

DIGITAL LIBRARY AND THE INFORMATION TECHNOLOGY LIFECYCLE MANAGEMENT

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ABSTRACT In this work, we focus on the practices in the Information Technology Lifecycle Management to support the Digital Library with focus on Web of Data - World Wide Web. First, we discuss the dynamics of Information Technology and the ability to generate innovations with a direct impact on the quality of the Digital Library services. Then we discuss how these new technologies have helped to increase the quality of the services provided by the Digital Library. To conclude, we presented the main challenges that the Digital Library will have to face in relation to the management of their information technology infrastructure, consolidation and simplification of their processes within their computing environments, aiming to increase, productivity, quality of services, and develop agile environments that allow the Library to meet the demands of Information Technology infrastructure as far as open data management strategy is concern.

KEYWORDS *Digital Library, Information Technology, Information Technology Lifecycle Management, Information Systems.*

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INTRODUCTION

An important part of a digital library is the ability to access the stored information effectively. Due to recent achievements in information retrieval, a digital library is usually equipped with an automatic search and retrieval system that users of the library may employ to find documents.

In many Digital Libraries, Information Technology (IT) has moved from providing largely back-office support to becoming the prime facilitator and enabler of the Library Services. Without proper alignment of Information Technology, it is unlikely that any Library will achieve and sustain long-term success through the delivery of value to its information users.

Document retrieval systems traditionally come in two forms. The most common are the retrospective search systems, which search a full database based on a query submitted by a user. Less common are the current awareness systems, sometimes referred to as selective dissemination of information systems. These systems search a smaller database consisting of current issues of journals and new books, based on an interest profile submitted by a user (Olsen, 1993)

For a Digital Library, the increasing availability of technologies has shown an ambiguity in their management. The management and support of these complex and heterogeneous environments - full of different computational resources, desktops and laptops, mobile and wireless devices, printers, networks and applications - have demonstrably proven difficult and expensive for the departments of Information Technology.

According to Organization for Economic Co-operation and Development (OECD, 2012), the Information and Communication Technologies (ICTs) play important and growing role in world economy. Industries and governments are getting increasing benefits from their continuous investments in ICTs, as well as from a wider use of the Internet in a knowledge-based economy. ICTs have stimulated innovation in services, increased the efficiency of production and creation, and at the same time, facilitated the management of inventories and administrative costs. It was a catalyst of changes in Digital Library computational environment, improving the organization of work, helping the Library to improve the quality and reduce the cost of their routine services. So crucial, ICTs, especially when associated with the raise of the level of skills and organizational change, apparently seem to support the improvement of productivity within Libraries. Such benefits have long term effects and will continue to develop, despite the difficulties and challenges with which Digital Libraries are facing today.

Based on this scenario, this article proposes to examine the critical factors that should be considered by Digital Library in managing the information technology governance with a focus on organizational performance and service quality, creating the grounds for a research that will help the digital libraries to set up the framework for their Information Technology Governance process.

As far as research methodology, in this paper we will implement a literature review focused on the change management aspects of putting a practice into effect within the workplace. Here the scrutiny is placed on each major stage of the process, not necessarily the long-term outcome.

DIGITAL LIBRARY AND INFORMATION TECHNOLOGY

According to Digital Library Federation (DLF, 1998), a working definition of digital library is:

"Digital libraries are organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of communities."

Digital information has occupied a central place in our lives today. Libraries are acquiring digital information and providing access to users. Most of the information accessed today is digital, Internet playing an important role in the process. Even analogue information is being converted to digital for ease of access and use. Digitization that was initiated as project in different institutions is now gaining ground. Libraries are digitizing their collections to make their presence felt outside the physical environs of the library. With all the benefits of digitized information, there are certain issues that invite discussion. Preservation of digital information, the phenomena of digital divide are some of these that are being discussed in professional circles (Ashraf, 2010)

Digital content has become a major driver of the Digital Library. Technological innovation and new information user's demands are leading to new and direct ways of addressing the creativity, new

methods of access, use and appropriation of information. Research results, for example, are becoming more accessible, and digital content is invading various sectors, for applications that may be more significant than the others in the search process.

Continuous improvements in technology, networking, mobility, software and hardware, including cellular and wireless service and protection of content and services, have made possible the development of advanced digital content. Greater cooperation is a major challenge, since the production of digital content requires agreements between content developers, equipment manufacturers, and organizers of information. This successful implementation requires efficient services and low cost in infrastructure and technologies to protect content. Issues of compatibility and interoperability must also be resolved (OECD, 2011).

Significant number of Digital Libraries wants to provide resources so that information users can track the progress of their searches through the Internet. In a preliminary study about the impact of the Internet towards the ability of managing information user's relationships, the reduction of costs in acquiring new information was the most important variable for Librarians. However, the fact that information users can enlarge the field of action using the Internet, does not mean that they will abandon their traditional research tools. To start planning the Information Technology governance process it is essential that the Digital Library can take into consideration the following indicators:

- The coordination and priority setting and general direction of policy in Information Technology and its contribution to wider goals of the service quality provided by the Library
- The promotion of innovation in the field of Information Technology
- The dissemination and use of the Information Technology resources
- Digital content
- Operational environment for Information Technology (with emphasis on intellectual property rights)
- Strengthening the infrastructure (particularly broadband)

The ability to leverage the potential of the technology is becoming increasingly critical to the success of Digital Library. According to the research project data, the main tool to acquire this ability is to develop an effective organization of Information Technology, focusing on three key areas:

- Definition of an organizational structure appropriate to the services and technological environments of the Library
- Development of processes and skills to centralize critical functions
- Model of governance structured to facilitate the alignment of service with responsibility for Information Technology personnel

Technological innovation and the ubiquity of communication tools, economic uncertainty, changes in workplace and educational structures, the global economy, generational differences, the blurred distinction between the production and consumption of information, and heightened national security production and consumption of information are just some of the factors affecting the creation of digital library programs (Kresh, 2007).

INFORMATION TECHNOLOGY LYFECYCLE MANAGEMENT IN DIGITAL LIBRARY

Information Technology has become crucial in the support, sustainability and operations of the digital library architecture. This pervasive use of technology has created a critical dependency on IT that calls for a specific focus on Information Technology governance (Wim van Grembergen, 2008).

Information Technology Governance is one of these concepts that suddenly emerged and became an important issue in the digital era. Today, because of the pervasive use of technology and in many cases the critical dependency on information technology, IT governance is high on the agenda and many organizations are implementing IT governance practices. Research on the measurement of the performance of information systems has predominantly focused on measurement processes including maturity models and IT balanced scorecard methods (McBrid, 2009).

The alignment of Information Technology with the overall operations of the digital library does not happen by accident. It requires full and active involvement from many levels and activities within the Library. It requires active and focused management. It is a continuous effort and requires world-class skills and expertise, either in house or outsourced. It requires risk taking, but with appropriate risk management. It also requires strong and demonstrable governance.

IT governance is fundamentally different from IT management. IT management is focused on the effective and efficient internal supply of IT services and products and the management of current IT operations McBride (2009). IT governance in turn is much broader, and concentrates on performing and transforming IT to meet present and future demands of the Library (internal focus) and its users (external focus) (Wim van Grembergen, 2008).

In the context of IT Governance, one could envisage that decisions relating to the acquisition of new products or services, the selection of alternative architectural standards or prioritizing IT investment options, might all be candidates for a rational decision-making process (Lock Lee, 2009).

Strategic alignment is one of the five domains within IT Governance, as shown in Figure 1 and as described by the IT Governance Institute in its Board Briefing on IT Governance.

IT Governance Domain

Strategic alignment	Focuses on ensuring the linkage of business and IT plans and on aligning IT operations with enterprise operations
Value delivery	IT delivers the promised benefits against the strategy, concentrating on optimizing costs and proving the intrinsic value of IT
Resource management	Is about the optimal investment in, and the proper management of, critical IT resources: applications, information, infrastructure and people
Risk management	Senior management, appetite for risk, compliance requirements, transparency about the significant risks to the organisation
Performance measurement	Tracks and monitors strategy implementation, project completion, resource usage, process performance and service delivery to achieve goals measurable beyond conventional accounting

Figure 1: IT Governance Domain

Source: IT Governance Institute - CAUBO ACPAU June 23, 2007 Pre-Conference Seminar

The consolidated management of the working environment of IT requires that Digital Library adopt a holistic approach directed to people, processes and technology throughout the computing environment. It also requires that Digital Library work with suppliers of IT that can analyze their operational needs, assisting the implementation and ongoing management and support of the solutions implemented, Paletta (2014).

To support these organizational changes, it also needs a strong cultural change: the information technology needs to be perceived as a quality level and Librarians should feel responsible, together with-IT professionals, by incorporating the technology in the services strategy. The supports of high direction, as well as the recruitment of professionals with the appropriate profile, are essential elements for achieving the change. According to the research project data, the basic challenges that Digital Library faces in the computing environments include:

- **Reduction of costs** – The environments for user-needs are moving quickly to mobile search locations, virtual and global, culturally diverse, which are expensive to maintain and support. Through the consolidation of hardware, applications and support processes within their working environments, Digital Library can manage and reduce IT costs, while simultaneously improving the return on investment and the quality of the service they provide.

- ***Increased productivity of professionals of information*** - To achieve this goal, Digital Library are seeking ways to improve collaboration and team work by creating a work environment without borders, reliable and secure, providing the connection and access to information anytime from anywhere.
- ***Reducing the complexity of IT*** - The lack of standardization within the computing environment can increase the time and cost required to manage and support this environment. At the same time, as the computing environments become more complex, the level of knowledge and expertise needed to support those increases. The tools for managing the IT lifecycle allow the standardization of the hardware platform; reducing redundant devices; simplifies and automates the computational processes; besides managing the support functions and building flexibility and stability that allow the creation of a dynamic management of digital information.

The increasing complexity of the technological assets has encouraged Digital Libraries to seek ways to improve efficiency in the operation to reduce costs, adhere to the regulatory aspects and meet the constant demands of Digital Library for a better response from the department of IT to the information user's demands. These factors have been a booster so that IT managers seek efficient ways to take control of everything that exists in their network Heine (2003).

According to the research project data, when evaluating a tool for IT lifecycle management, it is imperative to consider the following relevant features of the solution:

- Management of the lifecycle of IT assets via Web (World Wide Web)
- Identification and physical location of assets
- Physical and logical setting - hardware devices and software
- Monitoring of the use of software and hardware
- Management of maintenance contracts for HD (Hardware) and SW (Software)
- Increased productivity of users, IT professionals and network devices
- Resolution of problems ensuring the availability of resources and services
- Diagnostics and real-time information for decision-making
- Modular structure with flexible deployment
- Integration via Web with database and repositories of information
- Technical Support and Training of the use

As stated by Brown (2005), best practices for managing IT should allow adequate treatment to the complexities associated with the management of IT resources. The systems must be modular, allowing the definition of a technological structure compatible with the computing needs of the organization.

Developing the IT organization and structuring its relationship with the areas of services is the main instrument to build skills in IT. Analyzing the organizational models of Digital Libraries that stand out in the use of technology, we point out best practices on three key aspects to an effective organization of IT: defining the most appropriate organizational structure, functions and the critical competencies that should be centralized and governance for investments in technology.

The management of the IT infrastructure becomes increasingly expensive and complex. Studies indicate that more than 50% of all costs of IT are allocated to configure, upgrade, migrate and manage resources.

The largest expense of ownership of IT resources is not the initial purchase of hardware and software, but the complexity of implementing and maintaining these devices. To reduce these costs, Digital Library needs to invest in management software systems to improve reliability and availability of hardware and software, through all phases of a resource lifecycle, Paletta (2014). Figure 2 shows the main stages of IT Lifecycle Management.

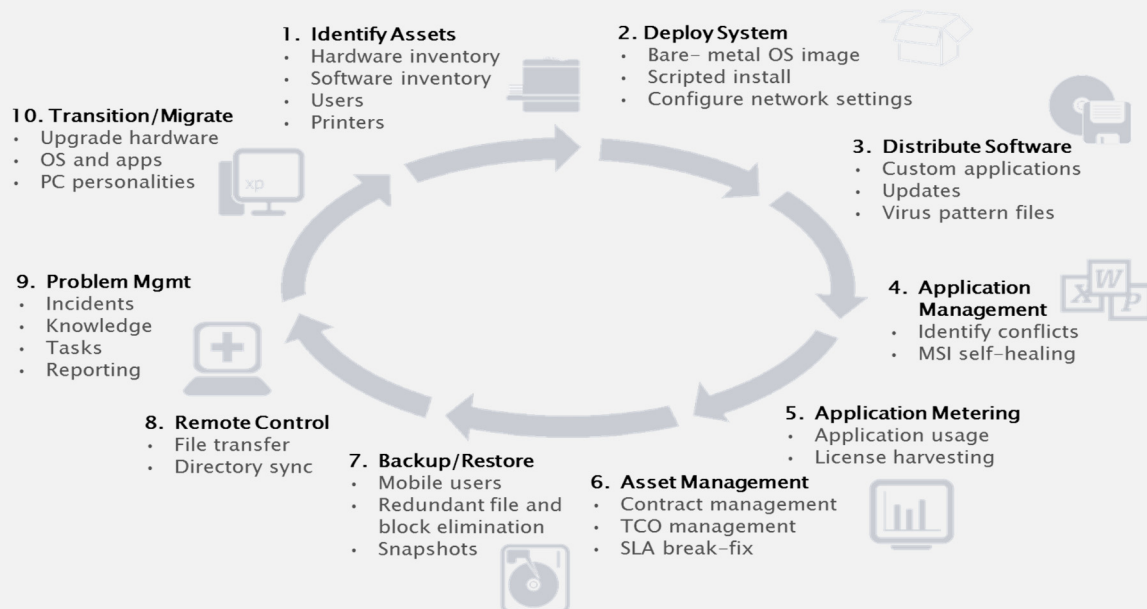


Figure 2: Information Technology Lifecycle Management

Source: Altiris Inc

An integrated solution for the management of assets combines the disciplines of management resources and services in a single architecture based on the World Wide Web, repository and console, helping to unite various departments and processes. To actively manage the entire lifecycle of resources, the solution should help the Digital Library to eliminate unnecessary costs for software and hardware, to proactively manage contracts with suppliers and align the resources of services with Information Technology Infrastructure Library (IITL), to ensure optimization of IT investments we can list three key requirements from the IT Lifecycle Management Web Integrated Solution:

- Monitor the configuration, the implemented versions, the relationships and historical information of IT resources
- Monitor the use of software and hardware for relocation and negotiation of contracts
- Ensure the availability of resources through the management of incidents/problems

The ability to leverage the potential of technology is becoming increasingly critical to the success of a Digital Library. The main tool to acquire this ability is to develop an effective IT organization, focusing on three key areas: the definition of an organizational structure appropriated to the Library operation and technological environments of the Library; the development of processes and skills to centralize some critical tasks; and a model of governance structured to facilitate the alignment of those responsible for service with the team of IT (Brown, 2005).

Associated with IT governance is the management of IT services provided. Organizations are grappling with the challenges of improving availability and capacity of business-critical applications while improving service levels, reducing support costs and lowering incident and problem resolution times (Cater-Steel, 2009). The eight requirements for an organization of IT to achieve operational excellence and maximize their performance according to Rockmart (1996) are:

- ***Getting Strategic Alignment between IT and Operation:***
 - To be an effective strategic alignment between IT and Digital Library Operation, the staff of IT should have a greater understanding of the operation and, concomitantly, the Librarians must keep in mind the potential that IT must "leverage" or even change the service quality provide by the Library
- ***Develop effective relationships between IT and operation:***
 - As the librarians are key users of IT applications, there should be a close and continuous relationship between them and IT staff, at each level of the organization. Successful priority systems and close relationship leads to a better understanding of the operation and a cyclical process of progress and successes
- ***Deliver and deploy new systems***
 - Placing of high-level line managers in the leadership of the projects, increasing the responsibility of future users with the system
- ***Build and Manage the Infrastructure***
 - Need for an infrastructure in terms of computers, telecommunications, software and data, that enables the provision and integration of information throughout the network
- ***Re-train (Reskill) the IT Organization***
 - Training in skills and knowledge of the operation itself, since IT is increasingly important and ubiquitous in all Digital Library
- ***Manage partnerships with suppliers***
 - The implementation and administration of outsourcing demand skills that permit to distinguish when a strategic partnership is being done or simply a business transaction
- ***Develop high-performance***
 - A concern in IT should be the time for development: information systems should be deployed as soon as possible - IT should seek operational efficiency: either in development or in the internal outsourcing
- ***Re-design and administer an IT organization***
 - A central IT organization to do the planning, allocation of resources with economy of scale, some autonomy for local operation to seek their specific solutions - with this structure, one can get the alignment with the operation, economy of scale and integrity in systems architecture

To accomplish all this goal as far as the Digital Library Strategies are concern, the use of digital technology is evolving toward comprehensive solutions to manage IT using a single repository and a single interface, dramatically reducing the costs and complexity of managing their resources, including desktops, thin clients, laptops, handheld devices and networks. It is essential to automate, simplify and integrate their functions to manage IT from a single console-based Web. Innovations in IT continue to emerge in a frenzied pace, driven by the rapid advancement of technology and Big Data. Information

is key assets of a Digital Library in the digital society. The correct investment in IT has been pressured for tangible and sustainable results and the management of IT resources is essential to Library operational success (Paletta, 2008).

CONCLUSIONS

IT managers need to align the Library's digital strategies with the policies of deployment and use of Information Technology as essential considering the following items:

- ✓ What are the challenges faced and the paths followed by the Digital Library
- ✓ What are the services offered to information users with the implementation of the practice of managing the IT cycle
- ✓ How to manage purchasing decisions and processes of IT assets
- ✓ How to develop predictive information and a real-time view of IT assets to
- ✓ improve the level of service, security and the use thereof
- ✓ How to keep a consistency and control of costs at a deeper level of user / department
- ✓ In what degree is your organization and what steps should it follow to optimize its practice of IT Governance

Given that, governance is mostly to do with decision making, the vision of management of Information Technology Governances, however, needs to be expanded at a higher level of functionality and processes, since administering assets throughout the lifecycle involves much more than counts them to reduce costs. And to manage the Information Technology Lifecycle within an organization requires an approach from the technological point of view to operational processes.

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