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Paper: K

The Shrinking Supply Chains of Information

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Abstract

The development of Internet has revolutionized the businesses across the globe by streamlining their supply chain, thereby achieving substantial cost reduction. The concept of "agile & lean manufacturing", which brought in radical changes in manufacturing systems all over the world has its bearing on the development of open standards and efficient networking across the corporate houses. In this paper, we look how the learnings from manufacturing sector could be translated into the "information industry", so as to develop libraries for the next millennium. We develop the supply chain of information, extending right from the point of origin to the point of use, thereby identifying the non-value adding delays in the process. The model is illustrated, without loss of generality, through the example of a journal publication. The paper brings out a decision model for effective deployment of technology for minimising these delays. The various stumbling blocks in this re-engineering exercise along with possible ways of elimination are also discussed. The pro-active libraries, constrained by resource limitation, can achieve quantum jumps in development, if technology is judiciously deployed to eliminate the delays in the supply chain. The main objective of this work is to develop a working strategy for developing "agile" libraries that are quick and flexible, to respond to the changing needs of the end user. The paper also details the policy measures required for the effective implementation of the supply chain model.

1 Introduction

Information is becoming the most vital resource in today's business. The competitive edge of organisations depends largely on their ability to access and process right information at the right time. More so, in the case of scientists, academics, students and other professions who are conventionally treated as "knowledge workers". Libraries, as nodal centres for this resource, hence play a very vital role. However the fast pace of development in the technology, the interdisciplinary nature of information requirement and spiralling costs of the information delivery agents (like books, journals, etc.) make the management of a library that cater to the varied needs of the users an up-hill task for librarians. The limitations of space availability and the sluggishness of print-media aggravate the complexity of this task further. All around the world, there is substantial reduction in the subscription of the journals. It is indicated that Denmark's National Technological Knowledge Centre and Library had cut 40% of its subscriptions between 1990 and 1997 [1].

Though it is a worldwide phenomenon, the libraries and information centres in India are facing unprecedented crucial resource building problems. On the one side, there is severe fiscal resource crunch while the prices of information resources and services are escalating exponentially. To make matters worse, the user needs are ever increasing and uncompromising. Resource sharing is the panacea advocated for this problem, which is being resorted to for quite long by the libraries and information centres the world over. Several studies and experiments have been made on the

sharing of library resources. Information technology and computers have been playing substantial role in library resource sharing ever since its inception. The advent of the Internet and its suite of tools have literally revolutionised the resource sharing process, as it allows access and dissemination of documents through its various tools like the WWW, FTP, Telnet, Gopher etc., just a few to mention. Unfortunately the libraries and information centres in India are yet to get the full potential and the fruits of this technology.

The "lean & agile" paradigm adopted by manufacturing organisations during late 90's made significant impact in their performance. By effective deployment of Information Technology, these organisations streamlined their supply chains, reduced the wastages in the transformation process, minimised the inventory, virtually integrated their upstream and downstream units to present themselves to the customers as a single entity. The "physically lean and virtually fat structure" enabled these organisations to quickly adopt to the changes in their customer requirements and maintain their competitive edge. Most of the pro-active corporate majors have subscribed to this paradigm and reaped rich returns.

In this paper we explore how this paradigm could be adopted in "Information Industry" to design modern libraries. The effective deployment of networking technologies enables various libraries to work as a coherent whole to cater to the varied needs of the user. Moreover by identifying the supply chain of libraries, we can minimise the wastages and non-value adding delays that occur through out the supply chain. This paper is divided into 4 sections. In the next section we look at the basic supply chain of the libraries. The possible delays in the supply chain are identified. The concept of hyperchain is also introduced. Section 3 provides a brief review of the technologies available and successful deployment of the same in libraries around the world. The revolutionary concept of the Internet and how it augments the value chain of the publishing industry is detailed in this section.

Section 4 presents a working strategy for the development of agile libraries and also looks at possible problems and limitations of such an exercise. In Section 5 we present our concluding remarks.

2 Supply chain for information

In manufacturing literature, supply chain refers to the business process that constitutes the product development right from the customer's order to the delivery of the product at the customer's end. The various units and activities that constitute the chain are detailed. The construction of supply chain is useful in identifying the value addition that occurs through the chain and to isolate those activities which cause delay in the process, for elimination. Conventionally for a manufacturing organisation, the supply chain involves raw material supply, the inbound logistics, the manufacturing operations, outbound logistics and distribution planning. For the information industry, the supply chain extends from the source of information to the point of usage. This is illustrated in figure 1.

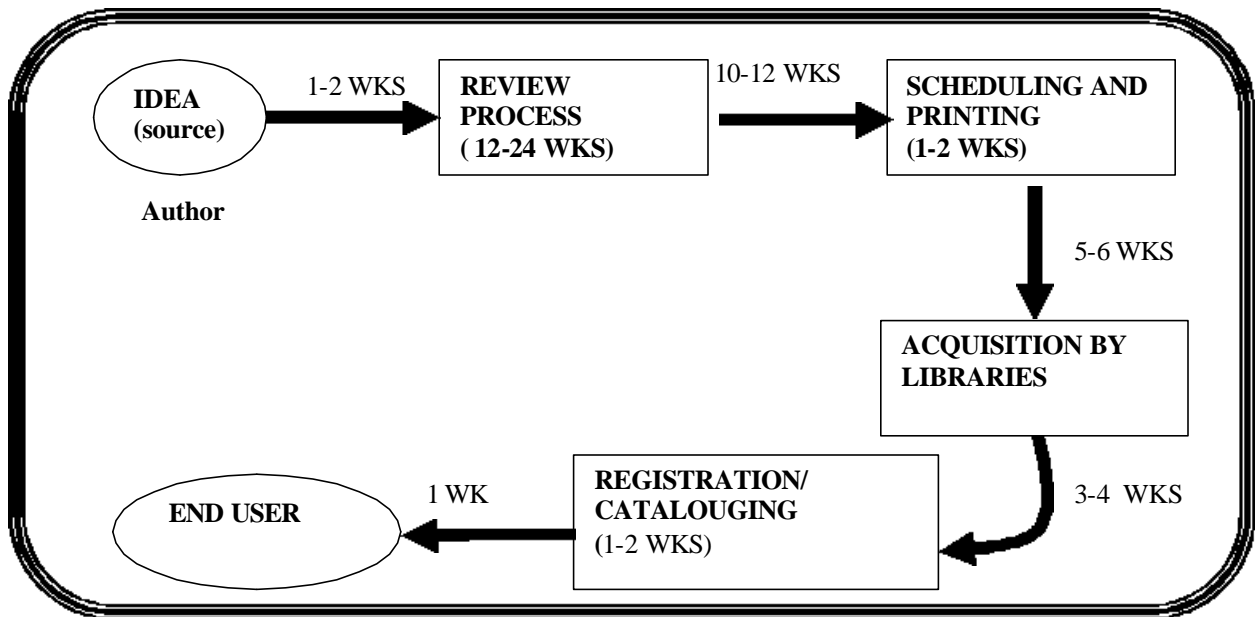


Fig 1: Supply chain for a journal article

In the figure 1, the business process for a journal article is illustrated. While, a library has many business processes, we illustrate the concept of Supply Chain Management through the example of journal article. This has been consciously chosen as the Universe of Knowledge grows through the exchange and establishment of primary scholarly literature for which journals act as the most sought after vehicle. The supply chain starts with the idea of the article or the research finding of an author. Once the idea is developed to a publishable entity, it generally takes 1-2 wks to prepare the manuscript for publication. The article then undergoes a detailed review process which normally takes 12-24 wks depending upon the journal. Once accepted it will be kept in inventory for printing (10-12 wks) though the printing process takes 1-2 wks only. The journals are generally distributed to various libraries using surface mail and it takes 5-6 wks for this transfer and again a delay of 3-4 wks for reaching regional libraries. Even a modern library takes 1-2 wks for checking and cataloguing of the same and finally after 36-52 wks the end user receives the information. It is surprising to note that in this total cycle time of 1 year, the value addition (generation, review, correction and printing) takes place in not more than 2 -3 wks indicating a huge wastage of time and money. Most of these delays can be easily eliminated at nil or marginal additional investments. The Physics e-print archive had shortened the supply chain to 1 wk by directly publishing the article on the web as soon as the author prepares it. Many leading publishers (Elsevier, Academic Press etc.) provide partial or full information to member libraries as soon as review process is over and thereby shortening the supply chain.

The technological advancements detailed in the next section could, to a large extent, minimise the wastages in the supply chain of information. But to make this effective for all libraries, it is necessary that proper sharing of resources is necessary. In a country like India, having limited communication infrastructure, the development of

lean and agile libraries depends largely on the development of "Knowledge Networks".

A major impediment in the implementation of electronic transfer of information is the conventional mind set that assumes an inverse relationship between the *richness* and

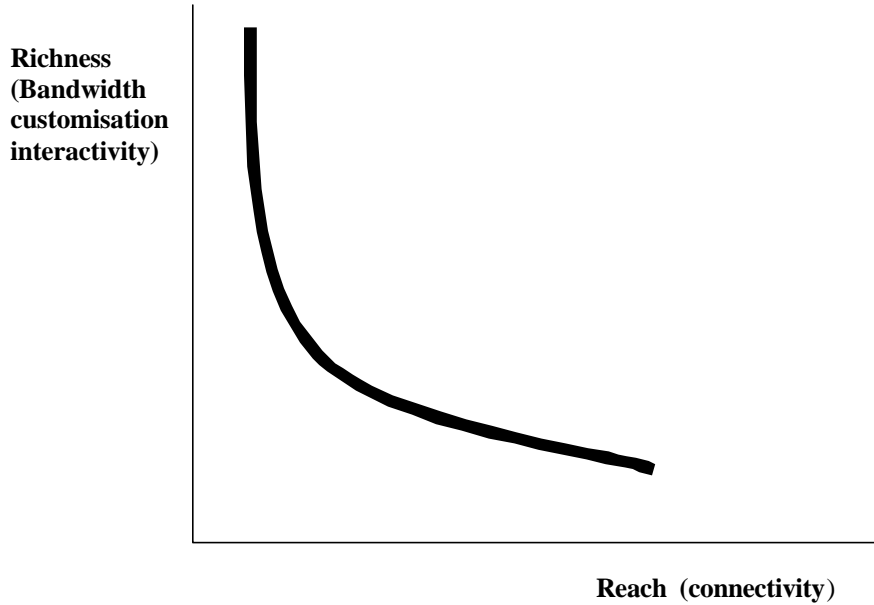


Fig 2: Traditional economics of information [Evans & Wuster, 1997]

reach of information (fig 2). *Reach* indicates the raw number of people exchanging information while *richness* is defined by the amount of information (bandwidth) degree of customisation and the interactivity. As indicated in fig 2, traditional economics of information assumes a trade off between these two variables. Rich information traditionally requires proximity and dedicated channels, thereby limiting the reach.

Evans and Wurster [2] suggest that as a society we are on the verge of a new era characterised by the removal of this trade-off. This, researchers [3] feel, will be the greatest promise of Internet and the conventional hierarchical structure of organisations will give way to new "hyperarchies", in which everyone will communicate richly with everyone else on commonly adopted standards. This will in turn lead to shortened supply chains which we term as "hyperchains", named after the web hyperlinks. Once a hyperchain is in place, the information will have physically static and virtually dynamic positions. As the information moves only through electronic media, the speed of transfer will be very high and the unwanted delays of existing chain will be completely eliminated

In order to develop a hyper-supply chain for information, various technological and functional barriers have to be removed. We look at the technological aspects of the same in the next section.

3 Information technology enabled supply chain

The open standards in computer communication that lead to the fast development of Internet have revolutionized the information transfer today. With electronic publishing gaining momentum, it is necessary to look at the technological advancements that offer promise to shrink the information supply chain. Internet attains the dual role of sourcing and channeling of information and provide a panacea for all the problems of information distribution logistics. However, it is interesting to note that, while the major publishers have adopted Internet for the outbound logistics operation, few have tapped its potential to minimise the delays in the inbound logistics and processing, which consumes a lion's share of the supply chain as shown in figure 1.

The usage of Internet as a medium of information transfer have definite advantages. The major one being the elimination of limitation in geographical reach of conventional medium. In addition, the ability to transfer interactive 3D information, add value to the supply chain. Thus, Internet or other standards of communication protocols like STEP, ISO-10203-1, enhanced the value of the hyperchain while drastically shrinking the same. Another advantage of this innovative technological advancement is the ease and cost-effective nature of its operation. It has virtually eliminated the space and finance limitations that used to plague the libraries for ages. The development of Internet tools over the last few years have brought radical changes in the computer based information transfer. The capability of Virtual Reality modelling Language (VRML) in transferring the information in a "book like form" has made it popular among the traditional users of the library. Similarly the new protocols like IGES, and XML are also adding value to the information transfer through the Internet.

The development of a web-based library that shortens the supply chain by developing a hyperchain involves developing interactive websites that emulates the real libraries. These libraries receive the information from the sources without any time delay and instantaneously make it available to the user on request. Most pro-active publishers have adopted these web publishing front-ends as a part of the business strategy. Fig 3 shows some examples of these websites:

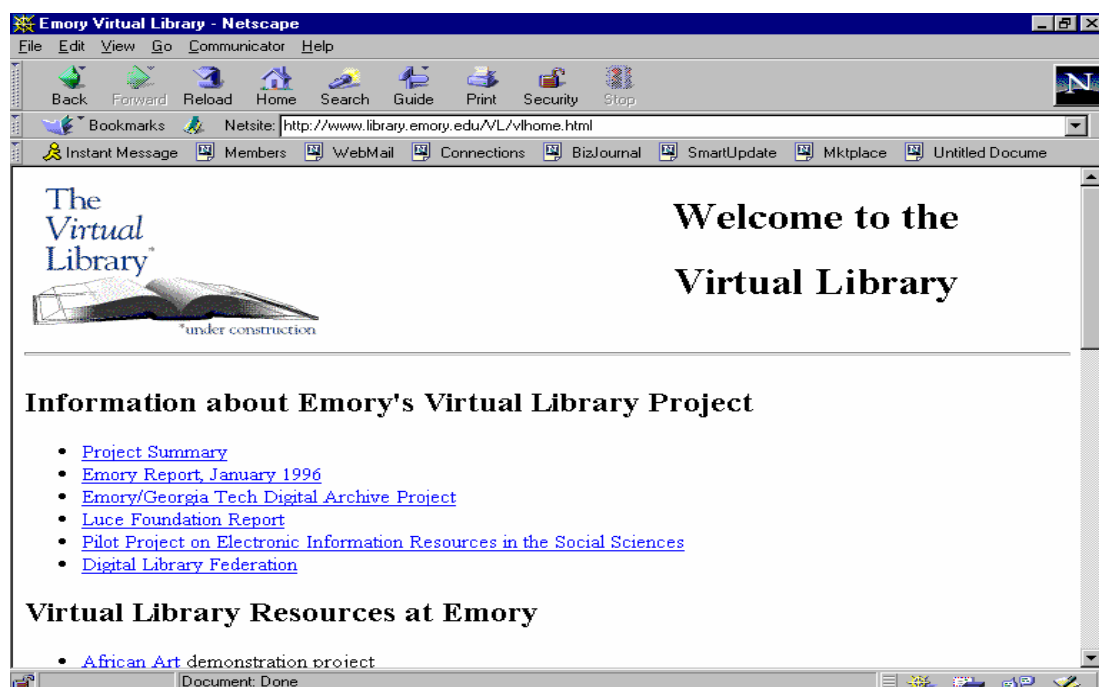


Fig 3a: Web site of a Virtual Library

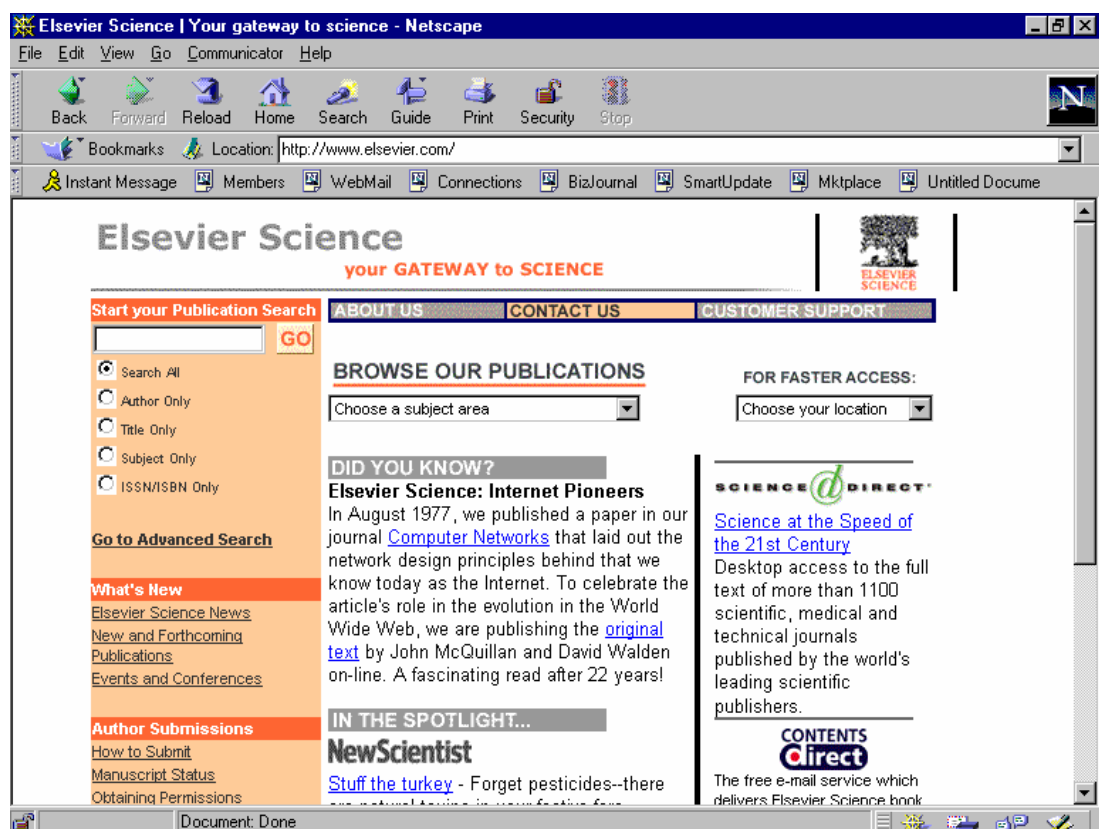


Fig 3b: Web site of Elsevier Science



Fig 3c: Web site of Nature Magazine

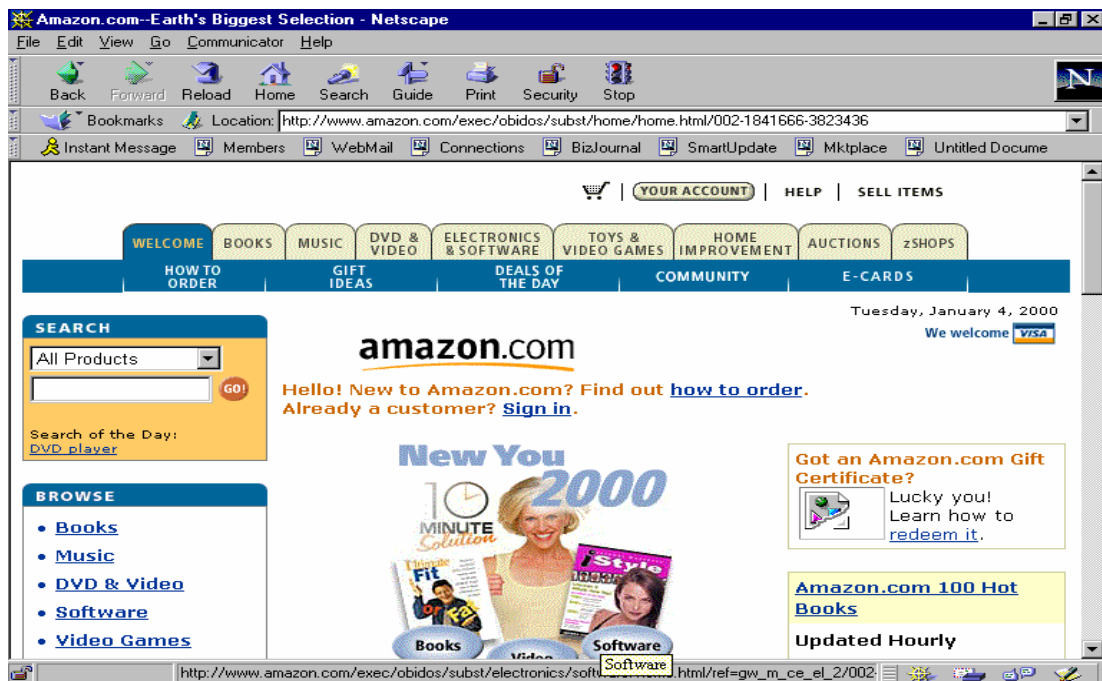


Fig 3d: Web site of Amazon, the web book mall

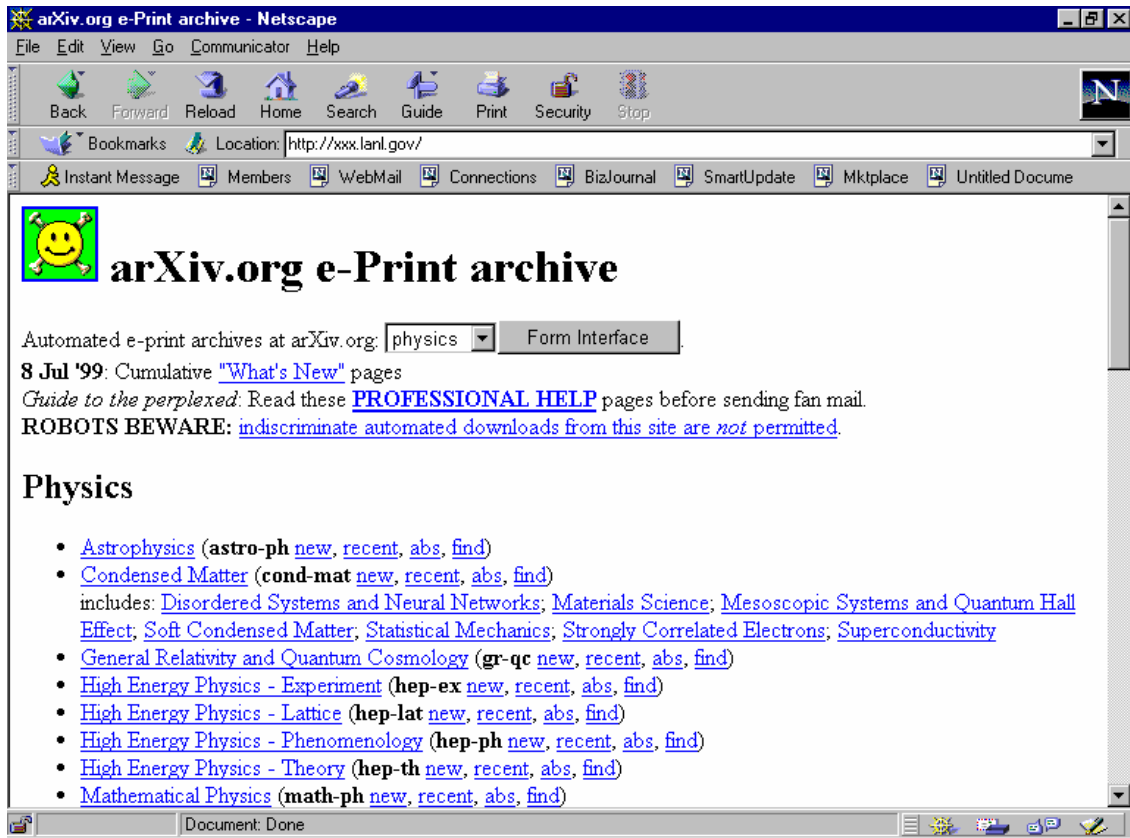


Fig 3e: The Website of Physics E-print archive

4 Development of agile libraries: policy issues

The supply chain of the information can be shrunk to attain competitive advantage, if technologies detailed in the previous section are deployed judiciously. The shortening of the supply chain has two direct impacts on these information centres:

- i) As the information is only virtually transferred, the physical storage of the same is not necessary. Even in cases where the data need be stored, it can be stored electronically, thereby attaining large percentage reduction in storage space. Thus, the libraries of tomorrow will be "lean" in structure.
- ii) The more important effect is the ability to respond to the varied needs of the user. Through networking the libraries can link with other information centres of many different disciplines. This in turn will increase the coverage of the library. Thus the library can cater easily to the needs of varied users as well as varied needs of its users effectively. Moreover, as the data transfer is primarily electronic, the "time to print" is reduced to hours or minutes. These multi-faceted capabilities and fast adoption to the changing needs will make the libraries more agile and flexible.

Even though technology is available to effectively network libraries for mutual resource sharing, there are many policy barriers that hinder the implementation of the same. The copyright laws and IPR laws are to be amended at the national and global level to ensure free and efficient transfer. Many countries are initiating serious attempts in this regard.

More serious issue in the effective implementation of the networks is the lack of mind set for accepting the resource sharing. Conventionally, the resource sharing imply the resource rich libraries give the resources to resource poor libraries. This creates a feeling of "*Lose-Win*" among the giver libraries and the "*free-lunch syndrome*" many a time plagues the receivers. In order to make the networking a possibility, it is necessary that measures that cultivate a "*Win-Win*" situation are developed.

For effective networking the "*Consortia-approach*" is best suitable. In this all participating libraries will subscribe to resources depending upon their financial position. These resources are mutually exclusive and collectively will form a large mass of literature. In order to make the resource sharing effective, it is necessary that the "rich" libraries subscribe only to focussed high priced resources while their money crunched counterparts should subscribe to low cost general resources required by the users of consortium. This will lead to a two-way sharing of the resources and make it effective on implementation. Moreover, by saving the money spent on general resources, the rich libraries can augment their specialised collection thereby increasing the worth of the consortia. The poor libraries also can augment their physical resources, as the discontinuation of highly priced journals, will give them a lot of financial leverage. Through a proper analysis, with the help of quantitative tools, one can easily identify the resources that each library have to subscribe so as to make a wealthy consortia.

5 Closure

In this article we look at the supply chain of information for a typical library. By taking a typical activity, the publication of an article in a journal, we illustrate the delays at various stages and show that more than 90% of the "time to print" is wasted in unwanted delays. Many times this also make the article irrelevant. For an agile library, the supply chain has to be considerably shrunk through the deployment of appropriate technological measures. The development of hyperchain, where the information sources and use-outlets are electronically linked through web, is a possible alternative. By developing interactive web pages using VRML, this is practically achievable. This lead to removal of duplication of resources, thereby creating lean and agile libraries.

The major bottleneck in realising this resource sharing paradigm is the mind set of the component libraries. We propose a Consortia approach where in all the participating libraries contribute to the wealth of the consortia for solving this. It is imperative that, all pro-active libraries should initiate technological and policy measures to shrink their supply chain in order to cater to the varied needs of its users more effectively.

Acknowledgement

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