

Users and Uses of Online Digital Libraries in France

Houssem Assadi¹, Thomas Beauvisage¹, Catherine Lupovici², Thierry Cloarec²

¹ France Telecom R&D, 38 rue du Général Leclerc,
92794 Issy Les Moulineaux, France
{houssem.assadi, thomas.beauvisage}@francetelecom.com
<http://www.francetelecom.com/rd/>

² Bibliothèque Nationale de France, Quai François-Mauriac
75706 Paris Cedex 13, France
{catherine.lupovici, thierry.cloarec}@bnf.fr
<http://www.bnf.fr>

Abstract. This article presents a study of online digital library (DL) uses, based on three data sources (online questionnaire, Internet traffic data and interviews). We show that DL users differ from average Internet users as well as from classical library users, and that their practices involve particular contexts, among which personal researches and bibliophilism. These results lead us to reconsider the status of online documents, as well as the relationship between commercial and non-commercial Web sites. Digital libraries, far from being simple digital versions of library holdings, are now attracting a new type of public, bringing about new, unique and original ways for reading and understanding texts. They represent a new arena for reading and consultation of works alongside that of traditional libraries.

1 Introduction

This article presents a study of online digital library (DL) uses called the BibUsages project. This project – a partnership between France Telecom R&D and the French National Library (Bibliothèque Nationale de France) – took place in 2002.

1.1 Objectives

The objective of the BibUsages project was to study online digital library usage. Such usage, although innovative, is part of well-established practices. Immediate access to a large body of works enables researchers to imagine unique and original research, which was not technically possible previously without access to large digital corpora. In addition, teachers find electronic libraries an inestimable resource to produce course materials.

The main project objective was to describe online uses of digital libraries, notably that of Gallica, the online digital library of the French National Library (<http://gallica.bnf.fr>), through a cross-sectional analysis of usage with user-population

characteristics. Another objective was to show how emerging patterns of use both affect and modify well-established practices (in the present case, those involving academic research and teaching, but also personal researches).

By use of methods originating from the social sciences, the objective was to explain, on the one hand, well-established usage (several electronic libraries are already available for free consultation on the Web), but of which a more thorough understanding would enable expansion upon the current range of innovative uses, while at the same time better adapting to user needs and characteristics. On the other hand, the study made use of innovative Internet traffic capture and analysis technologies in order to develop a user-centered approach, an approach that is rarely found in large-scale web-usage studies.

In this paper, we present the main results of the BibUsages project. After describing our methodology (§1.2) and giving a quick overview of the state of the art (§1.3), we give detailed results from our study: section 2 shows the specificities of the studied population (visitors of the Gallica Web site); section 3 gives a precise description of the way the studied population uses Internet and particularly DLs and other types of Web sites, data comes both from both Internet traffic analysis and interviews; and finally, section 4 is a discussion of the main qualitative results of this study.

1.2 Methodology

In the BibUsages project, we combined qualitative and quantitative methodologies to fully describe the studied population and their uses of online DLs, and more generally of the Internet.

The 12-month-long project, held in 2002, took place in three stages:

1. Online survey on the Gallica web site (March 2002).
For a three-week period in March 2002, Gallica web-site visitors were asked to respond to a questionnaire, in order to obtain a precise picture of the Gallica web site visitors and to recruit volunteers for a user-panel the Web traffic of which was to be recorded.
Other than the socio-demographic characteristics of Gallica Users, the questionnaire was tied into two main subject areas: usage of Gallica and general Internet usage. At the end of the questionnaire, respondents were asked to participate in the user panel that was being established.
At the end of this first stage, 2,340 people had responded to the questionnaire and 589 had accepted to take part in the user-panel.
2. Formation of a user-panel, installation of the system to capture user-panel Web traffic and collection of data.
At the end of the inscription and installation procedure, the panel consisted in 72 volunteers with socio-demographic characteristics which were representative of those of all the respondents to the survey. Panel-member usage data was collected from July to December 2002.
3. Holding interviews with a volunteer user-sample taking part in the panel (October 2002).

These interviews concerned 16 panel participants out of 72 and revolved, in particular, around three specific areas under investigation: general Internet usage, Gallica and DL usage, and links with "off-line" reading and cultural practices.

The cross-analysis of these three data sources — online questionnaire, traffic data and interviews — enabled the establishment of a highly-informative panorama of usage beyond the scope of online practices per se.

1.3 State of the art

The users of "traditional" libraries are relatively well-known, thanks to the investigations and studies undertaken by the main institutional libraries on their visitors. On the other hand, as far as we know, there is no general study of the uses of a diversified population of remote users of a digital library, population constituted of university researchers and postgraduate students, but also of high school teachers and students or individuals leading personal researches.

The conference "*The economics and usage of digital library collections*" – hosted by the University of Michigan Library in March 2000 – provides information about the behaviour of digital libraries users coming mainly from user surveys by questionnaire. The conclusions of the conference well summarize the situation: electronic access obviously increases the use of the documents but we do not yet completely understand the variety of uses. Who uses the documents? What are the objectives of these uses? Which value does this use represent?

The Association of Research Libraries (ARL) initiated in October 1999 a *New Measures Initiative* program for research projects on statistics of electronic resources usage. The library community has been working for five years on the refinement of the standard services measurement and assessment guidelines to cover the electronic services. The proposed combination of approaches includes:

- Transaction-based measures made by sampling or by transaction logs. They can record interactive sessions, downloads, hits, images or files counting.
- Use-based measures on user activities, user satisfaction, local versus remote site use.

The French National Library has been using a page mark-up methodology since 2001 for continuous transaction-based measurement, counting viewed pages, visitors and visits. Images and files downloads counting provides a measurement of the DL usage.

Some existing studies already showed the information that can be retrieved by servers' log analysis. In [3] and [4], Jones *et al.* propose a transaction log analysis of the New Zealand Digital Library. They report user sessions to be very short, with few and simple queries. These observations lead the authors to propose design improvements for the search interface. Similar analyses were led for other DLs, see for example the recent study by Sfakakis and Kapidakis dealing with the Hellenic National Documentation [5]. Although they provide valuable and detailed information on the use of online digital libraries, server-centric approaches fail to answer two questions: first, they have no information about the characteristics of the DL visitors (age, gen-

der and other sociological characteristics), and second they do not know which are the contexts of DLs usage.

From a broader point of view, Brian-Kinns and Blandford gave an interesting survey of user studies for DLs [2] that shows the diversity of used methodologies, ranging from qualitative approaches to log analysis. But one can notice that the majority of cited studies deal with design (human-machine interfaces and search tools) rather than users' needs and objectives.

Our approach, which relies on a combination of three methods: user-centric data analysis, online questionnaires and interviews, gives an enhanced description of DLs uses and users. In addition, by focusing on users and uses rather on technical issues, our study adds a new point of view to the existing user studies in the field of DLs (cited in [2])

2 Specificities of the Users of Digital Libraries

The data provided by the online survey in March 2002 gave us an accurate vision of the characteristics of the public of Gallica. In this section, we compare them to the general portrait of French Internet users.

Table 1. Gallica users and French Internet users

		French Internet Users (from NetValue, de- cember 2001)	BibUsages online Questionnaire (march 2002)
Men / Women		58% / 42%	69.3% / 30.7%
Urban		81.0%	86.4%
Age	Under 25	29.3%	11.8%
	25-34	23.1%	23.1%
	35-44	31.8%	21.0%
	45-54	12.5%	24.2%
	More than 55	3.3%	19.5%
Narrowband / broadband		91.1% / 8.9%	58.6% / 39.0%

The main characteristics of the Gallica users show that they are, in comparison to French Internet users, rather senior men, with an over-representation of more than 45 year old (see Table 1). The most important difference is related to the type of Internet connection: 39% of Gallica users declare that they use a broadband access, while they are only 9% among the French Internet users population. Besides, Gallica users are mainly old Internet users: 70% of them declare that they have had an Internet access since at least 1999. In addition, their socio-professional categories reveal a high level of education and intellectual occupations (university teachers and researchers in particular, but also executives in private companies), as well as high-degree students.

3 Usage Data

3.1 Global Internet activity

The traffic data confirmed the declarations to be found in the questionnaire concerning global usage intensity, which is very high in comparison to global French Internet users. This comparison is based on traffic data from a 4,300 people panel studied in 2002¹.

Our panel is globally speaking made up of highly active Internet users: 7.6 sessions² per week on average, in comparison to 2.4 sessions per week for the global population of French Internet users. The average duration of the sessions is on the other hand similar to that of the global population of French Internet users: 30 minutes for the BibUsages panel, 35 minutes for French Internet users in 2002. The difference thus exists in terms of number of sessions, and not in terms of duration of sessions.

3.2 Accessed contents and services

After 6 months of traffic capture, we collected a database containing 15,500 web sessions and almost 1,300,000 web pages (identified by their URL³) that were visited by the 72 users of our panel. We used a web mining platform developed at France Telecom R&D in order to analyze this database and to extract data related to the uses of certain categories of web sites.

When examining the different kinds of Web sites visited by the panel, we observed the importance of “search engines” and “cultural contents” in terms of audience (see Table 2). First, generalist portals (e.g. Yahoo) and search engines (e.g. Google) have a central place in the Web activity of our panel, and concern nearly all the users.

In addition, the panel is characterized by a very strong frequentation of the “cultural portals”: digital libraries, sites proposing cultural goods for sale (e.g. Amazon) and media sites (press, radio, television) occupy a privileged place. Moreover, the sites devoted to genealogy have an important place in the uses, and reveal highly individual centres of interest; we claim that these elements have to be connected with the particular audience of the personal Web sites, which are present in 20% of the sessions, and are important sources of information for genealogical searches on Web.

¹ These data were provided by NetValue, in the context of the SensNet project involving France Telecom R&D, NetValue, Paris III University and the CNRS/LIMSI.

² A session is a sequence of time stamped web pages visited by a user of the panel without an interruption longer than 30 minutes.

³ Uniform Resource Locator.

Table 2. Global audience from our panel (period: July – December 2002)⁴

Web site category	Number of sessions	Presence in the whole sessions	Number of users
Generalist portals	8005	51.9%	71
Search engines	4183	27.1%	67
Personal web sites	3142	20.4%	70
Digital libraries	1195	7.8%	57
Media / Newspapers	1144	7.4%	49
e-business / cultural goods	833	5.4%	63
Genealogy	684	4.4%	31
e-business / Finance	443	2.9%	30
WebMail	439	2.8%	14
Media / Radio	305	2.0%	34
Media / TV	219	1.4%	38

Use of search engines. Search engines occupy a very important place in the uses of the panel. During the six months of observation, 16 different search engines were used by the 72 users of our panel; Google arrives far beyond, being present in more than 75% of the sessions involving the use of a search engine, while Yahoo and Voila⁵ arrive in second and third position (present in 13.7% and 11.3% of the sessions with a search engine). The meta-search engines are frequently used: 24 people used them at least once during the period, and 10 used them regularly.

Besides the usual requests addressed to search engines, related to widely used services, we notice elements which show the specificity of the panel: “bnf” (for “Bibliothèque Nationale de France”, the French National Library) arrives thus in third position in the classification of requests in numbers of distinct users having addressed it. We can suppose that, for users already knowing well the BnF and Gallica Web sites, such requests are a simple and quick way to access these sites when they are not bookmarked, or when the bookmark list becomes too large to be efficiently used for site retrieval.

The request “genealogy” and its correlates show a genuine interest for this area; one finds this passion through very particular and precise requests often addressed by only one user, and it consists in proper names and place names. This observation is confirmed in the interviews:

“My personal research relates to regionalism, because I am native of [name of a town] and I love this region. Therefore I collect many things about that region, topics of genealogy and also of history and geography. [...] and I create] Internet sites for archaeological or associative subjects” [Male, 47, manager, broadband Internet access]

Researches related to family memory or regional history represent important centres of interest for a significant part of the panel; in this context, Gallica appears as a source of information among others for these researches.

Use of online DLs. We identified 17 online digital libraries. We adopted a rather wide definition of DLs, including not only institutional libraries such as Gallica, but

⁴ Audience is both measured in terms of number of sessions and number of different users.

⁵ A French search engine: <http://www.voila.fr>

also associative initiatives (e.g. ABU⁶) and online revues (e.g. Revues.org), all providing text collections mainly in French. The detailed audience of these various sites (see Table 3) shows that Gallica is the most visited DL, in number of sessions as well as in number of visitors. This table also shows that the audience of other text collections is not insignificant (while our panel was composed, originally, of visitors of the Gallica site): users of the panel don't limit themselves to institutional DLs, such as Gallica, they also visit a variety of other sites providing text collections.

Table 3. Audience of digital libraries and online text collections

Online digital library	Sessions	Visitors	Avg time in a session (min.)
BNF-Gallica	822	54	21.4
BNF-Other	577	51	6.5
ABU	31	13	3.0
Revue.org	22	12	1.8
Bibliothèque de Lisieux	20	11	3.9
Bibliopolis	15	6	8.0
Athena	14	10	1.1
ClicNet	14	8	0.6
Online Books Page	10	4	1.7
Electronic Text Center	8	5	0.7
BN Canada - Numérique	5	3	1.0
American Memory	4	2	6.3
Arob@ase	4	3	0.4
Berkeley DL	3	1	7.3
eLibrary	3	3	0.5
Gutenberg project	2	2	0.8
Alex Catalogue	1	1	0.8
Bibelec	1	1	0.0

Use of other categories of web sites. We also focused on the uses of two extra categories of web sites: media sites (press, radio, TV) on the one hand and e-business sites selling cultural goods on the other. The global audience analysis already showed us that these two categories of sites have high scores in terms of audience in our panel (see Table 2 above). This seems to show a link between the visit of digital libraries on the one hand, and the sites providing “readable content” and cultural goods on the other hand. We can easily draw a parallel between the frequentation of digital libraries and the frequentation of sites offering “readable content”. The use of Media/press sites shows high audience scores (Table 4), with a particularly intensive use of the site of the newspaper *Le Monde*.

⁶ « Association des Bibliophiles Universels » (Association of Universal Book Lovers): <http://abu.cnam.fr/>

Table 4. Audience of "Media / press" Web sites

Portal	Visitors	Sessions	Nb of sessions per visitor	Avg. time per session (min.)
Le Monde	37	719	19.4	8.1
Libération	24	86	3.6	3.9
Les Echos	17	118	6.9	5.3
Nouvel Obs	14	131	9.4	4.9
Telerama	14	107	7.6	6.3
Le Figaro	13	148	11.4	14.2
New York Times	6	81	13.5	7.7
Le Point	4	12	3.0	3.4

The frequentation of digital libraries is also closely connected to the frequentation of e-business Web sites providing cultural goods (see Table 5): the use of these sites shows the importance of bibliophilism, with an important frequentation of *Chapitre.com* and *Livre-rare-book*, two web sites devoted to bibliophilism. We also notice in this table the presence of publishers (e.g. Eyrolles, CNRS Editions...). These elements show a strong link between electronic and classical publishing: users not only seek for old books, but also visit publishers' web sites and use their catalogues, for either online or offline purchase.

Table 5. Audience of "e-business / cultural goods" Web sites

Portal	Visitors	Sessions	Nb of sessions per visitor	Avg. time per session (min.)
Amazon	55	386	7.0	4.1
Fnac	42	299	7.1	2.4
Alapage	29	107	3.7	2.2
Chapitre.com	26	160	6.2	9.3
Livre-rare-book	17	92	5.4	5.0
Galaxidion	6	73	12.2	6.4
Librissimo	6	7	1.2	4.5
Numilog	5	14	2.8	4.7
Eyrolles	3	4	1.3	1.0
CNRS Editions	2	8	4.0	8.6

3.3 DLs in context: Use of Gallica

Modalities of use. Access to Gallica represents a significant part of the traffic of the panel, since 6.2% of the 15,500 recorded sessions include a visit of Gallica. In addition, access to Gallica involves a significant number of users: 54 panelists out of 72 visited at least once Gallica during the six-month-period.

The distribution of the intensity of use of Gallica is similar to that of Web use in general: one third of the visitors of Gallica makes more than 77% of the sessions including an access to the Gallica web site, while another third part represents 4% of these sessions only. Moreover, the most intensive users of Gallica are also intensive users of the Web: over the period, they made 400 sessions on average, for an average

of 270 sessions for the other visitors of Gallica, and 150 sessions for those who never visited the site.

The 1,063 sessions including a Gallica access are overall longer than the others: 1h 01min. on average, vs. 28 minutes for the other sessions. In addition, in a session comprising an access to Gallica, the total time spent on this site itself is on average 24 minutes, that is to say almost the average duration of a session without Gallica.

Furthermore, the consultation of Gallica appears to be an activity excluding the alternate visit of other sites. In the sessions, we analyzed the alternation of the visit of the different sites. We observed that in 52% of the cases (558 sessions) navigation on Gallica occupied only one sequence, where it was not alternate with the visit of another site; and for 22% of the sessions only, we observed two distinct sequences on Gallica. “Multitask navigation” is thus seldom practiced, and navigation on Gallica tends to be a long and monolithic activity.

Within those long sequences of visit of Gallica, consultation and download of documents are the main used services (75% of the Gallica sessions), *via* the site’s search engine. “Guided tours” access is less used in terms of number of sessions (only 11% of the Gallica sessions), but 30 users of the panel tried it at least once.

Gallica in context. The inspection of the types of sites and services visited within the “Gallica sessions” allows us to see how the use of digital libraries is articulated with other contents and services available on the Web. For that, we compared the presence of various types of sites within the Gallica sessions and in the whole sessions (see Table 6).

Table 6. Presence of different types of sites and services in the Gallica sessions and in the whole sessions

	Presence in the Gallica sessions	Presence in the whole sessions	Variation of the presence in the Gallica sessions
Digital libraries	100.0%	7.8%	
e-business / cultural goods	9.9%	5.4%	+ 82.8%
Search engines	35.2%	27.1%	+ 29.7%
Personal Web sites	25.7%	20.4%	+ 26.0%
Genealogy	4.7%	4.4%	+ 6.0%
Generalist portal	52.9%	51.9%	+ 1.8%
e-business / tourism	0.8%	0.9%	- 7.4%
Media / Radio	1.3%	2.0%	- 33.4%
Media / Press	4.7%	7.4%	- 36.6%
Media / TV	0.8%	1.4%	- 40.4%
e-business / Finance	1.0%	2.9%	- 64.0%

We notice thus that search engines are over-represented in the Gallica sessions, where they are 1.8 times more represented than in the whole set of sessions. This important use of search engines demonstrates the importance of the use of Gallica in a context of information seeking, where a DL is considered as a source of information among others. We also notice that personal Web sites are over-represented in the

sessions with Gallica, they are valuable data and text sources for very specific subjects, such as genealogy.

The use of Web sites providing cultural goods, also over-represented, seems to correspond to a task of catalogue or “testing before purchase”, which is confirmed in the interviews:

“I go on the BNF web site because [...] I guess I will be able to find something, and that I will take a little time to see some images, or some documents which I will not be able to consult otherwise, or to be sure that I will buy a book; I spoke about [an author name], I bought after having consulted the BNF a book that interested me much, for 200 €” [Male, 47, manager, broadband Internet access]

In this context, the user leafs through an old book online before purchasing it on a site specialized in bibliophilism.

Media sites are, on the contrary, less present in the Gallica sessions than in the whole traffic: if the users of Gallica are intensive consumers of online newspapers, as we have already seen (see Table 2. Global audience from our panel (period: July – December 2002)), the access to these two types of sites does not correspond to the same practices and contexts, and is done in different sessions.

Dealing with documents. When observing the detailed activity of users on Gallica, we notice that they often consult more than one document, and do not read these documents linearly. Only an image format (pdf) is available for the majority of the documents provided by Gallica and the document is accompanied by tables of contents in text mode which allow to search them and navigate through books. Visitors of Gallica use mainly this function to grab information in documents, and do not seem to read online, as they would do for classical books of writers. Once the information is detected, people often download the document and store it, but the interviews showed that few people read them afterwards.

The interviews allowed us to know what people do with the documents they download from online DLs. For the majority of the interviewed persons, reading on the screen is rare; screen reading is often blamed for being “tiring”. It occurs in very specific contexts, where the user is mining for very specific information. If we consider the sub-division of the reading activity into sub-tasks by Adler *et al.* [1], we can say that we observed here two categories: reading to identify – “to work out which document it is (usually simply by glancing at it)” – and skimming – “getting a quick idea of the content of a document”.

Printing does not often occurs, mostly because of its cost. Nevertheless, a lot of people keep downloaded documents in “personal digital libraries” focused on their personal centres of interest, and store them on CD-ROMs.

These elements lead us to consider that the status of digital documents is close to reference books, whose utility is defined by the needs of a user for a precise question at a certain time, as seen in the interviews:

“I download [the document] and then I store it. Even, sometimes, I do not print it. But I know that it exists and then, the day when I write something, well at this time, I will print it or I will look at it.” [Female, 55, executive, narrowband Internet access]

“At the beginning I used to print, now I print less. I print what is useful, for example, when I have located [the document], I read it on screen, it is tiring but I read it on screen, and when I locate the pages which will be useful to me, then I print them.” [Male, 75, retired, narrowband Internet access]

The storing of digital documents and the constitution of personal DLs can be seen as an accumulation of reference documents for possible future needs, even though they are not consulted afterwards.

4 Discussion

First of all, the BibUsages project increased our understanding of users of digital libraries. Digital libraries attract a public who are not necessarily regular users, but who use the service for specific research purposes: in the interviews and through traffic analysis, it was found that digital holdings allow rapid and simple access to difficult-to-find reference documents in the context of a specific research. This public seemed quite different from that of a classical library, and "professional" researchers were, comparatively-speaking, mostly absent from this group. The majority of the observed population was over forty, and for them, digital libraries represented, above all, a source of information for personal research. Among this group, Internet usage intensity was much higher than among the general French Internet user population and went hand-in-hand with the high rate of broadband Internet equipment (cable, ADSL).

The BibUsages study also made it possible to understand the different contexts of usage of digital holdings. From a global audience point of view, DL users were also large consumers of "contents-to-read" (particularly online newspapers). But if we examine more precisely the sessions where DLs were used, we notice a high correlation between DL and search-engine usage, on the one hand, and e-commerce sites selling cultural goods (such as Amazon), on the other. Two profiles emerged: that of the "non professional researcher", whose centres of interest were specific and well-defined and that of the book lover, for whom Gallica served as a "catalogue prior to purchase". In both cases, reading online and printing-out downloaded documents were seldom occurrences and reading was related to searching for targeted fragments within vast collections, bypassing whole works. In this context, the status of online documents seemed to be brought under question: while paper publications remained the primary source for works of writers, electronic publications were more closely assimilated to reference books.

Knowledge of the DL public and the contexts of usage provide some interesting implications to the project's two partners. For France Telecom, as an Internet Services Provider, there are two points worthy of mention. First of all, there is a large percentage of senior Internet user population with broadband access whose centres of interest revolve around "cultural" content in addition to the standard offer in services and communications. This atypical population among French Internet users constitutes in and of itself an interesting population to study for France Telecom, for which it is now possible to adapt the service offer by orienting it more towards search tools and "reading" content. The study also showed a relationship between commercial and

non- commercial web sites. Whereas Internet players (content and access providers) perceive a dichotomy between those two categories, Internet users, themselves, move indifferently from one site to another; therefore, we ought to speak of mutual enhancement between commercial and non- commercial Web when seen in the light of actual practice.

For the French National Library, and digital libraries in general, the project enables a better understanding of its remote public and the ability to better adapt its offer. Through traffic analysis and interviews, the project revealed a strong user tendency towards downloading and a quasi-systematic use of search tools, in addition to points for ergonomic improvement. Furthermore, the BibUsages study will allow the French National Library to become more familiar with the contexts in which its digital library is visited. The user point-of-view adopted by the study provided information on the frequency of use Gallica “direct-competitors” offering online collections of texts. It also showed which types of links could be considered between Gallica and other kinds of Internet sites (booklovers' links, for ex.) and those which would not be pertinent (e.g. online newspaper sites).

Digital libraries, far from being simple digital versions of library holdings, are now attracting a new type of public, bringing about new, unique and original ways for reading and understanding texts. They represent a new arena for reading and consultation of works alongside that of traditional libraries.

5 References

1. Adler, A. *et al.*: A Diary Study of Work-Related Reading: Design Implications for Digital Reading Devices. Proceedings of CHI'98, 241-248.
2. Bryan-Kinns N. and Blandford A.: A survey of user studies for digital libraries. Working paper, 2000.
3. Jones, S. *et al.*: A Transaction Log Analysis of a Digital Library. International Journal on Digital Libraries. 3-2 (2000) 152-169
4. Jones, S. *et al.*: An Analysis of Usage of a Digital Library. European Conference on Digital Libraries. (1998) 261-277
5. Sfakakis, M. and Kapidakis S.: User Behavior Tendencies on Data Collections in a Digital Library. ECDL 2002, LNCS 2458, 550-559.