**Ministry of Human Resource Development**

**Department of Higher Education  
National Mission on Education through Information and Communication Technology**

**Report of the Sub-Committee relating to setting up of SWAYAM Platform**

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**Genesis:**

The Ministry of Human Resource Development, Department of Higher Education (TEL Division), vide office order F. No. 8-2612014- TEL, Dated, January 13, 2015, Constituted a Sub-Committee, relating to setting up of SWAYAM Platform, under the Chairmanship of Prof. S.V. Raghavan, Scientific Secretary, Office of the PSA to GOI. The office order and the Terms of Reference are given in Annexure – I. The responses to the Terms of Reference is given in Annexure – II. Besides, responses to the ToR of the Parent Committee on SWAYAM is given in Annexure – III.

**Method of Working:**

The committee met thrice – once to define the scope of engagement, then to deliberate on Indian alternative and endorse its use, and lastly to see a a demostration of the application platform on the in tegrated hardware and software platform. The minutes of the three meetings are given in Annexures IV, V, and VI respectively.

**Summary of Deliberations:**

The committee noted that there are variations in the experiences in MOOCs platform; viz., IIT Bombay on EdX, IIT Madras on Coursebuilder, and IIT Kanpur on a homegrown platform.

*Current Experience - Platform:*

* IITB is posting their course contents on S3 platforms outside India and the students interaction profile within India using their version of EdX implementation. They have plans to create their own Their input to the committee is given in Annexure – VII.
* IIT Madras had the Google based Course Builder platform ported in their own compute infrastructure and Google promised application level changes in tune with requirements of IIT Madras.
* IIT Kanpur had a home grown platform based on open source software, as mentioned earlier.

*Current Experience – Usage:*

* IIT Bombay is using EdX Platform actively in their T10KT program as well as in two courses related to Computer Science. They have a significant number of students already using it in its current form. They are also announcing few courses by IITB faculty, IARI, and IIT Madras (Prof Mangal Sundar). Based on their experience thay have given several suggestions for adding as features in the E-Sikshak Platform of CDAC.
* IIT Madras is using Course Builder Platform actively with technical support from Google. They have satisfactorily run a few courses for a large number of students. Besdies course delivery, IIT Madras also carried out proctored examination with the active participation of TCS and NASSCOM. While the courses were free, the Certificates were chargeable was the model. Based on their success, IIT Madras is planning close to 25 courses shortly.
* IIT Kanpur has a number of courses on their platform on subjects related to Agriculture Science. At present their experience is with a few hundred students.

The committee listened to presentations on:

* National Knowledge Network (NKN) (by NKN/NIC), its hardware platform, Elastic and scalable services, and integrated ID and Authentication services.
* E-Sikshak (by CDAC) as ported on to NKN with multi-tenancy for application scaling. CDAC also presented the existing features of E-Sikshak, including “all-click” logging feature.

**Recommendations:**

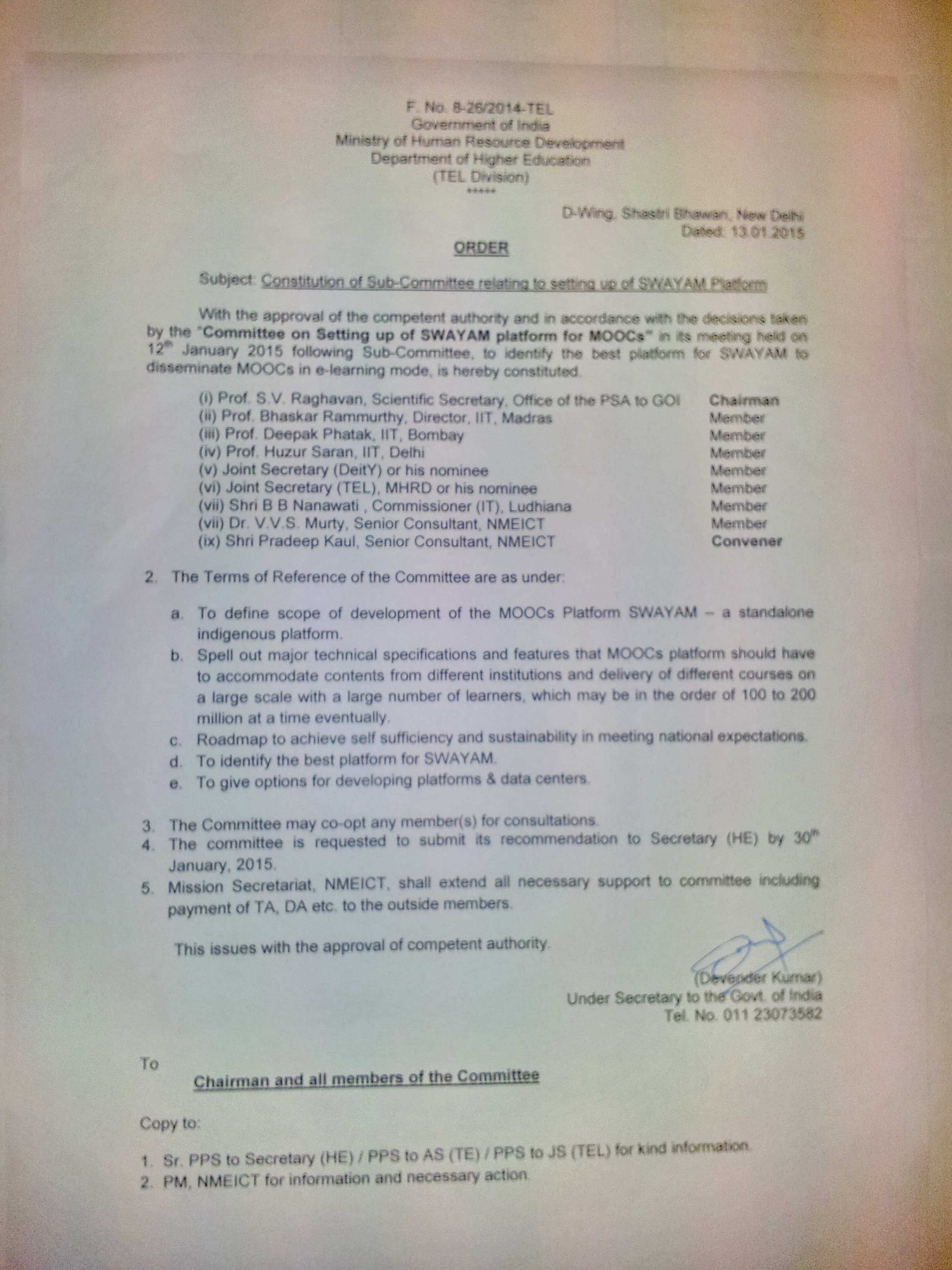
After careful deliberations, the committee recommends the following:

1. E-Sikshak (by CDAC) along with NKN Data Center is the solution to address the national needs. Both organizations are capable, robust, and are known for IT related technology and Services in the public space.
2. Both CDAC and NKN may be engaged for E-Sikshak and Data Center. They may be asked give proposals for additional hardware and for building teams.
3. CDAC will continue to incorporate all the features suggested by IIT Bombay, IIT Madras, and IIT Kanpur progressively.
4. The individual institutions may continue with their experiments as in the past and share their rich experience with CDAC and NKN/NIC for national benefit.
5. IIT Delhi may be encouraged to continue their research and development related to Data Center and Cloud Infrastructure, with focus on Open Source, Functionality, and Performance. They can continue to act as Technology Advisors for the E-Sikshak Platform and NKN Data Center.

**Way Forward:**

MHRD may seek specific proposals from CDAC and NKN and process them administratively.

**Annexure – I**

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**Annexure – II**

**The terms of reference along with Responses**

1. To define scope of development of the MOOCs Platform SWAYAM - a standalone indigenous platform.

*MOOCs Platform SWAYAM to be an indigenous requires two types of platforms; one related to the infrastructure and another related to the application that handles MOOCs specific pedagogy.*

1. Spell out major technical specifications and features that MOOCs platform should have to accommodate contents from different institutions and delivery of different courses on a large scale with a large number of learners, which may be in the order of 100 to 200 million at a time eventually.

*Robust and scalable Storage Infrastructure, flexible and scalable Compute Complex (in the form of a cloud; in at least two locations for ensuring business continuity), built-in Content Distribution Network (CDN), video streaming for content distribution, an Integrated Identification and Authentication System that can be Personalized to a course, an application with scalable architecture to handle interactions with teachers as well as students, and large scale usage data analytics.*

1. Roadmap to achieve self-sufficiency and sustainability in meeting national expectations.

*Self-sufficiency requires availability of an appropriate institution with relevant manpower and sustainability will require the main business of the institution identified being congruent to meeting national expectations. While NKN/NIC fulfils the requirement in Hardware Platform Infrastructure, CDAC fulfils the requirement of Application Infrastructure. Both are well known institutions with focused capabilities built over three decades or more. Both are performing national level technical services successfully. NKN, where all CFTIs are connected is run by NIC and CDAC has ported / integrated their e-Sikshak application platform.*

1. To identify the best platform for SWAYAM.

*Covered under ToR 3.*

1. To give options for developing platforms & data centers.

*In conformity with ToR 3, to achieve self-sufficiency and sustainability only one option is given. However, Data Centers may grow in number so long as they are in conformity with established practice in the first two data centers. It may be noted that this is the subject matter of another MHRD (NMEICT) committee on Bulk Servers and Storage.*

**Appendix – III**

**The terms of reference of the Parent Committee along with Responses**

1. In the initial phases (till May, 2015), should we allow multiple platforms (that are available in open source) to run MOOCs courses?

*In fact, individual institutions may (optionally) continue with their internal plans until they are ready to change over. The National Platform s ready and will continue to be enhanced in features based on usage.*

1. Evaluation of the presently available home grown platforms, such as edX based by IIT Bombay, MOOKIT by Prof. TV Prabhakar, IIT Kanpur, Course-Builder based by IIT Madras or any other platform and commissioning of the platform that best suits our needs.

*Efforts mentioned here predominantly refer to “applications” that require different styling of the “infrastructure”. When we in an Indian Open Platform, the “adaptability” is integral to the arrangement.*

1. To strengthen "Establishment of Compute Core Cloud" a project under NMEICT by IIT Delhi, capable to run and take load of all MOOCs needs of the country.

*At start,* ***two data centers*** *based on* ***cloud technology*** *is recommended, in active-active mode to ensure business continuity. One of them can be inside NKN and one can be in CDAC (bilaterally connected to NKN data center). Such engagement will help in scaling in geography as we grow and establish data center like facilities in CFTIs. They can be continued to be managed by NKN/NIC and CDAC, irrespective of location. This will subsume the ongoing project, the infrastructure for which is already inside NKN.*

1. Evaluation of Platforms to assess whether they can handle a large number of students for launch of MOOCs by HRD Ministry.

*While synthetic load tesing is done as a routine exercise before launch, platform maturity is evolutionary in nature. As the technical teams with high quality manpower (NKN/NIC has done India proud by creating and managing India’s largest Research and Education Network and CDAC is known for its capability in building Supercomputers and Grids in India) are in place, the committee does not foresee any problem in this regard.*

1. Feasibility and impact of commissioning a home grown platform with indicative timelines and its cost.

***Budget Estimates*** *– Actuals will be based on proposals received from NKN/NIC and CDAC formally by MHRD:*

1. *Two Data Centers aith a total cost of* ***100 Crores*** *INR. Cost of Each Data Center for Five years = 50 Crores INR. Includes, approximately 10000 Compute cores spread over ~1250 CPUs, contained in ~350 servers, located in 20 racks, along with 1 Petabytes of Storage, high speed link cost at 10 Gigabit speed or beyond and 5 years of Operations and Maintenance.*
2. *Two teams, one in CDAC and one in NKN for supporting continued development, operations, and maintenance of Applications and Platform respectively. Cost for 5 years =* ***50 Crores*** *(5 Crores per year per team).*
3. Examination of licensing/ IPR issues, incremental IP, patent if any, if an existing open source MOOCs platform is to be adopted.

*No licensing issues are involved. The product called e-Sikshak is already developed by CDAC. It has been ported to NKN Cloud infrastructure and integrated with NKN ID and Authentication system with multi-tenancy capability. The IPR therefore belongs to Government of India*

1. Issues relating to copyrights of the content to be hosted on MOOCs platform if edX/course-builder based platform is adopted.

*India can develop its own policy on hosting. Copyright of content will follow the law of the land or existing practices in MHRD in projects such as NPTEL.*

1. Strategy to meet testing and scalability issues of the selected MOOCs platform.

*As mentioned earlier, scalability is established with synthetic workload at the time of testing and deployment. It is an evolutionary process and will be overseen and reviewed constantly by a Technical Committee.*

1. A brief roadmap for Operation & Maintenance (O&M) post deployment of the MOOCs platform.

*Included in answer to Terms of Reference V.*

1. Ensuring data integrity and security concerns of the platform.

*Integral to the architecture. Optionally, CDAC may be asked to follow the best practices in Infirmation Security, after profiling it to suit MHRD’s long term needs.*

Annexure – IV

**Ministry of Human Resource Development**

**Department of Higher Education  
NMEICT**

**Minutes of the First Meeting of Sub-Committee relating to setting up of**

**SWAYAM Platform**

First meeting of Sub-Committee relating to setting up of SWAYAM Platform was held at 3:30 PM on **19th January, 2015** under the chairmanship of Prof. S.V. Raghavan, Scientific Secretary, Office of the Principal Scientific Adviser to Government of India, in Conference Room, 319, Vigyan Bhawan Annexe, New Delhi. The list of members present is attached at **Annexure-I**. The Agenda paper circulated for discussions in the meeting is at **Annexure-II**.

In his initial remarks, Chairman elaborated the agenda items and significance of having indigenous platform for large scale dissemination of education and the process involved in such development. He opined that simultaneous access of about 10 million online learners could be a design challenge for Indian Computer Scientists.

The members deliberated with the following outcome:

* The Indian **O**nline **P**latform for **E**ducatio**N** (OPEN) shall be a union of all good features from the existing initiatives. Perhaps, OPEN Platform for Education reflects the intent of the GoI (and MHRD) in letter and spirit.
* Data Privacy and Data Integrity shall be an integral part of the architecture.
* The Members agreed upon C-DAC as the prime developer of OPEN. IIT Madras, Bombay, Kharagpur and Kanpur will join the development of OPEN Platform.
* Committee expressed that the OPEN Platform can be used in Vocational and School education as well.
* For the OPEN Platform, the committee proposed the following parameters: Ability to handle 100 Courses in the first year; Around 1000 Server Blades with associated storage; Support for at least 1 Lakh concurrent users; Support at least 10 Million registered users.
* The OPEN Platform will initially start with the existing server complex created by IIT Delhi on a project mode for NMEICT and will organically expand.
* During the formative stages, the existing teams at the development sites; viz; IITB, IITM, IITK, IITKGP may look at the feasibility of porting their software alongwith the course material on to the “current” server complex created for NMEICT by IITD (hosted on NKN/NIC).
* While designing the architecture of OPEN, NKN may ensure in-situ scalability of servers in the server complex as well as geographical extension to other nodes/PoPs of NKN/NIC. Such design is expected to be future-proof in terms of mirroring (for performance) and Disaster Recovery (for eventuality).
* One of the members recommended a parallel path for appointing an agency through tender process that can prepare an RFP to Tender for *Sourcing OPEN Platform Providers*, in case the one being attempted by C-DAC & group of IIT’s does not meet the expectations. However, as it happens to be a commercial engagement, this aspect needs to be examined by the MHRD in the file for administrative reasons.
* CDAC will present to the Chairman on 27th January, 2015 their capability and current work-in-progress within CDAC on the NKN cloud. All members are requested to join either in person or through video-conferencing.

The meeting ended with vote of thanks to the Chair.

**Annexure – V**

**Ministry of Human Resource Development**

**Department of Higher Education  
NMEICT**

**Minutes of the 2nd Meeting of Sub-Committee relating to setting up of**

**SWAYAM Platform held on 3rd Feb. 2015**

Second meeting of the ‘Sub-Committee, relating to setting up of SWAYAM Platform’ was held at 11:00 AM on 3rd February, 2015 under the chairmanship of Prof. S.V. Raghavan, Scientific Secretary, Office of the Principal Scientific Adviser to Government of India, at Conference Room, 112-C, Shastri Bhavan, New Delhi. The list of members present is attached at **Annexure-I**.

1. Chairman, welcomed the Members and Member Invitees. Minutes of the First Sub-Committee meeting, held on 19th January 2015, were circulated to Members by the Convener; since no comments were received the minutes were read as Confirmed.
2. Chairman, in his initial remarks, elaborated the agenda items for the meeting, that there is significance to convergence ideas, features & experience in setting up the World Class platform for SWAYAM- the Indian MOOCs. Further in order to meet such objectives, Chairman invited suggestions regarding features etc., from all members. It was also pointed out that we should involve concerned Centrally Funded Institutes (CFIs) that are capable in contributing their work experience in our programme and leverage the support from NIC, NKN, CDAC’s etc. The India MOOCs initiatives should integrate relevant features available in similar platforms worldwide.
3. Prof Rajat Moona, Director General, C-DAC, Member Invitee, made a detailed PowerPoint presentation on capabilities, the organisational strength, road map that the organisation is willing to contribute in the development of India MOOCs. The CDAC presentation also shared some of their initiatives so far, such as, PARAM Super computer, Garuda grid computing, Open Cloud Meghdoot, etc. Dr. Moona mentioned that CDAC has successfully implemented large applications including real-time weather modeling (ISRO), Drug Discovery (CSIR), SCORM compliant LMS over NKN, BYOD (Bring Your Own Device) online examination, C-CAT, etc. He informed that CDAC has been connected through NKN at 10 locations. NIC’s NKN may further contribute towards user ID, authentication, and management. CDAC has already established open platform for Higher Education and integrated it with NKN. He also shared his approach in meeting the challenge in the development of India MOOCs Platform. Members present expressed their confidence in the design and approach and promised joint support to meet the objectives put before the team.
4. The members discussed certain design parameters: the Mission’s immediate strategy is to launch 100-200 courses; one Crore registered users, one Lakh Concurrent users that require a total bandwidth of 200 to 2000 Gbps through NKN, development and deployment of open stack based generic and specific features services for provision of e-Learning platform. Shri R S Mani, Project Director, NKN pointed out that NIC’s NKN – ID management services can be scaled up to Crores easily as it has been already extended LDAP services and ID repository for IITs, CSIR labs, etc.
5. Committee requested CDAC/NKN to demonstrate the platform in two weeks time, with associated services such as: administrative – content delivery, performance evaluation – certification – requisite communication services – record management, etc. CDAC agreed to do so at NKN NOC Shastri Park.
6. The objective should be to synergize all initiatives of MOOCs for reconciliation, adapting requirements to meet the features and technical specifications of Indian MOOCs for making it World’s best platform.
7. The Members requested the CDAC to showcase, by running a MOOCs type Course on Security, on 27th Feb. 2015 at NKN Data Centre, Shastri Park, New Delhi. All members are requested to participate in the Demo and offer advice based on their rich experience in the field.

The meeting ended with vote of thanks to the Chair.

**Annexure – VI**

**Ministry of Human Resource Development**

**Department of Higher Education  
NMEICT**

The ‘Sub-Committee on MOOCs, in its meeting held on 3rd February, 2015 at Shastri Bhavan, New Delhi, had requested the C-DAC to showcase, by running a MOOCs type Course on Security, on 27th Feb. 2015 at NKN Data Centre, Shastri Park, New Delhi. All members were requested to participate in the Demo and offer advice based on their rich experience in the field.

A demo on this was held at 11:00 a.m. on 27th Feb. 2015 at NKN Data Centre, Shastri Park, New Delhi. The following members attended the demo.

1. Prof. S.V. Raghavan, Chairman, MOOCs Sub Committee.
2. Shri. S.P.Goyal, Joint Secretary MHRD
3. Prof. Deepak B. Pathak IIT, Mumbai
4. Prof. Rajat Moona, Director General, C-DAC
5. Prof. Mangala Sunder Krishnan, IIT, Madras
6. Shri. R.S. Mani Senior Technical Director-NKN
7. Dr. Andrew Thangaraj, IIT, Madras
8. Bharathi, NPTEL project Officer, IIT, Madras
9. Nagesh Karmali, IIT- Bombay
10. Firuza Aibara, IIT- Bombay
11. Pradeep Kaul NMEICT-MHRD
12. Deepak Singh DeitY
13. Dr. C.S. Arora –NMEICT
14. Dr. N. Sarat Chandra Babu, C-DAC, Bangalore
15. Dr. Prahlada Rao, C-DAC, Bangalore
16. Dr. Yash Paul Sharma NCERT (CIET)
17. Sagar, NCERT (CIET)
18. Shri L.R.Prakash, C-DAC, Chennai
19. Kailash, C-DAC, Chennai
20. R. Nagesh, C-DAC, Chennai
21. V.A.Prabha, C-DAC, Chennai
22. Dr. Prahlada Rao B.B , C-DAC, Bangalore
23. Shri Sandesh Jain, C-DAC, Hyderabad.
24. Shri Shounak Acharya , NKN Delhi
25. Shri Amit Kumar, NKN Delhi
26. Shri Gaurav Kansal, NKN Delhi
27. Shri Anil Kumar, NKN Delhi

* The Meeting started with Prof. Raghavan explaining the purpose of the Demo.
* Shri RS Mani explained about the Services offered by NKN for any Organization/Teacher initially to enable their Application. The services made available are:
  1. Super Admin Account for an organization/institute
  2. Storage Service to support Storage
  3. Collabarative CAD
  4. eSikshak Service
  5. Single Sign On with LDAP Directory structure, Multiple LogOn Service( NKN, Aadhar, LDAP supporting any type of Login)
  6. Cell /Container Creation with Storage and Load Balancing Features.
  7. Elearning tool eSikshak demo is given by Sandesh Jain of C-DAC

The following are some of the questions asked by the members present. While some of them were answered satisfactorily, the remaining are taken as Action Points to be addressed by CDAC by incorporating those features inE-Sikshak MOOCs Platform.

1. Can a Teacher Select all by Default Choices for a course and deselect all that are not required by him/her?
2. Video Streaming Lectures with Sync Video should be made Part of Lecture and it is desirable that a user be able to search transcript and Join anywhere.
3. It is advised to create YouTube type of Video Streaming infrastructure.
4. Mechanism for auto-grading/ auto-correction, mechanism for long answers to be made available: Features such as Mathematical Formula Editor should be added, ML/AI Tech. & Crowd sourcing may be added.
5. It is recommended that professional Designer be engaged for UI for each frame of eSikshak.
6. Student’s behavior pattern, events for academic professor to be made available. Identify/Define the events types, for Teacher Versus Student to be done.
7. For a learner, a facility to re-login and start from where he stopped his learning during the Course duration to be made available.
8. Before launching a course beta testing facility through dummy students be implemented to give feedback and after testing, the developer to shift the same for production and made available for use.
9. Prof. Pathak proposed that AJAX like environment for development is used for better performance and it was answered that AJAX is used for all client side interactions.
10. It was recommended to Create a SandBox environment for testing the features of eSikshak, and make it available for IITM & other clients.

**The following additional suggestions were also made:**

1. Provide Teacher to Select all Default Choices for a course and deselect what all not required.
2. Video Streaming Lectures with Sync Video with any Part of Lecture, and user able to search transcript and Join Anywhere is desirable.
3. YouTube type of Video Streaming infrastructure be created.
4. Mechanism for auto-grading/ auto-correction Mechanism for long answers to be made available: Mathematical Formula Editor should be added.
5. Professional Designer for UI for each frame of eSikshak to be consulted.
6. Identify/Define the events types, for Teacher Versus Student to be done. Analytics on these events be made available.
7. For a learner, the facility to re-login and start from where he stopped his learning be made available.
8. Before launching a course beta testing facility through dummy students to give feedback, and after testing shift the same for production be available.
9. SandBox environment for testing the features of eSikshak be make available for IITM.

It was proposed that the C-DAC may engage and utilize the expert advise actively, in perfecting the design; specially Dr. S. Das Mandal & Prof. T. V. Prabhakar, IIT from IIT Kharagpur and IIT Kanpur respectively.

Members felt that it is an excellent work by CDAC and NKN and will evolve in to a great platform in due course. The next version of E-Sikshak may be demonstrated within 45 days.

The meeting ended with thanks to the Chair.

**Annexure – VII**

**IIT Bombay MOOCs related activities**

**2011-12, early 2013**

- Initiated evaluation of MOOCs started by Coursera, edX, Udacity and others

**May 2013**

- Discussions on MOOCs during the visit of Indian official delegation to US

- IIT Bombay appoints a high power committee to decide on its MOOCs strategy

- Committee recommends joining edX consortium

**June 2013**

- MoU signed between IITBombay and edX

- edX releases complete platform code in open source

**July to December 2013**

- IIT Bombay initiates activities for global offering of courses, and for adopting the platform for T10KT and blended MOOCs

- IIT Bombay participated in UGC committee deliberations on MOOCs

**January to April 2014**

- Courses announced for global learners on edX

- Proposal prepared and submitted to Mission for development of an Indian open source platform

- Work continues on customization of open-edX for T10KT and blended MOOCs

- A 2 day National Conference on Use of Technology in Higher Education held in IIT Mumbai with wider consultations between officials of MHRD and Planning commission, academicians, educational associations and technology providers

**May to July 2014**

- Platform project approved by PAB and Standing committee

- MHRD advised IIT Bombay to work full speed on the platform development, using funds available from other projects already approved and running, due to the urgent requirement to roll out MOOCs nationally.

- A preliminary proposal submitted to the mission for the national roll out. It envisages empowering of up to 50 universities to design and operate MOOcs. Wider discussion expected to happen leading possibly (as informed by Ministry) to a cabinet note.

- 3 courses for global learners launched by IIT Bombay on edX

**August to October 2014**

- On being asked for names, IIT Bombay proposes the name SWAYAM (expansion – **S**mart **W**ebs of **A**ctive **L**earning for **Y**oung **A**spiring **M**inds).

- As per advice of the ministry, IIT Bombay initiates activity on building SWAYAM version based on open-edX, and for training teachers to design and run MOOCs

- A mini cloud set up initiated on an urgent basis in consultation with the Ministry, which can offer initial courses when SWAYAM is launched.

- 22 Teachers for 10 central universities trained in workshops, on use of SWAYAM platform. Details collected on the courses they proposed to offer (20 courses). MOOC design activities started in the universities, as also identification of staff and TAs to run these courses.

- 24 School teachers identified by NCERT trained in similar workshops for preparing MOOCs for 9th standard Science and Maths subjects.

- IIT Bombay offers it’s blended MOOC to IIT students of a core course (total registered 545, completed 545, passed successfully 514).

- Wider discussion on MOOCs initiated by the ministry

- Hon’ble HRM visits IIT Bombay, and reviews SWAYAM preparations. Advises that the logo be put up on the mygov.in site for wider feedback and comments.

**November and December 2014**

- Financial due diligence on platform project of IIT Bombay completed by Mission in November. Fund release awaited

- IIT Bombay advised that national SWAYAM launch may happen later.

- Institute announces plans to offer its MOOCs now as “IIT Bombay X”, to be conducted jointly with 3 workshops under T10KT.

**January 2015**

Open Source platform version modified for these courses and workshops. These are to start from 26 January 2015