Architectural Aspects for LMS based Higher Education Model

Kamal K Vyas, Dr S Tiwari, Amita Pareek

Abstract: With the process of globalization, we are entering into the post-industrial society where knowledge has become a driving force and the information technology has revolutionized the whole process of the life. Today there is a need of e-learning enabled Higher Education System. During the past decade Education Systems have been re-engineered for bringing in efficiency, effectiveness and economy through the use of advanced technology like LMS based Higher education model. It is time to give a fresh look to the higher education and introduce such changes which can restore confidence in the ability of the state universities and colleges for providing, cost effective, education with a spirit "Any time Any Where". In this IT era, where distance is dead, "What use to be far is very near and What is local is global". With this objective in mind, this paper reveals the Architectural aspects for LMS based higher education model in this 3G and onwards era.

Index Terms: e-learning, LMS, Architectural Aspects, Higher Education Model, Framework, e-model generations, Cloud-computing

1. Introduction:

Today, there is an urgent demand of higher education architecture, based on Learning Management Systems. A framework for understanding these systems is generally been used and quality attributes like portability, interoperability, reusability and modifiability can be achieved. In this exploratory research paper, after analyzing the LMS based architecture, a suitable model is suggested which aimed to engineer Open Learning Management Systems. This paper is based upon available pedagogically [6] proved facts & available standards as well as well-established software engineering techniques. Before understanding about fifth generation higher education model, there is a need to review the advancement in different generations of education models. The story begins with the transformation of a relatively simple computer network used by a few researchers into a global Internet, involving hundreds of millions of people. The next few years will encompass the significant impact of broadband, wireless, smart cars, smart fridges, streaming media, voice recognition and the inevitable growth of new Internet technology like high speed fiber based back-bone in this 4G era [14]. Internet also has the power to transform [15] universities. The distance education [10,16] itself has evolved through the successive four generations. Many universities have already taken initiative to drive distance education through fifth generation technology. The fifth generation [12] distance education is essentially a derivation of the fourth generation, which aims to capitalize on the features of the Internet and its services around LMS. A central feature of fifth generation higher education model is the development of a customizable e- Interface, a campus portal through which students, staff and other stakeholders can engage with the university in a highly interactive and compelling manner. To become successful in the emerging global lifelong learning market, a university needs to create a campus portal that will achieve a degree of interactivity, user friendliness and personalization that does not exist in the vast majority of campus web sites today.

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2. LMS Based Open Learning Architecture

This architecture as shown in fig 1 comprises four key components, the Front End Interface (FEI), the Information Processing Center (IPC), the Learning Management System (LMS), and the Open Adapter Pool (OAP). The key ideas shown by the diagram are the relationships between the components, the physical separation of each component, and the role of the LMS as a facilitator of information and context.

2.1 IPC

The IPC consists of enterprise applications that are deployed on the institute infrastructure. In addition to providing information about faculty and students, the IPC fills other responsibilities as well. As the IPC consists of many systems that support the institute, only those that apply to the integration of the LMS are represented in the diagram.

2.2 AV Server:

Server used to provide streaming audio and video. Most of the digital media owned by the university is provided through this server and is made available through a player that can be embedded into virtually any web site.

2.3 CR Server:

The content Repository Server is used as a repository for documents and files. These repositories are under version control and are made searchable through a common web interface. Users can share documents using a static URL which links directly to a document.

2.4 Validity Server:

The Validity Server currently consists of an integration layer [11] and a set of Active Directory and LDAP identity systems. These systems contain simple identity information and provide authentication services to other enterprise systems.

2.5 ERP Server :

The ERP server for the university contains the current student and employee information as well as the course to user relationship.

2.6 Learning Management System :

The Learning Management System [13] (LMS) serves as a provider of internal system and administration services. Courses, Staff & Students' informations are stored locally and is synced with student, faculty and administrators' information from the institute's ERP server. The users of the LMS create different taxonomies. These taxonomies simply provide a framework for organizing individuals in the system. It also contains a set of tools that can be used by the target-group. Groups are created either from existing courses or Staff or students or completely ad-hoc. Groups are the foundation of all gathering that occurs at the institute.

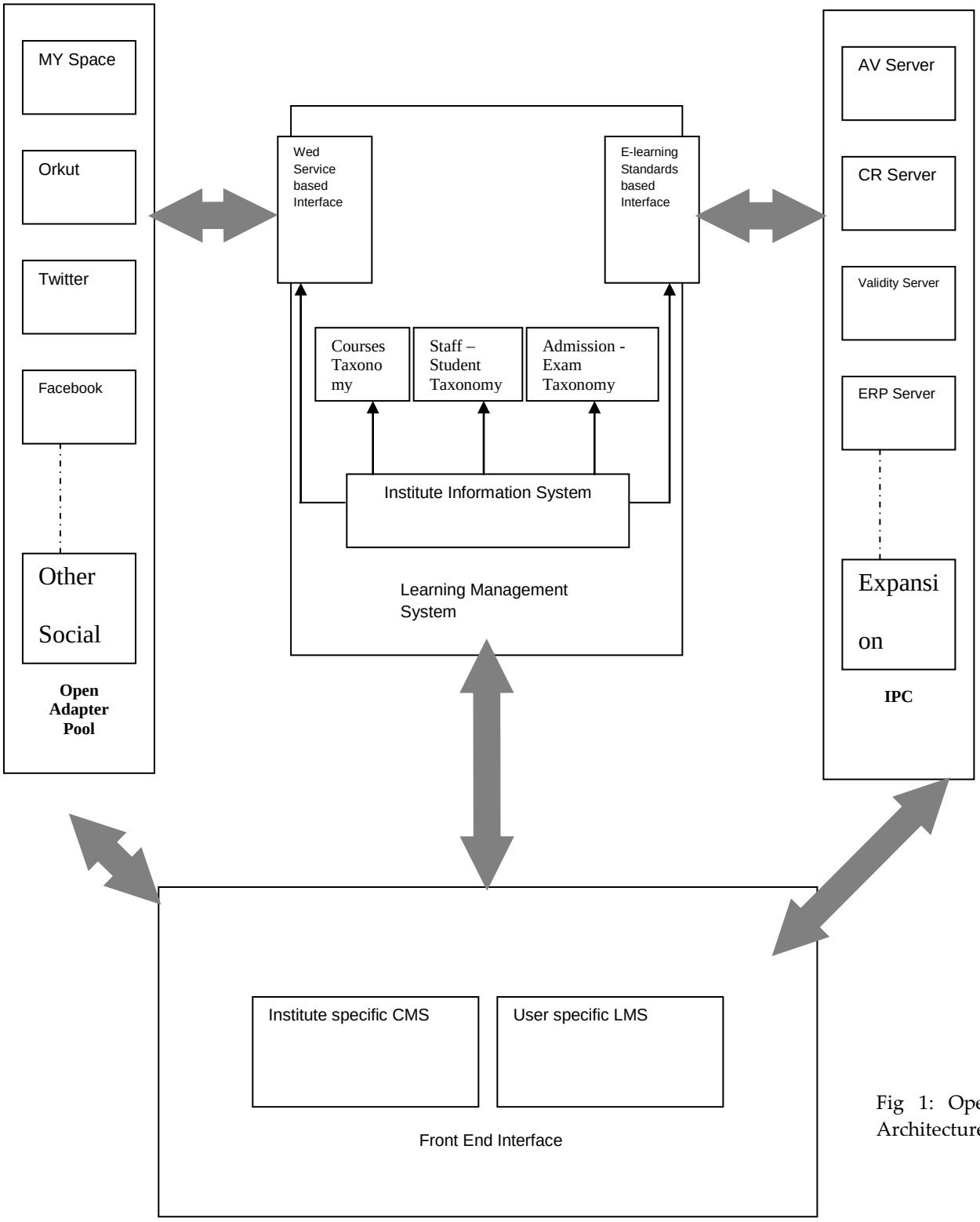

Fig 1: Open Learning Architecture

They provide users with a workspace to collaborate and share information. The tools that they use are tools integrated into the LMS through the adapter framework. Courses are specialized groups with added tools and are created by the system based on a taxonomy that comes from the institute ERP and are created and destroyed by the system.

The additional tools that are made available include Exam and Admission information. Functionality can be added by putting more adapters. The interfaces to the LMS are crucial. They provide the groups and courses with the tools that the users in the group will use. These interfaces also provide back-end developers with a way to get group and course taxonomies from the system such that they can provide context to their external applications. In addition to an open service based API, the LMS includes a e-learning standards based (e.g. SCORM 2004) interface. This interface allows the creation of SCORM compliant assignments and tests by the university and provides great flexibility in the medium by which they can be created.

2.7 Front End Interface:

In a traditional LMS, the user interface is largely static based on the design by the engineers who built the system. The presentation layer, however, will be better suited to the user-base if it is created and maintained by the university. This will allow administrators to enable and disable functionality, incorporate university approved branding, and integrate online and self-hosted web technologies seamlessly. In the proposed architecture, the presentation layer of the LMS is completely separate from the core systems. This allows the institute to tie their existing CMS system and the LMS into the institute web space. The flexibility that this architecture provides would promote a single and consistent view to all the tools the university and the web have to offer in a consistent and integrated environment.

2.8 Open Adapter Pool (OAP):

The proposed architecture focuses on the core value proposition of the LMS and not providing proprietary learning tools such as blogs, wikis, and others. In Indian context there is a need to provide the course and group context to external tools in a low cost manner. This is possible now through available web services as well as Social Networks like Facebook, Orkut, Netlog and Twitter etc.

3. Proposed Model of Learning

Before exploring the proposed learning model, it is essential to make platform of understanding on which the proposed model of leaning can be analyze with its embedded feasibility and technical viability features. It is further essential to talk about certain issues like –

3.1 Why Traditional Campus to Virtual Campus

The accredited campus-based institution aggregates, organizes, and manages the breadth of expertise (faculty), the learning resources (libraries and labs), the student services, and the management services needed to design and deliver courses, end-of-course assessments, and curricula and to maintain a record of the individual student's course and curricular credentials. With the exception of its reliance on the textbook publishing industry and outsourcers of a few auxiliary services, the traditional campus owns or leases significant bricks and mortar and hires most of the employees required to be a "full-service" learning provider. This will change, primarily because of the need for agility in the face of rapid change and because the costs of going it alone are high relative to the costs of contracting or partnering for capital, infrastructure, and services in an Internet economy that takes the friction out of sharing resources and that reduces service transaction costs in the process.

In considering the future of the traditional campus, it is important to note that even the traditional higher education market is not a one-size-fits-all market. But technology can give these institutions new opportunities to reconfigure their traditional offerings to make them more competitive and even to introduce new services for new audiences. And the growing life-long learning needs of the knowledge economy and the convenience of anyplace-anytime learning for all types of masses, are attracting new virtual-campus offerings from the profit learning providers and from brand-name private and public research universities. In such universities, the new virtual-campus opportunities are raising a host of intra-institutional academic cultural issues that have led in some case to the creation of profitable virtual-campus [14].

3.2 e-learning Standards

Designers and developers of on-line learning materials have variety of software tools. These tools range from presentation software packages to more complex authoring environments. They can be very useful in allowing developers the opportunity to create learning resources that might otherwise require extensive programming skills. Unfortunately, a number of software tools available from a wide variety of vendors produce instructional materials that do not share a common mechanism for finding and using the resources. A number of organizations started advocating standards for the learning technology. Standards are desirable for inter-operability, convenience, flexibility, and efficiency in the design, delivery, and administration. They provide consistent on-line dimension for all courses being designed so that all authors/ faculty are able to customize the on-line materials. The most preferable and unbeaten standard[17] is SCORM (Sharable Content Object Reusable Modules). The latest version is SCORM 2004 (introduced in March 2009)

3.3 CSIR Model of Learning –

Today most of the people have misunderstood the term e-learning model. Most of them taken it as teaching-learning approach through Internet. Few of them taken it as specific software used during teaching, which also supported with certain web enabled services. But real e-learning model is composition of hardware, standards based software and managed with well-defined well trained team in an optimized way. Here the model feasibility depends upon the available communication services' status. In India, people are still the digitally divide in-spite of mobile communication revolution. Hence there is a need of Hybrid [7] approach in which the constraints can be easily tackled. The proposed "Collaborative Shared Integrated Resources" (CSIR) Model of Learning is a true hybrid approach. Here the feature "Shared Integrated Resources" inherits from popularly available tested models. When this feature is used in collaboration with open architecture of the other universities then it become CSIR

Model of learning. It comprises pedagogical based implementation strategy, which is described below –

3.3.1 Implementation Strategic Approach

E-learning Framework [1, 2, 8] (ELF): A success story from a reference [19] tells that an implementation of e-learning framework [9] needed systematic approach. One of the approaches suggested here for CSIR Model of learning, which having following steps –

a. Setting the Scenario: Study reveals that as technology integrated into institution, they become more E-enabled. The most important requirement is develop independent learners with positive attitude. Next step is schedule the Key Commitments for e.g. -

Commitments	Real Time Progress	Remark
Design & Implement the *E-learning Strategy*	Suppose the launch of E-learning at an Institute by July 2010-11 Session.	
Demonstrate how E-learning Framework help the staff to access learning resources.	Teachers & Learners well connected with Learning Management System (LMS) of the Institute.	
All communities get access right of Single Repository where Knowledge and Learning Management resources stored.		Needed Extreme care for Security & Quality
Support the management services using partnership, collaboration etc to create Excellency in Education.	Approaches to national level Institute / Universities for sharing Knowledge Bank, it may finish by Dec 2010.	Needed Extreme care for Security & Quality
Achieve Excellent Fund pool for the institute	Initially get subsidies/ fund flow from Govt / Trust, then reuse the infrastructure for additional fund generation if needed. (by the end of June 2011)	

Table 1

b. Making it fit to meet purpose: To make it fit, *Primary step* is to ensure Quality of the System Resources. It is based on following principles –

- Sound Training Need
- Multidisciplinary way of working
- Appropriate Expertise should be utilized
- Regular Review process
- Standards of Framework should be used (initially may be optional for New Institute)

Secondary step is to follow Process flowchart. One such flowchart is suggested here in fig 2 for E-enabled learning system development –

The given process flowchart activities numbered in the order of execution –

1. Requirement Analysis phase is most important activity of the process, under which not only the courses are decided but also the material and training need is decided. The main Governing body Members governs this complete process. The requirement analysis team gives its daily report to governing body. The governing body (if feel necessary) sends its guidance weekly. Governing body can take the help of Store, Finance Department as well as in-house or hired Experts.
2. Once the requirement analysis is completed, immediately Steering committee should be formed. This committee decide the different subsection of the project and also responsible to make Project Teams.
3. A project team is responsible to make Specification Template as per affiliation guidelines and also ensure quality standards care about measures.
4. All team submit its finalized specification template formation to Steering committee.
5. Validation as per standards is combined responsibility of Project team as well as Steering committee.
6. Steering committee further makes a project team for Programme Development and hardware installation. Here in-house or hired / third-party team can be used.
7. Once the Programme Development finished, then steering committee inform the affiliation committee to get approval from State / National level authority.
8. Finally after getting approval, the developed resources can be uploaded and existing academic structure can run the E-enabled courses.

The Timescale is vital for the Project, it should be decided by the University by considering all constrains.

3.3.2 Feasibility and Technical Viability

Traditionally, learning was all about being in the classroom at the right time and with the right people. As a result due to time constraints, some people could simply not study. Since ICT was introduced, e-learning has been one of the technologies that has simplified lives for many people both in rural and in developed communities. By using e-learning people can presently choose what to study, when to study and how to study it anytime of the day. e-learning is not a new concept in ICT, but has been known for quite some time.

This paper suggests the most-needed task for "e learning in India" where in-spite of huge development in Communication technology, the country is still struggling

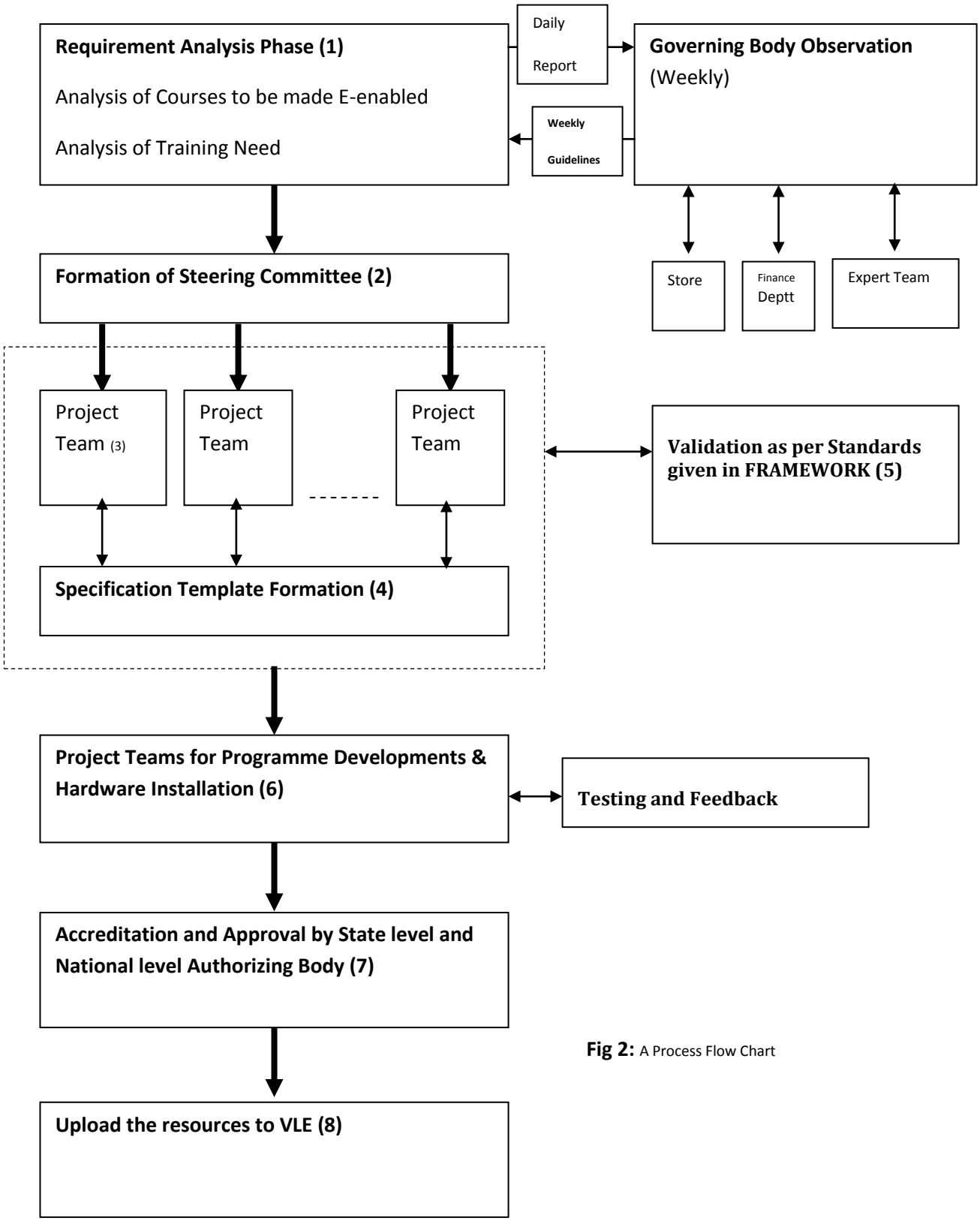

Fig 2: A Process Flow Chart

against the Digital Divide, untouched rural area waiting for Digital Democracy [18], hundreds of Open universities but not using economic and optimized ICT for all. The vibrating political condition and financial recession sometimes further off-centered the education progress. But inspite of all constraints the proposed CSIR Model of learning proving its Feasibility and Technical Viability because of its latest hardware architecture with additional strengthening factors due to cloud computing [3,4,5].

4. Conclusion:

In the proposed architecture of LMS based 5th generation Learning model, the presentation layer of the LMS is completely separate from the core systems. This allows the institute to tie their existing CMS system and the LMS into the institute web space. The flexibility that this architecture provides would promote a single and consistent view to all the tools the university and the web have to offer in a consistent and integrated environment.

The proposed architecture focuses on the core value proposition of the LMS and not providing proprietary learning tools such as blogs, wikis, and others. In Indian context there is a need to provide the course and group context to external tools in a low cost manner. This is possible now through available web services as well as Social Networks like Facebook, Orkut, Netlog and Twitter etc.

Certain factors, which help us to measure and prove Feasibility and Technical Viability of a Learning model. The proposed model CSIR since architect on these factors like not incurs license charge more than once, prefer only standards based development, Framework should not base on 'Once Only' design, develop content once only and update as and whenever, Architecture having option for technology updation regularly. Hence it is implied that proposed model is most Feasible and Technically Viable for any Indian Open University.

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