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Reference Management Software
as Digital Libraries:
a survey at the University of Torino

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[ABSTRACT]

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Reference Management Software are used by researchers in academics to manage the bibliographic citations they encounter in their research. With these tools, scholars keep track of the scientific literature they read, and to facilitate the editing of the scientific papers they write. Several different software packages exist, with sometimes different features and purposes.

This study presents the results of a descriptive qualitative survey performed at the University of Torino, Italy. The aims of the survey were to observe how much these softwares are used by the scientific community, to see which softwares are most known and used, and to understand the reasons and the approaches behind their usage. An online questionnaire was sent to the professors and researchers belonging to the STM departments, and direct interviews were performed. The data collected were analysed through a constant comparative analysis, and the following categories were drawn: a basic practical approach to the instrument, the heavy impact of the time factor, the force of habit in scholars, economic issues, the importance of training and literacy, and the role that the library can have in this stage. Describing the present situation, the study gives final directions to the libraries to better perform effective tasks about the matter.

The qualitative study presented here is the first descriptive survey of the actual distribution and usage of Reference Management Software in a large university. This picture can give an important glance to Reference Management Software as one of the elements in the academic digital libraries.

Keywords: *Reference Management Software; Citation Management; Academic Libraries; User studies*

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List of abbreviations

- API: Application Programming Interface

- OCR: Optical character recognition

- HSS: Humanities and Social Sciences

- JISC: Joint Information Systems Committee

- MMR: Mixed Methods Research

- OKF: Open Knowledge Foundation

- PIM: Personal Information Manager

- RMS: Reference Management Software

- STM: Science, Technology and Medicine

- UniTo: Università degli Studi di Torino, University of Torino

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> *"Golden friend, and dearest brother,*
> *Come together from our roamings*
> *O'er this cold and cruel country,*
> *O'er the poor soil of the Northland"*
> *(Kalevala)*
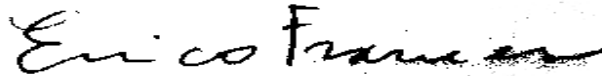
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Signed:

Enrico Francese

Date:

20/06/2012

1. Background

1.1.   The practice of reference management in digital libraries

In the symposium of 2000 John Unsworth makes a list of what he calls "scholarly primitives", meaning a set of methods that researchers have in common: "Discovering, annotating, comparing, referring, sampling, illustrating, representing" (Unsworth, 2000). These basic tasks are the core of every research process. Each of these steps is very precisely documented by the researchers in their papers through the practice of citation and bibliography management. The practice of bibliography is the spine of a scientific research work. This is confirmed by the authors of the 2009 OCLC Report "Scholarly Information Practices in the Online Environment": "Scholars depend on bibliographic references found in scholarly books, journal papers and Web sites to identify items to consult or read. This practice of backward chaining, or footnote chasing, has been confirmed as a distinct and prominent searching technique used across scholarly groups" (Palmer, Teffeau, & Pirmann, 2009).

In scientific research and production, the practice of "backward chaining" bibliographic references lays at the very core. Every librarian should see itself in the first line to provide support in this.

How does this fundamental activity take place in a digital library?

If we consider the digital library as a "component of communities in which individuals and groups interact with each other, using data, information and knowledge resources and systems" (Borgman, 1999) we see how the practice of reference management fits. But the second side of the workflow gains importance: the reuse of data for creating new knowledge.

The documents retrieved in the library are put into new research products; the references obtained from the databases and the other tools provided by the libraries become cited in a new piece of science. This seems to achieve the model proposed by

Atkinson in 1996: "the library does not simply respond to the need for core material (objects at the front of the content-value continuum) but also actually creates core material by boosting its accessibility" (Atkinson, 1996). In a digital networked environment, the library is not just a manager of contents and collections, but also a provider of new contents. The library user, especially if we think of scholars in academic environment, is not just a consumer of content, but a creator.

Lorcan Dempsey goes further, writing about "personal reference collections as digital libraries" (Dempsey, 2008): in a networked digital world a collection of references is not just a static list, but also a rich and useful set of data which could be connected "back into a library service for fulfilment, or indeed into other services". This core of references, and the connections arising from them, is a digital library itself.

In conclusion, then, the scientific citation management must be present in the agenda of an academic digital library.

1.2. Reference Management Software

If we look at it after Atkinson's insights, the citation doesn't end its path on the desk of the user, but it leads to new documents and new citations. This whole upgraded, seamless and more complete iter of the citation - form the storage to the reuse - can be managed by dedicated software tools.

These software packages are known with different names: 'personal bibliographic softwares' (East, 2003), 'Bibliographic Citation Management Software' (Cibbarelli, 1995), 'Bibliographic management softwares' (Fitzgibbons & Meert, 2010), but also 'Reference Management software', 'Citation managers', 'Bibliographic softwares' are used (see JISC & Open University, 2010).

The Encyclopedia of Library and Information Science (Schoonbaert & Rosenberg, 2010) has just one entry for "Personal Bibliographic System", but in the introduction it is stated that "various partially overlapping terminologies may be encountered".

Dell'Orso (2010) argues about the most proper choice of words, starting with some

exclusions. For example he claims that Personal Information Managers (PIM) "is rather another category of products on its own". Then he proceeds recalling the history of this type of softwares: "'Bibliography formatting software' is the name that has been used for a long time: it was familiar to users, it emphasizes one important feature that of formatting the output. Formatting citations for the output was the most preminent characteristic at the beginning of their 'history', it is still an outstanding one and it represents the core of the manuscript formatting procedure". In the end, he concludes making the point on the present days, and the complexity of the features presented and integrated: "Given the technical evolution of this family of software, pointing to a general 'management' capability and not just to the 'formatting' one, now it seems to me to be more appropriate to call it 'bibliography management software'" (Dell'Orso, 2010).

For the sake of consistency, I will choose through all this study the term "Reference Management Software" (from now on shortened in RMS) as adopted by the Telstar project (JISC & Open University, 2010) and as used by the main Wikipedia entries on the subject.[1]

Telstar (Technology Enhanced Learning supporting STudents to achieve Academic Rigour) was a project funded by JISC and OKF from 3 November 2008 to 26 February 2010; the project website titles "Integrating References and Citations into Learning Environments". Among the aims of the project we read: "model more effective bibliographic resource management for the institution and the broader e-learning communities which can ensure efficient, timely and more flexible distribution of these resources" and "investigate the impact on changing practice for managing bibliographic referencing within e-learning".

According to Telstar's definition, a Reference Management Software "enables an author to build a library of references by entering the details of each reference in a structured format. They usually support mechanisms for organizing sets of references by tagging or use of 'folders', and will generate references, citations or bibliographies in a range of referencing styles. Most packages support ways of importing records

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[1] see the entry at http://en.wikipedia.org/wiki/Reference_management_software and the related Talk page

from library catalogues and other bibliographic data sources in order to facilitate the generation of references. In addition, many packages offer plug-ins or add-ons for Word processing software which enable authors to insert references from their 'library' directly into a document as they are writing" (JISC & Open University, 2010).

To summarize, RMS have two main functions:

1. building a database of citations, useful for keeping track of and organize the documents useful for one's research

2. formatting bibliographies and citations when writing papers

Today's packages offer more sophisticated functionalities, and their basic functions are extended through advanced features which vary form software to software. Some of them allow to manage the actual full-text document together with the reference (e.g. PDF files), often including ways for annotation. Most of them take the best of the web environment providing APIs which allow integration with other softwares or other virtual environments, sharing and enriching the data, collecting them from different sources.

The most prominent feature relates to the very nature of a "global information infrastructure" (Borgman, 2003) as a place of continuous and seamless interaction and integration: from one document we can hop to another, following a never-ending trail of links. Technologies like cross-ref or open-url resolvers are deeply rooted in the habit of scholars, who are used to move in the bibliographic universe like in a hypertextual space.

In the case of bibliographic management, it happens that when we find a reference, on a journal's web page, or in a database, the system allows to save or export the citation; the same works in the opposite way: from the citations stored in our database, we jump to reach the relative article, or document. But this "backward chaining" practice can be seen also in the opposite direction, as "forward chaining", or "loop". Instead of reading it from the general literature to the single paper, we can see how citations spread from the single paper back to the docuverse: citations can be shared, discussed, commented, suggested within members of the same scientific community.

As technology allows seamless transmission of documents from the web to the desktop, it allows in the same way cooperation between users. In this way a RMS can also become a virtual research environment, or a platform for a collaboratory (Bos et al., 2007; Voss & Procter, 2009) Recent products inherit the features already adopted in virtual web collaboration networks, such as academic social bookmarking (Alhoori & Furuta, 2011; Fourie, 2011; Thomas, 2011).

1.3. Motivation

Since 2005 I work in the Digital Library of the University of Torino, Italy. My activities consist in implementing a set of digital services for the members of the university, from students to faculties; my main area of expertise is the catalog, as a tool for discovery and research of the bibliographic references. But looking at the activity of the university members, I often wonder how this information is not only found, but also collected, managed and reused. When in 2008 I found out about the Reference Management Software tools I saw it as an extremely interesting opportunity for the scholars in their everyday activity, and I have been exploring these instruments since then. I believe that an academic digital librarian must be aware of this practice within its community.

When I was studying at the Tallinn University for the second semester of the DILL program, I decided to make a first attempt to study the usage of the RMS among the estonian faculties. The result was a short survey which was later presented at the IC-ININFO conference 2011 in Kos, Greece (Francese, 2012).

The present research moves from that previous study, taking advantage of that experience and stepping from the same methodological approach to a deeper and more focused inquiry.

1.4. Research questions

Thinking about the role of the RMS in a large academic institution like the one described above, two questions naturally come to mind:

1) what level of awareness about RMS exists in the members of the University of Torino?

2) what are the major trends in the usage of the RMS among the scholars?

This whole study moves directly from these two questions.

1.5. Aims and Objectives

The aims of the study are:

- to explore and understand the measurements about the actual awareness and usage of RMS

- to understand the context in which scholars operate when dealing with citations and literature management

- to provide evidence-based information upon which libraries can base their strategies about services, assistance, training

To achieve these aims, the followings objectives are set:

- to verify how much users are informed about the potentials of RMS

- to verify whether RMS are used or not, and to what extent

- to establish which softwares are the most known and the most used

- to consider and understand the users' behaviour in dealing with citations

- to ask the scholars about the reasons which influence their use

1.6. The stage of the research: the University of Torino

The University of Torino - Università degli Studi di Torino, from now on shortened in UniTo - is one of the largest public universities in Italy.[2]

It was founded in 1404. Among the famous figures who studied here we found

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2   The data exposed in this section are taken from the University's Programming Plan 2007-2012, and are updated at the academic year 2010-2011. See: http://www.unito.it

Erasmus von Rotterdam, Cesare Lombroso, Umberto Eco and the nobel prizes Rita Levi Montalcini and Renato Dulbecco. Due to historical reasons, the university doesn't have a campus, but its facilities – offices, libraries, departments, hospitals – are distributed through all the municipal territory.

Its population counts ~70.000 students and ~2000 faculties (teachers and researchers). It ranks on the seventh place for number of professors among the italian universities. The average age of professors is 60, researchers is 44. Administration and technical personnel counts 2000 persons.

Since 2011, following the reform of the Italian university system[3], its organization is undergoing a large redistribution. Today it counts 55 departments, but at the time of this study they are being merged and modified, so it is impossible to provide a clear description at this stage.

The libraries are 55; they act as support scientific facilities for departments and faculties, from which they depend. As for the departments, a reorganization is ongoing. In 2002 a Library System Organization was born, aiming to coordinate the services and activities of the academic libraries. From 2010 the Library System is part of the Division for Libraries, Archives and Museums of the University. A central office named Digital Library Staff directs and coordinates all the activities related to digital services and collections, partaking in the organization of training and communication events and in the collection development.

EndNote at UniTO

UniTo is not new to RMS. In January 2008 the University, after solicitations by a group of professors, purchased 347 licenses for the software EndNote X1 (Staff Programmazione Servizi Bibliografici Digitali, 2008). To distribuite the copies of the software, a letter of announcement was sent, asking the faculties to state their interest about the software. A small amount of licenses was reserved for the libraries and the technical staff in charge of promotion and training. Then a list of candidates was

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3   Legge 30 dicembre 2010, n. 240. See: http://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2010-12-30;240!vig=

created.

The software was then distributed according to the interest showed by faculties. The largest group of was constituted by the Biomedical Faculties (40%) followed by scientific areas (18%). All other disciplinary fields have been covered by less than 10%.

The central staff in charge for the library services management (Staff SBD, Digital Bibliographic Services) offered training sessions on the software; the courses gained a moderate participation (1/3 of the people involved in the distribution opted for a training session).

At the end of the year, a questionnaire was sent to verify the level of usage and satisfaction about the software; the results seemed quite positive, since 2/3 of the respondents declared to be satisfied with the software and suggested the purchase of more licenses.

The distribution of the remaining copies kept on for the following years. In 2010 the licenses were not renewed due to two reasons: the lack of money and the technical difficulties posed by the new versions of the softwares (lack of compatibility with older operating systems, difficulties in upgrade, bugs, etc.).

This experience, promoted and carried on by the institution's official organs, is an important background to be considered in the study.

2. Literature Review

To prepare the ground for a survey about Reference Manager Software at university level, I consulted all the literature about RMS and citation management in academics. I started from some of the main bibliographic databases specialized in library and information science: LISA (Library and Information Science Abstracts), and the Library Science journals published by Emerald. I performed several searches using keywords such as Reference Management Software, Citation Management, Bibliographic Management; sometimes it was useful to use the name of software products: EndNote, Zotero, Mendeley, RefWorks. I extended the research to more generic search tools like Google Scholar, Isi Web of Knowledge and the Mendeley Database. The database search brought up around 30 articles; simple promotional documents or tutorial guides were not considered.

From the retrieved articles I performed a "backward chaining", consulting the relevant papers cited in each bibliography. This brought the most interesting discoveries, because the literature cites plenty of papers who did not show up in the database searches.

With this method I collected around 80 references. The present review of the literature specifically dedicated to RMS aims to be as complete as possible. Tangent topics like users behaviour, e-science or bibliometrics are barely touched just to identify the relationship with the main topic of this study, without any ambition of completion.

Literature about RMS focuses mostly on two main themes: on one side we find description, comparison and technical analysis of the features offered by the software packages; on the other we find papers about library initiatives of training and promotion. These two main threads are confirmed by Martin (2009) and McMinn (2011). Since RMS are practical tools used in a real-case contexts, it is worth to look at them from the perspective of the users' behaviours and their relationship with other

digital research tools. Finally, being this research about the usage of RMS, previous similar studies are reviewed.

Given this, the present review will be divided into these five areas.

2.1. Technical aspects

The simple technical analysis of the products is very common. A good overlook on the available softwares is the Wikipedia entry "Comparison of reference management software" (n.d.) which is a complete and up-to date list. Specific comparative studies of features were performed by (Dell'Orso, 2010; Gilmour & Cobus-Kuo, 2011; Zhang, 2012). The column "Internet Resources" of the Public Services Quarterly 6, 2010 (Cooke, 2010) offers a range of short reviews of different packages: Mendeley (Medaille, 2010), Zotero (Arellano, 2010), EndNote (Reichardt, 2010a), CiteULike (McMullen, 2010), RefWorks (Reichardt, 2010b).The same approach is provided by Butros and Taylor (Butros & Taylor, 2010) and Hensley & Kern (Hensley & Kern, 2011). Beside these articles we also find several papers focusing on single packages (Francese, 2011; Reiswig, 2010). This is not surprising for new softwares appearing on the market: attention and analysis of the novelty is normal, and new articles are to be expected as long as old softwares develop into new products.

Apart from the scientific articles like the ones just mentioned, description about the general features of the softwares and comparisons are very common as tutorial resources on the internet, often as learning materials available on platform such as Slideshare or YouTube.

A less practical approach is taken by Nagelschmidth, who draws the functionalities necessary in "an idealized reference management program" (Nagelschmidt, 2010). More general issues about this type of softwares and their potentials were discussed in two conferences organized by JISC and Open Knowledge Foundation in 2010, in the context of the Telstar project ("Innovations in Reference Management 1," 2010, "Innovations in Reference Management 2," 2010).

An important look is given to the reliability of these tools, especially when compared

to other bibliographic databases or when they are mistakenly considered as a "magic wand" able to automatically solve every problem. The article by Fitzgibbons & Meert, 2010, is a critical analysis of this problem. Van Ullen and Kessler (Van Ullen & Kessler, 2005) point at the role of libraries, and reference librarians in particulars, in providing information and support on managing bibliographies and citations. Their focus on the less-expert scholars (undergraduate students) brings her to state that a cautious approach must be used when suggesting and promoting the use of RMS tools, since they are not easy and require some expertise in citation management. Steele (2008) focuses on the accuracy of the use of citations in research papers, providing useful hints for those who have to make decision about adoption of these softwares.

2.2. Virtual collaboration

Another extremely interesting trend that is slowly gaining space in the literature is the connection between the personal citation management, its opening to the virtual collaboration and its impact on scientometrics. For example, Li, Thelwall and Giustini investigate the connection between the impact of scientific articles, as measured by Web of Science, and the practice of citation management with softwares like CiteULike and Mendeley (Li, Thelwall, & Giustini, 2011). This type of study is interesting because it unites personal Reference Management with a wide range of topics such as scientometrics (Moed, 2005), webometrics (Cronin, 2001), alternative metrics (Priem, Taraborelli, Groth, & Neylon, 2010), which are becoming more and more crucial in today's scientific publishing world. But the scope of the present research is too narrow to take all of this into consideration.

In a more general perspective which considers a wide range of digital tools useful to support the scholar's activity, in their article about the approach to digital libraries by researchers, Hull, Pettifer and Kell consider RMS as instruments that could enhance both personalization, social networking and collaboration, integration and accessibility (Hull, Pettifer, & Kell, 2008).

A first look at the correlation between reference managers and social bookmarking tools is given by Giglia (2010). The possibilities of social networking offered to the

researchers by new technologies in the Web 2.0 are mentioned by (Damani & Fulton, 2010; Fourie, 2011).

Giglia (2011) writes a good overview of the social networking solutions specifically addressed to the academics, such as ResearchGate, Academia.edu, and Mendeley. She points out both the novelty and the potentials of such solutions: "some social networks have been created and tailored to scientists' needs, in order to make them find researchers with similar interests or expertise, to keep in touch with their peers, to share their information. When the social network encompasses the Open Access logics, it allows you also to search, access and disseminate your scientific work" (Giglia, 2011). A similar analysis on the same topic is made by (Hane, 2011).

2.3. Researchers's behaviour

A study of RMS cannot ignore the researchers' habits and behaviour. Therefore citation management is often considered in the perspective of the whole scholar's research process (Niu et al., 2010; Ollé & Borrego, 2010), often compared to other digital tools. Haglund and Olsson find dramatic evidences among Swedish researchers: "Their searches seem simple, aimless, and unstructured, they do not read manuals, and they seldom use the alternative for advanced search". According to their study, there is no deep knowledge of the up-to-date digital tools that could enhance research and information management. Even if the library is perceived as a potential source of help, it is disconnected from the user's perspective: "Researchers take access to information for granted, but in this study the lack of an active and working relationship with the library is obvious. The researchers understand that it is the responsibility of libraries to organize access to information, but it is not something they reflect on. Neither is it something that generates contact with the libraries with questions concerning provision of information. The researchers visit the physical library more or less frequently, but often prefer to manage on their own. They seldom contact the library by phone, but e-mail is sometimes used. They do not consider contacting the library as the obvious thing to do neither do they even perceive it as something that would be easy" (Haglund & Olsson, 2008).

A similar lack of awareness is shown by Ollé & Borrego: according to their research at Catalan Universities, information management "is an area that poses problems for researchers; they themselves described their techniques as 'primitive' or 'rudimentary'. There were three main groups: (a) those who continued to use the traditional method of folders (now electronic folders); (b) those who used some kind of bibliographic management software; and (c) those who used no information management system at all" (Ollé & Borrego, 2010). Nevertheless, the researchers belonging to (b) were about 25% of their sample.

Finally, in their survey conducted in 5 american universities, Niu et al. (2010) find that half of the researchers maintain a personal bibliographic database. Their usage can be related to the marketing and support activities provided by their institutions, but they admit that "information-seeking and information-handling habits of researchers are very personal" and inconsistent behaviours can emerge. Their conclusion reveals a very interesting issue: "Another notable trend is that novel forms of scholarly communication such as collaborative information sharing technology are evolving gradually. This may be the beginning of a more significant transformative change, particularly in sharing information within laboratories or groups or among multisite collaborations" (Niu et al., 2010). In these collaboratories they find the presence of online sharing bibliographic databases and annotations.

The common point raised by these three studies, is that the usage of specific reference management tools is scarce and inconsistent.

Childress considers the RMS in a practical perspective, studying them within the researchers' needs and workflows, and reflects about the supporting role that libraries can have (Childress, 2011). His article offers a wide look at the whole problem, considering both the user's behaviour and the library functions, bridging the topics examined above with the second main trend found in the literature.

2.4. Role of libraries

This second trend consists in few interesting informations given about training initiatives that involved library staff (East, 2001; Siegler & Simboli, 2002). These

articles are interesting for the library professionals because they suggest the active role that libraries can take about this subject. East (2001) confirms the abundance of literature about software packages compared to the surprising lack of attention given to the role of libraries (in his case, university libraries) in providing support to scholars. According to East, the "well established role of the library in training researchers in searching electronic databases and downloading retrieved references", leads to the involvement in this matter. East points out that "in many institutions the library has come to be seen as the main centre of expertise in matters related to personal bibliographic softwares"; nevertheless, while librarians are experts in retrieving information online and have a skilled knowledge of databases, they seldom use RMS tools, so they can not be considered experts in the field: some effort must be put by them in self-training.

According to East, the big effort in support and training given by his institution would be a key strategy for the future, and it will require big investment in staff resources: "the role of the academic librarian in general is evolving into a much broader function, particularly as regards the new and emerging information technologies [...] Support for new technologies requires considerable investment in staff development and substantial expenditure of staff resources" (East, 2001).

The role of libraries is also confirmed by Crowley and Spencer: "Libraries also need to make their [i.e. the researchers'] research management and collaboration tools such as EndNote, EndNote Web, Zotero and RefWorks easily available, and ensure that all search interfaces incorporate a straightforward citation export function" (Crowley & Spencer, 2011).

McMinn (2011) also stresses the importance of library role. He performed a survey about the usage and the distribution of RMS starting from the library support and training activities; hence he questioned the libraries rather than addressing directly the users. His findings related to ARL libraries show a good commitment by library institutions in promoting, licensing and providing training on RMS: "there are significant levels of support for bibliographic management tools in major academic libraries as determined by the number of libraries providing licensing, the level of

instruction, and the creation of instructional materials and tutorials" (McMinn, 2011).

Collected objective data about the distribution and the variety of approaches to the tool will be the first step to understand the actual impact of RMS in scholars' behaviour. McMinn explains quite convincingly the importance of such an inquiry: "There are a number of reasons why it is important to examine the different approaches research libraries take in providing similar services: ensuring that the services provided are consistent with those of peer institutions; determining how services have been tailored to meet the unique needs of different institutions; determining the level of support and optimum allocation of resources" (McMinn, 2011).

2.5. Usage studies

Despite these good studies and their noble intentions, a focused study about the connection between RMS and their popularity and usage from the users' point of view instead of the library's is still missing from the literature. For example, Van Ullen and Kessler (2005) provide data about how much information is provided by libraries, but don't give any clue about the reception of this by scholars.

A lot of effort is put in training and promotion, but few data are provided circa the actual use and distribution. Steele (2008) claims that "citation management softwares exist since 1980 and are widely used today", but doesn't provide any reference for that. The only survey about the usage of RMS seems to be the one made by Cibarelli in 1995 (Cibbarelli, 1995). She asked her respondents to rate different aspects of the softwares (such as available documentation, ease of use, reliability, etc.) on a scale from 0 to 10. The results seemed positive, setting the average rating around 8, and the comments provided by the respondents seems encouraging towards a stronger attention for the subject. Cibbarelli's findings must now be considered out of date, since 15 years are a big leap in software development. But still, her survey was addressed to the customers of the software companies: she questioned people who were already using such a tool, she did not calculate the level of popularity.

To fill this gap I attempted a survey at the Tallin University, Estonia, in 2011

(Francese, 2012). The survey showed that the usage of these tools is low and not supported by a proper knowledge: scholars seem to be not fully aware about the potentials and the features of the RMS. The university library, in charge of the acquisition and distribution of licenses of RefWorks, could not achieve a strong impact in reaching all its members, even though its role was very appreciated by those who received communications and training. From the Tallinn survey a shallow and generic awareness aroused, which suggested to get deeper into the actual needs of the researchers towards these instruments.

3. Software review

For this research, I decided to consider a selection of softwares, among the packages available on the market. A complete and updated list is given on the Wikipedia page "Comparison of reference management software"[4], which provides very detailed informations about each software.

A lot of these packages are open-source projects which lack consistency in the development, and are not updated or maintained at a sufficient level. For this reason I chose to focus on the 10 softwares which Wikipedia indicates as active and updated in 2011:

- EndNote
- EndNote Web
- BibDesk
- JabRef
- Zotero
- Papers
- Mendeley
- Bookends
- Citavi
- Qiqqa

EndNote Web is treated together with EndNote, since they can be considered as parts of the same product, even if they are licensed and sold separately.

However I chose to add few exceptions to this list, to include softwares which are well known or present in the literature:

- RefWorks

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4   http://en.wikipedia.org/wiki/Comparison_of_reference_management_software   (last   checked: may   20th,
    2012)

- CiteULike
- Connotea
- ProCite
- BibSonomy
- BibTeX
- Reference Manager

CiteULike, BibSonomy and Connotea are not RMS strictly speaking, but their role in the Social Bookmarking applied to the academic literature is remarkable (see for example Giglia, 2010; Hammond, Hannay, Lund, & Scott, 2005; Redden, 2010), so they deserve to be mentioned here.

BibTeX is also included here even if it's not a RMS per se, rather than just a module for the LaTeX editing environment; but its usage among the physicists and mathematicians is so widespread that it cannot stay out of this study.

Another special mention goes to the citation management features included in the word processor programs, like MS Words or LibreOffice Writer; a simple yet complete dedicated function embedded in the software allows the user to manage a list of citations when writing a paper, without the need of external applications. This feature is not considered as a software on its own, so it is not listed in the questionnaire.

Finally, this study does not take in consideration the web platforms for social science, such as Academia.edu[5] or Researchgate[6], Even if softwares like Mendeley or Zotero are strongly oriented to the e-science and online scholarly communities, I decided not to focus on online environments solely dedicated to that. The awareness and usage of these type of virtual environments, however, was slightly touched during the interviews.

The information presented here are taken from the softwares' websites, indicated in a footnote.

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5   http://academia.edu/

6   http://www.researchgate.net/

3.1.   *EndNote e EndNote Web, ProCite, Reference Manager*

EndNote[7] seems the best known instrument in the field, as it is always cited in the literature about RMS. It is produced by Thomson Reuters, the big business data provider company also owner of important scientific bibliographic tools such as ISI Web of Knowledge. Thomson Reuters produce two more RMS: ProCite[8], whose latest stable release is from 1999, and Reference Manager[9], whose latest version is from 2010. They both were born in 1984, thus being the oldest products now in circulation.

EndNote provides an extremely rich set of features and a huge list of citation styles which probably make it the most complete suite in the market (Zhang, 2012).

EndNote is available in two platforms: a full-featured stand-alone desktop program and an online-only version called EndNote Web. EndNote Web can be integrated with the desktop version, serving as sync base of the citations personal library, but it is also available independently and can be fully functional on its own.

Its flaws consist in the fact that its commercial nature and its expensive license suffered the apparition of reliable free tools such as Zotero and Mendeley. Also the lack of a multi-platform approach (it is not available for GNU/Linux systems) constitutes a serious limitations especially in those scientific communities used to open-source environments.

While EndNote is supported for Mac, ProCite and Reference Manager were both distributed for Windows only. The main difference with EndNote is that they integrate network features, like the possibility to publish online a database of references, and share it with different users.

3.2.   *Zotero*

Zotero[10] is a project of the Roy Rosenzweig Center for History and New Media of the George Mason University, VA, and is funded by the Andrew W. Mellon

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7   http://endnote.com/

8   http://www.procite.com/

9   http://refman.com

10   http://zotero.org

Foundation, the Institute of Museum and Library Services, and the Alfred P. Sloan Foundation.

Zotero is an extension for the popular web browser Mozilla Firefox. It brings all the features of a Reference Management Software into the browser environment. This approach leads the citation management to be strictly integrated in the web surfing: the citation research and discovery and the reference management are seamless in the scholar's experience. The software's interface lies completely within a frame in the browser, and a simple icon allows to import the citations with a single click from any kind of web content.

It was launched in 2006 as a free open-source software. Even if it was not the first free-of-cost citation manager to appear on the scene, Zotero quickly gained popularity as the free open-source alternative to EndNote (Farkas, 2006). This competition reached a high point when Thomson tried to sue Zotero claiming the accuse "that Zotero "reverse engineered or decompiled" not only the format, but also the EndNote software itself" ("Beta blockers?," 2008). The lawsuit was later dismissed by the court (Takats, 2009).

In the later versions Zotero created an open network of users who could share their citations in a social bookmarking fashion, allowing the creation of virtual collaboration groups. The last update in the software is the release of a stand-alone version, unbound from the Firefox Browser and usable as an independent application.

3.3. Mendeley

Mendeley[11] was founded in 2007. The company was started by three PhD students who were frustrated by what they saw as the lack of good tools for organising their references and sharing relevant papers with others in their research group. Mendeley is a proprietary software available in the freemium mode: the basic version is free, and additional features can be purchased. The first beta version came out in 2008.

Mendeley is composed of a desktop program which is synced with the online user's

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11 http://mendeley.com

profile. It is a web-social-oriented software: it lives around its online community of users. The users, saving their citations in their profile, contribute to build a giant distribute database of citations. Although not exempt from duplications or mistakes, this database is large for number and multidisciplinarity: up to may 2012, it counts over than 150 million references collected by over 1.6 million users. It's upon this crowd-constructed resource that Mendeley builds its own services, like the newest initiative of a tailored institutional editions which provides statistics and measurements for the members of a university.

The community itself is very participating, and the company is very active in promoting dissemination and collaboration through initiatives such as App competions or the Mendeley Advisor Program. The availability of open APIs brings to the development of a lot of independent applications or plugins which enhance the features and interoperability of the original software.

3.4. RefWorks

RefWorks[12] was founded in 2001 and a business unit of Proquest, the leading company in electronic publishing. It is a web-based software which allow users to save and access citations on a central hosted database. The license can be acquired individually or institutionally: this latter solution allow all the members of the institution to minimize the costs and benefit of additional features such as sharing citations (Reichardt, 2010b).

3.5. Scientific Social bookmarking: Connotea, CiteULike, BibSonomy

Social Bookmarking is one of the first evidences of what is generally known as Web 2.0, an approach to the web which includes interaction, personalization and socialization (Stephens & Collins, 2007).

The Social Bookmarking platform which gained the widest success and contributed

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12 http://www.refworks-cos.com/refworks

to the popularization of the terms "social bookmarking" and "tagging" was Del.icio.Us[13], founded in 2003. It was based on one of the most common feature of the modern web: the "tag" concept. Users could save their favourite website not just in their own browser, but on a public platform to share them with other users. To each bookmark the user could attach several tags to identify it or describe it. This level of user-generated description is the only classification schema provided by the service, and it goes under what is defined as "floksonomy". Hammond et al. (Hammond et al., 2005) consider this term and its siblings in their article about Social Bookmarking tools: "This unstructured (or better, free structured) approach to classification with users assigning their own labels is variously referred to as a 'folksonomy', 'folk classification', 'ethnoclassification', 'distributed classification', or 'social classification'. Other terms that arise are 'open tagging', 'free tagging', and 'faceted hierarchy'. Following Adam Mathes in his paper 'Folksonomies – Cooperative Classification and Communication Through Shared Metadata' we would generally incline to the term 'social classification', or even 'distributed classification', as this, to our minds, most closely describes the nature of the activity, although we must concede that the word 'folksonomy' has gained considerable currency and there is little getting away from it" (Hammond et al., 2005).

   This way to give free and personal organization to the knowledge found on the web was soon adopted by two services aimed to scientific scholars: Connotea and CiteULike.

   Connotea[14] was the first platform to bring the social bookmarking approach into the scholarly publishing world. Its scientific vocation is given by the fact that it is produced by the Nature Publishing Group. The inspiration given by Delicious is honestly stated by his own authors: "Seeing the possibilities that Del.icio.Us was opening up for its users in the area of general web linking, we realised that scholarly reference management was a similar problem space" (Hammond et al., 2005).

   It's strongest feature is the DOI compliance, which allows to import the metadata of

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13 http://delicious.com/

14 http://connotea.org/

any article which is referred to by a DOI identifier.

Connotea's direct competitor is CiteULike[15], a web platform launched in the same year 2004 by Richard Cameron, from the Manchester University. Unlike Connotea, CiteULike is an open-source software published under a GPL license.

Both platforms allow to save web links in a public personal space, tag them and share them with communities of users. The most relevant feature is the usage of DOI number to automatically import the metadata of scientific articles from the online databases. A small javascript bookmark allows to capture the citation from the web page, a feature later adopted by other softwares such as Mendeley.

CiteULike features a more detailed metadata schema for its records, compared to the essential informations managed by Connotea. It also offers a wider choice of options for exporting the citations. In the later years, a "gold" account option was released: by paying an annual fee the user can unlock further features such as ads removal, PDF annotations, more citation styles available for export.

In 2006 another software joined the two above as scientific web-base social bookmarking software: Bibsonomy[16], developed in 2006 by the University of Kassel, in Germany. Bibsonomy also classifies web references through folksonomies. The main difference with the previous mentioned softwares is the possibility for the users to participate in the creation of a publication, instead of just sharing the references.

3.6. BibTeX

BibTeX[17] is not a Reference Management Software per se, but it is a module for LaTeX[18], the popular markup language and document preparation system well known to the mathematics and physics community. It was created in 1985 to integrate in LaTeX the reference management. LaTeX natively allows to insert notes and bibliographic references, but it requires an additional module, provided by BibTeX, to

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15 http://citeulike.org

16 http://bibsonomy.org

17 http://bibtex.org

18 http://www.latex-project.org/

create an automatic formatting of the bibliographies. BibTeX citations are saved in a database which is nothing but a text file with extension *.bib*. Every reference has standards fields. LaTeX calls the entries found in the *.bib* file through the *\cite* command. The citation is then displayed in a style provided by a style-sheet with extension *.bst*. A lot of journals provide their own *.bst* file to their authors.

BibTeX, just as his main component LaTeX, is distributed as free software.

3.7. BibDesk and JabRef

BibDesk[19] and JabRef[20] are both open-source applications which mainly act as BibTeX front-end: they provide a graphic interface for managing BibTeX formatted references.

BibDesk was created in 2002 for the Mac environment. JabRef, based on Java, is cross-platform. They are both well integrated with LaTeX and its editors; BibDesk is included in the MacTeX distribution, the LaTeX distribution with the Mac front end.

BibDesk allows to automatically digest and import citations from major databases like PubMed and Web of Science, but it can also perform searches via Z39.50 gates, like the Library of Congress catalogue.

Advanced Options include the full-text search in the PDF files associated to the bibliography, and an integrated web browser.

The open-source license allows the creation of many applets and improvements by the community.

3.8. Papers and Bookends

Papers[21] is a software for managing PDF files in a Mac environment, available since 2007. Its main purpose is to organize the PDF files stored in the pc in an efficient way. Its main inspiration, both as the interface as the features, was iTunes, the popular

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19 http://bibdesk.sourceforge.net/

20 http://jabref.sourceforge.net/

21 http://mekentosj.com/papers/

multimedia manager by Apple. Only with the version 2, in 2011, Papers becomes a reference manager, allowing to edit the citations according to different styles and paste them inside a paper. Its success lead its producing company, Mekentosj, to start developing a version for Windows.

Bookends is another commercial client for the Apple environment: the first version dates back 1984, and it was developed for the Apple II. It shares with Papers the typical feature of the Mac-based products: an extremely clear and usable interface. Beside the PDF reader, it also integrates a web browser.

3.9. Citavi

Citavi[22] was born in 2006 in Switzerland. The company behind it developed and commercialized the software as a re-designing of an older project conducted by the Heine University of Dusseldorf, called LiteRat. Its origin explains why it is quite spread in the German speaking communities, especially universities in Germany.

It is a proprietary software that runs on Windows systems only. It comes with a freemium license: the basic free version is limited to 100 references per project. Besides the commercial packages, it also offers an institutional edition.

Citavi offers the usual set of features for handling local files, integrating with word processors (both MS Word and OpenOffice are supported, together with several LaTeX editors). A "picker" tool allows to capture citations from the web: it is interesting how the picker is not only integrated with the web browser, but also with the PDF reader, allowing to capture a reference directly from the paper you are reading. Another original aspect relies in the integrated planning functions: alone among its peers, Citavi offers a "knowledge organization" system, which allows to organize keywords and quotes in hierarchies and groups, and a project planner for scheduling tasks and activities. This makes it perfectly fit for a collaborative scientific projects.

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22 http://www.citavi.com/

3.10. Qiqqa

Qiqqa[23] – pronounced "quicker" - is a freemium software created for Windows and Android systems, developed in UK and published in 2010.

Beside the usual RMS functions – PDF management, citation editing and management – it integrates original features. It uses its own integrated web browser and a very sophisticated PDF reader, which allows to tag PDFs, comment them, and create bookmarks. Tags, annotations and comments can be shared by the users on the cloud-based platform Qiqqa Web libraries. The most interesting feature is the OCR scan of the PDF files, which can extract meaningful portions of text and perform qualitative analysis on the content. OCR scan also works on the user added content, such as tags.

Probably the most original feature is a tool for creating and draw mind maps for brainstorming. It is the only software which joins the functions of PDF management with a powerful creative annotation system: this seems to realize what is proposed by Fourie in his article of 2011 about the integration of information management systems and mind maps: "Mind map or idea map software may be useful in depicting findings form surveys that can again be shared with end-users, as well as other librarians, i.e. findings on reasons and objectives for using PIM which are wider than citing sources and compiling a bibliography" (Fourie, 2011b). The various set of features proposed by Qiqqa is an example in what Fourie indicates as "the multiplicity of objectives for PIM and reference management".

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23 http://www.qiqqa.com/

4. Methodology and Method

This study attempts to understand how and how much RMS are used at the University of Torino. This purpose is expressed by 3 aims:

- to obtain measurements about the actual awareness and usage of RMS

- to understand the context in which scholars operate when dealing with citations and literature management

- to provide evidence-based information upon which libraries can base their strategies about services, assistance, training

To achieve these aims, a list of objectives is proposed. The list of tasks to be performed to fulfil the purpose of the study is the following:

- to verify how much users are informed about the potentials of RMS

- to verify whether RMS are used or not, and to what extent

- to establish which softwares are the most known and the most used

- to consider and understand the users' behaviour in dealing with citations

- to ask the scholars about the reasons which influence their use

All of the above objectives move around specific recurring concepts: "usage", "user", "context", "understanding". A specific behaviour of the users is inquired, the nature and extent of it is measured, and this will be realized through a direct involvement of the researcher. To accomplish these objects, reality must be observed in its phenomena, from which patterns of meaning have to be extracted. To sum up, the purpose of the study is to conduct "an investigation in natural settings of social phenomena" (Pickard, 2007, 11), which is one of the approaches to research used by the interpretivist paradigm.

The approach outlined by the above stated objectives matches the definition of

constructionism given by Crotty: "[Constructionism] is the view that all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context" (Crotty, 1998, 42). Crotty's definition uses all the central concepts declared above: human practices, interaction, context.

Hence, it appears that a constructivist approach under the paradigm of interpretivism must be the theoretical foundation of this research.

In a balance between qualitative and quantitative approach, this study takes both in account. Both approaches are needed for the achievement of the aims stated above. Pickard analyzes them through the examinations made by Gorman and Clayton: "quantitative methodology assumes the objective reality of social facts; qualitative methodology assumes social constructions of reality" (Gorman & Clayton, 2005, quoted in Pickard, 2007) Even though a contradiction seems evident, it's not impossible neither desirable to exclude a mixed methodology which considers both visions: Pickard concludes by admitting that "many researchers see methodological dualism as the only pragmatic option" (Pickard, 2007).

The combination of qualitative and quantitative methods can go under the label of Mixed Methods Research (MMR). This approach is discussed by Fidel in her article from 2008: "the motivation to mix methods in research is the belief that the quality of a study can be improved when the biases, limitations, and weaknesses of a method following one approach are counterbalanced, or compensated for, by mixing with a method belonging to the other approach" (Fidel, 2008). She writes with the purpose to "bring MMR to the attention of LIS researchers", and her findings show some prevalence of MMR in library and information science. In conclusion, this research follows the track indicated by Fidel.

Given this, to better perform a MMR, the chosen method is a survey.

As it is shown n in the literature review, research about the specific topic is basically non-existing. Therefore this study aims to provide new essential informations on a yet

unknown subject with the goal of providing background for future understanding and comparison. Consequently it is "descriptive" more than "explanatory". Since the purpose of the study is to reach a certain level of understanding of the behaviour of a specific circumscribed community, the descriptive survey appears to be the most suitable methodology. Foundation to this is given by Pickard, when she explains that "the purpose of a descriptive survey is to describe a situation and/or look for trends and patterns within the sample group" (Pickard, 2007).

My research conducted at Tallinn University in 2011 (Francese, 2012) attempted to take a first glance to the issue; the limited size of that study, nevertheless, halted at the simple collection of quantitative data, and suggested deeper and repeated inquiries. The present research moves from that original experience expanding its methodology, taking the research analysis further on the qualitative point of view. This extended study will allow to collect both quantitative and qualitative informations, and to combine them as means to provide a description of the situation observed.

4.1. Data collection

A mix of techniques concurred to provide the data.

1. A questionnaire collected the measurable quantitative informations. This is a sort of repetition and improvement of the Tallinn survey, used as an initial probing of the background.

2. Following interviews were conducted on a sample of the population to deepen, enlighten and circumscribe the data collected through the questionnaires with the aid of qualitative informations.

The reasons to start with a questionnaire are once again listed by Pickard: "you can reach a large and geographically dispersed community at relatively low cost, you can harvest data from a larger sample than would be possible using any other technique, anonymity can be offered as well as confidentiality, and the data analysis can be determined from the outset" (Pickard, 2007, 183).

To collect qualitative informations I decided to perform interviews. The reason for

this is almost self explaining; according to Corbetta, when operating under the interpretivist paradigm, the usage of interviews is "the only way" (Corbetta, 1999, 434).

Corbetta explains how to use interviews as a tool in a mixed-approach study: "Another usage of the qualitative interview in a quantitative-inspired social research is to deepen a particular theme that rises from the data collected through quantitative techniques" (Corbetta, 1999, 415) This research attempted to do the same: interviews were constructed upon the initial results as long as they were collected, and the potential questions were tweaked and adjusted following the hints emerging from the questionnaire.

Interviews were designed as "guided interviews" (Patton, 2002), or, to use the more precise terminology adopted by Corbetta, "semi-structured interviews". Semi-structured interviews work in this way: "The interviewer relies on a track that lists the topics he has to cover in the interview. The order in which the different threads are examined and the way to formulate the questions are left to the free evaluation of the interviewer" (Corbetta, 1999, 418). I chose this approach because of the freedom it allowed both the interviewer and the respondent. In this way the scholars interviewed could let emerge unpredicted aspects of their job and their practice which could lead me to clarify my vision on the issue and to formulate new ways to get closer to the heart of the topic. Corbetta acknowledges this freedom as an essential aspect of the semi-structured method: "This way of conducting the interview grants freedom to both interviewed and interviewer, assuring at the same time that all the relevant topics are discussed and all the needed informations are collected". Most of all, what I found crucial was the hermeneutical implications of this method itself: "[the interviewer] is free to develop threads which may arise during the interview, and that he finds important for the comprehension of the interviewed subject" (Corbetta, 1999, 418). Not only every interviewer could surprise me with unforeseen informations, but I was able to discover new discussion threads with which I could enhance my topic list; the initial grid of topics, in fact, slightly changed and adapted along the survey.

4.2. Data analysis

Among the possible strategies for analysing qualitative data, this study adopts the "constant comparative analysis" method (Strauss & Corbin, 1998). Constant comparative analysis consists in a comparison of each piece of data with all the others to formulate categories of meaning. From these categories and the relations between them the researcher can extract assumptions. This method is chosen because it is best used when categories have to be extracted, through the means of inductive analysis, from the raw data, which is the case of the present study.

Data are collected by two different means: the questionnaire and the interviews. The two data sets are first analysed and discussed indipendently; then the results are integrated and discussed together. These steps are structured according the 3 stages of constant comparative analysis:

- Open coding: "the analytic process through which concepts are identified and their properties and dimensions are discovered in data" (Strauss & Corbin, 1998 quoted in Pickard, 2007). The threads for the interviews were created along as the first responses to the questionnaire were coming. What Pickard calls "the constant interplay of data and analysis" (Pickard, 2007, 242) started to happen meanwhile the data were collected. The interview process itself was influenced by this dialectic phenomenon, because every answer could lead to new questions or untrodden threads of thought.

- Axial coding: "the process of relating categories to their subcategories" (Strauss & Corbin, 1998 quoted in Pickard, 2007). At this stage, categories and subcategories are drawn from the data collected and linked together. This happens when transcribing and analysing the interviews, when the main topics or relevant arguments begin to arise from the interviewee's words.

- Selective Coding: "this is the final stage in the process, the point at which we have reached theoretical saturation and no new properties, relationships or dimensions are emerging from the analysis" (Pickard, 2007). The final stage of the analysis wraps the conclusion of the study: concepts and topics, analysed in

categories and subcategories, are discussed together and the final results and considerations emerged.

4.3. Sample

The sample targeted for the survey was built upon several considerations. The dimensions and the variety of the population of the University of Torino, counting 55 different departments, did not allow to perform an extensive cross-disciplinary inquiry. Therefore a focused disciplinary area had to be chosen. The literature review seemed to suggest that the health sciences and bio-medical areas are the most sensitive to the RMS features (see for example: Lawrence & Ashwell, 1993).

To confirm this, I turned to few key informants to get clues about where to address my research. Pickard (2007) states that "in any bounded system there are 'key informants' who will have a great deal of knowledge about the case as a whole and what goes on at a variety of levels within the case".

My initial key-informants were the coordinators of the libraries of the different disciplinary areas: economical, medical, scientific and humanities. They confirmed the general awareness they perceived in their communities, and pointed me to some professors.

Then I turned to my second-level key-informants: they were prof. Michele Caselle, from the Physics department, who is coordinator of an inter-dipartmental PhD course and has a wide knowledge of the physics, mathematics, IT and biological areas, and prof. Luigi Benfratello, from the department of economics who has knowledge of the social sciences area. They both made me aware of the important role that the number of publications, from a quantitative point of view, has in the matter: researchers who write and publish often are more sensitive to the usage of a tool like a RMS. This happens in the STM field (Science, Technology and Medicine) more than in the HSS (Humanities and Social Sciences). This pattern was finally confirmed by dott. Elena Giglia, from the library system, who has a role within the Osservatorio della Ricerca, the office which monitors the scientific production of the institution. She confirmed that HSS researchers and professors usually don't have a number of publications high

enough to justify the need for a specific reference management tool.

In conclusion I decided to focus on the STM departments.

The questionnaire was addressed to the whole scientific population. Knowing that online questionnaires usually have a low-rate response (Francese, 2012; Pickard, 2007) I planned to reach a quota sample of at least 10-15% of the global population, so the data could be reasonably generalized from the quantitative point of view.

To select the interviewees, a snow-ball approach was chosen across the respondents. This is justified by Corbetta: "The qualitative researcher is not interested at all in the statistic representativity. He will choose the cases to deepen not because of their typicality or their diffusion among the population, but because of the interest they seem to express. Interest, by the way, which may change in the course of the research itself" (Corbetta, 1999, 61).

Rising from Corbetta's evaluation, 3 factors had to be considered in this study:

1. Availability. From the responses given to the questionnaire, some interviewees would state their availability for a direct contact. The willingness of the respondent was desired.

2. Interest. The level of interest offered by each subject was considered case by case, considering the community of belonging, the need to cover deeper some areas, the presence of outstanding or peculiar responses given to the questionnaire, etc.

3. The snow-ball chain itself. Each interviewee could address to other subjects.

When answering the question about how many interview subjects are needed, Steinar Kvale claims that there is no prefixed number: "Interview as many subjects as necessary to find out what you need to know" (Kvale, 1996). Yet he leans towards small numbers, as he explains when discussing pioneering studies in his field, in which the focus on single or small cases "made it possible to investigate in detail the relationship between the individual and the situation". He seems to suggest that few cases allow a clearer vision of the relationship between the individual respondent and

his context.

Wrapping up the considerations above, we must now consider all the limitations intrinsic to this study, which not slightly affect the choices expressed so far.

4.4. Limitations

The main limit of this study consists in being a master thesis due within just one semester: lack of time and resources forbid to achieve a certain level of depth in the inquiry.

Also, at the time of this study I was full-time employed at the University of Torino; job obligations prevented me from travelling or moving from my office, so the physical interaction with the questioned population was somewhat limited. This practical constraint had a heavy influence on the sampling method chosen. Above all, the number of people reached by the survey was strongly limited by this constraint.

Another limitation was constituted by the setting itself. The University of Torino is a multi-disciplinar institution. The study was conducted upon a small percentage of scientific fields covered by the university, so all its richness and diversity will not be represented. On a wider perspective, also, though we can foresee no significant differences among the several universities in Italy, this research doesn't guarantee that its result can be applied to all the Italian academic institutions, or to the global Italian scientific community. An extended comparative analysis can not be performed at this stage; this brings to narrow down the object of the study at a minimum.

All these limitations can be overcome by following studies on the same subject.

4.5. Experiences, qualifications and possible biases

Two personal biases must be stated before entering the result analysis.

1. I work for the Digital Library Staff of the University of Torino. Training and assistance for the digital services and collections to the members of the institution are part of the duties of the staff to which I belong. Even though this

study was conducted on a personal basis, the fact that I am part of the institution I am investigating constitutes an objective bias.

2. Since February 2011, I participate in the Mendeley Advisor Program[24]. The Mendeley Advisor Program is an initiative to promote the usage of Mendeley in the institution, by offering public presentations and demos, and inviting colleagues and members to the community. At the time of the study, I did not take any initiative yet in this sense. But this sort of promotional role, although it doesn't constitute any sort of job dependence or payed work, can be seen as a conflict of interest.

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24 http://www.mendeley.com/advisors/

5. Data results

5.1. The questionnaire

The questionnaire was based upon the one already piloted at the Tallinn University in 2011. There was no big need for developing new questions, because deeper informations were expected to be gathered through the interviews.

The questionnaire was sent to the professors, researchers and PhD students from the STM departments of the University of Torino. An email with an introduction to the research and the link to the online form was sent to a mailing list of 1031 addresses, collected from the address book of the University web site. The initial communication was sent on March 12nd. After 1 month different reminders were sent addressing specific communities: for this task I relied on the support of the department libraries and administrations. After 2 months (May 12nd) the questionnaire was closed.

The full list of questions is at Appendix 1 - The Questionnaire.

Response rate

The questionnaire collected 187 responses, reaching a response-rate of the 18,13% of the initial recipients. The responses came from all the departments addressed; the exact affiliation of the respondents cannot be profiled precisely, though, because of the reform which is going on in the Italian universities in the same days of this research (see chapter 1.6) so departments were changing names, being merged or suppressed.

This rate has to be considered positively: it is far higher than the one obtained at Tallinn University, and exceeds the expected threshold of 15% (see chapter 4.3) Two general considerations can be done about this number.

First of all, this number confirms the general awareness about online questionnaires response rate: as Pickard warns, "questionnaires produce a notoriously low response rate" (Pickard 2007). We must also consider some hidden problems in the address lists

used, which may contain out-of-date addresses, and similar issues which exist in the university personnel books and are beyond the control of the researcher.

Second, the number of respondents may lead to the temptation of interpreting the non-responses as a lack of knowledge or interest in the topic. This should be avoided, because it would be nothing more than a conjecture not subjected to proofs. Yet a preliminary information must be considered. Several people replied to my communication asking for informations about my research, and from their questions it was cleared that they completely misunderstood the object of the research, mistaking the concept of "reference management" for other concepts such as citation measurement, scientometrics, valuation and such. One respondent (not considered among the results) mistook the RMS for search databases such as Ovid. This confusion was not predicted, and although it is not confirmed by enough data to formulate a conclusion, it is worth noticing.

It is also very interesting to note how the survey itself raised some interest in the participants: some respondents used the open box in the end to say "This is the first time I hear about these tools, and I will soon search for informations about them".

The academic roles are equivalently divided among researchers and professors (42% and 38%), with a 6% of PhD students and 15% of other roles (postdoc, research fellow, lab assistant). The age of the respondents is also quite equilibrate: the majority is represented by people between 35 and 45 (37%).

The distribution among departments is impossible to interpret, because data about the global population are not available, and the university is undergoing a total reorganization: we only have the percentages among the total respondents. It is worth noticing, though, that all the departments are represented, and answers came from all of them.

Awareness and usage

The first important result is the general awareness about reference tools: only 8% of the respondents declare to not know any software. This data was also corrected re-

assigning one of the answers: a respondent indicated Ovid and PubMed in the blank field; thus his response was transformed into "I don't know any" since the object of the research was evidently misunderstood.
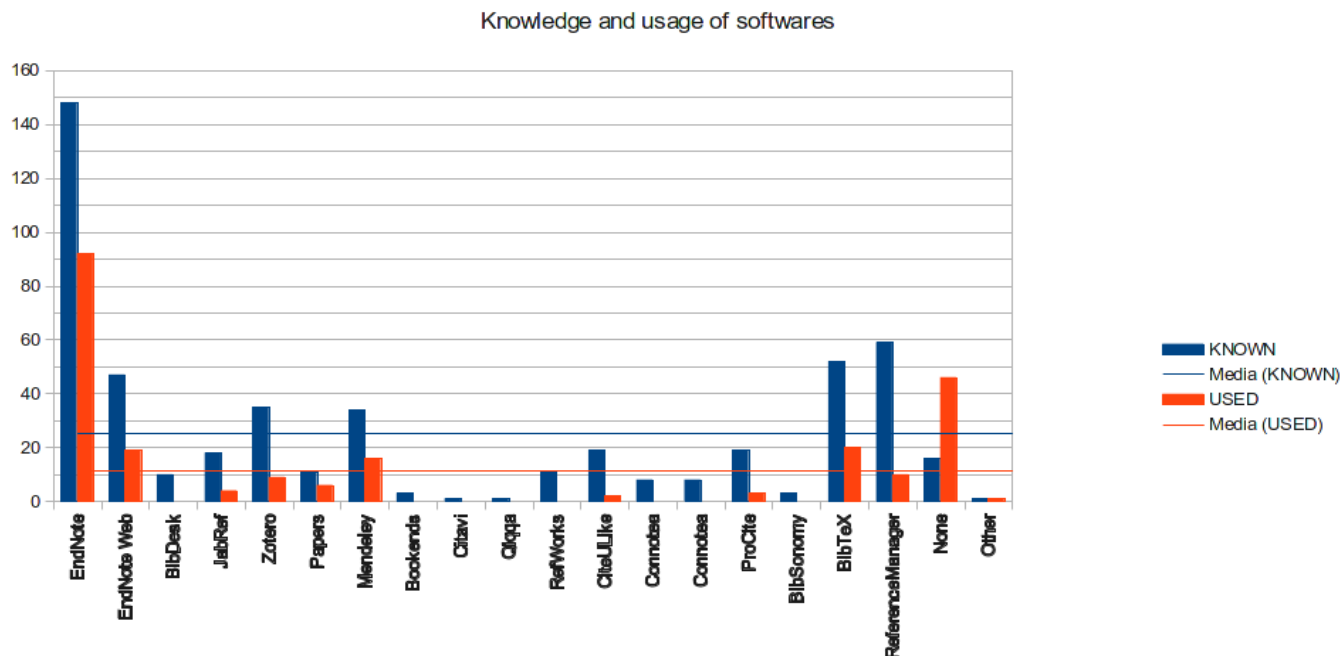
Knowledge and usage of softwares

Fig. A: Knowledge and Usage of Softwares

EndNote proves to be the best-known software: 79% of respondents know or heard about it, and among these, the 25% know about its web counterpart EndNote Web. The other side of this data is the relatively low knowledge about alternatives to EndNote. Only 2 softwares reached the 25%: BibTex (28%) and Reference Manager (32%). All the other softwares seem to be mostly ignored; Zotero and Mendeley obtain 19% and 18% respectively, and the rest are from 10% under.

Data about usage show a more extreme trend. The non usage is relevant: 24%, almost a quarter of the sample. Usage of EndNote doesn't reach the half of the sample: barely 49% is the number of actual users, and just 10% also use EndNote Web. Of all the other softwares, only two are around 10% (BibTeX 11%, Mendeley 9%).

It is remarkable the narrower set of softwares indicated in this answer: most softwares obtain 0 responses. Among the rich software offer and availability, scholars seem to choose a very small set of them. The general impression is that while half of

the sample is an EndNote user, the other half is divided between non-users and random users.

If we look at a correlation between the knowledge and the usage, we can obtain a percentage of "appreciation", .e. the percentage of those users who, knowing a software, don't use a different product, in opposition to the others who know the product but don't use it. EndNote still proves to be the stronger software (62%). If we consider the median value (16%) few softwares are below this number: CiteULike and ProCite.

The software distribution among age-ranges doesn't show any relevant result (figure B). There is only one fact worth of mention: the percentage of non-usage is higher among older scholars (42% for the over 55), and very low among younger (9% among people from 26 to 35). Other minor notable results are the higher presence of Mendeley among the younger as well as the absence of ProCite among them. It is likely that an old-school software like the latter is used by long-time users rather than beginners, who look towards a new modern web based software like the former; these data don't allow more than a generic assumption though.
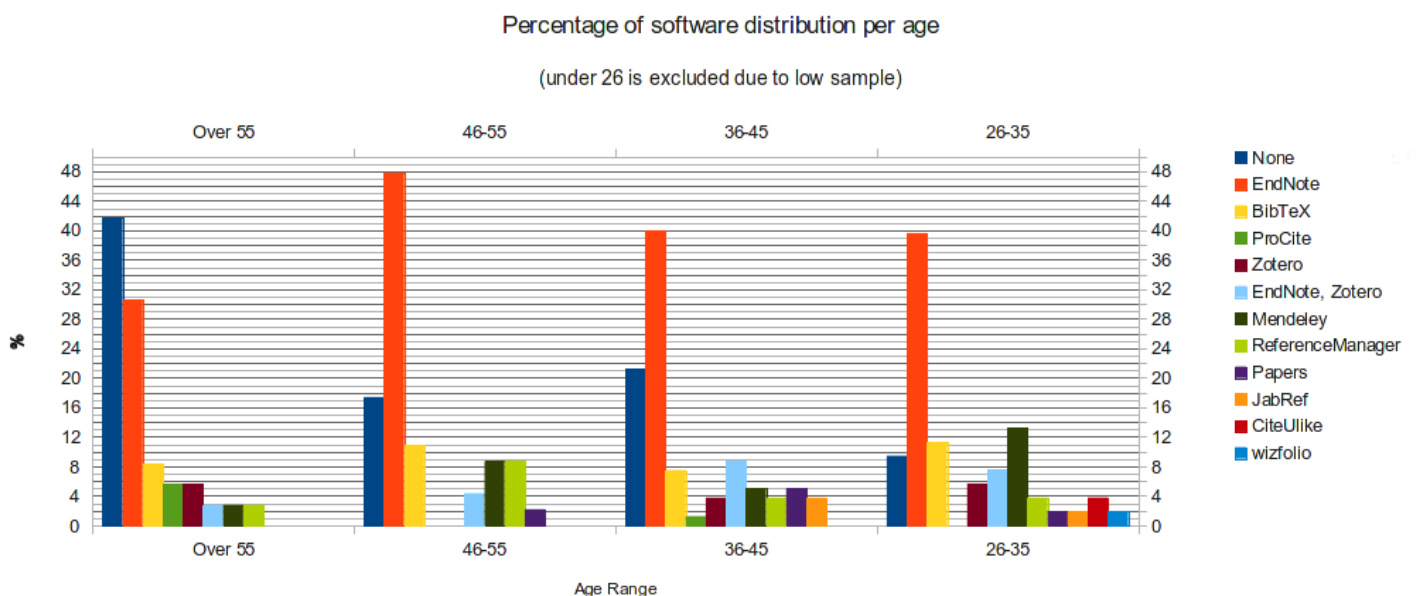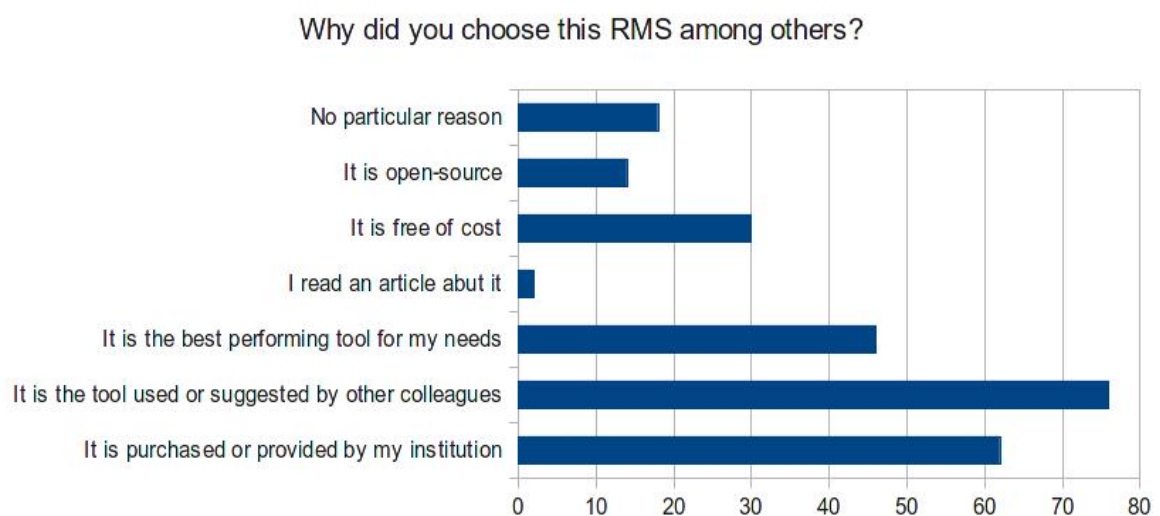

Fig. B: Percentage of software distribution per age

Reasons and behaviour

Informations about user behaviour and the reasons behind it have to be analysed through the interviews to be better understood. From a general point of view, we see that the most relevant reasons behind the choice of a software indicate a sort of passive behaviour (figure C): softwares are mostly used because provided by the institution (33%) or used by the rest of the community (41%). While the community has a strong role, external information hasn't: only 2% chose a software after reading about it in journals or magazines.

Why did you choose this RMS among others?

Reason	Value
No particular reason	~18
It is open-source	~14
It is free of cost	~30
I read an article abut it	~2
It is the best performing tool for my needs	~46
It is the tool used or suggested by other colleagues	~76
It is purchased or provided by my institution	~62

Fig. C: Reasons of choice

Gratuity and open-source collect different responses: while the 16% pays attention to the freedom-of-cost, only the 7% cares about the license behind it.

From a quantitative point of view, usage of RMS varies: the number of citations saved ranges equally from less than 50 to more than 1000 (figure D). Obviously, higher numbers (over 1000) match the longer usage stated at question #D.

How many references are saved in your RMS?
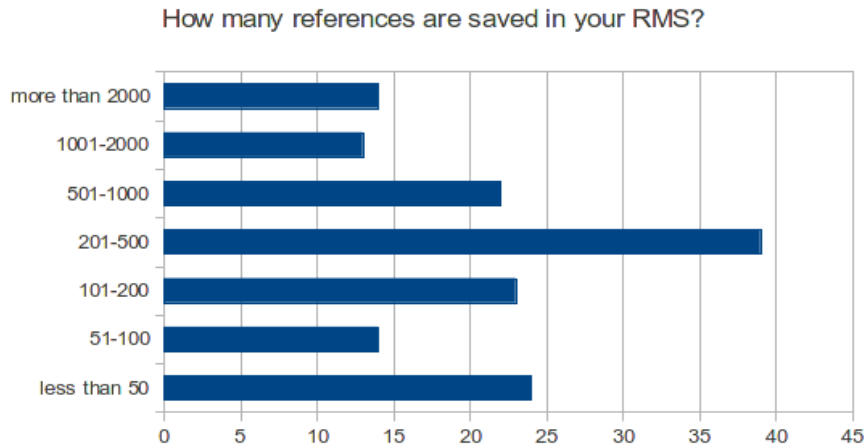
Fig. D: Number of references saved in RMS

Question #G reveals interesting data about the general approach to the tool (figure E). The most used features are the basic ones: editing (55%) and pasting (66%) the citations when writing the paper. Fewer respondents mention reference saving (39%) and management (24%), and organizing of articles (18%). Sharing citations is not a very relevant activity (13%). What impresses the most is the almost non existing usage of the RMS as a way to discover new references (2%) or connecting to other colleagues on the web (0%).

What features do you use the most?

Fig. E: Most used features

41

Training and support

Answers to questions #H-#K show the relationship between the user and other actors (figures F-I).

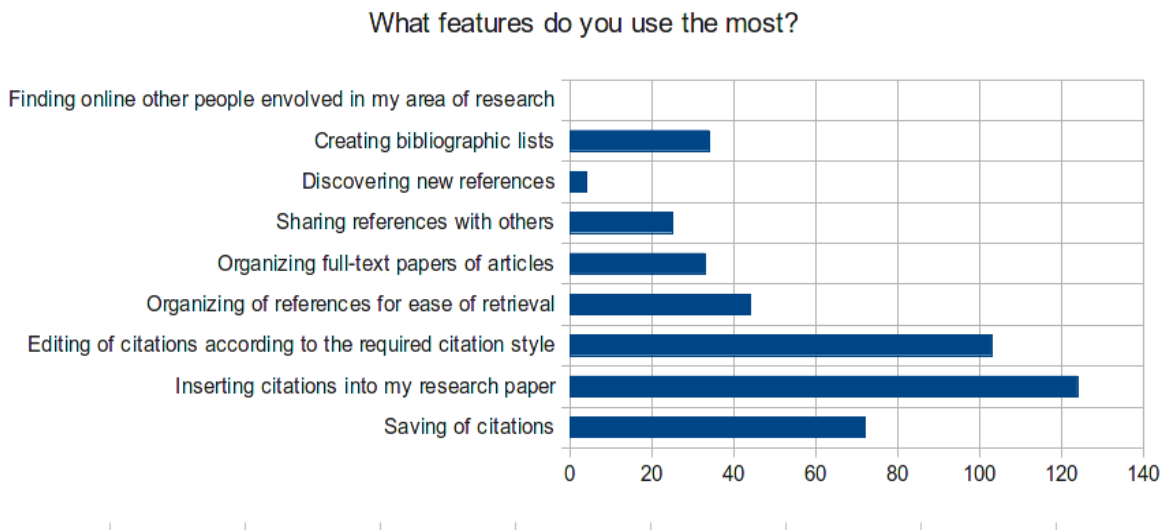Softwares are generally used as self-taught. Only 6% of respondents declared to have followed training sessions. The library seems external to these needs: only 13% of respondents state that they received help by the library in using the RMS. This particular question could not be simply answered with a yes or no, so it was offered the opportunity to go deeper with the help of an open question.

Of the 25 "yes", only 8 provided details. Those people generally refer to the EndNote distribution of 2008, when libraries provided copies of the softwares for their members together with informations, support, and training sessions. It is interesting to note that, out of 8 respondents, 7 come from different departments so they are served by different libraries. The support given therefore is equal across the areas, and there is no evident case of a single library more active than the others.

Of the 162 "no", 28 provided details. Most respondent admit that they just "never asked", or "never heard about any initiatives". This case reveals how much scholars may lack of initiative or time to dedicate to the subject, but also how weakly perceived is the role of the library. Some don't consider the library as a potential support in the matter: "I heard about these tools in foreign labs, from other colleagues", "documentation and manuals are more than enough", "practice and self-teaching are better than any courses". In at least one case, the respondent considers himself already skilled enough: "I have been using EndNote since 15 years, so I don't need any type of course".

When asked if they ever suggested the tool to other colleagues, the majority replied "yes" (63% against 37%). The exact opposite happened towards the students: only 38% of respondents declare to have suggested a RMS to students. It is remarkable how this answer comes from any type of academic role (professors, researchers, postdoc, research fellows, etc.); a minor percentage of the people who follow a research project, even on a master thesis level, underline the importance of managing such a tool by

suggesting its usage to the younger.

Have you ever attended a course or a workshop about RMS?

11

176

Yes
No
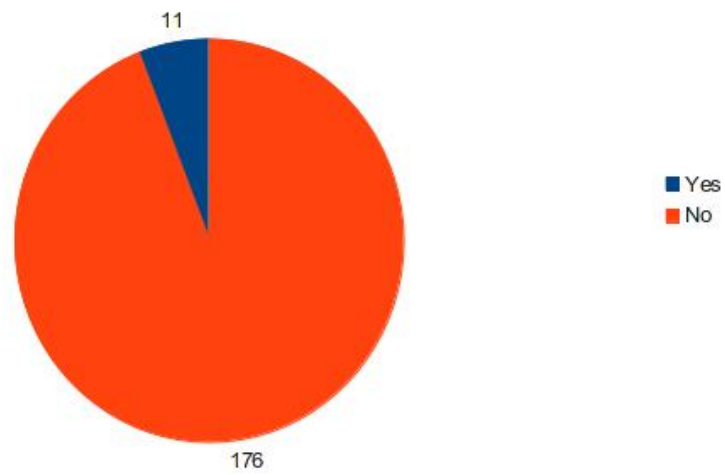
Fig. F: Training received

Did you get any support from your institutional library in using a RMS?

25

162

Yes
No
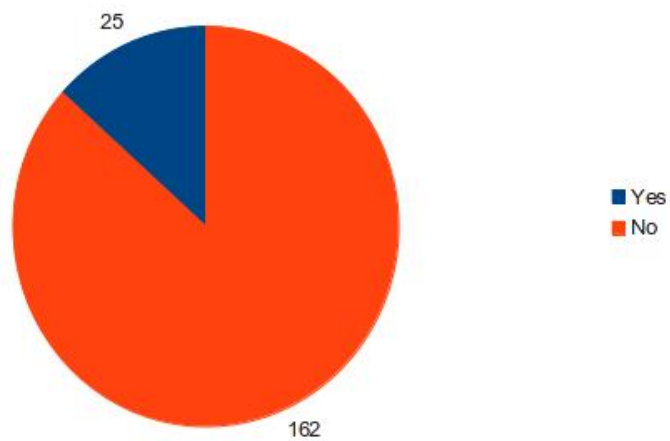
Fig. G: Support received by the library

Did you ever suggest the use of RMS to other colleagues?

69

118

■ Yes
■ No
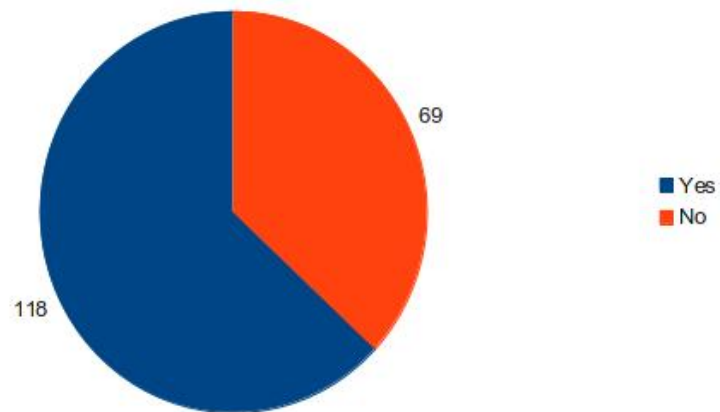
Fig. H: Suggestion to colleagues

Did you ever suggest the use of RMS to students?

71

116

■ Yes
■ No
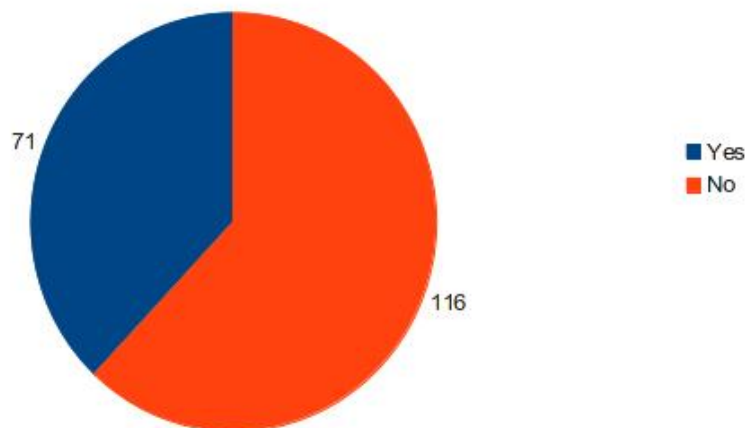
Fig. I: Suggestion to students

5.2. The interviews

13 interviews were collected from those who kindly gave their availability. The respondents represent all the scientific areas questioned. The interviews were designed as semi-structured conversations: I prepared a list of "threads", topics to cover, which were expressed through one or more questions. The interview was built around the

following threads:

1. Sum up your experience with RMS (which softwares you know, which ones you have used, when and how you started using them, etc.);

2. What is your research workflow, and how does the RMS fit into it?

3. How do you consider the virtual collaboration (mostly, but not only, related to RMS)?

4. Do you consider RMS as a fundamental tool for the academic work?

5. Have you ever suggested its usage to colleagues? Have you ever suggested its usage to students? Do you think students should receive training on RMS?

6. What kind of support does the library give you? What kind of role do you expect from it?

7. Are you interested in training, support or information initiatives?

8. How do you value open-source when selecting such a software?

9. Do you have any final considerations?

As the research went on, the starting grid of questions was slightly changed to better accommodate the topics emerging. For example, the original grid contained a question about the reasons for the non-usage ("what do you think are the reasons for the scarce diffusion of these tools?"), but I realized that it was not a proper question, because it asked the respondent for reasons outside of his own knowledge. Another question which was cut off was "do you think RMS can be used for other things than just formatting citations?": I decided to exclude it because it was too vague, and preferred to infer any unpredicted needs or usages from the answers to questions #1, #2, #3. On the contrary, question #4 was introduced later because I realized that respondents were generally reluctant to take a clear stance about their perception of importance of the tool; thus, a direct question was needed.

Interviews were performed in presence, face to face, and recorded. The interviewed was asked to sign an informed consent note. Interview sessions lasted from 20 to 55

minutes. Recordings were then transcribed; from the transcript emerged the topics presented here, divided by thread. The interviews were held in Italian; the excerpts and quotes used here are translated in English by myself.

The identity of the interviewed is hidden; in the following analysis respondents are indicated with a number in parenthesis, from 00 to 12.

Experience on RMS

This introductory threads of questions had two goals. The first one was to set the background of the conversation with the respondent, learning about his general knowledge and experience about the issue. It served as an "ice breaker" as a way to say. The second goal was to confirm and frame the answers given to the questionnaire.

This open question is the broadest of all. In the conversation different aspects of the usage were touched: time, selection, knowledge, reasons, suggestions, etc. An important detail of this thread was the participation in the EndNote distribution of 2008. This detail was left out of the questionnaire, and it emerged here: did the respondent participate in the distribution?

Softwares are used in a very practical way to satisfy a very present need. Users never explore the most sophisticated features: "I don't use it at the top of its potential" (06). When a software works, they feel satisfied and don't feel the need to know more.

Another critical issue is time: almost all respondents point out how crucial is the time factor in their work; for this reason there is no way to develop a strong mastery in the software. Some call it "laziness": "there is a particular laziness in every researcher: if something works, you don't feel the need for something else" (03). Easy and rapidity of use is highly valued: "When you are used to a certain product, you need a substitute with a very low learning curve" (05); "The reason I never change is one: habit. Upgrades are too much of a burden" (07).

Most respondents make clear that they seldom move away from a used and known product to discover or try a new one, and when they do they rarely feel satisfied. "I downloaded and installed 2 products, but I uninstalled them very soon: I did not

understand them, I felt them unfriendly, they did not do what I needed" (10); "I tried EndNote Web, but quickly abandoned it" (05). Sometimes change is hard even when the software used has evident flaws: "EndNote is good and very powerful, but it has a lot of problems, it's heavy on your system, it needs high requirements and is extremely hard to move it across different platforms" (05).

The choice itself of the software is never problematic: a software is chosen because already used or suggested by other colleagues (04: "I started using Reference Manager because it was used by a colleague with whom I worked when I was in another university") or because it's dominant in the community (03: "I use EndNote and ReferenceManager, because it is already available to all of us here in the lab, or because it is acquired by your superior"). The technological context is also a key factor: according to the operating systems and word processor used, the most compliant software is adopted: "In physics, we all use LaTeX, so BibTeX comes naturally" (00). It is interesting in this matter to note how EndNote was often already used before the institutional purchase made in 2008: that initiative was suggested and promoted by professors who already knew the product, and asked the university to make it available. Anyway, this enhanced the presence of a legal copy of the product in every lab, so the new researchers in need for a RMS often found it already available at hand.

Only two respondents adopted a different choice from what they found already available: instead of taking advantage of the available copies of EndNote, they sought different solutions. One because of the compliance with her system: "I decided to use Zotero because it works on Linux, which I use" (06); the other because of reasons related to the proprietary nature of EndNote: "I believe that in the university world we should use non proprietary software, so I looked for open-source – or at least free of cost – alternatives" (12).

RMS in the research workflow

This topic strongly emerges both from the literature and from the suggestions received by the key informants: RMS don't exist on their own, but are part of a

process. With the obvious differences due to disciplinary fields and community practices, all respondents show how strongly the RMS is related to the research and writing workflow. Some of them use it from the start, as an alternative interface to search online databases; some use it for storing the references, some just need it to change the citation style when submitting to different journals. The tool is always needed for the main purpose of writing papers; some users have additional alternative approaches: "I basically create a personal database about all the scientific literature that I consider interesting" (08).

What gets always underlined by the words of the interviewed are the functions which let them save time: for example, "it comes very handy to start from the same word file and change all the references with a click, to adapt them to the needs of each journal" (03).

The research workflow doesn't vary much among the respondents: a team leader usually wraps up all the contributions by the different collaborators and edit the final draft to submit to a journal. This sometimes explains the reasons behind the non-usage: when a researcher is not the project coordinator he doesn't take part in the bibliography editing: "Generally the supervisor actually writes the final paper, while we just run the experiments and collect the data" (02).

Virtual collaboration

The thread of virtual collaboration is suggested by a new trend, found in the literature. We can call it "e-science": the usage of web-based virtual environments to share ideas and products, discussions and resources, with colleagues distant from us. Some RMS, as shown in chapter 3, were born with this specific purpose. I wanted to verify how much this topic is acknowledged for and given importance.

The approach towards systems of virtual collaboration is almost non existent. The only forms of virtual collaboration happen in a very traditional way: through email, sometimes through some sort of peer-to-peer communication system (such as Skype). Scholars often use cloud-based shared folders systems, like Dropbox, to share journal articles. One first reason is the lack of knowledge about the possibility itself to

virtually collaborate with other colleagues. An interviewed (12) was a declared Mendeley user, but strangely he did not know about the social features which are the very heart of Mendeley. Another one (10) complained about the impossibility to share lists of references with his colleagues, but he did not know about the existence of specific RMS for that.

When moving on the more general topic of the science networking, like building an online presence to connect with other colleagues around the world through dedicated scientific networks (such as Mendeley, or Academia.edu), the respondents showed a sort of diffidence. One is very clear: "It is impossible: in science, when working on the same subject, you either cooperate, or you compete. If you collaborate, it comes naturally to work with daily tools; if you compete, you are very careful not to put reveal, anticipate, or share your data" (03). The same respondent, though, sees a possible scenario where one can benefit from a virtual presence: "When you have to move to new scientific fields on which you are not yet an expert, it can be useful to look at more experienced researchers, and meet the main figures in the field". Another one has the same opinion, even though a little more open to possibility: "There is no such thing as a virtual Alexandria. Data exchange is daily done within small groups. But you don't feel to share your data virtually with people you don't know well: we are used to keep our data secret until the final publication. But the difference between us and the scholars in Alexandria is that they did not have our obligations to publish. Therefore I don't think this is impossible to realize, but it's quite unlikely" (09).

Another reason is once again found in the specificity of a discipline. Some sciences are more used to collaborate than others. Respondent 09, a chemist, said: "We are not like physics, we are lab animals". More generally, the virtual collaboration through scientific networks has a scarce appeal.

Only one respondent gave a very different opinion: "Collaboration is fundamental: our job is always been based on collaboration on a international level. An online tool, cloud-based, through which I can invite other people to contribute to an online list of references, would be of utter importance" (10). Another respondent shares this conception of science as an international collaborative endeavor, and looks positively

to web platform that can act as a showcase for the scientific production: "I believe these sort of things – social networks, forums for mutual assistance – are very useful and interesting. It is very useful to be present and visible on the web to communicate, to share informations, to ask questions to more experienced people. But it requires an infinite quantity of time" (11). Once again, the time factor is underlined as essential.

Importance of RMS

This question, somehow rough and direct, had the purpose to probe the perceived importance of the tool despite all the different ways of usage. It gained a very wide range of responses. One interviewed was a complete non-user of RMS, and provided a very interesting chemistry-related metaphor to explain the reason: "I apply a principle of chemical kinetics: if you want to speed up a reaction, you have to modify the slow part of the process. I believe that in writing a research paper, the 'slow part' is not the reference management" (09). On the opposite scale, a respondent said: "They are absolutely essentials. It is crucial for the credibility of a paper to display properly formatted citations. I insist a lot on the reference check in the works of my group" (11). A middle-ground response is the following: "Nothing is really 100% essential, you can always do without anything. But on a scale of importance from 1 to 10, I would deem the RMS as 8" (12). Ultimately, the importance of the instrument, with these nuances, is generally considered high.

RMS suggestion

This two-sided question was made to understand the correlation between the user and his context, and see how the RMS is a node in a network. We saw in #1 that most people use a software because suggested by other colleagues, or because part of the workflow of the labs or departments where they worked some moment in their career. The reverse action happens in the same way. Some suggest the usage of a tool when they have to coordinate a research group which doesn't have such a system of managing the literature: "I always suggest to use EndNote to those who collaborate with me, because I don't want to waste time in fixing citations: it is a very practical reason" (10). Another explains: "I suggested a RMS when I saw my colleagues doing

everything manually" (7). There is always a very practical reason behind the behaviour: the topic is brought in when the need arises among people who need to collaborate; it is a rare topic of discussion among them outside the practical activity.

Somehow different is the approach towards students: respondents seem to be cut in two groups, those who consider essentials for students to learn how to use a RMS in the beginning of their career, and those who think that, before the PhD, students don't need such knowledge. "I always suggest to use a RMS, but I leave liberty of choice. This is helpful because it saves a lot of work to do in the end" (06); "You learn by doing. Generally I think it is useful to learn at the early stage of the career, as a sort of literacy" (03).

One respondent considers the literacy about RMS on a wider level than just the research career: "It is absolutely necessary that students, especially master students, learn the technical aspects of the research. Scientific techniques and methods will be useful in their future, no matter what career they choose" (12). In his vision, a RMS can be part of the scientific literacy of a student.

Other responses underline an opposite vision. "Master students already have many difficulties to face; introducing a sophisticated software like a RMS would be adding more trouble" (8). "I tried to explain the functions of RMS to students, but with no success" (4). This is often related to the actual need: "for a master thesis students don't need to handle so many citations to justify the learning of a specific tool" (5). Another response considers RMS as less important than other tools: "I would rather spend time to explain how PubMed works" (07).

The role of library

The role of the library and its perception are an important part of the study, as shown by the literature review (Kessler 2005, East 2011, McMinn 2011). One of the purposes of the present study is to help libraries to understand what libraries can do to assist their members in reference management. This topic was conducted around 3 main questions:

a) what is your general relationship with your library (department library or faculty library); this was a general question about the usage of the library.

b) did you ever received support by the library staff about this subject; this was a specific question about the relation between RMS and libraries.

c) what kind of role do you wish or expect from the library; this was asked as a kind of evaluation of the libraries, to understand the users' needs and to discover potential roles for the library professionals.

When asked about their relationship with their academic library, a general answer came out: it's almost non existing. "Libraries have disappeared from my life" (11); "I never go to the library: I do everything online, and if I need something more, I ask to colleagues and friends from other universities" (03). "We turn to the library staff only when we need documents not available online" (01). This dramatic response, however, needs to be put in context. They recognize the importance of the digital library infrastructure: "I don't step into the library anymore, but the library provides access to all the online resources I need" (09). Sometimes this infrastructure is invisible, and scholars don't realize what is there behind the online access: sometimes the content available online is considered as just "free" (01).

About the RMS, some libraries just provided the licensed copy of EndNote, some support information, and not much more. This doesn't mean that the library service is judged negatively: a researcher explained: "I never asked for assistance, even though I know they are very kind and professional; I just prefer to overcome the difficulties by myself" (04).

About the possible role for libraries, a respondent gave an interesting answer: "Libraries must have an active role, they cannot be just the keepers of knowledge anymore. Librarians must be more present and more active within the community. I know a lot of librarians who are willing and able to assume a more active role in the research process. But the institution must support this with proper funding and resources" (05). Other respondents wish for a more active role by the library: "Library could be very important in setting a standard within the institution; so far it never had

this role, but it would be important if it starts having it" (10). Another professor moved from a comparison with the situation with a previous experience she had abroad, in US and Switzerland: "Libraries should have transformed themselves into a place were information experts would help us to use online resources and perform searches. When I came here the first time, I just found an empty room with a lot of paper, and that was so sad. The supporting role is fundamental: we scientists never had specific training on research tools, we just went on by experience, and we need someone who teaches us what are the best tools, how they work, what can help us to do what we need, etc. I believe this can be a specific role of libraries" (11).

Other respondents have a different opinion, and don't believe that librarians have the required skills for providing useful support to scholars. This can be related to the specific contexts of their departments: "I never received support for advanced bibliographic search: I believe the library staff is not prepared at all for this – at least not here" (12). This sort of "assumption" is confirmed by other respondents, who say "I don't know if they can provide help" (08) or "It's something I never thought about" (09). This seems to suggest how low is the level of acquaintance with the library staff, therefore how distant are the libraries to some of their community members.

Interest in training initiatives

Training sessions, support initiatives and any sort of communications are considered welcome by all, despite their role or experience. Most respondents reveal to be self-taught about these tools. Some considers themselves fine with this, and don't feel a deep need for special training about RMS. Others recognize their need for a specific and structured training. As already discussed about question #6, training should be addressed to students, mostly.

A common point of view emerged from all the respondents: training and information sessions have to be extremely practical and to-the-point. Nobody is interested in introductory sessions, generic informations, or such. They need to learn how to do things, how to solve the problems they face in their work. Their amount of time to dedicate is too small. This is the only factor which is always underlined, often with

dramatic tones.

Importance of open-source solutions for RMS

The last topic may not seem relevant per se, at least judging from what emerges in the literature. But I personally believe that the choice of a software, especially in a public scientific institution, must be informed. The RMS landscape also shows a sort of competition between commercial-closed and open-free products (see for example the legal dispute between EndNote and Zotero mentioned in chapter 3.2).

Therefore I wanted to touch this topic, and ask how much is important for a scholar in a public university the issue of open-vs-closed nature of a software product.

One big picture comes out: the main difference perceived is about money, not about technology. When asked if they ever consider an open-source software, respondents always interpreted it as choice between an expensive software and a free one. Sometimes the interviewed didn't seem to have a clear distinction between the two concepts of open-source and free-of-cost. Most of the time the distinction was clear, but the focus was strongly put on the money issue: "It is secondary" (05); "I have never spent a single euro for a software: if I have to pay for a software, I don't use it, even if this means to go pirate" (09). Generally the reliability and ease of use is the main aspect considered for a software: "It must be stable and performing, otherwise it makes no sense" (08); "Free software are interesting also because they are easy: easy to obtain, to distribute, to copy, to patch, to upgrade. Limits put by commercial licenses push towards piracy" (10).

Other respondents gave extremely clear replies about the importance of open-source: "I believe the university must move on the open-source ground not for economic reasons, but because it's in its nature. What counts is the sharing and participation culture. I think that a researcher must have a wider vision of things: I always try put a conscience in what I do, thinking about the cause and impact of my actions" (12). "I consider open-source, not only because it's free of cost. I consider it as an element of evaluation: even though I'm not an extremist of the open-source movement from the ethical point of view, I like its philosophy. I never suggest to use closed products,

because it creates difficulties in sharing products, data, contents" (06).

It is nice to see some clarity about the link between sharing science and sharing technology: "I am interested in the idea of open-source: I like the fact that people cooperate as a community without a business view, especially in the academics where knowledge has to be shared" (04); "We work in scientific research without commercial purposes: it is hard for me to accept the idea of producing knowledge for an economic payback" (03).

5.3. Analysis

Following the constant comparative analysis describe in chapter 4.2 and adopted in this study, the following categories, or concepts, can be drawn from the data presented above:

1. basic practical approach;

2. time factor;

3. force of habit, or "laziness";

4. economic issues;

5. training and literacy;

6. library and information experts

The concepts will be now discussed and related to the research objectives stated in chapter 1.5.

The first objectives were actually achieved by the questionnaire: to verify how much users are informed about the potentials of RMS; to verify whether RMS are used or not, and to what extent; to establish which softwares are the most known and the most used.

Awareness is relatively high in terms of quantity (i.e., the majority of people know about RMS) but low in terms of quality: very few are the known softwares, and low is the relationship between knowledge and usage. RMS are used by the 75% of users.

The questionnaire clearly declares EndNote as the most used software, and a very low range of alternatives: Mendeley, BibTeX, Zotero, Reference Manager, all of them with incomparable low numbers.

For these initial goals, which served the aim of measuring the distribution of RMS, the numbers basically speak for themselves.

The remaining objectives were: to understand users' behaviour; to discuss the reasons behind the use. They were achieved through the interviews, which also helped to understand the raw numbers and put them in context.

Basic practical approach

For the researchers and professors involved in this survey, RMS are tools, and nothing more. They are used when needed (when writing a paper which requires a reasonable number of references), they are used in their basic functions, and they need to work fine. They are a tool do a job better, so they are not used for the sake of using them, or for the pleasure, or for curiosity. This explains the approach expressed in the questionnaire, which shows a very basic need underlining its usage. The small set of most used softwares is a clue for this, too: at this level of mastery of the tool, all the softwares look all the same, therefore scholars stick to what is already well known and tested.

This also emerges about the technological issue: participants in the survey don't show interest in the technological implications of the tool, as long as it works. This leads to be closed against additional extended features, or to paradigm changes: the ignorance about the world of virtual science and networking collaboration explains how little today scholars are aware of the opportunities provided to scientists by the web environment.

Time factor

One concept emerges very strongly from the interviews: time is a crucial factor in everything. This is strictly correlated to the previous category. No scholar is willing to

spend his time on something different than his work. Experimentation and curiosity are used for the scientific activity, not for writing its results. Therefore, everything additional in the process must speed their work and save time, not the opposite. This applies to all the aspects: choice of a software and discovery, deep knowledge of its functionalities, training and learning sessions. This is probably the most stressed concept emerging from the interviews, and it explains the numbers of the questionnaire: few softwares known or used, basic functionalities used, no contact with the library asked or desired, etc.

It is worth noticing that citation management is something often deeply rooted in the research process: yet it is often perceived as an element of minor importance, ready to be sacrificed towards other needs (such as looking for fundings). Overwhelmed with more urgent needs, the refinement of technological skills in the research process affects citation management in a very small part. It is also true, on the other hand, that a more proper training on RMS could help saving time: some interviewees point to this when considering the benefits of these skills.

Habit

A general laziness, or force of habit, prevents change. Softwares are used for a long time before they get changed to new, better performing, solutions. Even when researchers feel a push for change, or they feel unsatisfied with their current product, the issue is postponed. This attitude prevents scholars to discover new products or new features. When a RMS is used, generally it's because a former experience by some colleagues proves it useful. If the tool is suggested, then a scholar begins to test it and use it; if not, it is very unlikely that someone is willing to experiment something new on his own. When this happens, it generally leads to frustrating and unsuccessful experiences. This is shown by the fact that a very low range of softwares is actually used, compared the the softwares known. These numeric data are made stronger by the responses to the interviews, which show how low is the curiosity for different alternatives, due to the time and need factors discussed above. Finally, the fact that the University acquired and distributed licenses of EndNote made the faculties stick with

this software without worrying about other alternatives. Now that the licenses are not purchased anymore, it will be interesting to see how scholars will change their approach.

Economic issues

Economic issues are always important, even when selecting a software. Especially in these last years when fundings are being cut year by year, scholars are careful about the way money is spent. Everything that can save money is welcome: this applies to softwares as well. The cheaper solution is preferred.

Yet this seems true more on the intentions than in the practice: the economic issue is stressed by all the interviewees, but only 16% of the participants in the questionnaire actually indicate it as a reason of choice. The habit of already-in-use tools is stronger than the need to move on better instruments. Often the economic constraint is not strong enough to push people to experiment alternatives.

Training and literacy

Some respondents recognize that they need more information about RMS. Others seem to be confident about their current knowledge, but then they reveal how many useful opportunities they don't know. If we compare the answer to the questionnaire, which says that 87% never received or asked any support, with the interviews responses, which show how basic is the general knowledge of the tools and their functionalities, it is clear how impact has the lack of specific training. Even if not stated explicitly, there is need for training and literacy. Results clearly show how low is the awareness because scholars don't know RMS at all and don't have time to go deeper and improve their skills beyond the self-taught basics.

There are no common practices in the training to RMS: even if everyone's story can look the same ("I use it because suggested by a colleague" or "I use it because everybody else in the lab uses it") every scholar has his own path to it. The usage of a RMS is more part of a "tacit knowledge" present in the research environment, rather than a conscious part of the set of skills and methods of a researcher.

It is remarkable how every concept examined so far – shallow knowledge, time constraints, economic awareness – can be considered within a set of aimed training initiatives.

Given this, a strong condition arises: any kind of training must be tailored to the actual needs. This is heavily connected to the above concepts "Basic practical approach" and to the "Time factor". If RMS serve the purpose of facilitating the research process and saving time, any training on it must not go in the opposite direction.

A special attention must be dedicated to the students. They might benefit from a specific training in RMS as part of their academic information literacy. The strong stress given by some interviewees about this, nevertheless, doesn't match with the percentage of those who actually suggest a RMS to their students (38%).

Library role

The final point is crucial, because it relates to one of the aims of this research, which is to provide evidence-based information upon which libraries can base their strategies about services, assistance, training.

From the data collected, it is clear that librarians, as information experts, must have a more active role in RMS support. But this role must considered in the more general context of the library impact in a community. The survey shows that library staff skills are mostly not perceived, therefore scholars are alone when they face reference management issues. This creates a separation between the library and the academics instead of bringing a mutual dependence. If the library assumes the role of information assistants and technology experts, it can introduce their members to better solutions, improving their workflow and saving them the burden of testing unknown products; it can propose and support standards of use; it can provide training so that the knowledge and skills are equal; it can inform about updates or new solutions. It can be the link between the world of technological information solutions – such as RMS – and researchers' needs.

6. Conclusion

From the data discussed above, it is possible to draw some final considerations, trying to connect the data results with the aims of the research expressed in chapter 1.5.

RMS are considerably used across scientists, even though on a simple level. There is no unique approach to a tool such as a RMS; they are used mostly as a personal tool, like the pc itself, so its usage is tailored to the single person. They are nothing more than tools to facilitate the preparation of a final publication. RMS are used in their basic functions, without much consideration of the interesting feature development presented by the latest products shown in chapter 3. In the same way, virtual collaboration is a concept and a praxis still far from the habits of the University. This is evident already in the answer to question #G of the questionnaire, but the interviews made clear how little the topic is considered. Collaboration itself is very important, essential part of the research job some say, but technology is not perceived as something helpful with that. The scenario seems not mature yet, as if everything has stopped at the years 2006-2008, when web and social oriented software like Zotero or Mendeley stepped on to the stage providing new ways to manage scientific literature.

There is a lot of room for the library to be active in this process. Responses let emerge needs such as: information, training, guidance. Library is not the keeper of resources anymore, but also the keeper of bibliographic tools. RMS require a lot of time and skills that researcher seldom have; a professional expert in these tools could help the scholars guiding them across the wide range of packages, across the basic functions, focusing on problem-solving activities. This could be an extremely cost-benefit effective initiative. This considerations confirm what is said in the literature. East already noted the relationship between bibliographic support and reference management training. He recognizes "the well-established role of the library in training researchers in searching electronic databases and downloading retrieved references. From here it was only a short step to beginning to train researchers in the

management of those references" (East 2001). Every library, though, exists in a specific context, which is not the same everywhere. East notes that "in many institutions the library has come to be seen as the main centre of expertise in matters related to personal bibliographic software". This has not happened yet at the University of Torino, but the survey suggests that it should, and that a loud call for a new commitment is given.

This could apply also to students, as a part of information literacy strategy, but the survey doesn't provide clear evidence on how important is for students to receive this sort of training. This confirms what was already noted by Duong 2010: "Since most undergraduate science courses do not require writing-intensive research papers, many departments have not seen the relevance of IL instruction" (Duong, 2010).

6.1. Further studies

The present research shows important limits, both in the methodology as in the findings. Methodological limits due to practical constraints were predicted at the beginning of the studies, and expressed in chapter 4.4. This survey, the first of this type at least in Italy, gives an important picture of the distribution and usage of RMS in a big academic environment such as the University of Torino. The findings shown above give room for more areas of inquiry.

It would be extremely interesting to perform a similar survey to other universities, and compare the results finding patterns, similarities and differences among them to reach a nation-wide overview of the phenomenon.

It would be useful to perform a similar survey which includes the HSS disciplines, and give scientific evidence to the original assumption that these academic fields are unaware of RMS.

In the context of the University of Torino, EndNote licenses will be not renewed: it will be interesting to see how this affects faculties' behaviour.

Finally, it should be worth to analyze the results from the user context point of view, considering factors such as age more deeply than the present research. Many of the

concepts identified and discussed above can gain interest if looked considering the age factor: technological issues such as networking, open-source philosophy, openness to novelty and interest in training can affect very differently people of different age. Also, having proved that habit is a strong factor, searching for patterns of behaviour among different age ranges could lead to important understanding on how the phenomenon is likely to change in the next future.

Appendix 1 - The Questionnaire

Usage of Reference Management Software (RMS) in academic environment

This questionnaire aims to measure the extent of the usage of Reference Management Software in an Academic Environment. Reference Management Software (RMS), also called Bibliographic Management Software or Citation Managers, are software packages that allow users to save and organize citations from scientific papers and edit them according to the main citation styles (e.g. APA, Chicago Manual of Style, etc.). The results of this research will be used for my Master Thesis in Digital Library and Learning. The whole questionnaire will take less than 5 minutes. All the answers will be collected anonymously, and no connection to the identity of the respondent will be made. Everyone's attendance is important for my study, so I thank you in advance if you decide to participate, and if could share it with your collegues. For any further information, please contact me at my email address: efrancese [at] gmail [dot] com.

A - **Are you aware of the existence of the following RMS? (Please check the softwares you may have heard about even if you have never used them)**

- EndNote
- EndNote Web
- BibDesk
- JabRef
- Zotero
- Papers
- Mendeley
- Bookends
- Citavi
- Qiqqa

- RefWorks
- CiteULike
- Connotea
- ProCite
- BibSonomy
- BibTeX
- ReferenceManager
- I don't know any
- Other:

B - Which RMS do you currently use? (Please specify the softwares you currently use as RMS; one or more options are allowed)

- EndNote
- EndNote Web
- BibDesk
- JabRef
- Zotero
- Papers
- Mendeley
- Bookends
- Citavi
- Qiqqa
- RefWorks
- CiteULike
- Connotea
- ProCite
- BibSonomy
- BibTeX
- ReferenceManager

- I don't use any RMS

- Other:

C - Why did you choose this tool among others?

- it's the tool acquired/provided by my institution

- it's the tool used/suggested by my colleagues

- it's the tool I find best performing

- I read an article about it

- it is free of cost

- it is open-source

- no particular reason

- other (specify)

D - How long have you been using RMS tools?

- less than 1 year

- from 1 to 2 years

- from 2 to 5 years

- more than 5 years

- I don't use them

E - How many references have you saved in your RMS, approximately?

- less than 50

- 51-100

- 101-200

- 201-500

- 501-1000

- 1001-2000

- more than 2000

F - If you don't use any RMS, please explain the reasons why .

(open question)

G - What RMS features do you use most?

- Saving references

- Pasting references into the paper I'm writing

- Editing and formatting references in the needed citation style (i.e.: APA, Chicago, MLA, etc.)

- Organizing references for easier retrieval and management

- Storing pdf files of research papers

- Sharing references with colleagues

- Discovering new references

- Creating lists of references

- Discover new people with the same research interests

- Other

H - Have you ever attended a course or a workshop about these softwares?

- yes

- no

I - Did you get any support from your institutional library in using a RMS?

- yes

- no

J - Can you specify the previous answer?

K - Did you ever suggested the use of RMS to other colleagues?

- yes

- no

L - Did you ever suggested the use of RMS to students?

- yes

- no

Personal Information

The questionnaire is almost over; we now ask you few simple questions about

yourself.

M - **Your position**

- PhD student
- Researcher
- Professor
- Other

N - **Your Institution / affiliation**

- Dipartimento di Anatomia, Farmacologia e Medicina Legale
- Dipartimento di Biologia Animale e dell'Uomo
- Dipartimento di Biologia Vegetale
- Dipartimento di Chimica Analitica
- Dipartimento di Chimica Generale e Chimica Organica
- Dipartimento di Chimica Inorganica, Fisica e dei Materiali
- Dipartimento di Discipline Ginecologiche e Ostetriche
- Dipartimento di Discipline Medico Chirurgiche
- Dipartimento di Fisica Generale
- Dipartimento di Fisica Sperimentale
- Dipartimento di Fisica Teorica
- Dipartimento di Fisiopatologia Clinica
- Dipartimento di Genetica, Biologia e Biochimica
- Dipartimento di Medicina ed Oncologia Sperimentale
- Dipartimento di Medicina Interna
- Dipartimento di Neuroscienze
- Dipartimento di Sanità Pubblica e di Microbiologia
- Dipartimento di Scienza e Tecnologia del Farmaco
- Dipartimento di Scienze Biomediche ed Oncologia Umana
- Dipartimento di Scienze Cliniche e Biologiche

- Dipartimento di Scienze della Terra

- Dipartimento di Scienze Mineralogiche e Petrologiche

- Dipartimento di Scienze Oncologiche

- Dipartimento di Scienze Pediatriche e dell'Adolescenza

- Dipartimento di Traumatologia, Ortopedia e Medicina del lavoro

- Other

O - Your age

- under 26

- 26-35

- 36-45

- 46-55

- over 55

P - Do you have any other comments or observations?

Q - Would you be available for further contact? If so, please write to my address.

Thank you for your time!

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