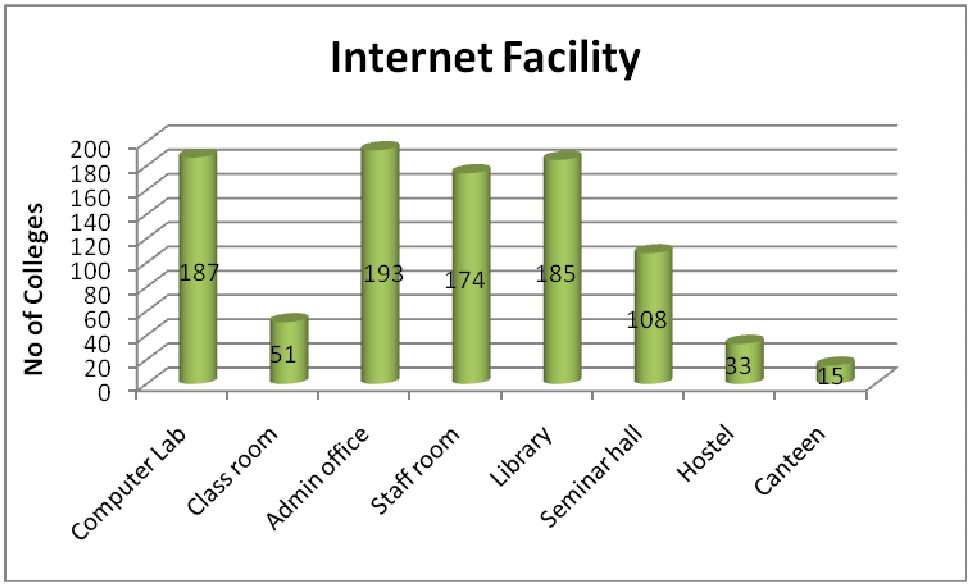
Twenty five colleges have Leased Line, two colleges have DSL, one college has Dial up connection and remaining 170 colleges have broadband connection.

BSNL is the ISP for most of the colleges. Internet bandwidth ranges from 512 Kbps to 100 Mbps.

10. Internet Facility

Most of the colleges have internet facility in their computer lab, administrative office, staff room, library and seminar hall.

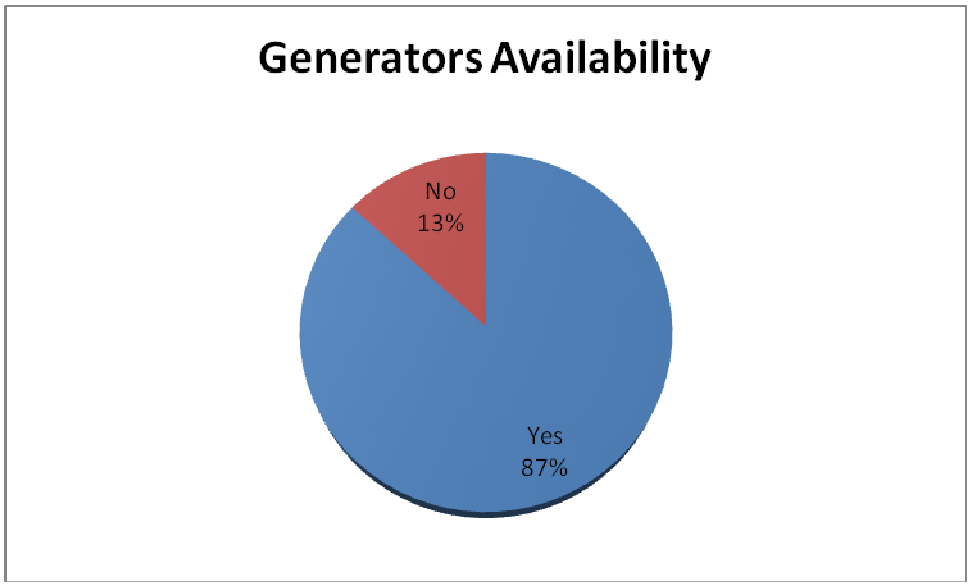
Internet Facility	No of colleges
Computer Lab	187
Class room	51
Admin office	193
Staff room	174
Library	185
Seminar hall	108
Hostel	33
Canteen	15



11. Generator Facility

Twenty six colleges do not have generator facility and rest of the colleges have generator facility.

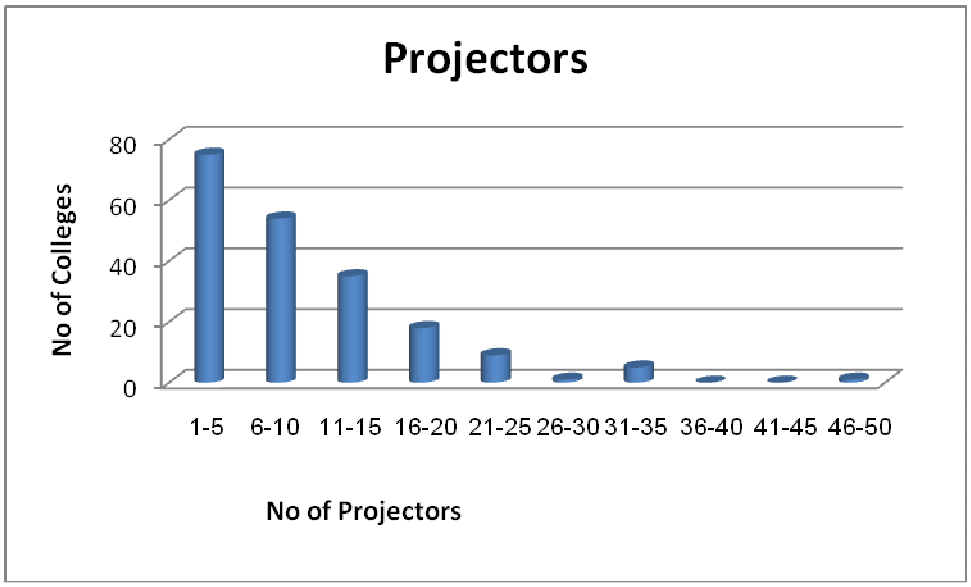
Generators availability	No of colleges
Yes	172
No	26



12. Projectors

All colleges have projectors. Majority of the colleges have less than 10 projectors in their campus. St Berchmans College Changanassery Kottayam has 50 projectors.

Projectors	No of colleges
1-5	75
6-10	54
11-15	35
16-20	18
21-25	9
26-30	1
31-35	5
36-40	0
41-45	0
46-50	1

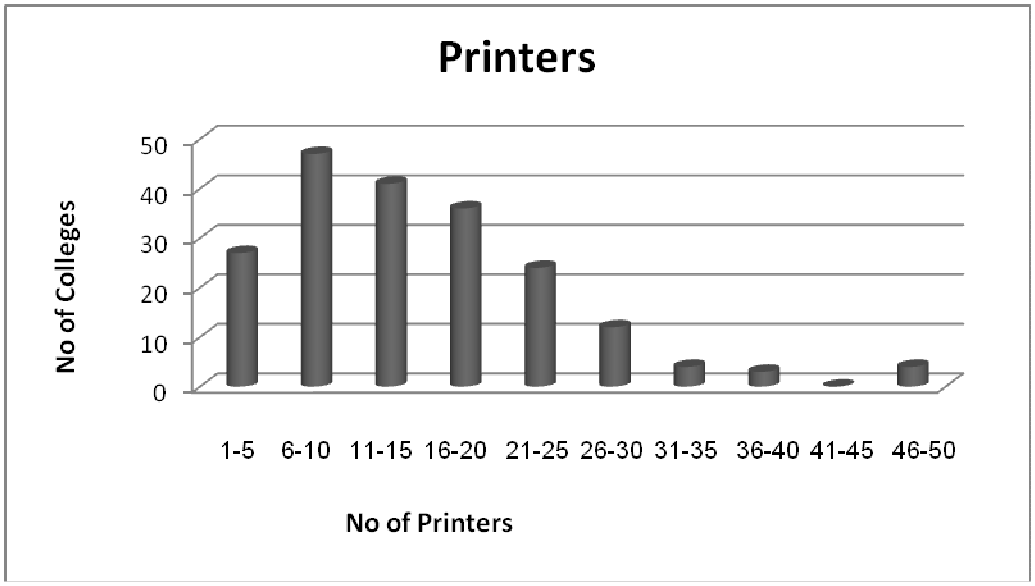


13. Printers

All colleges have printers. Almost 60 % colleges have 10-20 printers. St Berchmans College Changanassery Kottayam has 50 printers, Government College Chittur Palakkad and KMM

Government Women College Kannur has 49 printers each and Government College for Women Vazhuthacaud, Trivandrum has 47 printers.

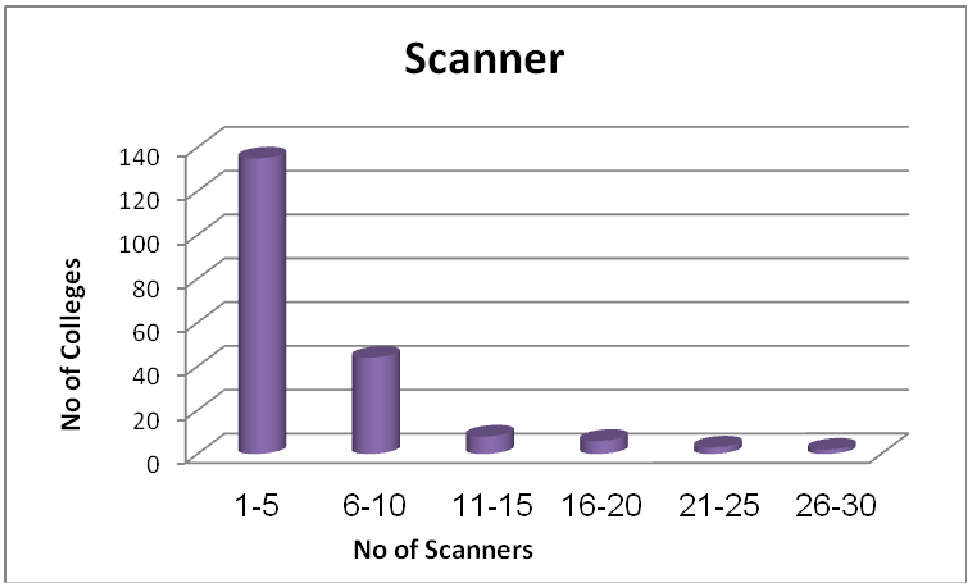
Printers	No of colleges
1-5	27
6-10	47
11-15	41
16-20	36
21-25	24
26-30	12
31-35	4
36-40	3
41-45	0
46-50	4



14. Scanners

All colleges have scanners. St Berchmans College Changanassery Kottayam and Farook College Calicut have got 30 scanners each.

Scanner	No of colleges
1-5	135
6-10	44
11-15	8
16-20	6
21-25	3
26-30	2

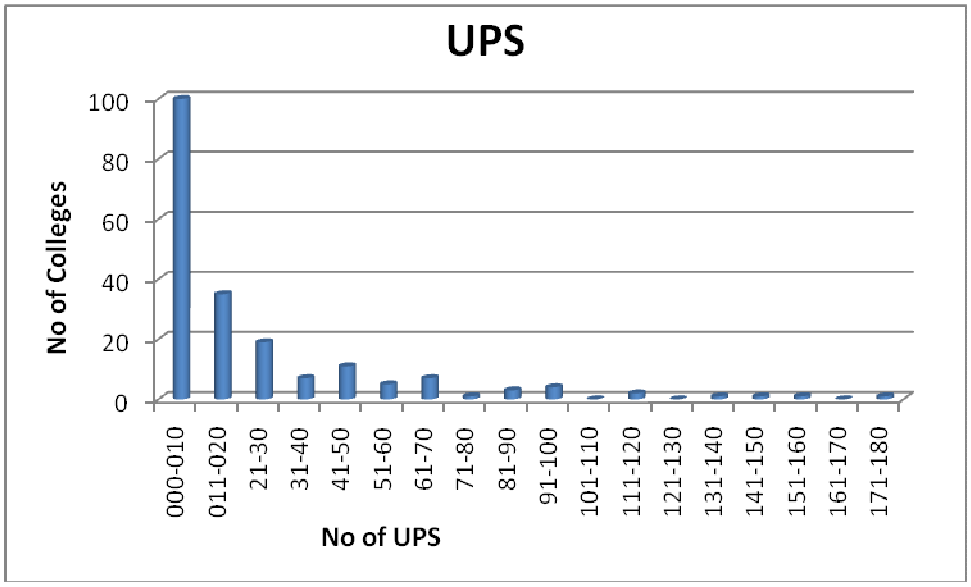


15. UPS

All colleges have UPS facility.

No of UPS	No of colleges
0-10	100
11-20	35
21-30	19
31-40	7
41-50	11
51-60	5
61-70	7
71-80	1

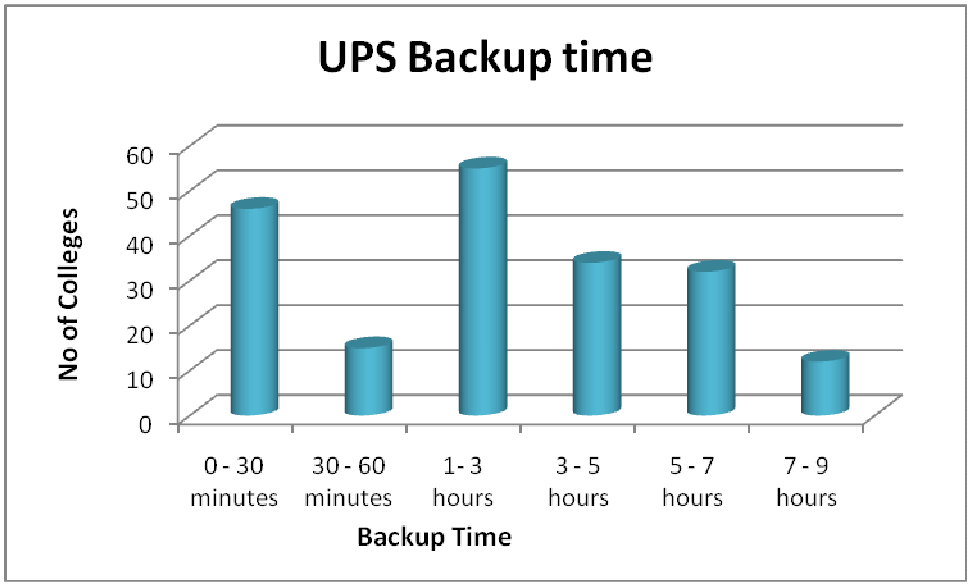
81-90	3
91-100	4
101-110	0
111-120	2
121-130	0
131-140	1
141-150	1
151-160	1
161-170	0
171-180	1



16. UPS Backup Time

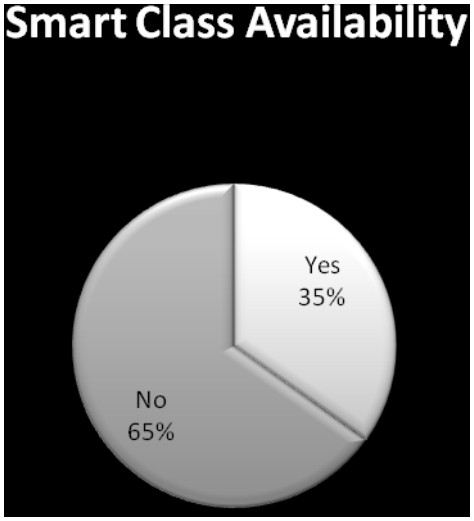
UPS backup time for some of the colleges is very low.

UPS backup time	No of colleges
0 - 30 minutes	46
30 - 60 minutes	15
1- 3 hours	55
3 - 5 hours	34
5 - 7 hours	32
7 - 9 hours	12



17. Smart Class

Smart Class availability	No of colleges
Yes	69
No	129

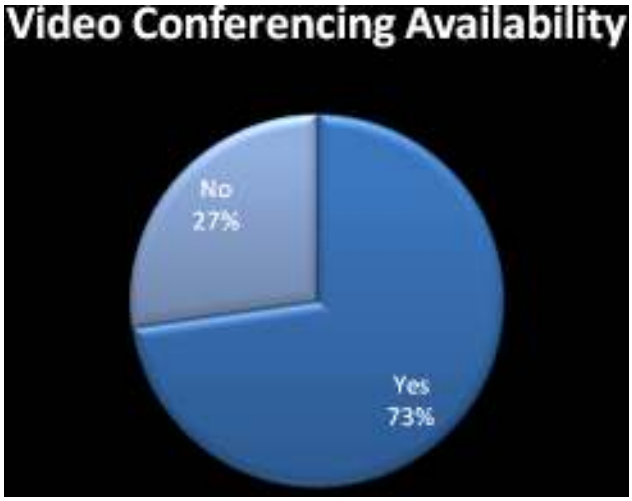


From the survey, it is surprising that a good number of colleges have implemented smart class in the campus. But still 65% of colleges have not looked into this area.

18. Video Conferencing

Video Conferencing availability	No of colleges
Yes	144
No	54

Although video conferencing is seldom used, 73% of colleges have confirmed the facilities for video conferencing. Colleges might have assumed skype kind of video chart as video conferencing. Further investigation is required in this regard.



19. UG and PG Courses

Most of the colleges are offering undergraduate and postgraduate courses in various disciplines. All together 1752 batches of UG courses and 975 batches PG courses are conducting by these 198 colleges. Around 224311 students are studying in these colleges. Most of the research funds are utilized for PG students.

No of Batches of UG Courses	No of Batches PG Courses
1752	975

20. Staff Strength

The staffs are categorized into Academic / Teaching, Technical / Nonteaching and Administration.

Type of Staff	No of Staff
Academic / Teaching	11580
Technical / Non-Teaching	3726
Administration	1844

SUMMARY AND CONCLUDING REMARKS

We have received e-readiness status from 198 colleges across the State. One college doesn't have data readily available with them. It is indicated that data once ready with them will be sent to us. Based on the inputs received, it is found that most of the colleges are making use of computers in their office duties. Some of the facts found in the study are listed below:

1. Out of 198 colleges 179 colleges have their own website.
2. Only 4 colleges have Biometric attendance system and remaining colleges have manual attendance system for their staff and students.
3. All colleges are making use of computers in their office duties and computer labs. St Berchmans College Changanassery Kottayam has got 462 desktops, which is the highest number of desktops in a college.
4. Microsoft windows are the most commonly used operating systems in colleges
5. Twenty one colleges use tablets.
6. One hundred and twenty four colleges don't have any server class machine. Around 51 colleges have one server class machine. Sacred Heart College Chalakudy Thrissur has 13 server class machines, which is the highest among all colleges.
7. Nine colleges use AMD processor along with intel processor and the remaining seventy seven colleges use only intel processor for their server class machine. RAM size of server class machine varies from 512MB to 16 GB and HDD is upto 500 GB.
8. Forty Eight colleges use windows OS, Nine colleges use linux OS and Sixteen colleges use both windows and linux OS in their server class machine.
9. Thirteen colleges use rack mounted server and remaining colleges use tower mounted server.

10. Twenty six colleges have configured RAID for their server.
11. It is also found that colleges have inadequate number of servers.
12. Fifteen colleges do not use any antivirus for their machines. Commonly used antivirus are AVG, MACAFEE, QUICK HEAL, KASPERSKEY, AVAST, NORTON, etc.
13. One hundred and twenty one colleges do not use any firewall and rest of the colleges use software firewall to manage internet traffic in colleges.
14. Twenty five colleges have Leased Line, two colleges have DSL, one college has Dial up connection and remaining 170 colleges have broadband connection.
15. BSNL is the ISP for most of the colleges. Internet bandwidth ranges from 512 Kbps to 100 Mbps.
16. Twenty six colleges do not have generator facility.
17. All colleges have projectors, printers and scanners within their campus.
18. UPS backup time for some of the colleges is very low.
19. There is no integrated system for file flow, finance, and academic matters
20. Digital Libraries are nowadays not a luxury. Survey reveals that no college has Digital Library.
21. An online Learning Management System (LMS) is required for effective interactive communication between teachers and students. Survey result shows that none of colleges has implemented any LMS. Teaching, Examination, Evaluation and all activities in college could be done in any LMS.
22. Colleges need to develop or enhance their ICT infrastructure like Networking (LAN and Wi-Fi) which requires additional cabling, switches, wireless access points etc.
23. Most of the colleges require investing in terms of Servers, Desktops, and Laptops. Tablets and other smart devices can be encouraged.
24. Surveillance systems are not implemented in most of the colleges. Hence we suggest placing CCTV or IP camera in all the campuses.
25. Most of the resources are underutilized, since there is no application to coordinate the activities of Administrative staff, Teachers and Students.
26. Alumni portal is missing in most of the colleges. It might help the colleges in better mobilization of their alumni.
27. SMS facilities have to be implemented in campuses to alert about events, notifying their marks and attendance, etc.
28. Technology enhanced learning and teaching awareness workshops have to be conducted on a regular interval.

29. Internet usages are not monitored and accounted. Internet usage guideline and enforcement mechanism has to put in place
30. Cyber security awareness programmes have to be conducted regularly for all including students and staffs.

4. TECHNOLOGY ENHANCED LEARNING AND TEACHING FACILTY AND FINANCIAL SUPPORT NEEDED @ COLLEGES

Technology Enhanced Learning and Teaching (TELT) Model provides learning through collaborations and interactions. TELT deals with a unique pedagogy model for Technology Enhanced Learning System which includes course management system, digital library, multimedia enriched contents and video lectures, open content management system and collaboration and knowledge sharing systems. Open sources like Moodle and Wiki for content development, video on demand solution with a low cost mid range system, digital library are provided in a portal system.

In last several decades, due to the technology advancement and the availability of high bandwidth Internet connections, there is a tremendous transformation in the philosophy of education system worldwide. The classical approach of education, merely classroom learning and exam centric system as a pursuit of knowledge has undergone a significant change. However, it is obvious that the present education system consisting of the colleges, universities and institutions, governed by a system of government bodies are only regulatory bodies, but hardly sufficient to touch upon quality of education. Providing quality education or education with relevance to current and emerging trends still remains a dream for many colleges in Kerala. Quality of higher education by imparting quality learning, supporting teachers with instructional tasks, generating more quality teachers, equipping colleges and universities with resources to manage the instructional processes are some of the challenges in education system. Many leading universities e-contents initiatives like MIT Open Courseware, Carnegie Mellons Open Learning, Open University UK, National Programme for Technology Enhanced Learning (NPTEL), INDIA are noteworthy.

The learning outcome of every course is translated into course content by a course development team. This course content is delivered to the students through the Learning Management System (LMS) installed on a Secure Server. The LMS can interface with digital library and several other digital resources. The Student Information System is also available on the Secure Server. The students can login to the system using secure authentication. The students can thus access their courses and can be linked to all related resources and services. Teachers share their teaching material as well as other resources through LMS and also conduct quizzes, clarify student's doubts through chats and forums and evaluate the students' performance.

So the TELT facility is must in all the colleges to improve the quality of education.

It is assumed that colleges have necessary cabling for power supply and data transfer.

The basic TELT infrastructure needed in all the colleges

1. Server (RAID 5 Configured, HDD at least 4 TB)
2. Operating System –Linux latest server version
3. Learning Management System [preferred MOODLE]
4. Proprietary software [Windows OS for desktops/laptops]
5. Internet Connection – wired (Internet connectivity should be at least 10 Mbps to ensure good video and audio quality in live lectures and courses served over the LMS)
6. Network Hardware – Unified Threat Management [UTM], Switches and Router
7. Desktop Computers and Laptops
8. Printers and Scanners
9. Digital Library Facility
10. LCD Projector
11. UPS
12. Video Conferencing Facility and
13. Diesel Generator

5. INVESTMENT REQUIRED TO SUPPORT GOVERNMENT AND AIDED COLLEGES IN KERALA

Estimated Cost to Set up TELT Facility at each College

Non Recurring Expenses

#	Item	Estimated Cost [Rs in Lakh]
1	Blade Server --- RAID 5 Configured, HDD at least 4 TB	4.0
2	Operating System – Linux latest server version	0.0
3	Learning Management System [preferred MOODLE] and WIKI --- Customization and Installation Cost	0.6
4	Unified Threat Management [UTM] --- for 100 Users	1.0
5	Switches --- for 100 Users	0.6
6	Router	0.6
7	WiFi Access Points --- 5 numbers	0.3
8	LCD Projector --- 3 numbers	1.5
9	UPS --- 20 KVA	2.5
10	Desktop Computers --- 50 numbers	15.0
11	Laptops --- 5 numbers	2.0
12	42 U Server Rack 20 U Switch Rack	0.7
13	Video Conferencing --- Dedicated Set of Equipment	1.5

14	Diesel Generator --- 10 KVA	3.4
	Sub Total	**33.7**

Recurring Expenses

#	Item	Estimated Cost [Rs in Lakh]
1	Internet Connection --- 10 MBps shared connection, Annual charge	2.0
2	Proprietary software [Windows OS for desktops/laptops] --- 55 license	4.0
3	Systems and Network Administrator / AMC --- Annual Charge	2.7
4	AMC for MOODLE and Wiki	0.6
5	CCTV --- 10 Camera and Console	1.7
6	DSpace - Digital Repository Solution --- AMC for customization and maintenance	1.0
7	KOHA – Library Solution --- AMC for customization and maintenance	1.0
8	Campus Management Software --- AMC for customization and maintenance	1.0
Sub Total		**14**
Recurring expenditure for 5 years [14 x 5]		**70**

Total investment needed to support one college for 5 years

= Rs 33.7 lakhs + Rs 70 lakhs = Rs 103.7 lakhs

Total investment needed to support 199 colleges for 5 years

= Rs 103.7 lakhs x 199

= Rs 206.36 Cr.