Are you ready? Tasks and roles for academic libraries in supporting Research 2.0

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Abstract
Purpose – The purpose of this paper is to identify tasks and roles that academic libraries have to fulfil to react to the developments brought in by the appearance of Research 2.0.
Design/methodology/approach – A review of current literature about the topic was performed.
Findings – Literature used reveals that currently, there is a need for providing information literacy (IL) education (mainly in the form of data literacy), providing research data services (RDSs) (addressing data quality and data citation), raising awareness of faculty members on different issues and providing individual support to them.
Originality/value – The paper intends to be an add-on to the body of knowledge about academic library support to researchers.
Keywords Academic libraries, Research data management, Information literacy, Data literacy, Research 2.0, Research data services
Paper type Viewpoint

Introduction
Recent library literature clearly shows well-grounded concern about the role of academic and research libraries (henceforth academic libraries) in supporting academic research (Brydges and Clarke, 2015). A number of researchers see libraries’ role restricted to being dispensaries of books and articles. Traditionally, academic libraries have focused mainly on issues regarding the “output” of scholarly communication, that is, collecting journals, monographs and other documents. Being occupied with this, academic libraries did pay enough attention to the core process of research and the dynamics of change within scholarly communities (English, 2004; Genoni et al., 2006; Jahnke et al., 2012).

As long as this is not simply a question of having beliefs based on superficial viewpoints, but reality, there is a need for change. No doubt, changes in researchers’ information behaviour and in the publishing world are calling for a major transformation of the role and tasks of the academic library. These changes have been induced by the appearance of Research 2.0 (Science 2.0 or eScience). In this paper, Research 2.0 is understood as research in the sciences, social sciences and the humanities that makes use of the power of the Internet that enables different new forms of networking, encourages openness and provides the possibility to access and manipulate massive amounts of data.

When describing the role of academic libraries in supporting Research 2.0, the main objective of this paper is producing an inventory of tasks and roles that academic libraries may be required to fulfil now and in the near future. As new developments evolve, new content can be added to this inventory.
Having said this, it has to be added that the reception of Research 2.0 by researchers has not been unanimous; thus, there are contradictions and controversies. On the one hand, information technology has radically altered the means by which scholars communicate (Borgman, 2007). On the other hand, technological changes did not change the measures of trust and authority. Therefore, many researchers are convinced that there is an important distinction between experimenting with new tools and using the well-established channels of scholarly communication (Acord and Harley, 2013; Nicholas et al., 2014). Empirical investigations show that researchers experience a higher-education climate that favours peer review and citation indices because there are no generally accepted measures to evaluate social media-based content (Nicholas et al., 2015). Neither are there any career benefits, resulting from using social media. Novel services are beginning to make their mark on research, but not yet in a sustained or systematic way, and there is little evidence that the extended use of social media services will lead in the short or medium term to radical changes in scholarly communications. In general, while Research 2.0 is with us, there are numerous barriers in the way of its wider uptake (Collins, 2013; Koltay et al., 2015).

The data-intensive component of Research 2.0 shows a different picture in the sense that – as yet – its development has been highly dependent on research funders’ requirements. Therefore, due to the higher activity of the research funders, the UK is on the forefront in Europe, and we can see considerable development in Austria, Germany, Ireland, The Netherlands and Norway. The European Commission itself is also an initiator and active participant in these processes. Beyond the EU, Australia, Canada and the USA, open access (OA) to research data is required by a number of research funders (RECODE, 2015). This is a motivating factor for academic libraries, as well. Still, in less research-intensive universities, it is usually difficult to get managers to recognize that data-intensive research requires specialist staff and skill development (Gwyer, 2015). This problem is also manifested when we regard the situation of universities in different countries of the world, where there is less motivation towards Research 2.0 by funding bodies. Nonetheless, even these countries and institutions should be aware of the potential of the importance and possible impact of related developments.

In accordance with the above, this paper addresses the following activities:

- information literacy (IL) education;
- research data services (RDSs) (with attention to data quality and data citation);
- raising awareness on different issues; and
- supporting individual faculty members.

**IL education**

In a number of countries, providing IL education to different groups of (graduate and undergraduate) students can be qualified as a traditional activity of academic libraries. However, this may not be true in the case of all researchers, who can be faculty members, non-teaching researchers, postdoctoral researchers and doctoral students.

A relatively wide circle of this target audience is addressed by the *Information Literacy Competency Standards for Higher Education*, conceived in the USA by the Association of College and Research Libraries (ACRL, 2000) and also in its newly developed version, that is, the *Framework for Information Literacy for Higher
Distinguished attention has to be given to the SCONUL Seven Pillars of Information Literacy. Core Model for Higher Education was devised by the Society of College, National and University Libraries in the UK (SCONUL, 2011).

The Vitae Research Development Framework is slightly different from these documents because it demonstrates the role of IL in the researchers’ life through the researchers’ eyes, and we will focus on this document. It defines the knowledge, behaviours and attributes of the effective and highly skilled researcher. It operates with lenses that focus on knowledge, behaviours and attributes that are developed or acquired through or used in the broader contexts of being a researcher. It consists of a series of lenses that address, among others, employability, leadership, public engagement and mobility. It has a lens on academic literacy, defined as the ability to understand, interpret, create and communicate appropriately within an academic context, and also an IL lens. IL is described in three phases. In the first phase, the main thrust is on the use of information technology, while emphasizing the need to obtain expert advice from information or data managers, archivists and librarians. The second phase develops awareness of the creation, organization, validation, sharing, storing and curation of information and/or data, as well as understanding legal, ethical and security requirements. Knowledge on the purpose of metadata also appears in this domain. Phase 3 focuses on advising and educating peers, less-experienced researchers, students and staff of the above requirements. The final phase is about developing new techniques and anticipating trends.

The IL lens underlines that IL is necessary not only for finding, analyzing and evaluating data and searching for literature, but for publishing, as well. In these qualities, it is fundamental to the whole process of research. It demonstrates how IL can contribute to the overall professional development of researchers, by making clear how the skills and attributes they have developed through research can contribute to their development in IL, and in which areas of IL do they need to develop into being more effective (Vitae, 2011).

An important new development is the growing attention towards data literacy. This literacy is an emerging one, which has close ties to IL by being situated at the intersection between scholarly communication and IL (ACRL, 2013).

Data literacy can be defined as a specific skill set and knowledge base, which empowers individuals to transform data into information and into actionable knowledge by enabling them to access, interpret, critically assess, manage and ethically use data (Koltay, 2015). Data literacy education should incorporate both the social and technical aspects of data (Sharma and Qin, 2014). This is demonstrated by the list of abilities that define data literacy, conceived by Calzada Prado and Marzal (2013), as follows:

- knowing how to select and synthesize data and combine them with other information sources and prior knowledge;
- identifying the context in which data are produced and reused;
- recognizing source data value, types and formats;
- determining when data are needed;
- accessing data sources appropriate to the information needed;
- critically assessing data and their sources;
- determining and using suitable research methods;
- handling and analyzing data;
• presenting quantitative information;
• applying results to learning, decision-making or problem-solving; and
• planning, organizing and assessing ourselves throughout the process.

Research data services
Research data are managed on different levels by varied players of the related processes. These processes include research data management (RDM) and data curation. RDM is a set of general activities not specifically attached, but potentially performed by the library. It means caring for research data, facilitating access to it, preserving and adding value to these data throughout its lifecycle that is one of the key determinants of open data publication and data curation, bringing the benefits of enabling finding and understanding data, avoiding unnecessary duplication and validating results (University of Edinburgh, 2015).

RDM is a crucial element in the publication of research data sets, especially if we endeavour the openness of data. It is also a main constituent of data curation services (Si et al., 2013). Librarians are familiar with the research data needs of researchers, and have been among the supporters of innovative publishing models, including OA publishing. They are already involved in acquiring necessary abilities to manage data (Hswe and Holt, 2012). This involvement is demonstrated by the fact that the growing importance of RDM has been identified as an imperative by the ACRL Research Planning and Review Committee (ACRL, 2014) and the Horizon Report of the New Media Consortium (NMC, 2014). The high request for professionals who can assist scholars in their research activities is also an indication of this (Marcum, 2015).

RDM is not always clearly differentiated from data curation, which is broader than data management, and involves maintaining, preserving and adding value to digital research data throughout its lifecycle (DCC, 2015). A model of this lifecycle is offered by McLure et al. (2014), who also underline that data repositories, through which data can be curated and shared, provide an important means of data curation, and this fact also strengthens the connectedness with libraries.

RDSs is an overall service framework that is related to these processes, and should be provided by academic libraries. The Association of Research Libraries (ARL) declared that academic libraries are in a favourable position to help researchers to meet the challenges of a data-intensive research paradigm by providing RDS, and a few academic libraries already offer RDSs, and the number of libraries that plan to engage in such activities is growing. As a rule, these services are extensions of traditional services (Tenopir et al., 2014). Informational services consist of consulting with faculty, staff or students on data management plans (DMPs) and metadata standards; providing reference support for finding and citing data sets; or providing web guides and finding aids for data or data sets. There are also technical services in the form of providing support for using data repositories, preparing data sets for a repository and deselecting them from repositories (Tenopir et al., 2012).

One of the most important technical RDS activities is creating metadata for data sets that supplements the provision of “traditional” metadata to books and journal articles. By providing this type of service, academic libraries may fill in a niche in the support chain. One useful tool for this may prove the DataCite Metadata Scheme, which features a small set of mandatory properties, and an additional set of optional properties for more
detailed description. Its kernel contains the mandatory properties, such as the data set’s identifier, creator, title, publisher and publication year (Starr and Gastl, 2011).

DMPs represent the basic level of both RDM and RDS. Preparing DMPs has been the first and widespread activity that complies with the varied requirements of funding agencies (Molloy and Snow, 2012). There is also a model for assessing requirements for RDM support (Lyon et al., 2014), and – in general – it can be said that RDS has become a new embedded information service (Si et al., 2013).

The significance of RDS is understood by libraries and by librarians. The League of European Research Universities (LERU) examined several issues related to RDM tasks, including the role of libraries. In their opinion, academic libraries can provide help in increasing the visibility of research data, and they are well placed to advocate best practices in data management and data citation. Supporting RDM is a new role for them, so they have to be encouraged to adapt to this changing landscape. The main reason for this is the need to minimize the time that researchers have to spend on technical and administrative processes.

According to the LERU report, successful RDM requires cooperation between librarians and researchers, especially in clarifying what is expected of researchers when describing and citing data. Libraries’ role is to support data management and discovery that encompasses curation, preservation, data publishing and archiving and access to data resources. Libraries have to provide guidance on finding and assessing data, OA licensing, data citation and DMPs. Librarians, involved in data-intensive research, must maintain a continuous watch on the evolution of formats and technologies (LERU, 2013).

In light of the above, it becomes clear how important are the ten recommendations for libraries to get started with RDM, elaborated by the Association of European Research Libraries (LIBER). While stressing that they do not need to be delivered at once, the document contains the following recommendations:

- Offer RDM support, including DMPs for grant applications, intellectual property rights advice and information materials. Assist faculty with DMPs and the integration of data management into the curriculum.
- Engage in the development of metadata and data standards and provide metadata services for research data.
- Create data librarian posts and develop professional staff skills for data librarianship.
- Actively participate in the development of institutional research data policy.
- Liaise and partner with researchers, research groups, data archives and data centres to foster an interoperable infrastructure for data access, discovery and data sharing.
- Support the lifecycle of research data by providing services for storage, discovery and permanent access.
- Promote data citation by applying persistent identifiers to research data.
- Provide an institutional data catalogue or data repository.
- Get involved in subject-specific data management practice.
- Offer or mediate secure storage for research data (Christensen-Dalsgaard, 2012).

Both RDM and data curation require distinguished attention towards data quality that is determined by the following main factors:
trust;
• authenticity;
• reliability;
• understandability;
• discoverability;
• accessibility; and
• integrity (Giarlo, 2013).

Data citation is a potential source of motivation for researchers to share and publish their data, because it may become a source of reward and acknowledgment for them. Citations can also be used as an implicit measurement of data quality (Candela et al., 2015). There are several initiatives and guides to provide standardized forms for data citation (e.g. CODATA, 2010; IASSIST, 2012). Having recognized its importance, Thomson Reuters, a major commercial information provider, started his Data Citation Index.

Among the various issues of data citation, the – perhaps less widely known – problem of granularity has to be mentioned, because data sets are little more complicated than print publications, where the issue of citing at different levels of granularity is relatively straightforward. Just to give an example, single-author monographs are referenced as whole books, while each article of a journal issue is referenced individually. In the case of data sets, it is not always obvious what would constitute an intellectual whole (Ball and Duke, 2015).

Supporting individual faculty members
As said above, faculty members make up an important and relatively large group of researchers. However, many of the academic libraries’ support activities that are directed towards different groups of researchers, but not individual faculty members. Therefore, it is crucial to strengthen such support activities offered by academic libraries.

As individual’s needs are often difficult to articulate, to achieve success in this field, two general issues have to be made clear:

(1) What is the perception of librarians about their own role in relation to the research activities of faculty and how do they want to achieve?

(2) What is the perception of faculty members about the supporting role of librarians in their research?

The involvement in the support of individual research can be grouped into the following categories:
• providing informal alerting services;
• purchasing requested resources;
• answering in-depth reference questions;
• creating visual representations of data;
• co-researching about scholarly publishing in a specific area of knowledge;
• co-researching the scholarship of teaching; and
• consulting about searching (Brydges and Clarke, 2015).
Awareness raising

Many of the tasks that academic libraries are expected to address are non-traditional in the sense that they are not offered directly by the libraries themselves, but the librarians are the ones who can make researchers aware of their existence.

Despite the restricted use of social media tools already mentioned, librarians have to raise awareness of social media sites designed for professionals in general (like LinkedIn[1]) and, in particular those, meant for researchers (e.g. Academia.edu[2] or Researchgate[3]). At present, it is namely not clear enough if their existence had fundamentally changed the picture that we painted about their use by researchers.

OA to scientific publications is still important. In particular, there should be information about the Diamond, the Gold and the Green routes of OA, not forgetting about issues of article processing charges (APCs). A relatively new and, to an extent, controversial problem is the presence of predatory publishers. Such journals and publishers are enumerated in the List of Predatory Publishers[4]). However, due to the fuzziness of the concept of predatory publishing, besides blacklisting, whitelisting reliable publishers and journals may be a viable solution, as the example of the Directory of Open Access Journals (DOAJ[5]) shows it (Berger and Cirasella, 2015).

Open data require data to meet the criteria of being accessible, useable, assessable and intelligible, while there has to be an awareness of the legitimate boundaries of openness set by commercial interest, the protection of privacy, safety and security. The barriers to openness have to be scrutinized carefully to limit prohibition to cases, when research could be misused to threaten security, public safety or health (Royal Society, 2012).

Awareness of researchers has to be raised of other initiatives, as well. One example is the Dutch Data Prize, which awards the efforts of researchers who bring data together, document it and make it accessible to others (Research Data Netherlands, 2015). The Data Seal of Approval (also a Dutch institution) that gives data producers and funders the assurance that their data will be stored in a reliable manner and can be reused is similarly interesting.[6]

Data journals may overcome several barriers to open data, as they promote the publication of data papers in a way that mirrors the scientific publication model (Candela et al., 2015).

Alternative metrics (often called altmetrics) of scientific output are an essential feature of Research 2.0. The availability and accessibility of big quantities of textual material, in particular full texts of journal papers and books, makes technically possible to go beyond traditional, but often criticized measures of scientific output. However, alternative approaches may not become easily institutionalized and accepted by the communities of researchers or other stakeholders in the research field as funders, universities, research centres, learned societies or publishers. Nonetheless, using alternative metrics may supplement well what has been done traditionally in the field of measuring research impact.

From the already existing academic library activities, the promotion of institutional repositories can be mentioned here, as well (Brydges and Clarke, 2015).

New role models for academic librarians

A 2014 review article on data management issues by MacMillan (2015) shows – among others – that librarians have to develop new expertise and much deeper understandings
of the research lifecycle, if they want to remain relevant. As Ramirez (2011) put it, with the exponential growth of digital data and a higher use of digital repositories, librarians have to become expected liaisons between data authors and users.

This expertise consists to a substantial degree of fulfilling the roles and tasks, outlined above. However, the related roles and partly overlapping duties appear under different names.

**Blended librarians** may have multiple roles, including those of the researcher (Corrall, 2010). Professionals are also often called **embedded librarians**, who may be a part of research teams (McCluskey, 2013). The work of **scholarly communications librarians** is closely tied to IL (Davis-Kahl and Hensley, 2013).

Data-related librarianship in general has now become a significant part of the academic library workforce (Xia and Wang, 2014). This wider category of duties appears under different names. The term **data specialist** is rather an umbrella term itself (Si et al., 2013). Related titles, such as **data librarian** (Maatta, 2013) and **data management librarian**, have also emerged (Xia and Li, 2015). A **data scientist** may not be used by libraries, though they combine the skills of computer scientist and librarians with an expertise in the given field (LERU, 2013).

The types of assistance provided by **research informationists** are a logical extension of the libraries’ traditional offerings, because they mirror the tasks that librarians apply to library documents, even though the main thrust of their work is on data (Federer, 2014).

Auckland (2012) identified several key skills, where the involvement of librarians in supporting and advising researchers is considered to be important now and is expected to grow in the future. These include:

- the preservation of research outputs;
- data management and curation;
- complying with the various mandates of funders, including OA requirements;
- potential data manipulation tools;
- data mining; and
- the use of metadata.

The list of names will grow, and the required responsibilities are already much wider than indicated in the above example (Xia and Wang, 2014, Xia and Li, 2015).

**Notes**

1. www.linkedin.com/
2. www.academia.edu/
3. www.researchgate.net/
5. https://doaj.org/

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