

# Ecosystem for Digital Preservation in Indian Context: A Proposal for Sustainable and Iterative Lifecycle Model

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## ABSTRACT

The ecosystem and iterative loop shaped lifecycle model are the imperatives for long term sustainability of digital preservation in India. Digital preservation initiative can be launched with minimum upfront investments and basic infrastructure combined with long term and user centred vision. Training and certification, process design, stakeholder ownership, tools and technologies relevant in Indian context can immensely help in building the digital collections. Continuous enhancements, technical support, collective learning, auditing and validation of quality can truly empower the archiving organizations and gear up for sustenance. Content enrichment and value added applications for users can make the digital preservations truly sustainable.

## Keywords

Ecosystem, Iterative Lifecycle Model, Long Term Digital Preservation, Archives, Sustainability, Socio-economic Conditions in India

## 1. INTRODUCTION

### 1.1 The Indian Context

Digital archiving projects in India so far have focused on using computers for cataloging the materials. Computerization of libraries and archives is primarily used for managing local and physical transactions of books or antiquities or films or any other materials. Online digital libraries are a recent phenomenon here. On the contrary, microfilming has been the most preferred technique for preservation of documents. Long term digital preservation and providing accessibility to the outside world has rarely been explored. When we refer to digital preservation in India, the first thing that comes to one's mind is digitization of materials in analog form and then comes the born digital data.

Using digital technology for long-term preservation is entirely a new paradigm for archives and museums in India. The socio-economic conditions, implication of legacy of laws, work culture in archiving organizations, speed and level of acceptance to new technologies and age-old procedures need serious consideration. Therefore, based on some examples and the common trends observed in India, we propose to suggest an ecosystem and an iterative lifecycle model for long-term digital preservation.

### 1.2 Ecosystem for digital preservation

Analogically, if digital preservation is considered as an organism then it becomes inevitable to treat it with the knowledge that life

is a manifestation of ecosystem [3]. It requires you address the most vital issues such as-

- What kind of environment is essential for it to come to existence?
- How should it be nurtured?
- How will it sustain?
- How can we know if its survival is threatened?

Therefore, we have tried to visualize an ecosystem for digital preservation, which is particularly relevant in Indian context. Our discussion is primarily based on following aspects-

- Ecosystem for digital preservation
- Iterative lifecycle model for digital preservation

## 1.3 Experience of Digital Preservation at Indian Museums and other heritage archives

The proposed ecosystem and iterative lifecycle model of digital preservation is conceived based on prior experience of working with the leading museums and heritage archives in India, where Human-Centred Design and Computing (HCDC) group of C-DAC, Pune has deployed its digital collection management system named "JATAN: Virtual Museum Builder". The HCDC group has worked with following museums-

- Salar Jung Museum, Hyderabad, India
- Chhatrapati Shivaji Museum (erstwhile Prince of Wales Museum), Mumbai, India
- Raja Dinkar Kelkar Museum, Pune, India

## 2. RELATED WORK

Many approaches to lifecycle models for digital preservation management have been proposed up till now. The life-cycle concept has been useful in promoting a sense of order, a systematic approach, to the overall management of recorded information [1].

The report prepared by Nationaal Archief on costing of digital preservation illustrates the cost model and recommends that the costs incurred in making future changes need to be incorporated in the computational model right from the very beginning [7].

The LIFE project research review also investigates both life cycle costing and digital preservation, with a view to creating a useable lifecycle costing model that can be applied to digital preservation. The general concept of lifecycle costing (LCC) is explored as a cost management tool [8].

Digital Curation Centre (DCC) has also proposed a curation lifecycle model. It primarily focuses on illustrating the sequence of major steps and technical activities involved in digital curation [4].

Each lifecycle model has emphasized and characterized different aspects of digital preservation depending on the nature of digital data and the context. It is important to note that existing lifecycle models for digital preservation do not mention the need of *ecosystem* as that is taken for granted due to inherent resourcefulness in developed countries.

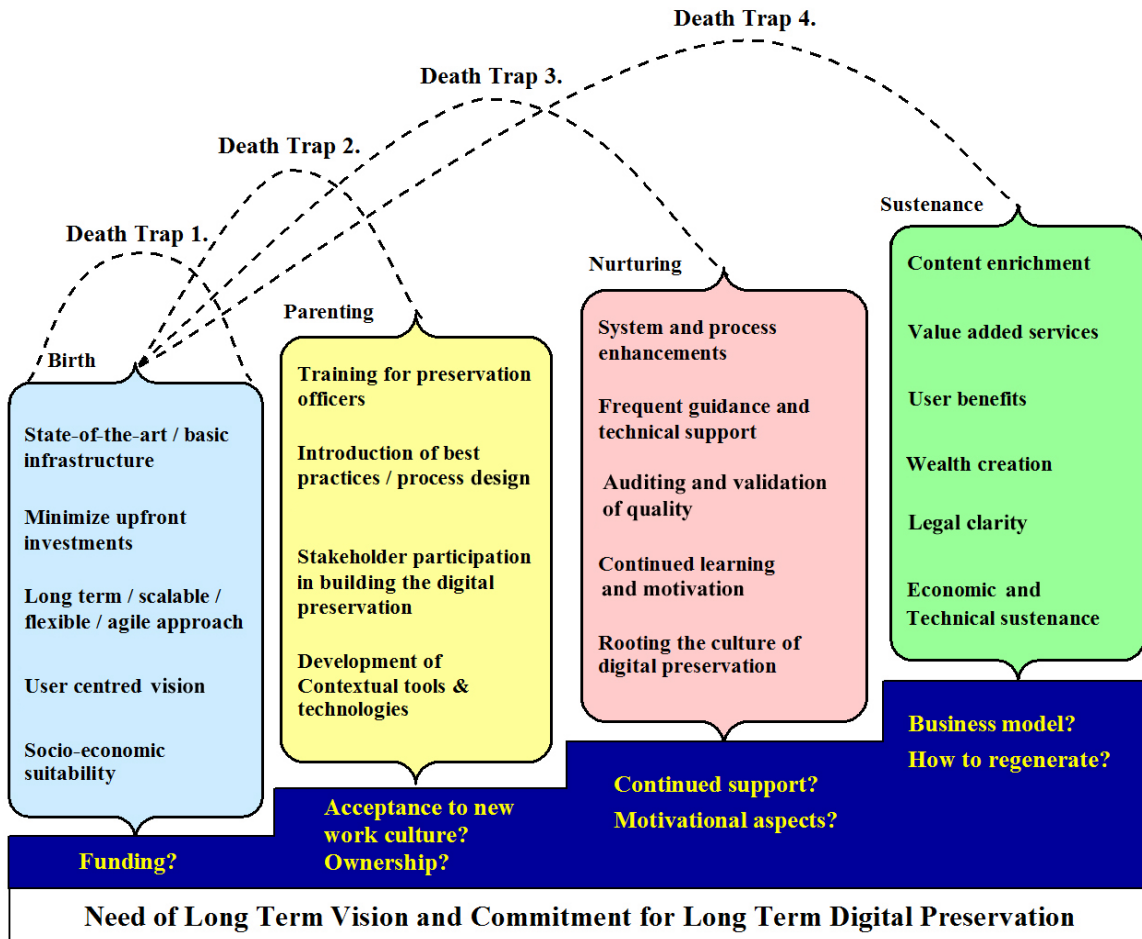


Figure 1. Analogical illustration of “The Ecosystem for Long Term Digital Preservation in Indian Context”  
Absence of conduciveness at every stage of growth is indicated as the potential *Death Trap* for digital preservation.

### 3. STAGES OF GROWTH AND DEATHTRAPS IN DIGITAL PRESERVATION

We have applied the analogy of Birth, Parenting, Nurturing and Sustenance to visualize the stages of growth in digital preservation (refer Figure 1.). An ecosystem supporting all stages of growth is most essential for the long term survival of digital preservation. Absence of conduciveness at every stage of growth is indicated as the potential *Death Trap* for digital preservation. These are explained by giving some examples relevant particularly in Indian context.

#### 3.1 Birth of digital preservation

We discuss some of the important steps involved in starting a typical digital preservation project, which are broadly grouped in the stage of *birth* as shown in figure 1.

- **State-of-the-art but basic infrastructure**

We have always ensured that our museum clients refrain from exhausting their funds on unwieldy computing infrastructure. We never encouraged them to buy Storage Area Network (SAN) systems while starting the project, as their digital data was in the process of getting created. Today, after 5 years have passed, they can easily buy 1 terabyte storage disk for very less price. In this

approach, we not only saved their money but also provided an opportunity to procure more sophisticated technology.

- **Minimize upfront investments**

Many times the funding patterns and the tendency of technology vendors are such that the archiving organizations end up making huge upfront investments in buying heavy computing infrastructure and exhausting all available funds. This lands you up with unwieldy infrastructure which may not get used fully in the beginning of digitization projects. By the time the project reaches its peak, such infrastructure becomes old and obsolete. Therefore the *mantra* is to create minimum necessary infrastructure while saving the funds for more sophisticated technologies that could be procured at right time.

- **Long term / scalable / and flexible approach**

Long term approach implies long term commitment, scalability and flexibility that allow you to adapt with the changes in technology. C-DAC's museum archival system is developed using open source web technologies that provides lot of flexibility for adapting to changes. It is observed that archival software developed using proprietary and closed source tools and databases often pose difficulty in migration after some years.

- **User centred vision**

All decisions pertaining to digital preservation must be taken based on deep study of user needs. The primary users of digital preservation are archivists, curators, collection managers, administrators, etc. And the secondary users include all those who use the digital contents and benefit from the knowledge derived from digital collections. Digital preservation initiatives, though very few in India, seem to be more technology centred than user centred in the approach.

- **Socio-economic suitability**

It is extremely important to study the socioeconomic conditions and contextual needs of users while deciding the roadmap to digitization of collections managed by libraries, museums, and archives. In a developing country like India much more support, guidance and time is required for proper adoption of digital preservation practices.

*Digital preservation initiative can be launched with minimum upfront investments and basic infrastructure combined with long term and user centred vision.*

## 3.2 Parenting for digital preservation

Funding agencies and decision makers need to play the role of *parenting* and facilitate the following activities, when a digital preservation project is shaping up.

- **Training for preservation officers**

Training and certification programmes on digital preservation, starting from introductory level up to advanced level are essential for preservation officers. Specialized topics under digital preservation based on the type of contents such as audio, video, films, images, documents, etc. need to be given proper coverage to enable the preservation officers.

- **Process design**

Digital preservation processes need to be designed with proper understanding and interweaving of traditional processes followed

by the archiving organizations, to reduce the resistance or to avoid complete rejection to new processes.

- **Maximize stakeholder participation**

Many times the funds are made available to archivists with improper anticipation of time and effort required for digitization. As a result, to pass on the difficult target, the archivists in India tend to sub-contract entire project to private parties. But in the process of subcontracting, main stakeholders like archivists, preservation officers and curators remain unexposed to technologies and processes. You miss a great opportunity of technical capacity building within archivists and collection managers. The final outcome of such subcontracted project lacks the sense of ownership. The archiving staff faces difficulties in managing such digital archives due to lack of technical knowhow.

Effective partnerships between the prime stakeholders is most essential, for instance in case of museums - department of culture, department education, and the department of information technology should collectively support digital preservation initiatives [5]. Interdisciplinary cooperation and collaborative efforts between government and the private sector need encouragement [6].

- **Contextual tools and technologies**

Digital preservation tools and technologies need to be grounded in the Indian context to address local needs and achieve greater acceptance from users.

*Training and certification, process design, stakeholder ownership, tools and technologies relevant in Indian context can immensely help in building the digital collections.*

## 3.3 Nurturing the digital preservation

The stage of *nurturing* translates into encouragement, mentoring and helping the digital preservation and the staff that manages it mature.

- **System and process enhancement**

The digital preservation system and process design is not a onetime activity but it requires continuous enhancement until it matures. Systems and processes need to be tuned and enhanced based on the feedback of preservation staff.

- **Frequent guidance and technical support**

C-DAC's team has been supporting its museum clients for the past 5 years for all the aspects involved in the creation of digital archive. It includes guidance and support for hiring of technical staff, upgrading the archiving system, process design, training and helping in unforeseen problem situations.

- **Auditing and validation of quality**

Best practices are never static, they have to keep evolving. The implementation and effectiveness of best practices must be ensured through periodical auditing and validation.

- **Continued learning and motivation**

Organization and participation in seminars, workshops and conferences for archiving professionals will help in raising their exposure to new developments and knowledge of digital preservation. It will also help in creating a vibrant community of digital preservation practitioners and researchers. Other motivational aspects like *incentives* can be considered for speedy transformation from traditional to digital.

- **Rooting the culture of digital preservation**

Synchronization and effective implementation of all activities involved in stages like birth, parenting and nurturing together can create the much required culture for digital preservation.

*Continuous enhancements, support, collective learning, auditing and validation of quality can truly empower the archiving organizations and gear up for sustenance.*

### 3.4 Sustenance

- **Content enrichment**

Users of digital preservation can truly benefit if the digital archive is rich with contents and description of metadata. We have observed that most Indian museums are able to describe only 10% of the parameters for every digitized antiquity. They do not have historical description about ancient antiquities, which is of great interest to users.

- **Value added services**

Applications and value added services need to be built while keeping the interest of users in focus. For example, it is possible to build e-learning applications for teaching 'history' using the museum archives.

- **User benefits**

Mere digital preservation is like *mummification* unless its rich information content is not disseminated and made accessible to its potential users.

- **Wealth creation**

Wealth in terms of knowledge, accessibility to digital information resources and revenue generation from value added applications can provide sustainability to digital preservation.

- **Legal clarity**

Legal clarity with regard to copyright sharing, dissemination and usage of digital contents is most important when we think about sustainability of digital preservation. Due to lack of knowledge on legal aspects and government's policy, the archiving organizations are caught up in the *copyright phobia*, which results in futility. The digital preservations remain unused.

- **Economic and technical sustenance**

Economic sustenance leads to technical sustenance. The digital preservation can get its second birth or it can rejuvenate itself only and only if it has sufficient financial resources to undertake technological upgradation and migration.

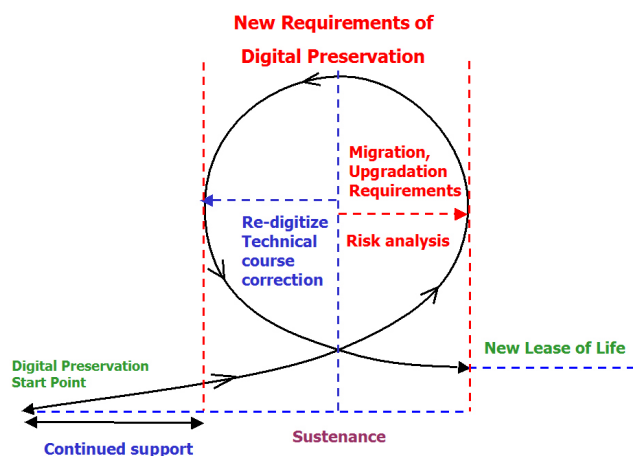
*Content enrichment and value added applications for users can make the digital preservation truly sustainable. In summary, an ecosystem with conducive environment is most essential to support all phases in the evolution of digital preservation for its sustenance and growth. Absence of conduciveness at any stage can become a potential death trap for the digital preservation.*

## 4. ITERATIVE LIFECYCLE MODEL

In our proposal, we have incorporated Barry Bohem's spiral model [2] at an *abstract level* in each loop of the lifecycle. It is primarily because the spiral model gives major emphasis on risk analysis, risk resolution and overall risk management in an *iterative* and *evolutionary* manner.

We have tried to focus more on the overall ecosystem and sustainability of digital preservation, which is most relevant in a developing country like India. Due to adequacy of computing infrastructure and resources in USA and European countries, their digital preservation lifecycle models seem to presume the availability of basic ecosystem and focus more on the curation and costing activities.

On the contrary, the model proposed in this paper is '*loop shaped*' and it focuses more on the issues of *sustainability* and how the digital preservation could rejuvenate itself and possible funding patterns for it to survive. The '*loop shaped*' lifecycle model is an integral part of *the ecosystem for digital preservation*, which is an imperative for any lifecycle to run.



**Figure 2. Loop shaped and iterative lifecycle model for digital preservation**

The loop is divided in two parts as shown in Figure 2.

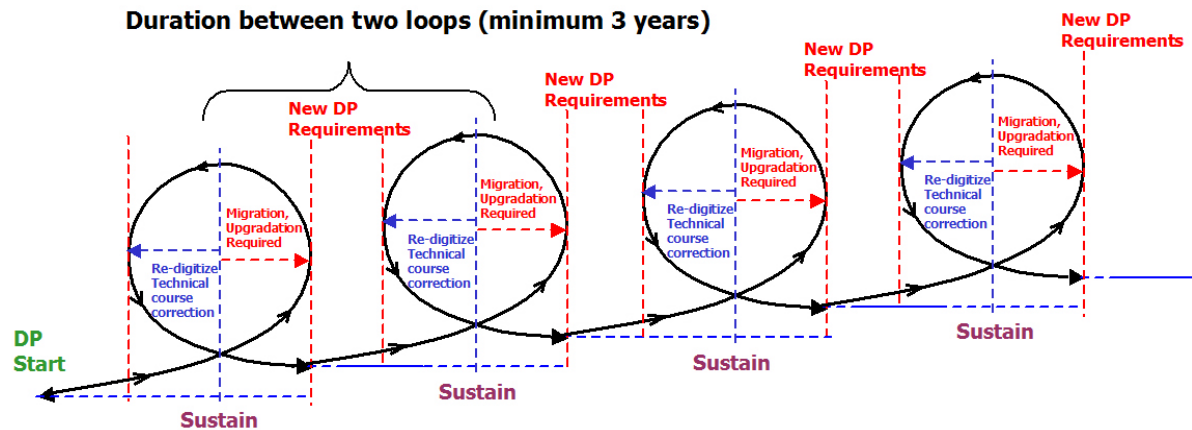
- **Risk analysis (involving migration and upgradation requirements)**

In the right half of the loop, one requires to evaluate the validity of file formats of digital data, storage media, meta-data, databases, accessibility, software compatibility, etc. In case of technological obsolescence or non-compatibility threats or problems with backup media, appropriate migration or upgradation plans have to be prepared.

- **Re-digitization or technical course correction**

Based on the outcome of risk analysis, validation and evaluation of digital contents- re-digitization, conversion, migration and upgradation activities need to be undertaken, which eventually provide a new lease of life to digital preservation.

Self-sustenance is most crucial while performing the above two activities that need to be performed repeatedly with certain periodicity.



**Figure 3. Repetition of loop in the lifecycle model of digital preservation**

## 5. CONCLUSION

Indian government should plan for creation of proper ecosystem along with long-term commitment to sustain the entire lifecycle of long-term digital preservation. Short-term plans with short-term commitments will never lead to long-term digital preservation.

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