Pragmatic and Usable Approach for Digital Library Initiatives in India

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Abstract:

Archivists in India have to go through a transformation in terms of their mindset and the style of working for the success of digital library initiatives. Sponsors of digital library projects in India must notice the rate of technology obsolescence and the pace of archivists in adoption of new technologies. Digital library initiatives will survive if all transformational aspects are facilitated and supported. It is extremely important to study the socioeconomic conditions and contextual needs while deciding the roadmap for digital library. Success of digital libraries in the developed countries is due to continued efforts of modernization in the past several decades. Effective partnership between the prime stakeholders such as cultural, educational, and technological organizations is the key to success of digital libraries. The paper deliberates upon some of the myths about 'digital library' prevalent in India. The causation of each myth reveals many problems and gaps that need to be addressed. Technical experiments undertaken by C-DAC's National Multimedia Resource Centre, Pune, India are illustrated to demystify the myths wherever applicable. Totally there are 15 prominent myths consisting of 10 myths of technology developers, 3 myths of archivists and 2 myths of government agencies. The deliberations on myths of digital library bring out the need to focus on pragmatism and usability.

Keywords:

Myths, digital library, museums, saint literature, collection management, User Centred Design (UCD), usability, stakeholder participation, developing countries

Introduction:

A multi-disciplinary activity like 'Digital Library' requires support from all stakeholders namely technology developers, archivists, librarians, curators, collection managers, educationists, scholars, students and government agencies. But the digital library initiatives are not very effective due to uni-disciplinary approach of implementation in India. The lack of awareness, technical knowledge and the resultant bottlenecks cannot be removed due to unavailability of forums for facilitating the exchange of diverse viewpoints and concerns of the stakeholders. This has resulted in the mythical perceptions about 'digital library' among professionals from different disciplines. Some of the prominent myths encountered by the author are discussed in this paper. The paper also presents the development initiatives undertaken by C-DAC's National Multimedia Resource Centre, Pune, India, which are focused to demystify some of these myths.

Let us take a brief overview of the myths and wrong assumptions about digital library (Levy et al, 1995) already documented by the researchers. Kuny et al (1998) have enlisted very general types of myths that may be true all over the world, e.g. Internet is the digital library or digital libraries will be cheaper than printed libraries, etc. Tan et al (1998) have discussed the myths of searching the digital library by characterizing the nature of scanning, exploring, browsing and wandering in the digital library. Whereas, Pacifici (1997) strongly confronts the mythical claim of the demise

of conventional libraries. Sellen et al (2002) refute the myth of the obsolescence of paper and the claim of so called paperless office.

However, this paper presents the myths of digital library that have born out of India's social, economical and technical context. It is quite possible to find different variations of similar myths in other developing countries. The perspective of the myths presented in this paper is more multimedia content centric, as the author has worked on museum collections and Indian spiritual texts. The myths show a common trend of ignorance of Human Computer Interface (HCI) and usability issues of digital library (Nielson, 2002).

Roles of main contributors to digital library initiatives in India are defined below for clarity in the deliberations hereafter.

- **Technology Providers:** Computer professionals involved in the development and supply of digital library systems
- **Archivists:** Museums [it includes archeological, anthropological, craft, science & technology, weaponry, musical instruments and many other types of museums (Agrawal, 2003)], libraries, film archives, manuscript archives etc. We will be referring the domain users of digital library as archivists.
- **Government Agencies:** Funding organizations and controlling bodies dealing with culture, education, technology and planning; policy makers, government officials
- **Users:** Research scholars from India and abroad; research organizations; educational institutes where library science, archeology or other specialized topics are studied; schools and colleges; teachers, students, tourists and other general users

The specific myths of technology developers, archivists and government agencies are categorized separately. But there is a general myth among all three categories, which is explained below.

<div align="center">

Myth 1. Digital library manages the collection of books only.

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Reality:
There is a general misunderstanding about 'digital library' due to conventional usage of the term 'library' in the context of books. The digital library is expected to manage digital collections (Cleveland, 1998) consisting of books, museum artifacts, satellite images, x-rays of patients, geographical data, video films or any other types of contents. Whenever, we proposed the digital library solution to museum authorities in India, very often they clarified to us that they deal with 'museum collections' and not 'library'. Therefore, we named our product as "JATAN: Virtual Museum Builder", a specialized digital library system for museums (Katre, 2004) for more clarity.

Following myths are more prevalent among the technology providers.

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Myth 2. Digitize all images at highest possible resolution.
Myth 3. Bigger the storage needs better the digital library.

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Reality:
Most technology providers have propagated the need of high-resolution digitization of all images in a rather unrealistic manner. The large collection of ancient manuscripts requires high-resolution digitization of millions of folios (pages). It inflates the storage requirements of digital library. This approach compels the organization to make upfront investment in High Speed

Scanners, Storage Area Network and large Database Servers, etc. Such infrastructure is very demanding for its effective usage, maintenance and sustenance. The technology providers propagate these myths for commercial gain. The costly investments for digital library infrastructure are prohibitively high for economically backward countries to venture into digitization.

The myth about high-resolution digitization is also a result of standards like NARA (National Archives and Records Standard), which are suitable to highly resourceful organizations in developed countries. Early digital library initiatives were launched to exploit the computational resources built in the form of supercomputers (Griffin, 2005). The developed countries are promoting digital library application to utilize the abundant computational resources. But this is not the case with developing countries.

Many heritage organizations in India do not have the much-needed technical manpower, IT culture and business model for sustaining the digital library infrastructure. Many museums do not have even one computer. Some museums have two/three computers but they are not networked. While emphasizing the need of digitizing the information resources, Rao (2005) has highlighted the limitations of Internet services and powerful systems to provide access to general population in India. Considering these prohibitive factors, we have identified a simple formula for justifying the allotment of DPI (Dots Per square Inch) resolution for digitization of objects. It is helpful in reducing the storage needs of digital library.

Figure 1. Varied intricacy of design in clay pot and vase

Variable allotment of DPI resolution:
Practitioners in India either choose uniform DPI resolution or they randomly set the resolution while digitizing. On the contrary, we propose to allocate appropriate DPI resolution on the basis of certain parameters. This approach helps in regulating the storage needs of digital library. We observed that curators attach different degree of importance to different objects (Chapman and Kenny, 1996). Ancient, precious and fragile objects are given special attention and care as compared to other objects. Similar logic could be applied at the time of digitization. As shown in figure 1. the clay pot (A) need not be digitized at very high resolution, as its surface does not have any designs. Whereas, the vase (B) has very intricate designs on its surface that need to be digitized at higher resolution for clarity. It is possible to evaluate each object based on parameters like age, intricacy of design and condition for allocating appropriate DPI resolution.
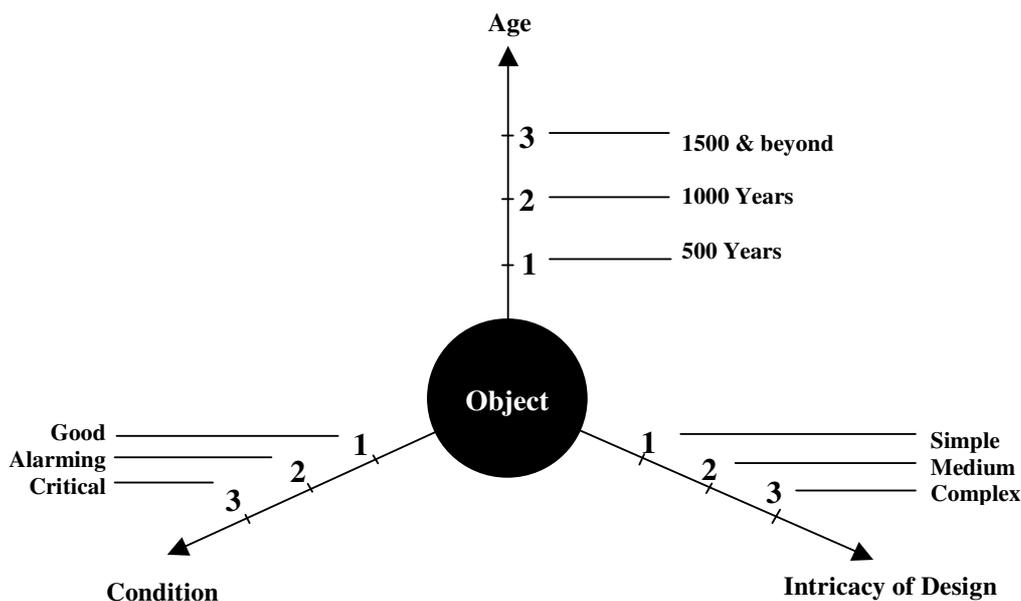
Age

3 ——————— 1500 & beyond

2 ——————— 1000 Years

1 ——————— 500 Years

Object

Good ——————— 1
Alarming ——————
Critical ——————— 2
3

Simple
Medium
Complex
1
2
3

Condition

Intricacy of Design

Figure 2. Parameter based allotment of DPI resolution for digitization

Every parameter is measured on the scale of 1 to 3. In this way, all three parameters total up to 9. Let us assume that one has decided to allocate maximum 300 DPI resolution for digitization of an object. We will now evaluate an object based on the parameters shown in figure 1 and allocate appropriate DPI resolution for digitization, e.g. if an object is rated as under-
Condition (1) + Intricacy (1) + Age (1) = 3

The total rating is 3 out of 9. Therefore, proportionately, the object is allotted 100 DPI resolution for digitization. The highest ratings (9 out of 9) will permit you to digitize an image at 300 DPI. The denominations of 'Age' parameter could be extended beyond 1500 years if necessary. This approach helps in logical allotment of DPI resolution and effective usage of storage space. We have introduced this technique while designing a low cost digital library solution for museums. It also saves the time required for digitization. **From this experiment we realized that a sustainable digital library with optimized storage requirements is more effective than the non-sustainable and elephantine digital library infrastructure.** This type of pragmatic approach is particularly more suitable in Indian context.

Myth 4: Metadata is nothing more than library attributes.
Myth 5: All images are same from the technical viewpoint.
Reality:
Mostly, the museum artifacts are digitized as images due to unavailability of 3D digitizers. Though these are all images, every artifact embodies different type of historical information. It is necessary to go beyond typical library attributes such as accession no., classification, topic, title, etc. Digital images of manuscript folios, sculptures, miniature paintings, architectures, weapons etc. serve different purposes. The experts can extract different information from each of them. Therefore, it would be wrong to treat them just as image files.
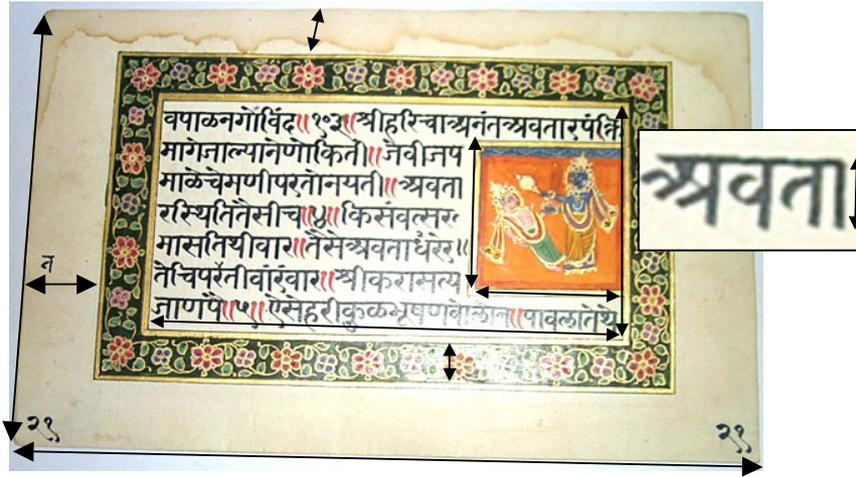
Figure 3. Measuring the ancient manuscript folio

Need to see beyond file formats:
We have developed a tool to capture various dimensions of ancient manuscripts. The manuscripts are made up of various materials like palm leaves, wood, metal, cloth, leather and handmade paper. The curators have to take various measurements of the manuscript folios manually. A functional software prototype has been developed to measure and extract the metadata from the digitized images of a manuscript. It can capture vertical and horizontal margins, letter height and width, leading space, line width, number of letters in a line, stroke width and angle, border thickness, picture size and the color of folio. These are true attributes of manuscript unlike the artificial library attributes. Similarly, it is possible to design different tools for extracting the metadata from different types of images. This example clearly explains that images can have same file format but they can produce different metadata.

Myth 6: Technology developers need not indulge in content creation process.

Reality:
The technology developers in India are less familiar with User Centred Design (UCD) practices like contextual inquiry, field studies, apprenticing with users for requirements research (Holtzblatt et al, 1995). Instead, most of them prefer honing their programming skills in the computer lab. They consider content creation as 'none-of-my-business'. As a result the requirements research happens at surface level. Digital library technology is also expected to facilitate and speed up the content creation process.

Productivity tools for content creation:
We conducted a full fledge case study to identify opportunities of technology development in content creation. We created the multimedia content for *Dnyaneshwari* and *Bhagavadgita.* Basically, it is a Hindu religious book. *Dnyaneshwari* is a profound commentary in *Marathi* language by saint *Dnyaneshwar* on *Bhagvadgita*. Our main objective is to design a specialized digital library system for integration of Indian saint literature. During this effort, we had to digitize and edit the recording of vocal rendition of approximately 13,000 verses. It was a mammoth task as the total duration of recitation was more than 240 hrs. We had to edit each verse and create a separate WAV file for integration along with the text. All together 13,000 audio files were to be edited. This task became very tedious, as the existing audio editing tools are not designed for such voluminous nature of audio editing. It was eye straining to look at the visual representation of audio signal for marking In and Out markers for defining segments. We identified this as a major usability problem.

Therefore, we designed a specialized audio editing tool for editing the recitation of verses named as SliceIt. It allows you to define multiple segments (verse by verse) in the audio track by pressing a key on the keyboard, while listening to audio. One does not require seeing the audio signal. The tool also supports segment wise annotations, incremental alphanumeric naming standards and automatic addition of fade-in and fade-out effects while saving the file. The tool can slice hundreds of segments into separate audio files in no time.

Such productivity tools prove useful while creating large amount of content for digital library. Opportunity of tool development like SliceIt can be discovered only through participation in the content creation process. Therefore, the technology developers dealing with digital library should not hesitate to indulge in content creation.
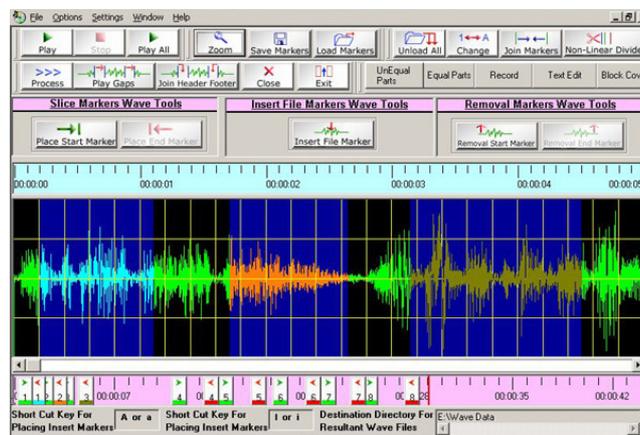

Figure 4. SliceIt software for editing the recitation of verses

Myth 7. Cognitive experience and presentation of information are not our problems.
Reality:
Comparison between physical library and digital library provides insight into a variety of Human Computer Interface (HCI) issues. If we recall our experience of physical library, we predominantly remember the environment of library. It includes the details of surrounding campus, architecture, various sections partitioned by cupboards and bookshelves, reading room etc. This atmosphere attracts readers to library. Similar environments are created for museums as well. **Present digital libraries lack such environmental qualities.** The contents in a digital library are merely presented in the form of a hyper linked structure of files.

Furthermore, we remember the books or artifacts in the museum through spatial clues, colors and shapes. We remember the objects by their color, shape and location. Such spatial clues and physical attributes are essential for human cognition, which are usually missing in most digital libraries. Adding spatial feel to digital library is a challenge.

3D model of *Bhagavadgita* temple:
Saint *Dnyaneshwar* has metaphorically visualized the *Bhagvadgita* (Hindu religious book) as a temple in the 18th Chapter of *Bhagvadgita*. He has associated various parts of temple with the contents of *Bhagvadgita*. He has also linked various other spiritual scripture with the temple architecture. He has illustrated this visualization in the form of lyrical verses.

We have converted this temple metaphor into a 3D model as shown in figure 5, wherein the chapters and philosophical scriptures related to *Bhagvadgita* are hyperlinked. Here, the temple metaphor serves like a 3D index of contents. It helps the users in easily remembering the location of every hyperlink provided in the 3D environment.
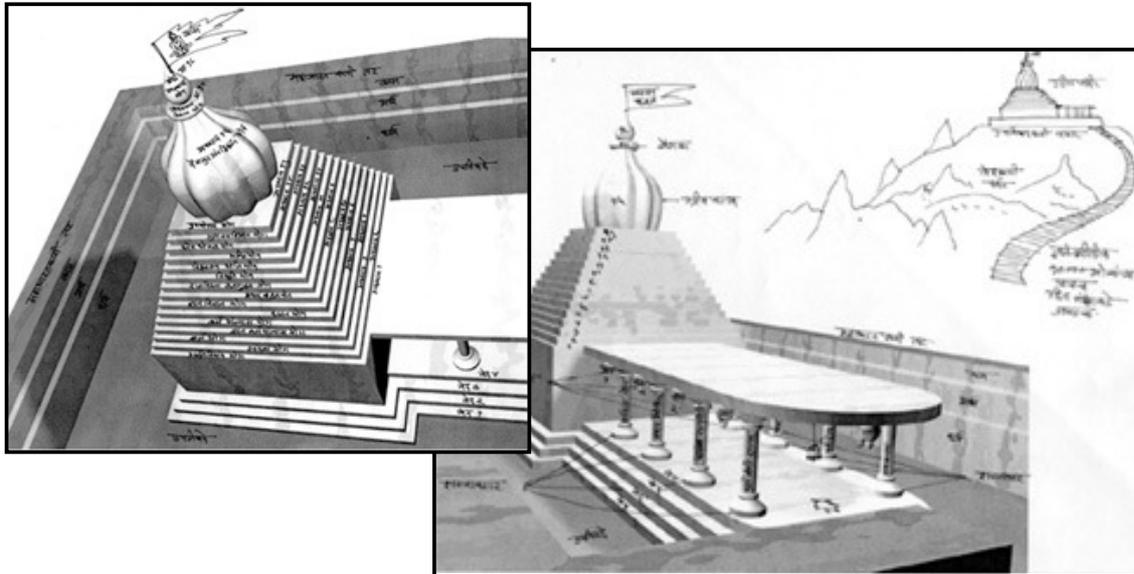

Figure 5. 3D index for spatial navigation through digital library

For example, the 18th chapter is at *Shikhar* (the vintage point on the temple). The *Vedas* are placed on the steps of the temple. The fencing wall around the temple represents *Mahabharata* (ancient Indian epic).

Conventional digital libraries provide a flat structure of links to the collection. In case of the 3D temple metaphor shown in figure 5, we have provided a 3D structure for linking the contents. It helps in adding spatial clues to the arrangement of contents (Katre, 2002), which also serves like a mnemonic device for users. WebBook and Web Forger experiments corroborate with our proposition with regard to spatial clues as they represent digital library as 3D bookshelves and books with unique colors (Card et al, 1996). The 3D temple example proves the need of addressing the human cognitive needs through digital library.

The contents of digital library loose their external look and feel, e.g. the technical manuals, books and ancient manuscripts get converted to PDF format. As per Bertrand Russell (1921), any scientific interpretation of the phenomena requires knowledge of physical attributes and not perceptual attributes. Contrary to this, our experiments with metadata description for manuscripts and 3D *Bhagvadgita* temple show that perceptual attributes of content can change the design of digital library system. This is because, from the point of view of human cognition, perceptual attributes come first and then physical attributes.

Myth 8: There can be single digital library solution for all types of collections.
Reality:
Every digital collection is unique in terms of information, content, process of digitization, archiving techniques, archivists and users. The requirements of archivists and expectations of users differ depending on the type of collection. However, many technology developers in India

presume that supporting various file formats and providing some customizability are adequate to make a generic digital library solution.

Presentation of Indian saint literature:
Figure 6 shows an example of how Indian saint literature can be presented while maintaining the traditional look and feel of content. However, the religious and culture specific representations pose the challenge of cross-cultural acceptability. But this can be tackled by localizing the interface metaphors (Katre, 2004). The lyrical verses used in saint literature and objects wise presentation of information in museums; make both types of digital library applications very intricately different. Let us know about the museum requirements through the case study of JATAN: Virtual Museum Builder.
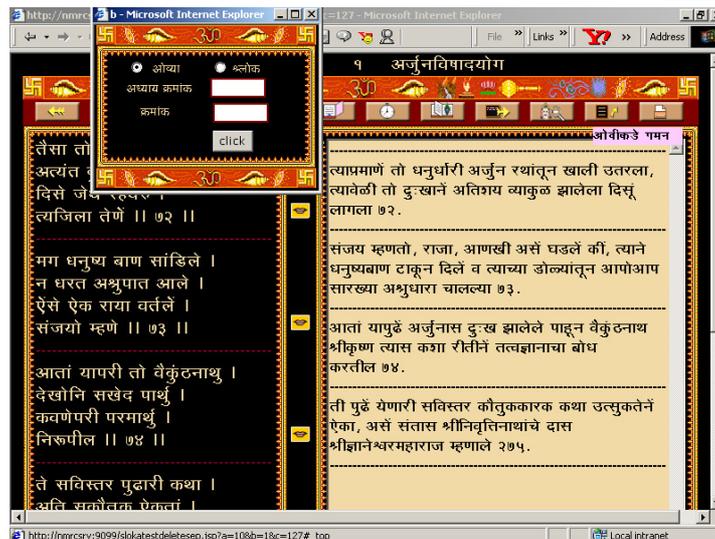

Figure 6. Presentation of Indian saint literature

Specialized digital library system for museums:
We performed extensive field studies to understand the work culture of Indian museums. We observed the procedures of documentation practiced by National Museum, New Delhi; Prince of Wales Museum, Mumbai; Raja Kelkar Museum and Bhandarkar Oriental Research Institute from Pune. Let us go through the features of JATAN system to find the uniqueness of museum requirements.

JATAN: Virtual Museum Builder is a specialized digital library system for 'Indian' museums. We studied some western digital library solutions like Gallery System to find that 'Indian' museums follow different practices, e.g., unlike the western approach almost none of the Indian collections are insured. Therefore, the features of Gallery System about insurance policy of every artifact are presently not relevant in Indian scenario.

JATAN system focuses on digitization, cataloging, archiving and dissemination of museum information. It supports integration of artifacts as well as manuscripts in digital formats. A comprehensive record entry form is evolved through study of documentation practices in several museums. Support for integration of multimedia contents like audio, video, 3D objects, interactive panoramas is provided. JATAN system allows the authorized users to execute decisions like deletion, approval, publishing and withdrawal of records. The database of finalized records is accessible through the Main Accession Register in the system. It is possible to publish

Virtual Museum on Internet for dissemination of information to students, teachers, archaeologists and scholars across the globe. JATAN system dynamically generates the website which can be easily controlled and managed without any technical assistance. Access to special information and downloads from the virtual museum is dependent on user privileges. The manuscript folios and paintings with exceptionally long width or height can be integrated and displayed through auto scrolling feature for ease of viewing. Virtual walkthrough of the museum galleries can be provided on the website with hyper links in 3D environment for accessing the contents from JATAN database.
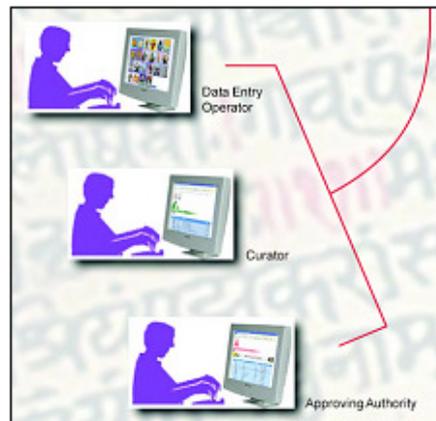

Figure 7. Collaborative framework of JATAN: Virtual Museum Builder

JATAN system is already deployed at two leading museums in India namely Prince of Wales Museum, Mumbai and Raja Dinkar Kelkar Museum, Pune. The design of JATAN system is so specialized that it is not possible to use it for other types of digital collections. **A multipurpose digital library solution can be subjected to several usability problems.**

Our experiments with digital library for Saint Literature and JATAN system for museums reveal that it is not appropriate to thrust single digital library solution for all types of digital collections.

Myth 9. Archivists will have correct, complete and just the required amount of data.
Reality:
There is a tendency to assume that every record is bound to be complete and correct at the time of data entry. Due to this myth, the technology developers provide a plain form for data entry. Contrary to this, we made a realistic assumption that the record is not likely to be complete and correct in the beginning, but it will be completed through an iterative process (Katre, 2004). As shown in figure 7, JATAN system allows the data entry operator, the curator and the indologists to collaboratively and iteratively develop the metadata.

Myth 10. Training will help in institutionalizing the digital library practices.
Reality:
The chance of conflict between the existing practices and newly defined digital library processes if the developers have not followed User Centred Design (UCD) approach. **In such case, the archivists are likely to suffer from 'foreign body syndrome' as experienced in many e-governance projects. Though the digital library system is fully operational it is not likely to receive full acceptance from users.** As a result, the digital library processes never get institutionalized.

It is necessary to achieve seamless fusion and interlinking between the old and new practices. This can also be achieved through selection of appropriate interface metaphors for capturing the mental model of users. We documented the existing museum processes in the form of 'Commentary of Task Performance' and visualized the new processes in the form of 'Interface Play Script', to establish the interlinking between both old and new practices, while designing the JATAN system (Katre, 2005). It also helped us in identifying the metaphors for user interface design. If the interlinking aspect is ignored then the training program can never help the archivists in institutionalization of digital library practices.

Following myths are more prevalent among the archivists and senior administrative officers working in heritage organizations.

Myth 11. Subcontracting the entire digital library project is most convenient.
Reality:
Many times, the funding for digital library project is made available with improper anticipation of implementation time. As a result, to escape from such difficult or at times impossible responsibility, the museums decide to sub-contract the entire project to private parties. Another reason is that the museum staff considers such project as an additional burden of work without any incentives for them. Government of India should consider offering incentives for speeding up the digitization. But in the process of subcontracting, the main stakeholder, in this case it is the museum, remains unexposed to the processes involved in building the digital library. The staff of museum fails to develop new technical skills and to internalize the new processes. Such digital library built by the subcontracting agency is not likely to succeed, as the museum staff lacks the sense of ownership and remains incapable of managing it.

Digital libraries can sustain only if they become part of our regular work culture. It is important for the archival staff to internalize the digital library processes through active participation. **This is indispensable, as digitizing does not replace the need to perform all the traditional tasks like acquiring, organizing, cataloging, and preserving materials (Erway, 1996) using new tools and techniques.**

Myth 12. Others will copy our digital collections.
Reality:
Many museums accept to build the digital library but they resist the idea of publishing it on Internet, fearing that others will steal their copyright. When we probed further into this aspect, we found that their opinion is based on ignorance. We had to demonstrate to them that they could choose what to publish on Internet and control the access of users through various subscription models. Furthermore, there is lack of clarity about the copyright law. As a result, most of them play safe by resisting the concept of digital library itself.

Awareness must be developed about the value of copyright, its protection and modes of sharing the copyrighted material for price. **Digital mummification of cultural heritage is not sufficient for its preservation. It is best preserved through dissemination.**

Myth 13. The business model for digital library will succeed immediately.
Reality:
Most Indians museums do not have technical manpower to maintain the digital library infrastructure. They cannot afford to depend upon external agencies for day-to-day problems. Recruitment of technical manpower, maintenance and upgradation of computing infrastructure is

possible only if the digital library generates some revenue. The digital collections must be accessible and usable to the outside world on payment basis. Persistent efforts need to be taken for expanding the user base of digital library. Innovative applications harnessing on the digital collections should be developed to attract and benefit the users. **The private museums in India, which usually like the concept of digital library for its business potential, must realize that the business model of digital library can succeed only through long-term vision, persistent efforts and innovative applications.**

Following myths about digital library are observed in government agencies.

Myth 14. Our job is to give funds for building digital libraries.
Myth 15. Stakeholder organizations will collaborate by themselves.

Reality:
Archivists, technology developers, government agencies and users should be involved in the making of digital libraries with proper synchronization (Levy et al, 1995). Presently, there are no synchronized efforts between the information technology, tourism & culture and education departments. This approach is likely to result in duplicate investments for the same cause. Present digital library initiatives in India are implemented in isolation and without the required partnerships and synchronization.

The educational syllabus for schools and colleges should be appropriately redesigned and linked with the national digital library initiatives. Educational CD ROMs and e-learning programs should be developed as extensions of digital libraries for transfer of Indian history, culture and heritage. Scottish Cultural Resources Access Network (SCRAN) founded by national museums in Scotland is a well-synchronized effort between all the stakeholders as reported by Royan (1998).

The government agencies have a pivotal role to play. They should not only provide financial support but also involve all concerned stakeholders in the digital library initiative and provide required ecosystem for its survival and growth.
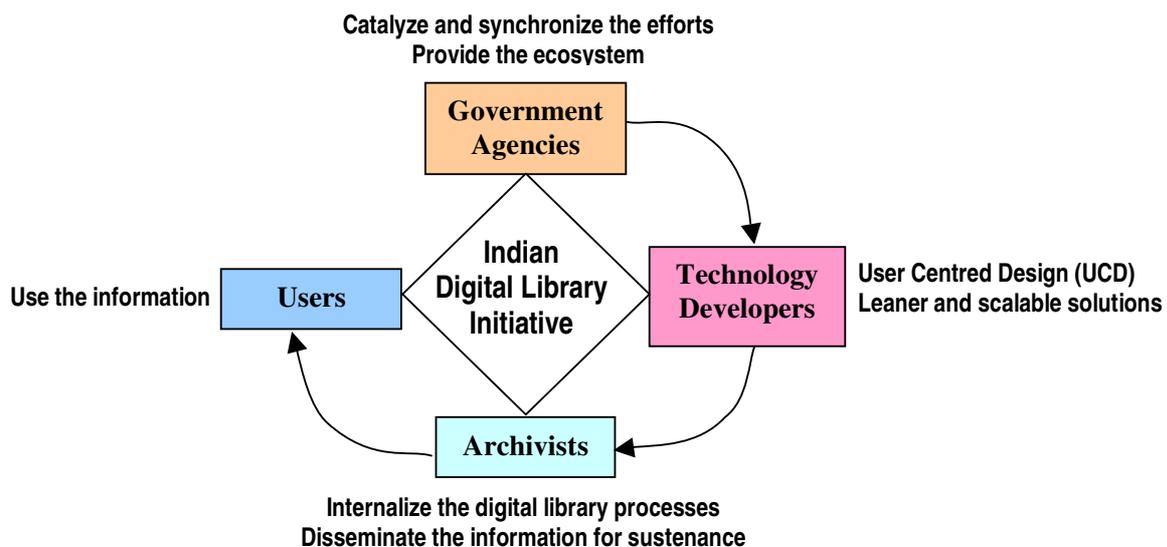

Figure 8. Pragmatic and usable approach to digital library

At this stage, we have completed our deliberation on the myths about digital library prevalent in India. Technology developers have several other myths or inappropriate assumptions about museums and users. Discussing all these will amount to probing into very micro level issues, e.g. there is an assumption that users will type exact keywords while searching the digital library (Tan et al, 1998). There are many such myths with regard to user capabilities, business model for digital library, standards etc. But these topics can be tackled separately.

Conclusion:
- **Leaner, scalable, usable and pragmatic approach to digital library will be most suitable for Indian conditions.**
- **Government agencies should catalyze and synchronize the collaborative efforts between archivists, technology developers and users.**
- **Technology developers should adopt User Centred Design (UCD) approach for designing the digital library systems.**
- **Developing countries like India should identify the prevailing myths about digital library in their respective regions and launch systematic efforts to demystify them.**

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