Chapter 6

Children National Science Digital Library for India (CNSDLI): A Proposed Conceptual Model
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CHILDREN NATIONAL SCIENCE DIGITAL LIBRARY FOR INDIA (CNSDLI): A PROPOSED CONCEPTUAL MODEL

“It always seems Impossible until it’s done”.
- Nelson Mandela

6.1 Introduction

A quick peep into the ancient, medieval, modern and contemporary history of India reveals that India inherits a rich history, culture, civilisation, socio-economic life, and other aspects which make us distinct among the comity of nations. This history also reveals that India has made significant contributions to all walks of life, in its own way. When viewed closely at the areas of education, science, technology, medicine India’s rich accomplishments and contributions are nowhere inferior to any developed and developing nations. Building the sizable of science and technology infrastructure, especially after attaining independence, the successive governments have taken numerous steps to develop and sustain the scientific temper as enshrined in the Constitution. The outstanding scientists, leaders, industrialists and dedicated band of academicians have immensely contributed for the cause of science in many ways. The Government of India along with support and cooperation from state governments as well as international organisations has created separate departments, setup institutions, science museums, agencies and centres and initiated number of projects, programs to effectively promote science at all levels starting from schools. The professional bodies, non-government organisations, media, national level laboratories have added
their might towards the promotion of this cause. In nutshell, there have been countless efforts made to ensure that the scientific temper is developed among the children, so that they lay a solid foundation to the overall development of India, through science and technology. Chapter 3 in the thesis presents a brief and quick account of efforts made by individuals and organisations in India to popularise and promote science India. This chapter also give an opportunity to assess progress (through the published literature) and identify the gaps with regard to whether libraries can play a role in promoting science education. The published literature and also various initiatives by government and non-government agencies did not give enough indications that have been planned to promote and popularise science among children through the digital libraries established exclusively for this cause.

During last two decades, India has witnessed rapid developments in information and communication technology field and this has brought in the noticeable transformation as far as the impact of technologies and information delivered. These technologies have bridged the gap existed before. Library being major player in collection, organisation, processing and disseminating information to different segments of society, including the children who have been familiar with and its role in efficient and effective delivery of information. The Chapter 4 has presented an overview of digital libraries. It also describes specific tools and technologies, standards, guidelines, organisational methods and other
issues concerning developing digital libraries. This chapter analyses the range of issues and the steps involved setting up a digital library.

To harness the potential of ICT to access and deliver the services to the point of need, libraries and their allied agencies all over the globe have to make attempts by creating the state-of-the-art digital libraries. In order to get an overview of the digital libraries created all over the world, an extensive review of the published literature was carried out objectively besides making a comprehensive search to see the functioning of existing digital libraries within and outside India. This was also done to ensure that there is no glaring difference in the model that the researcher is proposing in this study. As a part of this exercise, researcher did come across with some good examples which are some way are similar, but in the context of structure and monitoring are different from what is being conceived and prosed for India. Some of these examples are, ICDL, NSDL, IPL2, Intute, BUBL, INFOMINE, NSDL India, Vigyan Prasar Digital Library and several others. These examples give some insights in to issues that one need to take cognizance of and provide some useful insights. While NSDL India setup by NISCAIR under a plan project is targeted towards higher level students and offers only text book collection and Vigyan Prasar Digital Library which is a simple website provides access to its own publications. These two have their own limitations and may not take up or expand to accommodate the kind of model prosed in this study.
Keeping in view what is being proposed by the researcher in this study, to find out the need, feasibility, usefulness and expected impact, a detailed survey was carried out covering four major stakeholders. As mentioned in the previous chapters, four sets of different samples were selected and questionnaires were specially designed and administered. The data collected from these samples have been analysed, interpreted and presented in Chapter 5. The data so presented clearly reveals that, there have been no such attempts to promote and popularise science among children in India either through traditional libraries or by creating digital libraries specifically to encourage the basic sciences in the primary and secondary level of education.

Taking in to account the inputs from the earlier chapters and considering the changing trends in the information technology and role of libraries, and realising the greater need for having a digital library at the national level in India to popularise and promote science among children, the following conceptual prototype model given in as Figure 1, for the Children's National Science Digital Library for India (CNSDLI) to serve as a national gateway for Indian science digital resources for the students of Kindergarten to 12th standards is proposed and presented.
Figure 1: Proposed Model of CNSDLI
6.2 Vision of CNSDLI

- The vision of proposed CNSDLI is to be a vibrant state-of-the-art national digital library and serve as gateway for preserving, promoting and accessing the Indian contributions in the field of Science and thereby promoting excellence in teaching and learning science at the school level.

- The CNSDLI will be a tool for developing scientific temper among children by promoting the use of high quality science resources.

- To be a national Learning Resource Centre to achieve excellence in teaching and learning science from Kindergarten to class Twelfth in India.

6.3 Mission of CNSDLI

The mission of the proposed CNSDLI is to serve as catalytic tool to preserve, showcase the Indian science literature in digital form. It will also serve as an aid to inculcate scientific temper among school children through teaching and self-directed learning thereby preparing them to deal with fast changing world where science and technology has a pivotal role in the overall development in bringing out science conscious citizens for the knowledge society.

6.4 Objectives of CNSDLI
To translate the above stated vision and mission, the following broad objectives are formulated for the dynamic Children’s National Science Digital Library for India (CNSDLI). These stated objectives are,

1. To identify, select, collect, organise and provide access to high quality digital resources in the area of science highlighting Indian contributions.

2. To provide required policy guidelines for developing quality collection of resources of all types and in different formats required for children.

3. To adopt all required and widely accepted international standards set for creating digital libraries, so that the CNSDLI will be accessible and interoperable among other digital libraries in India and abroad.

4. To identify and recommend suitable technology tools for designing, developing and accessing the CNSDLI.

5. To recommend and offer the state-of-the-art information services based on resources collected and the need of the user community.

6. To provide personalised information services using most used technology devices, networks and social media.

7. To serve as a platform for preservation and promotion of Indian science literature.

8. To act as an effective pedagogic aid to enhance the science teaching and learning process in schools.

9. To integrate itself as part of science curriculum at school level.
10. To create an awareness and offer Information Literacy Programs to increase the usage of collected resources
11. To partner, collaborate and bring together on one platform all agencies, institutions, departments and individuals who have been working towards promoting Indian science and scientific temperament among children.
12. To serve as one point access to Indian science literature meant for children.

6.5 Implementation and Operational Details

In order to convert this conceptual model of the proposed digital library into a successful, implementable, operational and long term sustainable system, the following components have been considered as essential.

6.5.1 Implementation of CNSDLI as a Project

The proposed digital library is a mega activity encompassing all states. It is proposed to cover all types of resources in different Indian languages focussing on science disciplines with children as target group in mind. It is also proposed that, several agencies will be involved at different level for different activities. To begin with, it would be safer to take this as a project and start implementation with project mode for the first three years. The pilot project in the first year and following two years it will be in project mode if found worth going ahead with plan. First year It is important to apply the project management techniques and ensure the smooth implementation. Depending on the success of pilot project, further steps to
be taken to implement the same in different phases. If the project succeeds in achieving its set objectives within three years, then it can be converted into a Centre on the lines of UGC's Inter University Centres (e.g., IUCAA, INFLIBNET, CEC etc) or Vigyan Prasar of Department of Science and Technology.

6.5.2 Model to be adopted

In order to implement the proposed digital library successfully, it is suggested to follow the models in phases. It can start with a first model and move to second model when the entire project execution ends and then it can move to the third model when the whole activity takes shape in the form of an autonomous Centre;

- Centralised input - centralised processing and organisation - centralised management - distributed access (Pilot Project Phase)
- Distributed input - centralised processing and organisation - centralised management - distributed access (Project Phase)
- Distributed input - distributed processing and organisation - centralised management - distributed access (Autonomous Centre)

In the first model collection of information, processing and organisation and management of the entire project happens at the centralised location. Considering that it is in project mode, implementation has to be from one place. At this stage besides managing overall project implementation, one can focus on resources available in English language and test the system.
from the one location. The access to the collected resources will be distributed which means that resources can be accessed from any point.

The second model suggests that resource collection work can be distributed among the nodal agencies located in each state, processing and organisation of the same will take place at the central location, management from one location will continue and then access to the resource from any location.

The third one, which depends on the success of the previous two models, can be adopted upon completion of the three year project mode. By this time, it is expected that the whole process for creating and managing digital library collection is tested and functioning well. At this stage, collection and processing and organisation of its resources can be distributed and monitoring of the entire activities (Centre) has to be controlled from one location ie. Head Quarter of Digital Library and access as usual will be distributed.

The idea of suggesting these models is to pave the way for such a steady and gradual implementation, so that it will automatically lead for proportionate expansion and growth of the total system.

6.5.3 Support and Funding

This being a national level project covering the entire country to serve the cause of science and also to attract the young generation towards science
learning. To make this a national system successfully operational, Government of India should be the primary source for funding. Depending on any other agencies or state government solely may not help achieve its goals. Therefore, it is suggested that the following means can be considered as source of funding and support;

- The Department of Education, Ministry of Human Resource and Development, along with National Mission on Education through Information and Communication Technology (NME-ICT),
- Ministry of Culture under the National Mission on Libraries,
- Vigyan Prasar, an autonomous body under the Department of Science and Technology.

In addition, the voluntary support from any philanthropic trusts, industrial houses, corporate bodies, individuals, non-resident Indian donors can also be considered. Funding from international bodies like UNESCO, UNICEF and others for specific type of activity or services will help in strengthening the proposed digital library.

6.5.4 Governance and Management

As mentioned above, the first three years, the digital library activity will be in project mode. One may choose the suitable governance and management system for project management & implementation. Once the project gets going the CNSDLI becomes an autonomous body under the
Department of Education then it can have its own (Figure 2) Governing Council and Executive Board which will help in framing policies and guidelines. Subsequently, formation of National Advisory Committee, National Management Advisory Committee and National Expert Committees to advice, guide and assist in implementation of policy decisions follow automatically. The Executive Director with four set of team of highly competent professional staff representing the following areas is entrusted to carry out implementation of CNSDLI successfully.

- Scientific staff with background of science disciplines and versatile communication help in identifying, selecting, evaluating, editing the resources that will be added to the collection regularly.

- Library and information professionals will help in collecting, selecting, processing, organising and providing access to resources identified by scientific, teaching and research faculty. They will also design the required services to promote the use of resources added to digital library.

- Computer and Networking staff will take care of deployment and management of required technologies, tools, software etc, for smooth running of the digital library.

- Administrative staff will work as a supporting team for the entire management of the proposed digital library.
All these teams, particularly the first three will work as a close and cohesive group to promote the use of CNSDLI.

Figure 2: Governance and Management
6.5.5 Technology Support

National bodies like National Informatics Centre, Centre for Development of Advanced Computing, Department of Information Technology, National Knowledge Network, INFLIBNET Centre and others would provide the technology support and infrastructure (Figure 3). Wherever necessary, support from other external agencies can be availed.

In terms of creating digital library, it is suggested that the latest hardware and software platforms suitable for implementing this mega project demands the involvement of many experts. For managing digital library, most widely used open source software may be used. It is important to ensure that the selected software is compatible with all international standards and protocols followed for creating digital library arena. Once created, it is expected that the CNSDLI will be interoperable and accessible on all platforms on the web. It should be able to host and provide seamless access to all types and formats of science subject’s contents required for school education.

Since, the proposed digital library, besides English, will cover the resources in all Indian languages, will need to deploy the technology both hardware and software that handles the resources published in multi-languages. This also becomes important issue as to how these resources will be indexed by various search engines.
To connect with all schools and agencies involved in promoting science, possibly National Knowledge Network infrastructure may be used or alternatively other networks with good bandwidth to access text, video, audio based resources may be identified and used.

The INFLIBNET Centre having created number of digital resource databases has required competency and expertise to develop the digital library which can cater to the national needs.
6.5.6 Access and Retrieval

To provide seamless access and also to be one point access for Indian science resources, it is important to study how search engines like Google works. The new generation accepts every access and search interfaces have to be of the type. For this purpose, the digital library will use widely used and internationally accepted Open Source Software search tools which supports all required standards and protocols at all levels. This will provide a robust & user friendly search interface and will enable data harvesting by search tools. This digital library will be prominently visible in all educational platforms and accessible through newer mobile devices and also social network platforms. The resources added to the digital library would be indexed and searchable through general purpose and specialised search engines. Certain resources available on the platforms like YouTube, TED, Khan Academy will be integrated. Over all, the search, access and retrieval of resources should be seamless and faster. Integration of the resources of several leading organisations will drive children to use resources frequently. Access to the resources available in the CNSDLI will be governed by the set of well-defined policies and guidelines.

6.5.7 Collection of Resources

The proposed digital library being a catalogue of digital resources will covers the following resources (Figure 4) in English and all other Indian languages;
- Books, magazines, journals, science news sources
- Biographical sources
- Learning objects
- Educational resources
- Reference collection
- Instructional materials
- Educations awards, fellowship, scholarships etc.
- Tutorials, Video lectures, documentaries, online lectures
- Student projects
- Photographs
- Sources relating science institutions, programs, events
- Science Olympiads
- Oral science history
- Government documents
- 3D Models
- Open Access Scholarly resources
- Text books brought out by central, state boards and other agencies
- And many other sources

The above list is only an indicative one and open to adding any resources that is supporting the science curriculum in schools. Each of the resource will have the metadata along with descriptive abstracts, keywords and other relevant information. This information gets updated regularly. The addition of resources to the digital library will be guided by a set of Collection Development Policy guidelines which considers will all aspects
including copyright issues. It will also be guided by what the user community in the schools need.
6.5.8 Organization of the Collection

Organization of resources in the digital library will be guided by the best practices and latest methods used by similar libraries all over the world. CNSDLI will adopt well proven library classification systems, indexing methods, subject heading systems and metadata standards like Dublin Core and others. Broadly follow new guidelines viz. Resource Description and Access which will address most of the issues posed by the resources in digital media. The digital library will also take in to account new tools introduced and their effectiveness in retrieving information. Attention will be paid to how organise materials in different file formats added to the collection. This part of the work will be mostly guided by standards set by IFLA, NISO, DLF, OCLC, Library of congress and other bodies which have come out with comprehensive standards and guidelines.

6.5.9 Partnership

Partnerships are a must for the progress and success of any project of this magnitude particularly if they are stakeholders as contributors and its users. This being a national level digital library to cater to the needs of all users - teachers, students, parents, administrative staff and others for its successful implementation requires overwhelming support of State education departments, state education boards, different government and non-governmental agencies, central government agencies, professional societies, research institutions, private foundations, industrial houses,
national library, public libraries and all others who are concerned (Figure 5) with popularisation of science and promoting basic sciences at the school level.

6.5.10 Collaboration

India is a huge country in terms population and geographical area. Over the years, several individuals, institutions and government departments and others have been directly or indirectly in some form or the other are involved in promoting science in India. Though, it is proposed that, MHRD will be a nodal agency for funding and coordination at national level, the collaboration with other governmental organisations like (Figure 5) DST, Vigyan Prasar, NCERT, SCERT, CEC, NCSTC, Community Science Centres, Science Cities, and Science Museums is going a long way in bringing out the new generation of students at the primary and secondary level of education.
Figure 5: Collaborators and Partners
6.5.11 Resource Contributors

To create such a huge digital library covering science resources in digital form published in English, Hindi and other regional languages, it is proposed that there should be discipline coordinators, editors, teachers, scientists, freelance science writers, school librarians, authors and others who will identify, evaluate and contribute the resources (Figure 6). Such resources will be duly evaluated by the subject experts/editors at the digital library using set criteria before adding to digital library collection. It is suggested that, any one, irrespective of their location and affiliation, who would like to contribute a resource to the digital library should have the provision to do so. In fact the digital library can have an empanelment of active contributors. These collaborative efforts enable to the large great extent to build the rich and comprehensive resource base.
Figure 6: Resource Contributors
6.5.12 User community

The CNSDLI will be a public funded initiative. As mentioned above, it will be funded by Govt. of India through the Department of Education. Hence, it is suggested that the access to the resources of this library should be open to everyone who is interested in learning, teaching and promoting understanding of science. It is expected the major target user group (Figure 7) for this proposed digital library would mainly be school administrators, students, teachers, parents, educators, policy makers, science promoters, public at large. So while designing the library and its services, this target group will have to be kept in mind. The usage of these resources will be governed by well laid out policy, so that there is no violation of intellectual property of the authors. Most of these resources will be copyrighted and covered under the Creative Commons Rights.
Figure 7: User Community
6.5.13 Services

Proposed model library would offer variety of services to motivate and promote the use of scientific literature in digitised from among children. Some of the recommended services are (Figure 8), Virtual Reference Service, create subject pathfinders (bibliographies), stream the lectures and tutorials, provide personalised alerts, offer virtual training suites, organise virtual exhibitions, career counselling, software tools, connect to virtual laboratories, facilitate virtual interaction with experts, help discovering information resources, create knowledge banks containing questions and answers, provide services to distant learning, support self-learning individuals. These services will be evaluated from time to time and will create new services whenever required. Many more services can be added by conducting periodically use and user studies. Even with the induction of new technology also the services can be restructured and reformed.
Figure 8: Information Services
6.5.14 Link with National and International Digital Libraries

Having made a huge investment in terms of money and effort, this library cannot work in isolation. It has established formal links with many other digital libraries, traditional libraries, agencies involved in promoting science within and outside India. Therefore, it is proposed that, CNSDLI will have a close links with other libraries of similar type established at the International level (Figure 9). This will help to draw expertise and at the same time promote the library services to international users.
Figure 9: National and International Linkages
6.5.15 Evaluation of the CNSDLI

Any system of this magnitude established with public funding will need to assess for its usefulness, impact it has created, value addition it has made. This has to be done periodically and professionally. Most digital library management software should be able to give the usage statistics. Besides this, detailed surveys, focus group discussions and methods suitable for evaluation may be considered, so that it will pave the way for reengineering of the entire system.

These are some of the major aspects that would constitute as major components of proposed CNSDLI. These are by no means comprehensive and complete issues which would take care of every aspect involved. An academic research study like this provides a solid base for starting the activities and provides further inputs to develop further taking into consideration the emerging technologies.

6.6 Conclusion

The proposed model for CNSDLI is a prototype which has a potential for development with the passage of time. Primary to higher secondary level education in India is gaining momentum. The 12th Five Year Plan has formulated a broad based policy. To support the popularisation and promotion of science education, recently launched mission oriented programmes like National Mission on Education through Information and Communication Technology (NME-ICT), Right to Education empower the system much more strongly. Digital technology environment and the fast
extending communication facilities are promising the education field more effectively and efficiently than ever.

The new generation is the generation born with technology spoon in their mouth. Irrespective of the social and economic conditions, educational and technological conditions, the emerging technologies particularly ICT and digital technologies and numerous products have made very significant impact on the life of the people. Governments, social organisations, private sectors, academies and parishats are overwhelmingly coming forward to acquire and apply the cutting edge technologies. In India, time has come to make all preparations to accept and adopt the changes. Digital library impact is one such powerful area where the educational programmes right from the KG level to K12 can explore and exploit the benefits for the production of new generation with appropriate scientific temper.

The present study, though modest, in all respects is a micro study. It makes a bold step forward in giving new direction and dimension for the promotion and propagation of basic science in primary and secondary schools. It is envisaged that if the concerned authorities invest time and money in the acquisition and application of ICT for education delivery, formation of National Science Digital Library for India for the Children (CNSDLI) gains the priority. A proto type model like the one designed, developed and presented in this chapter may become a right ignition point in the direction of building a strong science base in the country.