Strategies and alliances into action to improve national collaboration

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Abstract

The Italian NILDE network of libraries continues to grow through the use of the NILDE system and currently comprises more than 600 Italian librarians and about 10.000 registered end-users.The system allows to daily manage and to record all the Inter-Library-Loan (ILL) operations, with a high national coverage.
This paper presents the NILDE network governance and evolution and the strategies that have been put into action to improve collaboration in resource sharing among the participants.
These strategies include:

- release of best practices and worst practices;
- activities to promote the knowledge about the network;
- cooperation with the Italian national catalogs and consortia;
- data analysis about ILL and its performance, related to: turn around time, reciprocity factor, requested/supplied documents imbalance analysis, analysis of ILL requested serial titles and their relationship with consortial e-only acquisitions.

The availability of such a high volume of ILL data has allowed for the first time to analyze the trends and gaps of ILL and to help future cooperative acquisitions planning.

Introduction

Specialized journals, often available in electronic format, are the main path for scientific dissemination and knowledge exchange. Therefore, their importance has been growing (Vitiello, 2003) and their cost has become the heaviest charge for academic and research libraries. This is one of the reasons why ILL services play a strategic role in library policies (Zaetta & Mangiaracina, 2008).

The *Guidelines for Best Practices in Inter-Library Loan and Document Delivery* written by Document Delivery and Resource Sharing Section IFLA[1] well clarify the importance and functions of ILL services. Using automatic protocols, ILL services let the libraries find out useful information resources and make them available to end users, ensuring homogeneous and high quality standards.

[1] http://www.ifla.org.sg/VI/2/p3/Guidelines_ILDD-en.htm

In this framework, the NILDE (Network for Inter-Library Document Exchange) [2] project has been developed since 2001 by the Bologna Research Area Library of the National Research Council (CNR). The NILDE initiative is emblematic of the situation in which libraries have to operate in Italy. It is the result of the librarians' ability to find creative and innovative solutions to provide and manage services despite the lack of unified national approaches.
The Italian context in which the NILDE network has grown is characterized on the one hand by a long delay in the setting up of a common national ILL system and, consequently, of national policies and quality standards; on the other, by the existence of ILL networks of libraries which are delimited either geographically or thematically (Ponzani, 2009). Bibliosan, Essper and Bess well represent these experiences.

Bibliosan[3], funded by the Italian Health Department, is a library network of over 60 Italian biomedical research institutions, and joined NILDE since 2004 as a consortium [4] (Fruttini, 2008).

ESSPER, established in 1995 on the initiative of the "Mario Rostoni" Library (Carlo Cattaneo Free University, Castellanza, Italy)[5], is an association including over 120 libraries for Social, Economic, Law and Historical studies. It aims at developing a comprehensive catalog of journals available at all the joining libraries, and a freely accessible online database of journals, articles and working papers by Italian authors (Guazzerotti & Origgi, 2003).

BESS (Biblioteca Elettronica di Scienze Sociali ed Economiche, meaning Economic and Social Sciences Electronic Library)[6], in the social sciences field is a service created in 2001 by 15 academic and administration libraries in the Piemonte Region. BESS has joined NILDE as a consortium, and it uses NILDE for resource sharing among participating libraries: in three years the number of exchanged documents among BESS libraries has risen from 150 to 1200 a year (Grazioli, M et al., 2008).

Most of the libraries joining to the NILDE network, at its beginning, were linked to scientific and biomedical area. With the launch of NILDE service in 2006, an increasing demand of access from libraries with different features was registered and this had different subjects joined and a wider volume of heterogeneous contents added[7].

In summary, NILDE has developed to provide effective responses to the daily needs of users, represented mainly by libraries of the Italian universities and scientific research and health care centers[8], which are the most exposed to the monopolistic policies practiced by large publishing houses.

NILDE: Italian software and network for ILL

NILDE is a web-based software for libraries and users (Mangiaracina et al., 2008). It allows libraries to:

1. Manage automatically the entire workflow of ILL;
2. Allow secure electronic transmission of documents via a web-browser system with

[2] http://nilde.bo.cnr.it
[3] http://www.bibliosan.it
[4] In 2008, Bibliosan supplied the Nilde network with 23% of total documents and requested 17%; libraries in the Bibliosan system shared 15% of total Nilde documents (i.e. 123.141 documents).
[5] http://www.biblio.liuc.it/essper
[6] http://www.bess-piemonte.it
[7] The percentage of libraries of scientific and biomedical area has been decreasing from 79% in 2005 to 70% in 2008 (Source: Nilde data).
[8] The percentage of libraries belonging to university and research institutions amount for the 86% of the total.

dedicated server;
3. Offer a personalized service to end users;
4. Obtain a track record of ILL performance for each library;
5. Integrate in the automation software ILL performance indicators, such as fill-rate and turn around time.

In order to join NILDE, each library must subscribe the NILDE Rules and Regulation, agreeing to:
1. Reciprocally supply documents;
2. Facilitate access to its holdings, through joining at least one of the Italian union catalogs or meta-catalog (such as ACNP, SBN, MAI)[9];
3. Supply documents as soon as possible;
4. Supply documents at no charge and, in case of heavy usage, ask for a one-off payment at the end of the year;
5. Equally distribute its requests among all libraries.

As a tool, NILDE allows libraries to activate standardized and structured processes for ILL services thus simplifying their operations and reducing their costs. However, joining the NILDE network for a library means not only to make use of an efficient ILL-manager software, but also to be part of a community that acts as a trust based organization, to adopt widely shared quality standards, and to actively be involved in library cooperation (Mangiaracina et al., 2008) - see also the Proceedings of the I-V Italian conferences on Internet Document Delivery and Inter-Library Cooperation[10].

Sharing human resources and processes: the role of the NILDE Library Committee (CBN)

At the beginning of 2001, NILDE was created by the CNR Bologna Research Area Library with the financial support of CNR, the main Italian research institution. Gradually, due to the grow of the library network, NILDE has developed a management system based on a horizontal collaboration and the set up of formal procedures.
To entry NILDE and be part of its management system, a joining charge is required [11], that covers the maintenance, the technical support and new developments of the service. But at the same time, they can be part of the management.
Since 2006 NILDE has the following management structure :
1. NILDE ADMINISTRATOR: the CNR Bologna Research Area Library. Its responsibilities are to guarantee the service, provide help-desk and technical support to libraries and work on the system software evolution;
2. NILDE SUBSCRIBER ASSEMBLY (ASN): its composition ensures a representation to each joining library the whole assembly. Its tasks are to elect the NILDE Library Committee and to meet periodically, during the NILDE biannual conference;
3. The NILDE LIBRARY COMMITTEE (CBN), elected by the ASN, it attends the libraries

[9] ACNP (Italian National Collective Archive for Periodicals) is the main Italian resource for journals articles/ not-returnable ILL http://acnp.cib.unibo.it/cgi-ser/start/it/cnr/fp.html. SBN (Italian National Library Service) is the main Italian resource for monographs/returnable ILL http://www.internetculturale.it/moduli/opac/opac.jsp , http://www.internetculturale.sbn.it/. MAI (Italian Meta Opac Azalai) is a meta-catalog mainly collecting other university OPAC, managed by the CILEA consortium and the Italian Library Association http://www.aib.it/aib/opac/mai2.htm3

[10] Nilde Conferences Proceedings available online at: http://leonardo.isti.cnr.it/metaopac/servlet/Isis?Dsfor=200&Obj=%40cnr-pListtibib_r.pft%2CSortedBy%3A%40cnrSS_r_yetyti.pft&Opt=search&Field0=&Field1=&Field2=&Field8=&Field4=&Field3=B2&Field5=BIBO&Rqar=y&Conf=%2Fexport%2Fhome%2Fmetaopac%2Fmpisa%2FcnrpConf%2Fcnr_bibo-pub-list.sys.file_x&SrcWin=1&Dsfr=1

[11] http://nilde.bo.cnr.it/contratto/2009/cond_economiche2009.html

interests. Its tasks are to monitor the network, report any unfair behaviour to the Administrator, and reach a solution that can be submitted to both the ASN and the Administrator[12].

It is important to remark that relationship between the Administrator and the CBN defines the NILDE service governance.

When a criticism is raised or a problem detected, one or more CBN members organize a working group to collaborate with the Administrator to its solution.
CBN works to improve the service and to extend the network to other libraries, increasing exchanges and decreasing management costs. The CBN works also to improve collaboration with all subjects of scientific communication in Italy, from publishers to library consortia, from libraries to Opac and Meta-Catalog administrators.
The actions and work of the CBN and Administrator are innovative. They collaborate organizing open and dynamical working groups for problem solving. Groups are connected through flexible, practical communication routes mostly based on internet (Skype conferences, wiki, mailing lists).
CBN acts as a network at the service of a bigger network. Sharing human resources and working practices seems to be successful key factor of CBN, which focuses its action on:
- Promotional activities (toward the network's members: release of working tools, such as best practises, organization of training courses; toward all: information materials, meetings, invited talks, ...)
- Monitoring and studying activities (monitoring the overall network status and libraries behaviours, performing data analysis).

Promotional activity inside and outside the network

One of the first concrete actions undertaken by the CBN has been the drafting of the Best Practices (BP) to improve the internal network performance.
BP were discussed into the mailing list "NILDE CBN", and refer to the "Guidelines for Best Practice for Inter Library Loan and Document delivery" published by IFLA in 2006, to improve network use. BP have been introduced mainly for two reasons:

- to provide a *vademecum* (handbook) that can help librarians working for ILL service;
- to decrease the ILL un-fill rate (13%)

After one year, the un-fill rate reduced to 12% . It's maybe too early to understand if BP have influenced this result, which could also be a follow-up of the librarians' training courses promoted by the NILDE administrator. The release of a complementary document, said the Worst Practises (WP), is undergoing.

The CBN spent a considerable part of its activity to promote NILDE through several kinds of actions, mainly aiming at giving visibility to NILDE as a reliable and authoritative tool for ILL. Taken all this into account, working groups on promotion created brochures, CBN members attended international and national conferences and congresses on the subject of ILL services, and collaborated at the organization of the 2006 and 2008 NILDE conferences. The biannual meeting has a strategic role in promoting activities. It gives the opportunity to discuss goals, gaps, trends, and problems. During the meeting users report their experiences and the Administrator illustrates future developments of the network.
Many other initiatives, such as training courses on the use of the NILDE software and technical workshops focused on the integration of NILDE with other systems, involved CBN

[12] On the CBN composition and elections, see NILDE Rules and Regulations : http://nilde.bo.cnr.it/index.php?st=11

members in order to promote NILDE.
Another undergoing activity is to encourage initiatives that aim at disseminating and promoting Open Access journals in Italy. In April 2009 the CBN in agreement with the ACNP team, sent the network libraries a letter inviting them to participate to the cataloguing of open access journals in ACNP, paying particular attention to those published in the Italian academic world.

Monitoring activity about general network status

NILDE, which is by itself a service and a tool to share information resources, is based on the view that joining NILDE means being part of a network sharing the best practices. One of these, undoubtedly the most important, concerns the commitment to actually make its periodicals available through national catalogs.
Data on ILL transactions shows that the library that does not publish its holdings in a national catalog, acts mainly as "invisible", having a large amount of borrowing requests in debt. Previous investigation has shown that only 76% of NILDE joining libraries published their holdings, and could be successfully queried by a national coverage catalog such as ACNP or SBN or MAI (Olimpieri, 2006). In order to avoid this imbalanced situation, a CBN working group has been constituted, which monitors the activities and verifies the behaviour of NILDE joining libraries.
The working group has initially contacted the libraries and afterwards formally required to make their holdings available in the national catalogs. Moreover, to give visibility to the MAI's libraries, a Meta-Catalog MAI-NILDE was created in cooperation with Cilea and MAI editorial boards[13].
NILDE libraries that were not present in these catalogs, had two years to meet the required quality standards. At present, only 6% of the libraries has not met the dictates of the Rules and Regulation, most likely due to technical troubles or problems in internal management (see fig. 1).

Figure 1: Comparison between the total number of Nilde libraries and the number of libraries not belonging to a National Union Catalog or Meta-Catalog

The monitoring activity of the working group, which is still underway, includes direct contacts with the manager of ILL service in each library. This process has led to a virtuous circle, where the number of NILDE libraries joining national catalogs has been increasing. As a result, up to 94% of NILDE libraries offers their holdings on a nationwide catalog: figure 2 shows their distribution among them.

Figure 2: Distribution of Nilde libraries in the Italian union catalogs, year 2009.

It is important to notice how the set up of a stable partnership with the ACNP has been very significant.

Integrating all catalogs that can be thus queried as one, ensures efficiency in transaction managing and therefore a considerable time saving for both the operator and the end user (library or individual researcher). The integration of a NILDE query in the ACPN phase is a particularly easy solution, which was further implemented by using a ACNP-NILDE mask query limited to the NILDE network libraries[14]: in fact, most of NILDE transactions originates from ACNP search.

ILL data analysis as a monitoring activity

CBN recently aimed at monitoring the network through collecting more detailed information to set up procedures for in depth analysis of the ILL data flow.

[13] http://azalai.cilea.it/nilde
[14] http://acnpweb.cib.unibo.it/cgi-ser/start/it/cnr/fp.html?libr_name=Acnp+-+Nilde&libr_th=nilde

ILL transactions analysis is an important instrument for monitoring the network performance and supporting the decisions and future strategies of library managers. For these reasons, the analysis has focused on two different topics:
a) analysis of network performance in terms of turn around time, reciprocity factor and requested/supplied documents imbalance;
b) analysis of ILL more requested serial titles and their relationship with consortia e-only acquisitions.

However, NILDE network is continuously changing its body, due to every year joining up of many libraries and leaving of some of them. The number of new entries has been constantly growing[15].
These elements of flexibility also suggest a more careful approach in evaluating performances of selected groups of libraries, since data sets may be affected by such a continuously changing framework.
Complete data about ILL transactions from 2005 to 2008 were acquired from the CNR Bologna Research Area Library, the NILDE administrator, that maintains the NILDE software and database (Mangiaracina et al., 2008). All the transactions, successful or not, relating to the four-year period taken in examination have been stored in a new warehouse database, that will also serve for further analyses.

A) Analysis of network performance

The main issue in analysing the network performances is to understand if only simple indicators coming from the system stored data of ILL transactions can give a picture of such a very complex environment - public, academic, healthcare sector, scientific research institutions libraries, which are no longer connected to restricted subject area and with not comparable volumes and types of users as well. It is evident that simple performance indicators could not represent this heterogeneity.
A good analysis of performances can be pursued only through collecting detailed data to create homogeneous library clusters, but this is a hard duty. The situation is even worse if we consider the number of leavings and new accesses which not allow comparisons year by year, and also the difficulty in sizing the dimension of each library[16] (G.I.M., 2009).
NILDE success is well assessed by the increasing volume of exchanges[17]. Following this over time consolidated result, analysis of collaboration and cooperation aspects has been recently performed, comparing *"reciprocity factor"* in the exchange[18] and *"efficiency of the service"* indicators.
The data presented here are the result of an analysis carried on all libraries belonging to NILDE network, and studied on the basis of the reciprocity factor (RF) indicator, i.e. the ratio between the number of documents supplied to the network (L for lending) and those requested (B for borrowing) by a library (Mangiaracina, 2003) (RF= L/B). RF has been evaluated for clusters of libraries with similar features. The reciprocity factor RF allows an evaluation of the balance reached from any library, clusters of libraries or selected groups in terms of requested and supplied documents.
The more the factor is equal or over 1, the higher is the balance reached between requested and supplied documents. Libraries operating in a completely or relatively balanced environment show a RF ratio between 0,6 and 1. A RF ratio between 0,4 and 0,6 represents a heterogeneous amount of libraries fluctuating between a growing efficiency research and stable condition of imbalance between requested and supplied documents, probably due to structural factors. The interval with a

[15] More than 670 libraries (Source: Nilde data, August 2009).

[16] Recent publication of the Interuniversity Group for Monitoring the university libraries systems (GIM) provide interesting hints about difficulties met – into the Italian university – to define homogeneous groups with similar behaviour in relation to specifics characteristics. For reflections/considerations on "cluster analysis" and "factor analysis" see the Report at page 123 and followings.

[17] From 86.457 exchanged documents in 2005 it passes to 123.141 documents in 2008 (Source: Nilde data).

[18] Reciprocity factors are studied in reciprocity theory and relationship marketing to build marketing networks, that is, mutually profitable relationships among several actors, mainly among marketer and customers (Huang & Wan, 2005).

RF lower than 0,4 shows a chronic imbalanced situation.
It is important to stress that libraries having L=0 or B=0 have been excluded, because in both cases a RF ratio will not result meaningful for the analysis[19]. In the following figures we take exclusively into account libraries with almost 1 borrowing and 1 lending for the four-year period, 2005-2008.

Descriptive analysis: NILDE indicators

Figure 3: NILDE libraries divided on the basis of reciprocity factor RF, middle values percentages, years 2005-2008 (Elaboration on NILDE data).

Looking at the results it can be noticed that the increased number of libraries[20] - over each of four years under observation – does not link to a different allocation (in percentage) within the groups.
The most critical interval (RF < 0,4) - consisting of those libraries that make much more requests than supplies – decreases sensibly only between 2005 and 2006, but later on the trend grows again, stabilizing around the significant value of 23% of the analyzed libraries (see fig. 3).

FINDING: The increase of the absolute number of joining libraries and documents exchange volume[21] is not connected to an equal mobility between the intervals expressed by RF ratio.

This could mean that the overall number of libraries with RF < 0,4 remains substantially the same due to structural conditions and only more in depth researches could express different considerations about this sign of strong stability.

Since it is not possible to group NILDE libraries into homogeneous clusters using only the RF ratio[22], new indicators have been introduced to better study future behaviours and performances.
The performance indicators given by NILDE are: fill rate (success rate=SR) and turnaround time (TT) (Jackson, 1997). Fill rate (SR) indicates the percentage of documents delivered by the libraries. Turn around time (TT) indicates the elapsed time, expressed in days, between the request of an enquiring library and the response from the enquired library, including delivery procedures specifications.
It is important to notice that the SR is negatively influenced by partially or completely wrong data input of the enquiry (bibliographic reference), and also from mismatches in addressing the request of a journal to the wrong library[23].
Furthermore, the SR might be sensibly influenced from the ability of operators in charge to manage the request flow. For its sensitivity to such heterogeneous factors, SR itself should not be considered as a reliable indicator. Therefore it should be better matched with the second available indicator TT.

Figures 4-7 show a complete overall network evolution and also the evolution path of selected clusters of libraries. RF, SR and TT for those libraries with the best and worst reciprocity factor have been compared among them and with the NILDE average[24].

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[19] From the statistic analysis has been eliminated around 100 libraries in every year taken in examination, these libraries don't show characters of reciprocity, being or providing libraries, or requesting libraries. The ratio RF of the overall network, representing the total number of lending and borrowing it is always equal to 1. But having excluded the libraries with non valid RF – generally having L=0 -, it slightly results superior to 1. The elaborations order the libraries according to their RF. The number of considered libraries in the analysis in the four years has respectively been: 398 (2005), 448 (2006), 491 (2007), 541 (2008).

[20] +35,9% in 2008 compared with 2005 (Elaboration on Nilde data).

[21] Records an increase percentage of the exchanges in 2008 in comparison to the 2005 of 42,4% (Elaboration on Nilde data).

[22] In the future, the reciprocity factor RF could be more representative if it will be combined with the total number of the transactions (L+B) and to the balance of these (L-B).

[23] The percentage of unfilled requests for different reasons is of 12,3% on the total one during 2009 (Source: Nilde 2009). It is important to remark the role of CBN on the promotion of Best Practises, discussed in the previous sections.

[24] Data has been elaborated with the same limitations adopted in precedence, respectively focusing the trend of the indicators

Figure 4: Evolution of the performance indicators SR, TT and RF for the 100 libraries with lower RF, years 2005 -2008. (Elaboration on Nilde data).

Fig. 4 shows that RF is almost constant for the 100 libraries with the lowest RF; whereas TT shows a consistent decrease over the four years, moving from 4,5 days to less than 2 days.

FINDING: At the end of the period the value registered for TT is very close to that indicated in the NILDE Rules and Regulation (Mangiaracina et al., 2008).

By comparing NILDE indicators with those registered for the 100 libraries with best and worst RF, it is possible to notice a growing performance for the top 100 performers cluster. This is in contrast with the general static behaviour registered for the worst 100 performers cluster.

Figure 5: Evolution of the average RF. All, worst100 and best100, years 2005 -2008. (Elaboration on Nilde data)

Figure 6: Evolution of the average SR. All, worst100 e best100, years 2005-2008. (Elaboration on Nilde data)

The SR indicator shows a decline for the worst 100 performers cluster and somehow also for the top 100 performers cluster. However, the overall network maintains values over 82% of delivered responses.

Figure 7: Evolution of the TT average. All, worst100 e best100, years 2005-2008. (Elaboration on Nilde data).

TT evidently improves (+183%) over the four years of activity with NILDE, and even more consistently (+266%) for the worst 100 performers (see fig.7).

Therefore we can conclude that the TT performance indicator is the parameter indicating the highest volume of successes, also because it is more influenced by the positive practices operated in the network (i.e. shared best practices and policies, use of dedicated mailing lists and software training). "TT indicator is maybe the most meaningful indicator to check the users' needs satisfaction level; users like students and academic researchers, who's main expectation is to get documents in the shortest time" (Mangiaracina, 2003).
If we do consider only delivered documents, we can notice a constant improvement of the TT and consequently of the overall NILDE service.

	% filled documents			
Timeliness	2005	2006	2007	2008
1 day	43,20%	51,04%	60,53%	67,93%
1-2 days	35,50%	30,81%	24,26%	21,43%
2-3 days	8,08%	9,06%	9,48%	6,76%
Within3 days (value % in Nilde)	**86,78%**	**90,91%**	**94,27%**	**96,12%**

Table 1: Percentage of filled requests within 3 days, 2005-2008. (Elaboration on Nilde data).

FINDING: In 2008 over 96% of the documents have been delivered within the three days, considered as a standard in the NILDE Rules and Regulation. Particularly, the number of documents delivered within 24 hours from the enquiry has increased (>67%) (see table 1).

for the best libraries in comparison to the reciprocity factor RF (best100), the worst (worst100) and for the whole Nilde (all = with valid RF).

On the other hand, the RF indicator seems to be more influenced by structural features[25] rather than by the establishment of cooperation and network policies.
The value connected to the best 100 and the worst 100 out of the total number of exchanges (L+B) shows a decreasing trend over the years.

Figure 8: Percentage of the total Nilde ILL transactions, for best100 and worst100, years 2005 and 2008.[26]

Fig. 8 shows the decrease of deliveries from those libraries with the highest reciprocity factor. This might indicate that most exchanges come from libraries with performance indicators very close to average values of the network.

Factor analysis

After analysing the main system indicators for the four-year period 2005-2008, we focus on the *cross-section* data regarding the year 2008[27], which is particularly interesting because only since that year it was possible to compare performances of the NILDE libraries with the data regarding their holdings.[28]
The variables taken into account are: number of owned journals (holdings), reciprocity factor (RF), fill rate (SR) and turnaround time (TT)[29]. If we examine the distribution of the number of holdings by the libraries in the analyzed sample, we see that the highest percentage is owned by medium/small sized libraries, i.e. with holdings ranging from 0 to 500 (60% on the total one).

Figure 9: Nilde's libraries distribution (in percentage) based on their journals holdings, year 2008.

Let's now extend our analysis by investigating the relation between the number of journals owned by the libraries and the reciprocity factor (RF), calculating an index of linear correlation between the two variables according to the model shown below:

```
                        |   RF / periodicals held
            ------------+------------------
RF / periodicals held   |   1.0000
                        |   0.1318   1.0000
```

The result indicates a positive correlation between the two variables (as the holdings increase also RF increases and vice versa), but this correlation appears to be not statistically significant (0,1318)[30]. Therefore it is possible to deduce that libraries owing a larger amount of journals do not necessarily deliver the largest number of articles. The dispersion diagram of the sample may help us

25 It's probable that the imbalance among lending and borrowing documents is determined by the consistence of the bibliographical patrimony available for the single library, a hardly modifiable condition.

26 For homogeneity with the other data we have excluded by the calculation the libraries with L(lending)=0 or B(borrowing)=0.

27 The analyzed sample takes into account exclusively libraries that supply reliable information about their holdings and for which it is possible to estimate the reciprocity factor (494 libraries).

28 Data about libraries' holdings are supplied by ACNP.

29 Figures processed with software STATA, further details available at: http://www.stata.com/stata9.

30 " The coefficient of linear correlation among two variables is equal to the relationship between the covariance and the product of the mean square (standard) deviation. The index is a pure number, that is to say independent from the unit of measure, and is always included between -1 and 1 […] it measures the strength of the relation between two quantitative variables, -1 reveals the presence of an inverse linear relationship among the occurences of the two variables whereas 1 indicates a perfect linear relation; value 0, on the contrary, indicates the absence of a linear relation" (Pacini & Picci).

better understand why this correlation is no significant (fig. 10). For a better representation of the dispersion of the analyzed sample, data relating the highly severe *outliers*[31] are omitted.

Figure 10: Nilde libraries dispersion, based on RF and holdings, year 2008.

Points are spread in all of the 4 sections created by the intersections of RF - equal to 1[32] - with the average number of holdings. The intersection generates 4 groups[33] for which the fill rate and the turn around time can be evaluated.

Group A represents libraries with high RF and high holdings.

Figure 11: Characterization of libraries belonging to group A, with high RF and high holdings

We observe the following: 113 libraries; average fill rate (SR)=87,55%, average turn around time (TT)=1,27. TT beyond 6 days=2,7% (3 libraries).

Group B represents libraries with high RF and low holdings.

Figure 12: Characterization of libraries belonging to group B, with high RF and low holdings

We observe the following: 161 libraries; fill rate (SR)=86,03%, turn around time (TT)=1,21. TT beyond 6 days=4,9% (8 libraries).

Group C represents libraries with low RF and low holdings.

Figure 13: Characterization of libraries belonging to group C, with low RF and low holdings

We observe the following: 176 libraries; fill rate (SR)=81,16%, turn around time (TT)=1,33. TT beyond 6 days=6,8% (12 libraries).

Group D represents libraries with low RF and high holdings.

Figure 14: Characterization of libraries belonging to group D, with low RF and high holdings

We observe the following: 38 libraries; fill rate (SR)=80,80%, turn around time (TT)=1,90. TT beyond 6 days=2,6% (1 library).

FINDING: Lacking any dominant trend in the relationship between the number of holdings and RF, it is possible to draw the following observations for every group:

- contradictory results in the 4 groups are obtained as far as fill rate (SR) and turn around time (TT). All the groups express homogeneous middle values (between 1,2 and 1,9 days) for the

31 An outlier is an observation that lies outside the overall pattern of a distribution (Moore & McCabe 1999). Usually, the presence of an outlier indicates some sort of problem. This can be a case which does not fit the model under study, or an error in measurement. A convenient definition of a outlier is a point which falls more than 1.5 times the interquartile range above the third quartile or below the first quartile.

32 RF is considered as equal to 1 because this value represents the perfect equilibrium of the system for total lending (L) and total borrowing (B).

33 The groups have been placed in a decreasing order according to the level of efficiency shown *ab initio* in the intersection RF=1 with average holdings.

TT and more varying values for the SR, about 87% for groups A and B and about 81% for groups C and D. Furthermore, in every group the average turn around time exceeds 6 days for some libraries. It is interesting to remark that within the group with the worst performance level (D), there is a very limited number of libraries that does not comply with the delivery terms (only one, representing 2,6 % of group D), whereas in the other groups this number varies from 3 to 12 libraries, representing up to 6,8% of group C.

- The TT performance indicator (which is most likely influenced by the best practices adopted by the network) shows the most homogeneous trend in all the 4 groups.

B) Analysis of ILL requested serial titles

Due to the economic crisis, many libraries are facing severe cuts in journal subscriptions because of budget reductions, increased subscription rates, reduction of staff involved in customer services and storage locations. The maintenance of a core collection of journals is a major problem and journal-article resource sharing, mostly traditional ILL, provides some breathing space.
After the analysis of NILDE performances, we focus on articles exchanged in the network during a four-year period, from 2005 to 2008. This analysis represents the starting point for a deeper investigation of network dynamics. Data analysis can be useful in evaluating when it is better to subscribe to a journal rather than using ILL or commercial document suppliers (Wiley & Chrzastowski, 2001). Statistical information about requests, in particular recurrence of the same title, helps determining when to subscribe or to borrow.

The aim of this study is to determine how many journals are involved in resource sharing and which have the highest number of ILL transactions, in order to identify "the core journals" collection.

Methodology and problem-solving encountered in title analysis

Even if the software was originally developed to manage articles[34], libraries are often asked for chapter or part of monographs. As the fields to be filled in the electronic form are typical of journal papers, it is not easy to precisely recognize these transactions. Some librarians adopt easily identifiable rules, others not. Because borrowing requests of book chapters are unknowable and uncountable, in this first approach to data analysis we considered all requests.
As a first step, we excluded unsuccessful transactions, since a negative result produces a reiteration of request for the same article, increasing the number of requests for the same journal.

The list of titles was refined through both *ad-hoc* software procedures and manual intervention by the authors of this paper. Total requests numbered for 369.489 and referred to 40.209 apparently unique titles. Actually, many titles appeared in different versions and it was necessary to substitute them with a univocal one to conduct a statistical analysis (see table 2).
Heterogeneity is due to several causes, as the request form can be filled in many potentially different ways. Even a blank space could cause a duplication of the same title.
Variations may occur for different reasons:

- The request origins from several catalogs using different rules for title cataloguing: metadata of the title are different (ACNP or MAI);
- The NILDE software is OpenURL-compliant: the references derived from databases such as Pubmed or ISI Web of Science use different standard for title abbreviation.
- Manual compilation with orthographic mistakes or different title abbreviation.

[34] In this paper article means a part of a journal, newsletters, conference proceedings, annual reports, monographic series.

Such variability has no effects on the librarian work, because the operator can correctly process a partially wrong request, but the software has not the same skills in recognising the same title in different versions.

J AGR. FOOD CHEMISTRY
J AGRIC FOOD CHEM DEP VET VIII B
J AGRIC FOOD CHEM.
J. AGRIC. FOOD CHEM
J. AGRIC. FOOD CHEM.
J. AGRIC. FOOD CHEMISTRY
J. AGRIC.FOOD CHEM
J.AGRIC. FOOD CHEM.
J.AGRIC.FOOD CHEM.
JOURNAL AGRICULTURAL AND FOOD CHEMISTRY
JOURNAL AGRICULTURAL FOOD CHEMISTRY
JOURNAL AGRICULTURAL FOOD CHEMISTRY.
JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY.

Table 2 Example of title variability: at the beginning of the analysis the title Journal of agricultural and food chemistry was written in 13 different versions.

Two sources were used to automatically uniform titles: a list of abbreviations and correspondent full titles from ISI Thomson[35] and the XML file available by FTP in the NLM journal lists directory[36]. The second source contains the alias of thousands of journals and their abbreviations for several disciplinary fields[37]. After this first step the number of titles decreased to 30.175. Manual interventions assessed the number at 22.488 unique titles. Supplement journals hits were summed to the related main title, even when supplements have their own ISSN and could be considered single titles too.

Results found in title analysis

Year	Borrowing libraries	Articles supplied	N. borrowed article/library
2005	511	75,652	148.0
2006	552	87,846	159.1
2007	595	99,083	166.5
2008	651	106,908	164.2

Table 3. Data show the number of active libraries for each year, the number of articles supplied and the average annual requests for each library.

The number of lent articles has been increasing all over the four-year period (only successful transactions were considered).

FINDING: Growth is only partially due to the increasing number of libraries joining the network: the average number of articles requested by each library is increasing too, assessing at a mean of 159,5 supplied/year for library (see table 3).

35 http://www.in-cites.com/journal-list/index.html (retrieved April 2009)

36 ftp://ftp.ncbi.nih.gov/../pubmed/jourcache.xml (retrieved April 2009)

37 The XML file from NLM was created to reach other aims very different from ours. Unfortunately it caused mistakes in automatic conversion of titles to a univocal term. I.E. the journal Circulation was converted in BMC Circulation. When we recognised the mistakes, we searched and corrected manually all occurrences involved.

Despite this recent evolution, the NILDE network is still mainly constituted by biomedical and science libraries, which are interested in up-to-date publications. Moreover many titles have become electronically available to University and Research centres users since the '90s, thanks to consortia acquisitions. Considering this background, we focused on requests of articles published from the request date back to 10 years (11 years of analysis including articles published the same year of the request), as described in table 4.

Requests date	Article publication date
2005	1995-2005
2006	1996-2006
2007	1997-2007
2008	1998-2008

Table 4. Data range of articles publication for the analysis of titles.

Figure 15: Percentage of last 10 years publication requests vs total requests.

The trend of requests of articles published in the last 10 years is shown in figure 15. The percentage of articles no more than 10 years old is decreasing (going from 63% to 58%), even if the numbers of total request are increasing. In fact, budget cuts influenced subscriptions only in recent years (Van Orsdel & Born, 2009), while this phenomenon was not relevant in the '90s. The impact of the economic journals crisis on ILL services should be especially detectable in the recent years, which are the object of our analysis. It is probable that the diffusion of homogenous collections based on consortia *big deals* (Peters, 2001) reduced user needs of up-to-date articles from specific publishers. However, budget cuts increase the need of small publishers titles (extra *big deal* titles), and consequently, library needs of ILL services. Moreover, arts and humanities libraries are now joining the network increasing their percentage of requests in their disciplinary fields, searching for articles published in a larger range of years.

Turning the attention to the high-use titles, that is, according to (Wiley & Chrzastowski, 2001), to journals requested more than 20 times in a year, we find that these titles amount for 10% of all requested titles (in the same year; see fig. 16) and account for 50% of all requested articles published during the previous decade (see fig. 17).

Figure 16: Titles requested more than 20 times per year amount for 10% of the total titles.

Figure 17. Titles requested more than 20 times per year amount for 50% of total article requests.
*Only articles published in the last 10 years.

The aim is to verify if the most heavily requested titles define a stable core during the four-year period and which titles are always in the top list for number of requests. This information is important to isolate titles making up the most frequently borrowed group, point out critical situations in sharing sources and eventually invite high borrowing libraries to subscribe and share their journals.

Tables 5-8 show analysis results.

Year	Total article requests*	Article requests in core journals*	%*
2005	47.320	15.682	33% (21%)
2006	52.966	17.601	33% (20%)
2007	58.086	18.595	32% (19%)
2008	61.818	20.080	32% (19%)

Table 5. Core titles requests amount for 33% of last 10 years publication requests. In brackets percentage is calculated with respect to total requests, without the year of publication limit. * Only article published in the last 10 years.

Year	Total titles requested	Core titles	%
2005	6.308	371	6%
2006	7.087	371	5%
2007	8.087	371	5%
2008	8.317	371	4%

Table 6. Core titles percentage vs total titles requested.

	Mean requests/title	Max requests
2005	42,3	294
2006	47,4	434
2007	50,1	345
2008	54,1	239
average 2005-2008	48,5	328

Table 7. Data show the average number of requests for core titles and the highest number for the top title

	n. of titles with requests/library average ≥ 3	n. of titles with requests/library average ≥ 5
2005	28	2
2006	29	2
2007	31	3
2008	40	1

Table 8: Title request frequency (core journals). Data show the number of titles which average of requests/library is ≥ 3 (1st column) and the number of titles for which average of requests/library is ≥ 5 (2nd column) Core journals are 371.

FINDING: The core list includes 371 titles. Core titles counts for 33% of total requests (see table 5) and their percentage in average is 5% of all titles (see table 6).

FINDING: The average of core titles requests is increasing, while the highest requested title of all is decreased after a peak in 2006 (see table 7).

FINDING: Core journals received few requests by each library: during the four years the average request-per-title for libraries is always equal to 2.

To know the distribution of requests among the network is useful to understand if the rate cost-effectiveness is in favour of ILL services rather than subscriptions. When few requests are made for a title, it is usually more economical to borrow that title than to own it. So we find out how many titles have an average of more than 3 and 5 requests by the same library (see table 8).

Almost all titles received less than 5 requests in average for library (considering only libraries that asked for at least 1 article from the same title). Only 8 titles were requested more than 5 times in one year by the same library, but this appears to be an isolated and accidental phenomenon. While there are probably some titles generating a lot of requests, it is reassuring to see that overall, the average is within an acceptable number if compared with the Copyright Guidelines CONTU[38].

FINDING: Core titles mainly belong to small publishers, which sell their subscriptions out of *big deal* contracts. Requests of such core titles are increasing, maybe because of cuts in budget libraries.

Fewer and marginal titles belong to publisher involved in consortia contracts (ACS, Nature Publishing Group, Wiley, Blackwell) or national contracts (Elsevier, Springer). Some titles are Elsevier journals not included in the "Freedom collection" subscribed by the most part of Italian Universities and Research Institutions.

The top twenty titles are listed in table 9 (ordered by requests average). It's interesting to observe that the top title, Annals of the New York Academy of Sciences, came across a sharp reduction of document supply in 2008, maybe because it is now available through Wiley-Blackwell subscription. We guess that the title could walk out the top twenty list of journals in a couple of years, and maybe out the core too. Moreover, sometimes the standard deviation of some titles is very high with respect to the average, indicating a great variability of requests during the years.

FINDING: We observe no correlation between the Impact Factor value (2008) and the number of ILL requests. The most heavily supplied titles have not the highest Impact Factor (IF) of the group, sometimes lower than 1, and some titles correspond to serials without IF.

The analysis of more than 350.000 ILL requests demonstrates a wide use of journals, the majority of which are biomedical and science journals. We identified a core collection of the most required journals by Italian users, considering the national distribution of the network. Data are consistent with the fact that biomedical and science libraries are the largest part of the network and their users are interested in up-to-date documents. Still, during the last years, arts and humanities libraries joined the network giving their contribution to increase the number of transactions for titles from different disciplinary fields. Biomedical libraries are the most important contributors for resource sharing, but they are not self-sufficient: even those libraries which are strong suppliers, need documents and have to request them to other libraries to satisfy their users (Mangiaracina et al., 2008).
This study focuses on frequently requested titles, which form a very important core collection in Italy for library end-users. Since this is a core group of material, it should be useful that NILDE libraries look at the possibility of buying electronic full text journals through consortia agreement for these titles, to best serve the needs of users and avoid the indirect ILL costs. Highest requested titles should be available in many libraries in print and/or electronic copy. Librarians and system library managers must be careful in dismissing journal subscription, if they risk losing an easy access to documents and frequently turning to commercial providers to satisfy their users.

NILDE libraries are sharing their resources in a virtuous way. Libraries use ILL services to request few articles from the same journal. At present, there is no evidence that ILL services are a strategy to avoid subscription.
Many libraries are responsible for highest request titles, so the average number of requests for each library is low.

[38] Italian copyright law limits reproduction to 15% of the entire issue or volume. Electronic transmission of copies of printed articles is forbidden.

Data analysis confirmed previous information about the rising number of lending, in part due to the increasing number of libraries (Mangiaracina et al., 2008). Moreover, focusing on the distribution frequency by title, data assessed a great variability of journal titles requested in the years, except for a short list of core titles representing an average 5% of all titles every year. This core collection mostly consists of biomedical and science journals.
Few core titles belong to national contract subscriptions (Elsevier or Springer), or consortia[39]. Most of titles are Institutional single subscriptions to journals of small publishers or scientific associations; for those cases the hypothesis of a new consortia subscription should be evaluated.

Library system managers need tools to support acquisition strategies. This analysis indicates the need for a national strategy of acquisition, to increase the access to the most ILL requested titles and to preserve useful titles that are out of *big deal* contracts and which are facing higher risks of cuts due to lower budgets.

Conclusions and Further Developments

This paper sets the bar for future analyses conducted on the basis of the great amount of archived data. A future in-depth analysis (also making use of interviews and surveys) about ILL titles and network performance will provide more highlights.

With regards to the pool of libraries showing best network performances, only an in-depth analysis will clarify if they actually share common characteristics in ILL operations, such as the ones reported in the literature (Jackson, 1997), and single out the winning factors.

With regards to shared resources, further goals will be:

- to map the national distribution of collections and evaluate the impact of ILL transactions among libraries of different disciplinary fields;
- to aid in establishing journal acquisition priorities for libraries and for consortia;
- to support choices about cancellations and weeding;
- to set up procedures for the production of annual reports on ILL transactions as a useful tool in decision-making processes of acquisitions and weeding for all NILDE libraries and library systems managers.

NILDE seems to be a virtuous system of ILL, in which libraries satisfy users' needs with a good cost-effectiveness rate, but not with the aim of avoiding subscriptions. Libraries set up strategies to improve their performance in order to assure their participation in wider national collaboration system.
Finally, using the monitoring and data-flow analysis presented here, we can conclude that NILDE represents a strategic tool for decision-making, mainly in view of future needed partnerships between the major contributors of the Italian resource sharing system.

Acknowledgments
The authors wish to thank all the colleagues who helped with their work and fruitful discussion: Alessandro Tugnoli, Diego Malipiero and all the NILDE's developers team at CNR Bologna Research Area Library, for their help in the data ware-house and software for ILL data analysis, Gianluca Ciciriello for his help in the STATA software data elaboration, Vincenzo Verniti, Gabriella Boninsegna and Orietta Bonora for the great collaboration in providing ACNP data, Federica Tamburini and Giusy Luciani for help in revising the English version of this paper and finally, a special thank is due to all the members of the CBN, particularly to Luisa Fruttini, Barbara

[39] In Italy consortia are CILEA, CIBER and CIPE.

Pistoia, Ingvild Unterpertinger and Marco Chiandoni.

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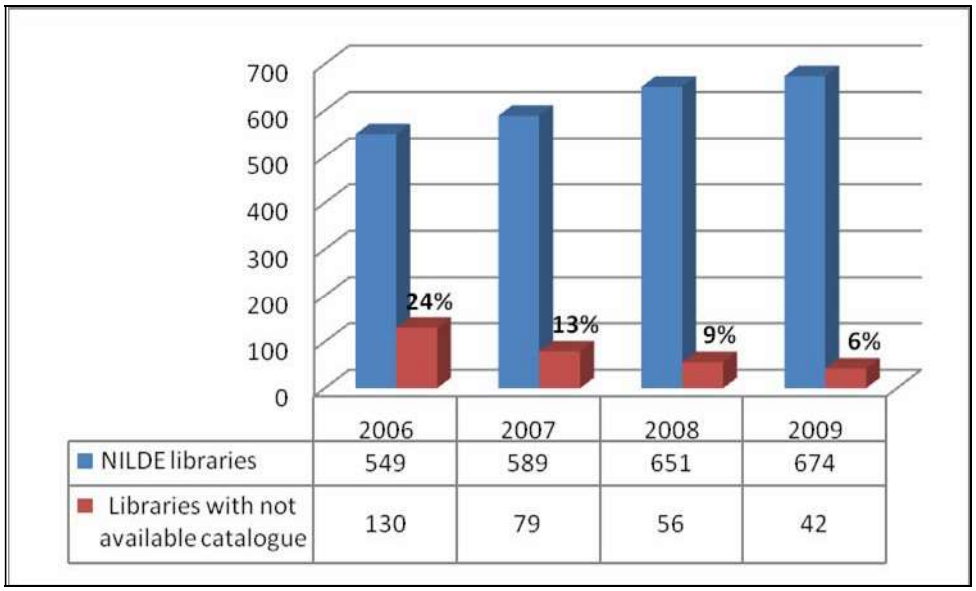


Figure 1: Comparison between the total number of Nilde libraries and the number of libraries not belonging to a Union National Catalogue or Meta-Catalog

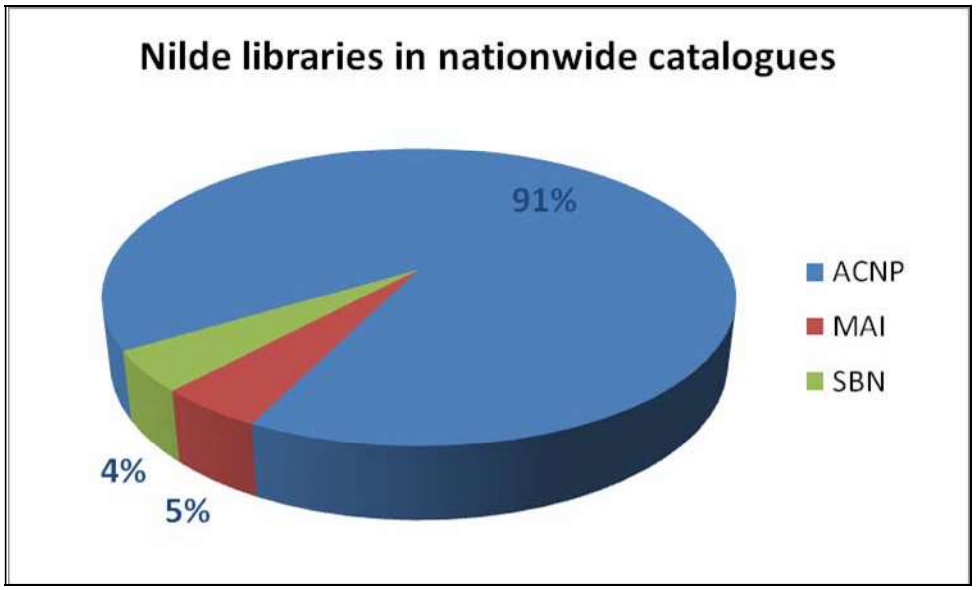


Figure 2: Distribution of Nilde libraries in the Italian union catalogues, year 2009.

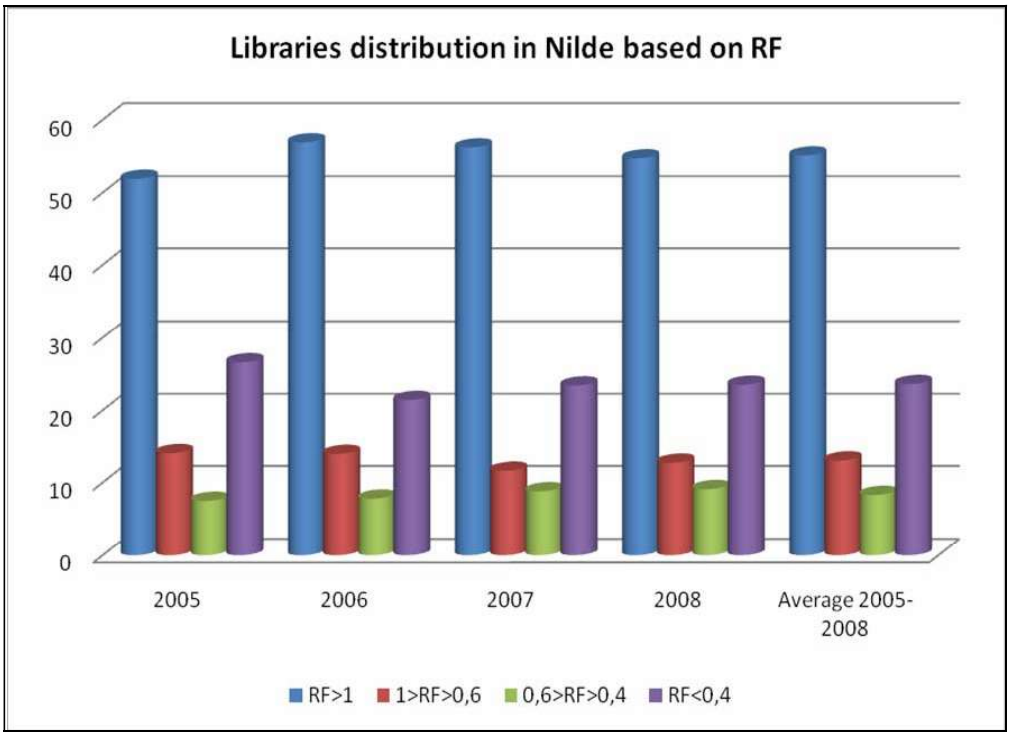
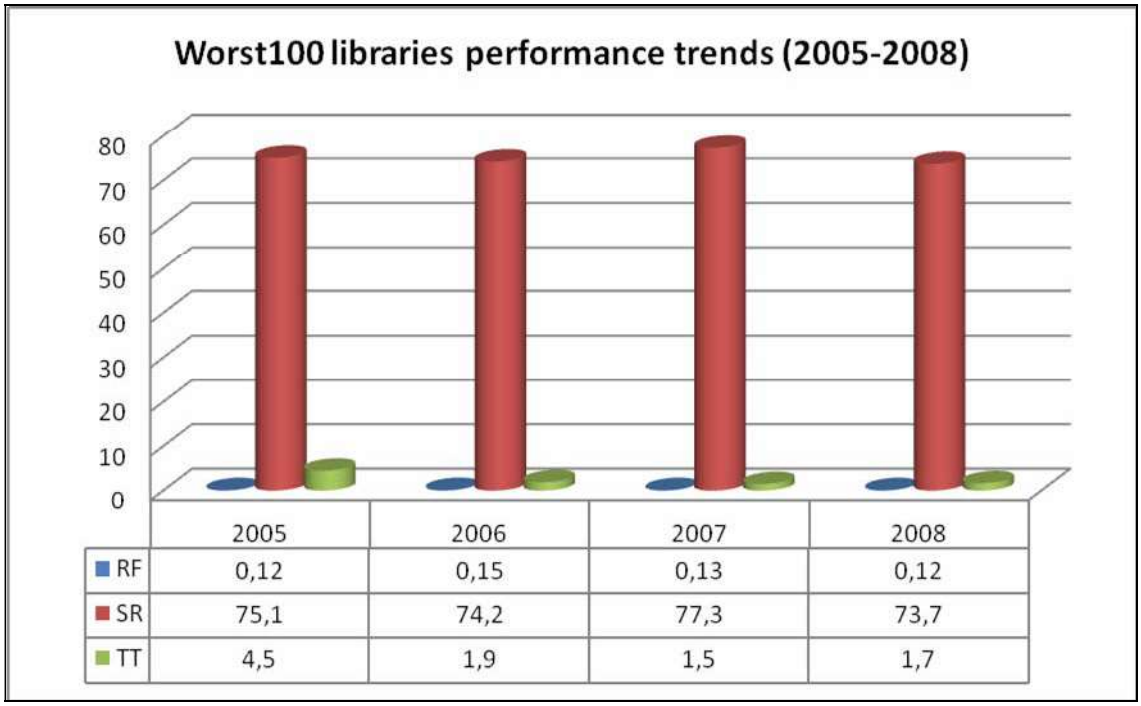


Figure 3: NILDE libraries divided on the basis of reciprocity factor RF, middle values percentages, years 2005-2008 (Elaboration on NILDE data).



	2005	2006	2007	2008
RF	0,12	0,15	0,13	0,12
SR	75,1	74,2	77,3	73,7
TT	4,5	1,9	1,5	1,7

Figure 4: Evolution of the performance indicators SR, TT and RF for the 100 libraries with lower RF, years 2005 -2008. (Elaboration on Nilde data).

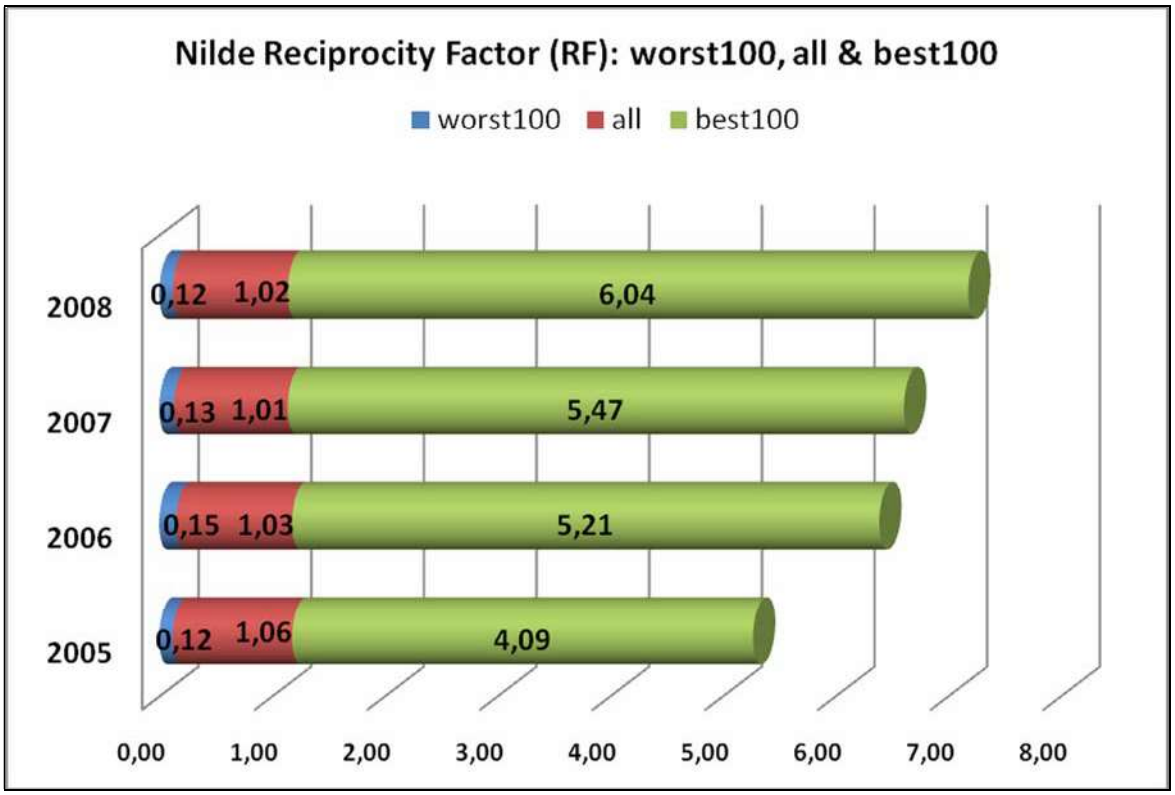


Figure 5: Evolution of the average RF. All, worst100 and best100, years 2005 -2008. (Elaboration on Nilde data)

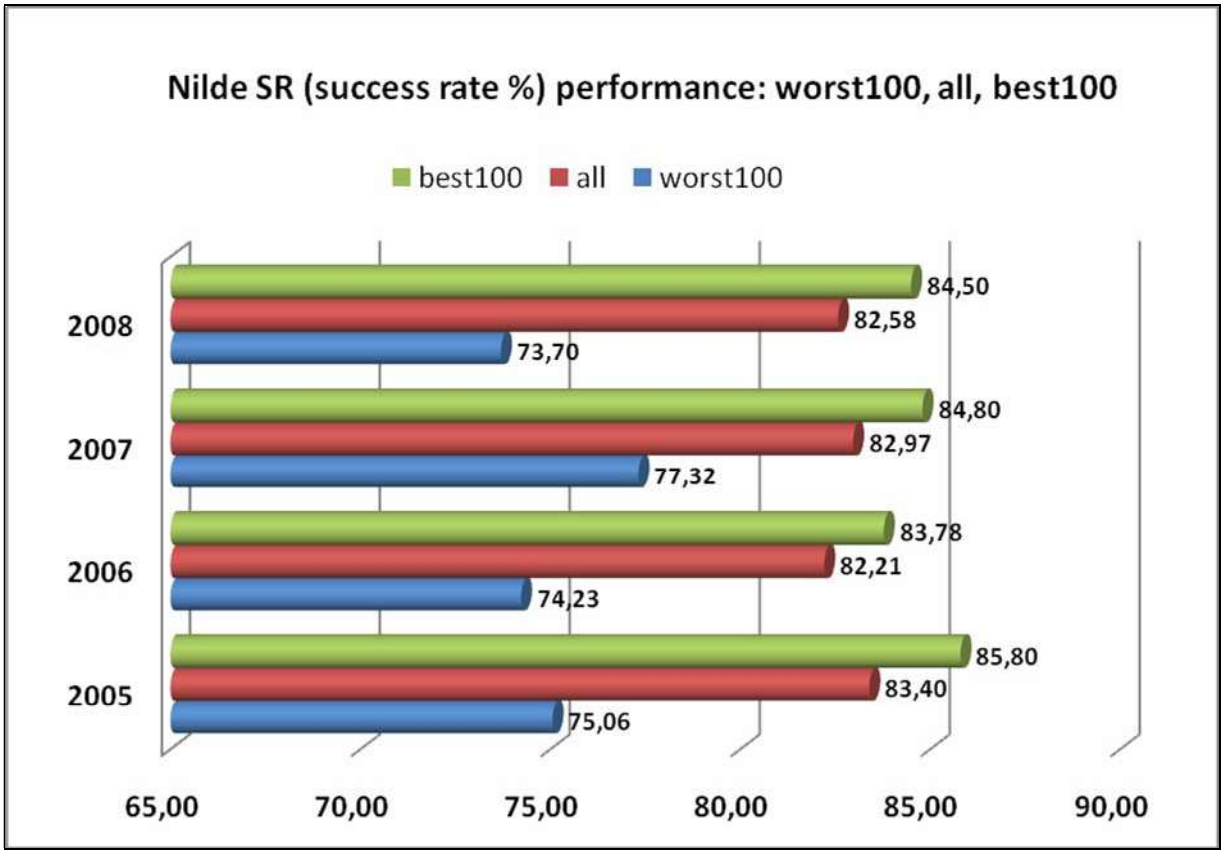


Figure 6: Evolution of the average SR. All, worst100 e best100, years 2005-2008. (Elaboration on Nilde data)

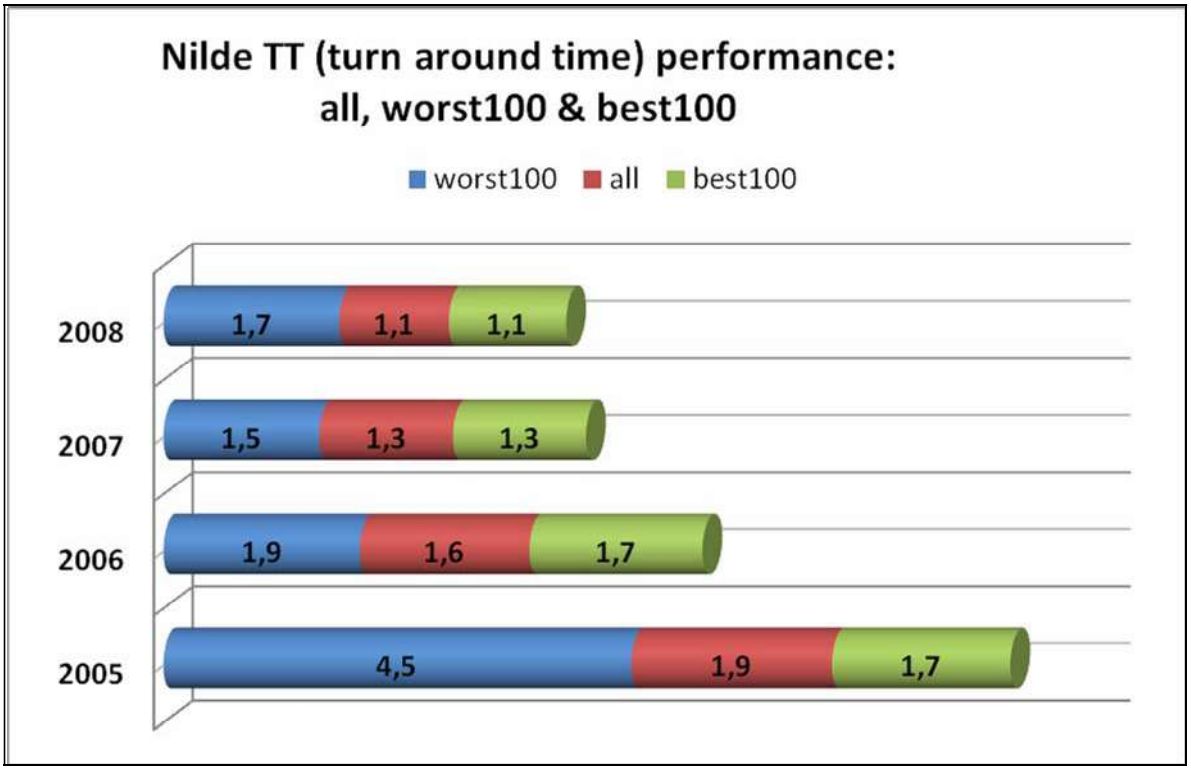
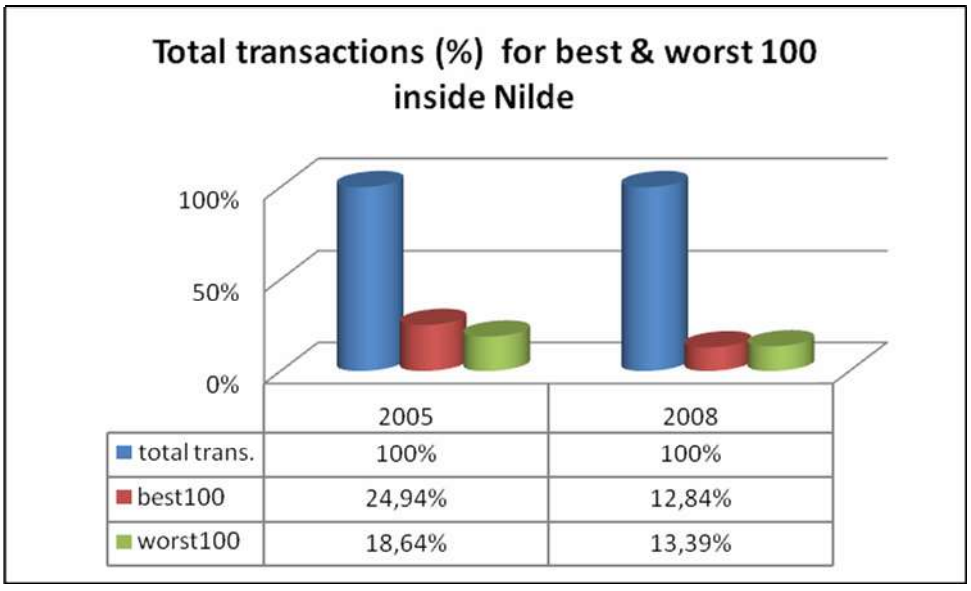


Figure 7: Evolution of the TT average. All, worst100 e best100, years 2005-2008. (Elaboration on Nilde data).



	2005	2008
total trans.	100%	100%
best100	24,94%	12,84%
worst100	18,64%	13,39%

Figure 8: Percentage of the total Nilde ILL transactions, for best100 and worst100, years 2005 and 2008.[1]

[1] For homogeneity with the other data we have excluded by the calculation the libraries with L(lending)=0 or B(borrowing)=0.

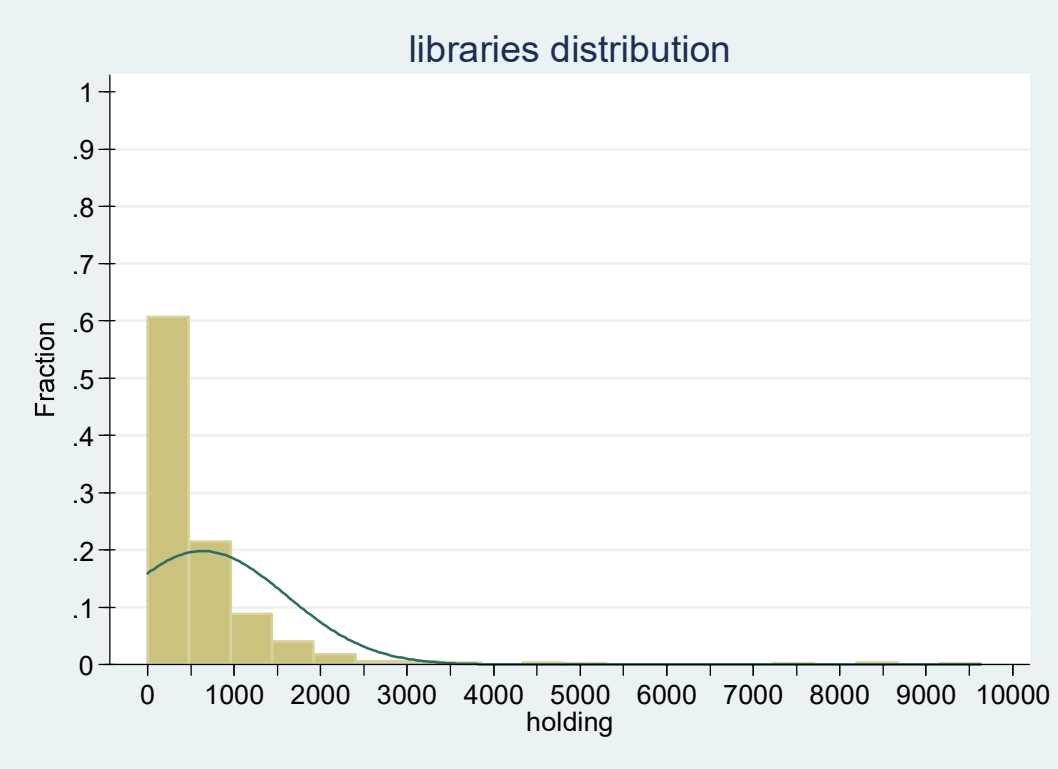


Figure 9: Nilde's libraries distribution (in percentage) based on their journals holdings, year 2008.

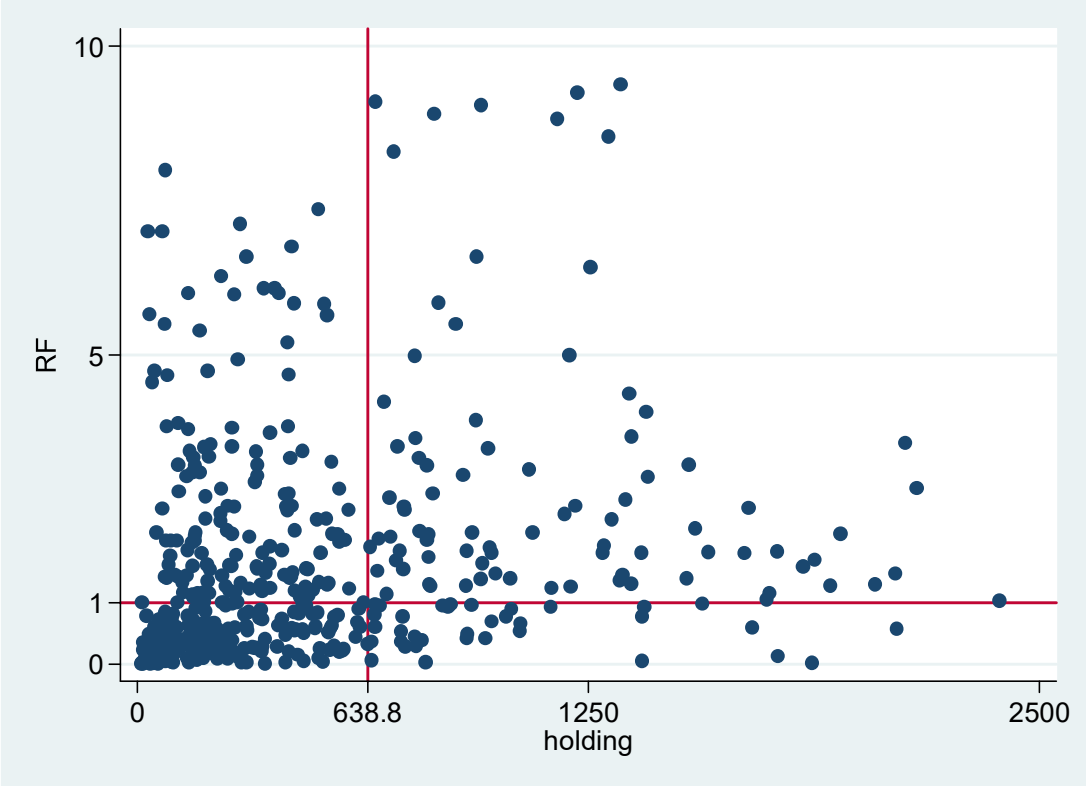


Figure 10: Nilde libraries dispersion, based on RF and holdings, year 2008.

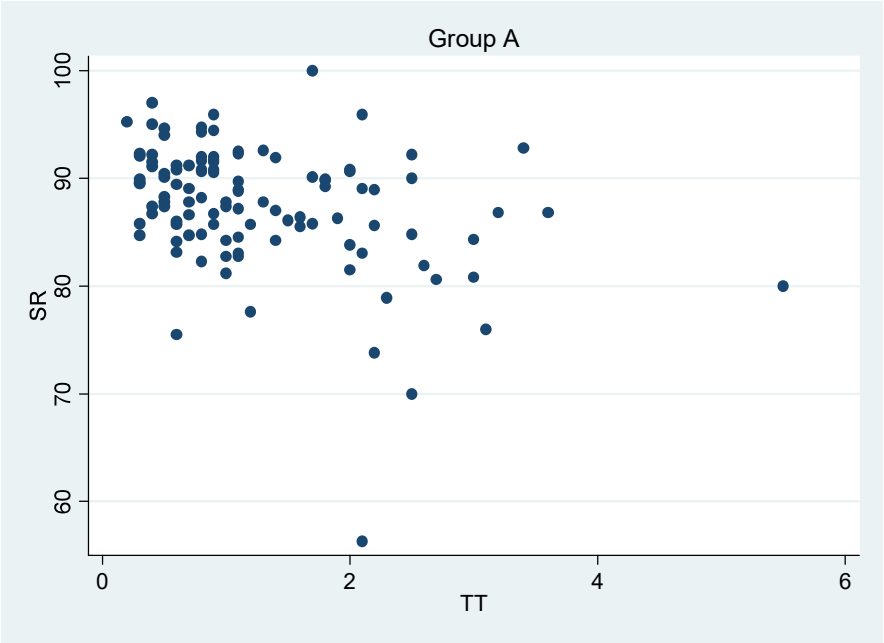


Figure 11: Characterization of libraries belonging to group A, with high RF and high holdings

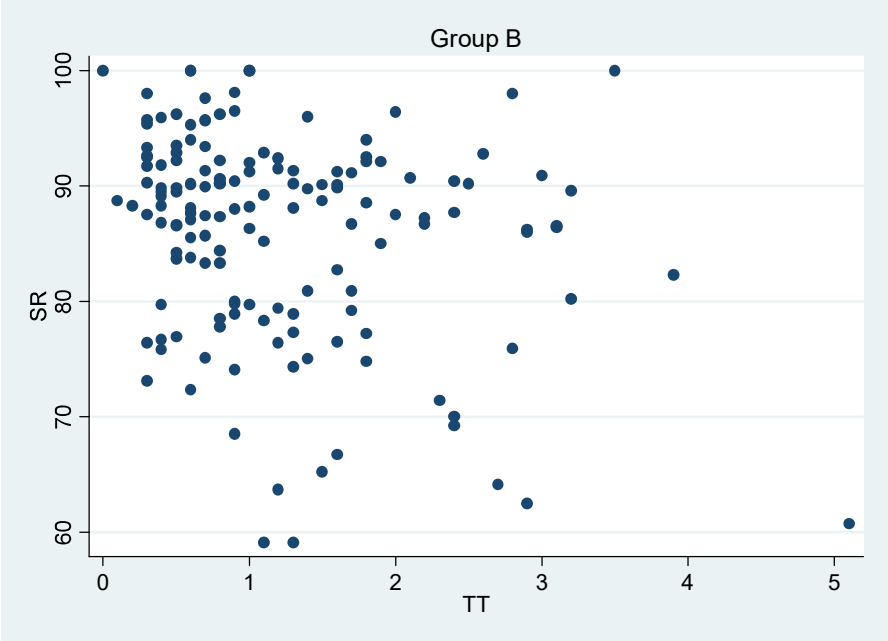


Figure 12: Characterization of libraries belonging to group B, with high RF and low holdings

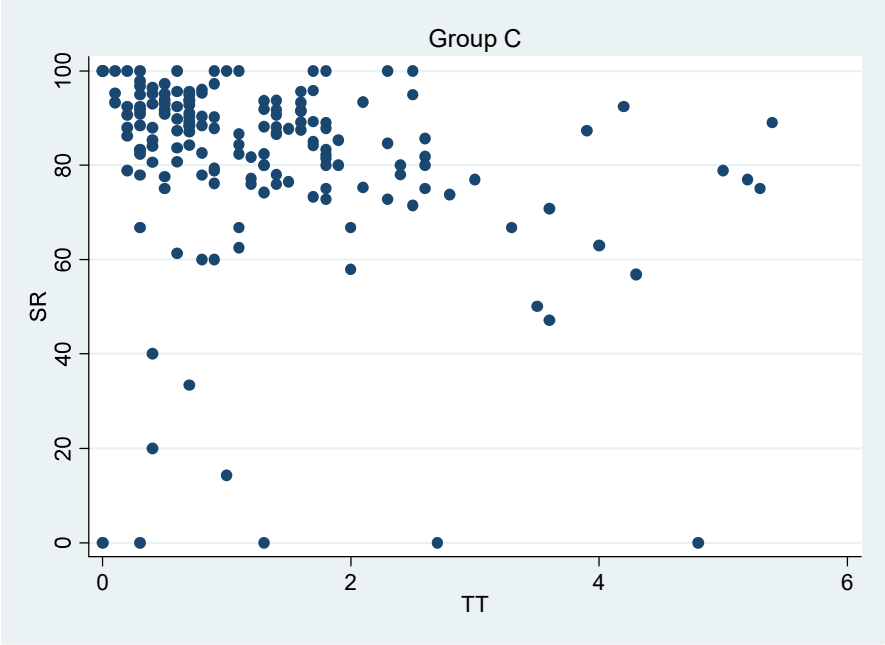


Figure 13: Characterization of libraries belonging to group C, with low RF and low holdings

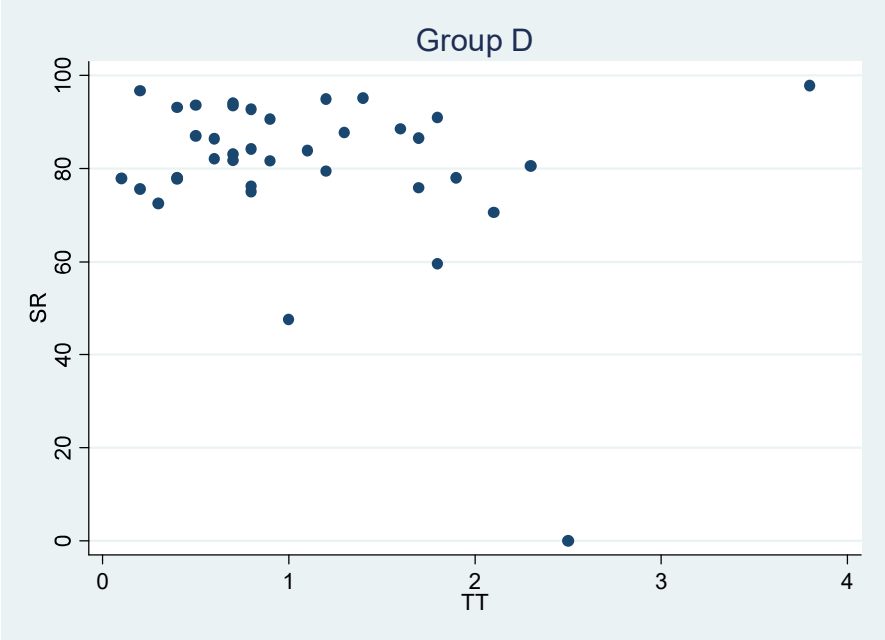
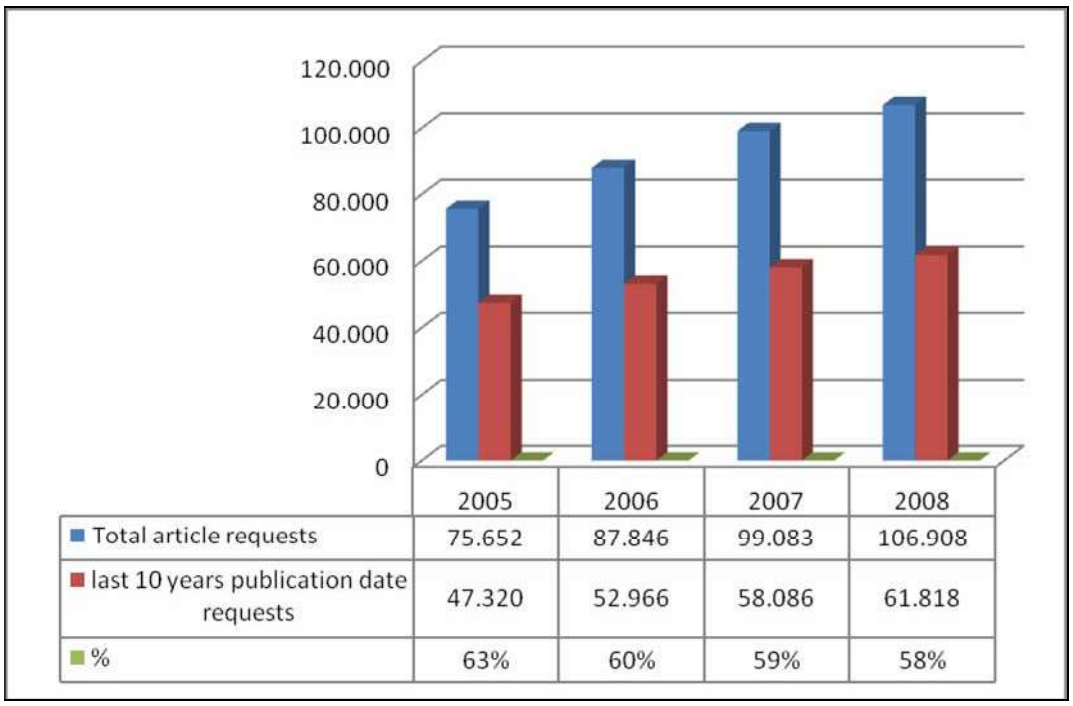
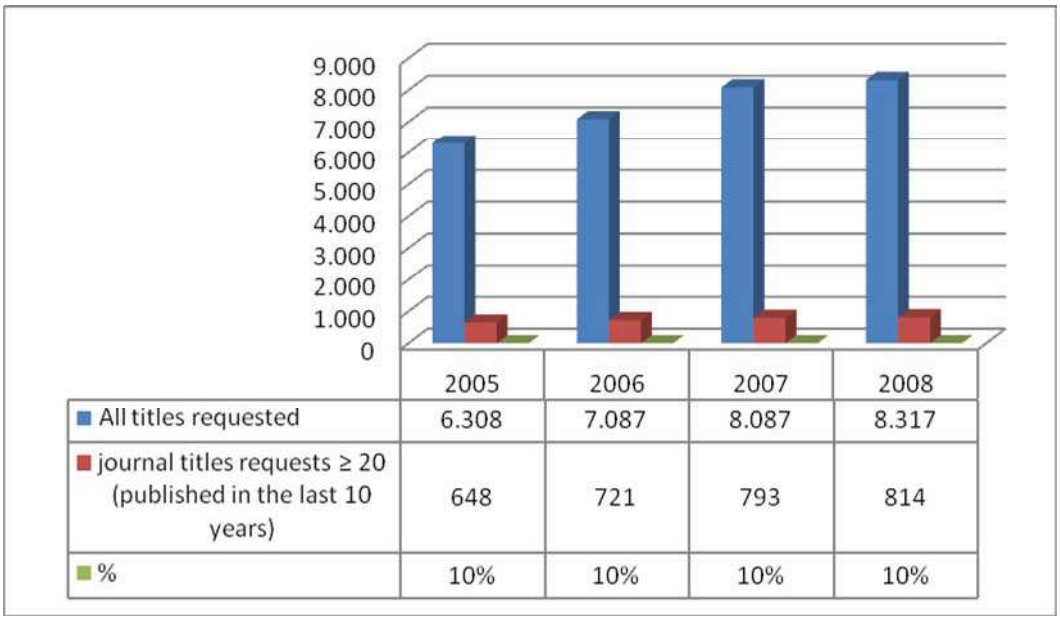


Figure 14: Characterization of libraries belonging to group D, with low RF and high holdings



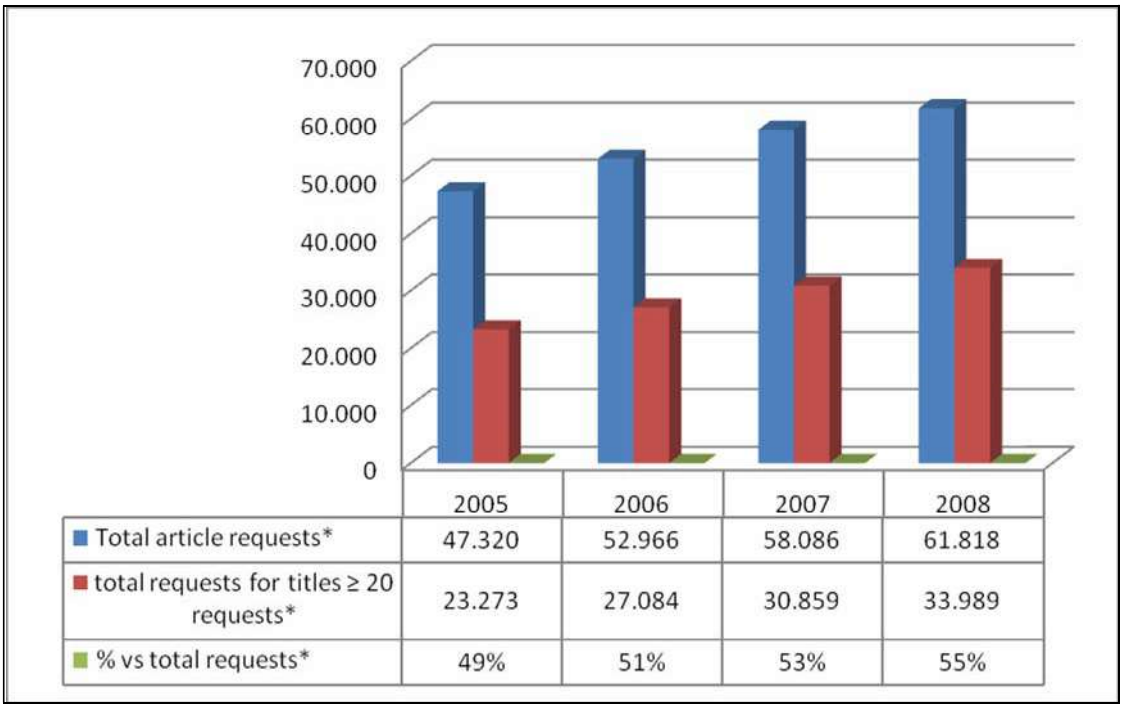
	2005	2006	2007	2008
Total article requests	75.652	87.846	99.083	106.908
last 10 years publication date requests	47.320	52.966	58.086	61.818
%	63%	60%	59%	58%

Figure 15: Percentage of last 10 years publication requests vs total requests.



	2005	2006	2007	2008
All titles requested	6.308	7.087	8.087	8.317
journal titles requests ≥ 20 (published in the last 10 years)	648	721	793	814
%	10%	10%	10%	10%

Figure 16: Titles requested more than 20 times per year amount for 10% of the total titles.



	2005	2006	2007	2008
Total article requests*	47.320	52.966	58.086	61.818
total requests for titles ≥ 20 requests*	23.273	27.084	30.859	33.989
% vs total requests*	49%	51%	53%	55%

Figure 17. Titles requested more than 20 times per year amount for 50% of total article requests.
*Only articles published in the last 10 years.

Serial title	2005*	2006*	2007*	2008*	Media**	Standard deviation***	ISSN §	IF 2008 §	Publisher (2008 data) §
ANNALS OF THE NEW YORK ACADEMY OF SCIENCES	294	434	345	150	306	119	0077-8923	2,303	BLACKWELL PUBLISHING
ANTICANCER RESEARCH	177	177	232	216	201	28	0250-7005	1,390	INT INST ANTICANCER RESEARCH
CURRENT MEDICINAL CHEMISTRY	103	107	171	239	155	64	0929-8673	4,823	BENTHAM SCIENCE PUBL LTD
CURRENT PHARMACEUTICAL DESIGN	109	135	153	184	145	32	1381-6128	4,399	BENTHAM SCIENCE PUBL LTD
JOURNAL OF NEUROSURGERY : OFFICIAL JOURNAL OF THE CONGRESS OF NEUROLOGICAL SURGEONS	98	105	122	191	129	43	0022-3085	2,124	AMER ASSOC NEUROLOGICAL SURGEONS
HEPATO-GASTROENTEROLOGY	135	112	117	149	128	17	0172-6390	0,680	H G E UPDATE MEDICAL PUBLISHING S
ONCOGENE	164	104	101	136	126	30	0950-9232	7,216	NATURE PUBLISHING GROUP
ADVANCES IN EXPERIMENTAL MEDICINE AND BIOLOGY	99	127	104	150	120	23	0065-2598	NO IF	SPRINGER
METHODS IN MOLECULAR BIOLOGY (CLIFTON, N.J.)	79	107	150	136	118	32	1064-3745	NO IF	HUMANA PRESS
JOURNAL OF PEDIATRIC ENDOCRINOLOGY AND METABOLISM : JPEM	126	83	135	119	116	23	0334-018X	0,938	FREUND PUBLISHING HOUSE LTD
JOURNAL OF FOOD PROTECTION	95	106	112	122	109	11	0362-028X	1,763	INT ASSOC FOOD PROTECTION
THE BRITISH JOURNAL OF CANCER	130	100	86	114	108	19	0007-0920	4,486	NATURE PUBLISHING GROUP
NEUROLOGY	97	103	85	144	107	26	0028-3878	7,043	LIPPINCOTT WILLIAMS & WILKINS
EXPERT OPINION ON PHARMACOTHERAPY	32	80	122	181	104	63	1465-6566	2,077	INFORMA HEALTHCARE
JOURNAL OF CLINICAL ONCOLOGY: OFFICIAL JOURNAL OF THE AMERICAN SOCIETY OF CLINICAL ONCOLOGY	83	93	80	144	100	30	0732-183X	17,157	AMER SOC CLINICAL ONCOLOGY
THYROID (NEW YORK, N.Y.)	78	107	101	104	98	13	1050-7256	3,000	MARY ANN LIEBERT INC
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	56	81	98	150	96	40	0027-8424	9,380	NATL ACAD SCIENCES
JOURNAL OF ENDOCRINOLOGICAL INVESTIGATION	71	92	110	109	96	18	0391-4097	1,888	EDITRICE KURTIS S R L
THE JOURNAL OF RHEUMATOLOGY	70	90	107	109	94	18	0315-162X	3,282	J RHEUMATOL PUBL CO
DRUGS (ABINGDON, ENGLAND)	54	76	117	123	93	33	0012-6667	4,128	ADIS INT LTD

Table 9: Top 20 title among core journals. *Requests of articles published in the last 10 years ; ** media requests 2005-2008; *** standard deviation requests 2005-2008. § Data from Journal of Citation Reports 2008 (July 06 2009) [Thomson Reuters]