



Contents lists available at ScienceDirect

# The Journal of Academic Librarianship

journal homepage: [www.elsevier.com/locate/jacalib](http://www.elsevier.com/locate/jacalib)

## Research data services (RDS) in Spanish academic libraries

Roberto Martin-Melon<sup>a,b,\*</sup>, Tony Hernández-Pérez<sup>a</sup>, Sara Martínez-Cardama<sup>a</sup>

<sup>a</sup> Department of Library and Information Science, University Carlos III of Madrid, c/Madrid 126, 28903 Getafe, Spain

<sup>b</sup> Library of the Universidad de Cantabria, Avda. de los Castros, 52., 39005 Santander, Spain

### ARTICLE INFO

#### Keywords:

Academic libraries  
Research data management (RDM)  
Research data services (RDS)

### ABSTRACT

Research data services (RDS) are actions undertaken to provide researchers with support, advising, training, information, a technological infrastructure and a regulatory framework with respect to research data management (RDM) throughout the life cycle of the data. The implementation of RDS is an activity that is becoming increasingly important within the functions carried out by academic and research libraries. The aim of this study is to provide a snapshot of the research data services implemented in academic libraries in public universities in Spain, identifying the number and types of services deployed. We conducted a Website Content Analysis of the libraries of the 48 Spanish public universities to discover which RDS they are implementing and promoting. The results show that, despite a lack of institutional policies regarding research data, libraries are deploying these new services, albeit unevenly in terms of both the number of services and the type of support provided. Services related to development of the data management plan (DMP) and preservation of the data in repositories predominate. This inventory is presented as a first step towards learning the level of RDS implementation in Spanish academic libraries, providing a partial perspective and leading the way to exploring other aspects in greater depth in future studies.

### Introduction

Technological advances in recent decades have made it possible to generate, collect and process massive amounts of data which are then explored in order to extract the underlying information. This has resulted in the emergence of new disciplines such as data science: a new way of producing knowledge based on data-intensive computing. Given that data have become a key element in the research process, access to them is essential to ensure the necessary scientific transparency (Munafó et al., 2017), with their openness and reuse being priority areas in the Open Science Agenda 2025 (European University Association, 2022).

These research data have to be understood in a broader and more complex context that encompasses policies, standards, regulations, public and private interests, and the different technologies and infrastructure that enable them to be safeguarded and accessed securely, on top of requirements that these data be open and also adhere to the FAIR principles (Wilkinson et al., 2016).

In addressing the complexities these research data involve, two related and complementary concepts emerge: research data management and research data services.

Based on the definition of Cox and Pinfield (2014), RDM covers a

series of activities and processes associated with the data's lifecycle which entails collection and/or creation of the data, as well as their storage, security, preservation, recovery, exchange and reuse, all taking into account technical issues, ethical and legal considerations, and the governance frameworks developed for these data.

This data lifecycle, according to the UK Data Archive (Eyden, 2013), encompasses six stages, which in turn include a group of activities (Table 1), both technical and organisational, ranging from the creation of these data to making them available to other researchers for reuse.

On the other hand, for the purposes of this study, we define research data services (RDS) as actions undertaken to provide researchers with support, advising, training, information, a technological infrastructure and a regulatory framework with respect to RDM throughout the life-cycle of the data.

Together with the various Spanish and international scientific agencies and bodies supporting and promoting the openness of scientific data, research and academic libraries are assuming an important role in developing RDS. This is highlighted in the latest European University Association survey (Morais et al., 2021), which shows how European universities are advancing in the implementation of different open science policies and that research libraries are perceived as the units most

\* Corresponding author at: Library of the Universidad de Cantabria, Avda. de los Castros, 52., 39005 Santander, Spain.

E-mail addresses: [roberto.m.melon@alumnos.uc3m.es](mailto:roberto.m.melon@alumnos.uc3m.es) (R. Martin-Melon), [tony@bib.uc3m.es](mailto:tony@bib.uc3m.es) (T. Hernández-Pérez), [Smart1@bib.uc3m.es](mailto:Smart1@bib.uc3m.es) (S. Martínez-Cardama).

<https://doi.org/10.1016/j.jacalib.2023.102732>

Received 16 December 2022; Received in revised form 2 May 2023; Accepted 4 May 2023

Available online 23 May 2023

0099-1333/© 2023 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

**Table 1**  
Adaptation of the UK data archive data lifecycle.

	Creating data	Processing data	Analysing data
ACTIVITIES	- design research - plan data management - plan consent for sharing - locate existing data - collect data - capture and create metadata	- enter, digitise, transcribe and interpret data - check, validate and clean data - anonymise data where necessary - describe data - manage and store data	- interpret data - derive data - produce research outputs - author publications - prepare data for preservation
	Preserving the data	Giving access to data	Re-use of the data
ACTIVITIES	- migrate data to best format - migrate data to suitable medium - archive data - create metadata and document them - place data in repository	- distribute data - share data - control access to data - establish copyright - promote data	- follow-up research - new research - undertake research reviews - scrutinise findings - teach and learn

involved in the concept of shared data and FAIR data.

As a result of their experience and knowledge in acquisition, processing, and management of data and, in recent years, as publishers of the information generated by their institutions, academic libraries are positioned advantageously to take a leading role in providing services related to research data, and this is seen as one of the areas that will most need to be developed in coming years (ACRL, 2018).

However, taking on these new services is challenging because of the special nature of the data: very heterogeneous in type, they can require a very large storage capacity; data are used differently in the cultures of different scientific disciplines; they can include sensitive personal information; they require adequate security measures to avoid loss, deterioration or unauthorised access; and they can rapidly become obsolete, complicating preservation. These and other factors create the need for new technical, organisational and even leadership skills on the part of academic library staff to ensure that RDS implementation meets the needs of both the institution and its researchers.

In order to understand how these new services have been implemented, different studies have been conducted in academic institutions around the world to analyse the types of activities as well as the difficulties and barriers that exist in their implementation. These studies on RDS, as Cox and Pinfield (2014) indicate, have a practical value because they help librarians, other providers of professional services and policymakers to evaluate the development of library services, both nationally and internationally.

The aim of this paper is to provide a snapshot of the research data services implemented in academic libraries in public universities in Spain, identifying the number and types of services deployed. This identification and inventory is done through an analysis of the institutional websites, considering this information source to be a “reasonable approximation of institutional legitimacy” (Radecki & Springer, 2020, p. 10).

So, the three research questions addressed were as follows:

RQ1: What services are being implemented by Spanish academic libraries to support researchers in the management of their research data?

RQ2: Which of these services are more developed and which are less developed?

RQ3: What is the role that Spanish academic libraries are assuming in RDS?

## Literature review

A variety of studies have analysed and discussed the RDS deployed in academic and research libraries in different countries and institutions around the world. For example, in Tenopir et al. (2012), the directors of libraries in the Association of College and Research Libraries (ACRL) were surveyed to discover which RDS they have implemented or plan to implement in the future. The analysis of the total number of responses revealed that few libraries in the United States and Canada were starting to implement these types of services and that libraries that had started the process were focused on informational and consultative services, with ones of a technical nature being few and far between. The analysis also highlighted the importance of staff training to address the complexity associated with RDM. Despite the timid results, the authors present RDM as an opportunity for libraries to play a more prominent role in their institutions. Subsequent revisions to the study (2015 and 2019) showed little change in the results, confirming that academic libraries continue to be more likely to offer informational and consultative services on RDM than technical services, and that RDS had not grown as much as hoped based on the results of the earlier surveys.

Tenopir et al. (2017) transferred the methodology used in the analysis of the ACRL libraries to the European context, analysing the libraries that belong to the LIBER (Association of European Research Libraries). The results were similar to the survey of the North American libraries, with consultative and informational services on RDM being more common than technical ones. It identified the need to have trained staff by offering training opportunities and hiring new staff with the training to address these services.

Another association, the ARL (Association of Research Libraries), analysed RDS in its member libraries (Fearon et al., 2013). The data collected in this study are very extensive and show how many libraries were starting to develop these services even before their institutions had a research data policy in place. This suggests that libraries feel capable of and are assuming these types of services as part of their functions.

The data in the ARL survey were later used as the basis for subsequent analyses, such as that of Yu (2017), which aimed to show showing the evolution of RDS. Their results show how the various RDS have increased overall since 2013, with libraries being the units spearheading and promoting these services within their organisations, thereby reinforcing their leadership. However, deficiencies centred around the lack of infrastructure, a general policy to support and regulate these services, lack of funding, as well as the need for training to enable staff to assume these new roles.

Unlike earlier studies based on surveys and interviews, Yoon and Schultz (2017) in 2015 analysed the websites of 185 libraries in the United States, with their results coinciding with those of other studies. The services most implemented were those of consultation, preservation and assistance in creating the DMP, while training activities on data were hardly implemented.

More recent, and also focused on academic libraries in the United States, are the studies of Gowen and Meier (2020), Radecki and Springer (2020) and Fu et al. (2022). The first analyses the changes between 2015 and 2020 in the RDS offered by libraries in the AAU (Association of American Universities), finding moderate growth in the number of librarians specialised in data and in libraries offering these services. It also found significant growth in the number of new institutional data repositories, with these doubling in number, and a slight drop-off in the number of institutional repositories. Radecki and Springer's analysis, for its part, identifies advisory services as the most common, with training events such as workshops and seminars being an important format for these activities. Aspects such as web development and data visualisation and others of a technical nature, however, continue to be in the minority. Lastly, Fu's analysis focused on Central Washington University and asked the research staff and graduate students which services they most request. Locating resources for improving their research topped the list, followed by finding existing datasets, finding a repository for their

data, data analysis and visualisation and, lastly, cleaning, documentation of data and DMP creation.

Although the majority of these analyses have focused on the context of North American libraries and associations, there are also examples of more global studies, like those of Cox et al. (2017, 2019), conducted in libraries in Australia, Canada, Germany, Ireland, the Netherlands, New Zealand and the UK, which found a very diverse international environment with respect to the role of libraries in the services associated with data and research. They did, however, identify some common patterns described in earlier articles, those of Tenopir and Fearon for example, such as the preponderance of consultative services compared to technical ones or the requirements of funding agencies as the drivers of these services. As far as deficiencies or difficulties are concerned, these are related to lack of financial resources and staff, lack of knowledge on the part of librarians, and researchers' lack of knowledge about or interest in sharing and managing their research data.

Another two studies at the international level were conducted by Si et al. (2019) and Nahotko et al. (2023). The first of them used the 100 top universities in the QS World University Rankings as a reference. An analysis of their websites revealed that their libraries are the main drivers of RDS, with this being the second most common service provided, surpassed only by services to support open access. Their conclusions highlight the importance of the skills of the library staff in ensuring the success of these services.

The study by Nahotko et al. analysed the maturity level of RDS in Polish academic libraries, using web scraping techniques to identify a series of previously agreed keywords that were directly related to the existence of these services. The results showed that the libraries have assumed these services conservatively, adapting them to the traditional functions, with issues related to preservation of data in repositories, DMP creation, storage and assignment of metadata predominating.

In the Spanish context, the survey conducted in 2013 of CSIC research staff for the purpose of learning their habits in the management of their research data is noteworthy (Bernal & Molina, 2014). A lack of knowledge and awareness about the proper handling of these data was revealed, recommending the development of policies for dissemination of the data, clear policies regarding their ownership and the development of RDS, calling for the transformation of research libraries to put these new services in place.

Focusing on three Spanish universities, Arias-Coello et al. (2018) sent a questionnaire to senior and research staff at these universities to learn their needs and deficiencies in relation to the management of research data. The responses received reflected a lack of knowledge related to the DMP and deficient awareness and use of metadata, highlighting the need for training in data management.

The Spanish Network of Academic Libraries, REBIUN, (Grupo de Repositorios de REBIUN, 2018; Subgrupo de Acceso Abierto de REBIUN, 2017), found examples of good practices in the implementation of these services in Spanish academic libraries, with a large percentage of them having adapted or planning to adapt their own repositories to accommodate data and nearly a third planning to create an open data policy.

Martín-González and Iglesias-Rodríguez (2022) reviewed the training activities of Spanish academic libraries, but focusing on the broader concept of data literacy, that is, open data literacy, which would include sub-literacies such as research data literacy. Their results show that few libraries in Spain offer training focused on research data management and how to cite these data. The authors consider that, in order to provide adequate training, the figure of the data librarian needs to exist and be recognised. At the same time, this professional needs to be provided with an adequate training programme to acquire the necessary skills for this new service.

## Materials and methods

To answer the questions posed in this research project, a descriptive study was developed using the quantitative content analysis (QCA)

technique. This type of work requires classification of the content being studied to ensure that the information to be analysed is recorded in a systematic way. The object of the analysis is limited to public universities in Spain, as these are the ones that dedicate the most resources to research (Pérez García & Aldás Manzano, 2022), analysing the available information on RDS available on the institutional websites of these libraries.

The directory of the universities associated with the Conference of Rectors of Spanish Universities, CRUE, (<https://www.rebiun.org/quienes-somos/bibliotecas>) was used to select the public universities to be included in the study, with a total of 48 libraries categorised as public.

A literature review (Fearon et al., 2013; Cox et al., 2017; Yoon & Schultz, 2017; Yu, 2017; Chiware & Becker, 2018; Tenopir et al., 2019; Mushi et al., 2020; Radecki & Springer, 2020; Fu et al., 2022) identified the research data management-related services to be included in the process of analysing the websites. This coding was supplemented by a prior and random review of several academic libraries in order to harmonise the services detected in the documentation, very centred on the English-speaking context, with those in the Spanish libraries.

After completing this stage, and once the services to be included in the analysis had been identified, these were grouped into five categories (Table 2):

Each of these sections encompasses a series of subcategories, 48 in total, that were reviewed in the analysis of the websites and coded as an existing service or not based on their presence in the offer of services of the academic library examined.

The following protocol was used to code the information:

- The coding of the fields will be absolute based on the Yes/No designation, without judging the quantity or quality of the services offered.
- The information must appear on the library's website (the information itself or information that provides a link to another resource that expands on it) and not in the sections of other units of the university analysed, such as the research findings transfer office or research support units unrelated to the library.
- The information must appear on the library's institutional website, with this identified as the main tool for contact and communication with its users. Therefore, informal channels, such as blogs, or social platforms, such as Twitter, Instagram and the like, will not be taken into account.

**Table 2**  
Categorisation of the RDS analysed.

Category	Description
Advising	The library offers some means (e-mail, form, in-person, telephone, etc.) of contact to provide advising on the subject of research data.
Information/ guides	A description, information and a series of resources, own or external, related to the different types of RDM (infographics, videos, PDFs, HTML, etc.) are provided.
Training	Training is considered to mean any RDM-related educational activities conducted by the library, or any training activities with the participation of the library staff, aimed at transmitting to the attendees (of any type, whether this be teaching and research staff or students at any level) knowledge and skills related to RDM. This training may be in-person or online (synchronous or asynchronous) through workshops, specialised courses, information sessions.
Data repository	Depositing research data in a proper repository, whether this be specifically for data, in-house, external or consortial, or in a multi-purpose institutional repository, is publicised and/or recommended. Also a review of the number of datasets stored in the different types of repositories.
Data governance	Policies and/or action plans for management of research data exist. This would be any type of standards: either the library's or the university's, committed to the principles of open research data, either on a singular basis or grouping research data within the concept of open science/knowledge.

- If the information appears in the section of the website consulted, the item corresponding to “Yes” will be marked.

The data was collected between April and June 2022, with the review supplemented by a Google search on the term “research data” in the main language of the website (“datos de investigación” in Spanish, “dades de recerca” in Catalan/Valencian) followed by the website URL. The information was coded using the Google Forms platform, with subsequent processing of the data in Excel and Tableau.

### Findings

The analysis of the information obtained on the websites of the institutions examined generated a large volume of data that paints a descriptive picture of the current status of RDS implementation in the libraries of Spanish public universities at very different levels: their content, scope, advisory services for researchers, related training, etc. These are described in detail below.

#### Overall data (Graph 1)

Nine of the 48 libraries analysed (18.75 %) have implemented some type of service related to the first four categories: they have communication channels for providing advising; they have created web guides; they conduct training on research data; and their repositories can preserve the data generated by their researchers. Of these nine libraries, three have created or updated their open access policy to include research data and, of these, in only one case is this policy complemented by an institutional data management plan. At the other extreme, eleven academic libraries (22.9 %) have not implemented any of these services to support research data.

#### Advising

58 % of the libraries (28) offer advising on how to manage research data: they provide one or more means of contact (Graph 2), either an e-mail address or a form, with the library’s generic contact information being the most common (in 14 cases), followed by the contact information of the university’s institutional repository (9) and that of the research support service (7). Two libraries provided the personal institutional e-mail address of a librarian as a means of contact, and only one of the libraries had a service dedicated to this type of advising

Only 11 of the 28 libraries that offer advising explicitly indicated this type of service. The most frequently offered service by these 11 libraries is related to data preservation, that is, to depositing the data in the institutional repository, followed by preparation of the DMP (6 libraries)

and assistance in finding research data (6 libraries). With respect to the rest of the subcategories analysed, just one or two libraries offer these services: open data and FAIR data (2), requirements of funding agencies (1), advising on legal and ethical aspects (2), work with research data (3), metadata (1), storage and backup copies (1), how to cite data (2). Although this category was included, none of them advised on the use of tools related to data processing, management and visualisation.

#### Guides and information on RDS

75 % of the libraries analysed (36) have some section on their websites dedicated to providing guides and tutorials. The materials available are highly varied in terms of both the format used (videos, text, infographics, etc.) and the completeness of the content. These resources are produced in-house or outside other libraries or institutions that work on issues related to management of research data. Thus, many of these libraries use the infographics created by REBIUN or by the Catalan University Service Consortium (CSUC).

As regards the content provided, all have guides related to preservation of the data, in either the institution’s own repository or an external one. There is also a high percentage of guides on the concept of open research data and FAIR data (32), the creation of data management plans (35) and resources to assist in drafting them (PGDonline or DMPonline) (34), and legal and ethics-related information associated with the data (25). The subjects that receive the least coverage are the guides on selecting metadata (8) and publication of the data as a supplement to a journal or in a data journal (7).

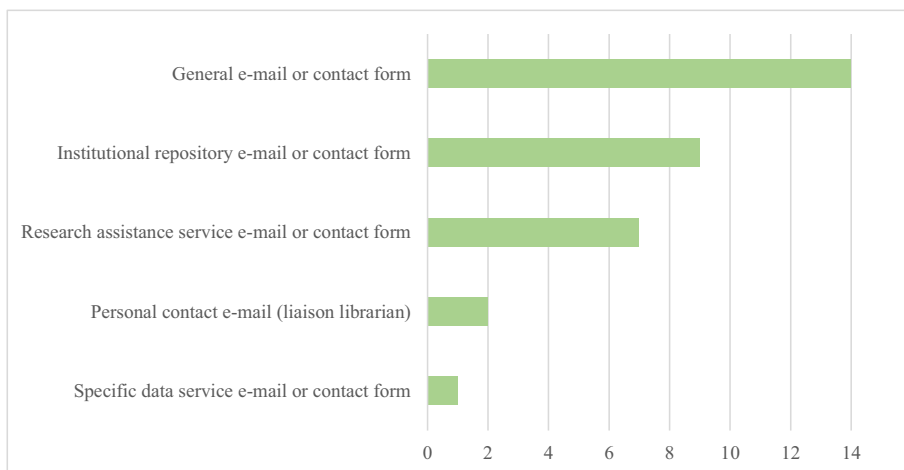
#### Institutional repositories for data

In this category, there was an analysis of whether the website recommended some type of repository managed by or related to the university to which the reviewed library belongs. This analysis was conducted to detect the existence of libraries that, despite not mentioning their repositories as an option for preserving the data, did in fact collect some types of datasets. Sixty-seven percent of the libraries, 32, recommend preservation of research data in their repositories.

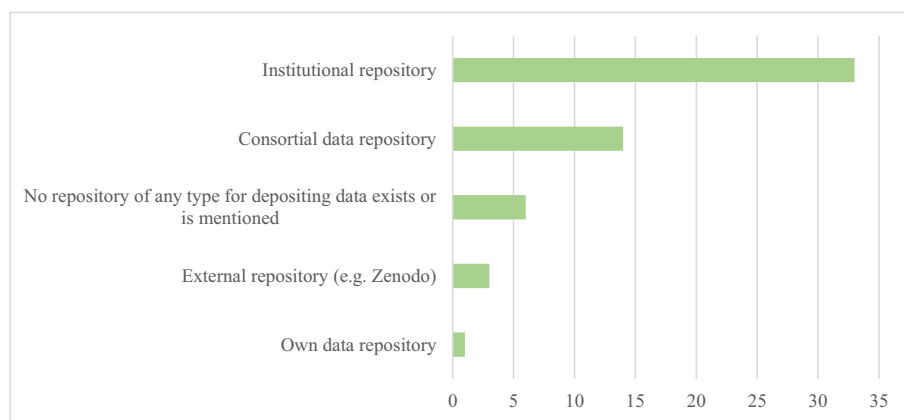
The other subcategory analysed was the type of repository used for preservation (Graph 3). In some libraries, there were several types of repositories recommended according to the size of the data: this may be because the institutional repositories were designed to store documents, which are smaller in size, and not data, which can occupy large amounts of storage space on servers. Thus, libraries were identified that have data in their own institutional repositories but also in consortial data repositories and, in some cases, using an external repository (mainly by creating their own collection in Zenodo). The most common option is the



Graph 1. Overall results.



Graph 2. Means of contact provided for RDM advising.



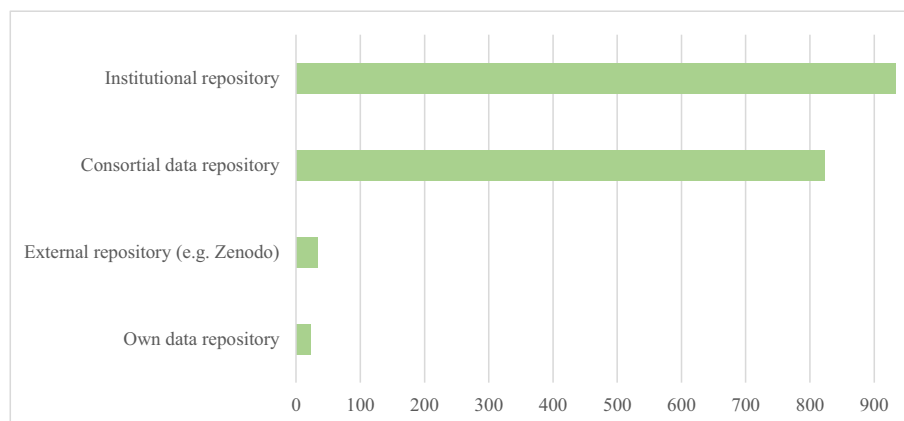
Graph 3. Type of repository used to store research data.

institutional repository, with a total of 34 libraries, followed by a consortial data repository, with 14 libraries belonging to the Consorcio Madroño of the regional government of Madrid, with its e-cienciaDatos data repository, and Catalan academic libraries belonging to the CSUC, with its CORA.RDR repository. Three libraries used creation of a collection within the Zenodo repository as a solution, and only one library used its own data repository, but through a commercial solution such as Elsevier's Digital Commons. The rest did not have any type of repository for storing their research data.

The total number of datasets stored in the repositories comes to 1812 records (Graph 4), with 51.5 % (934) in institutional repositories, 45.4 % (823) in consortial data repositories, 1.8 % (33) in external repositories, and 1.2 % in in-house data repositories.

*Training on data management conducted by the academic library itself*

23 % of the libraries (11) participated in or held courses that involved subject matter related in some way to research data. These are



Graph 4. Distribution of datasets in the repositories analysed.



synchronous courses, although in some cases offered via digital platforms, with the vast majority oriented towards teaching and research staff (nine courses) and graduate students (six for doctoral students and one for master's students). Four of the courses were also offered to administrative and support staff. None of the courses identified were offered to undergraduates.

In reference to their content, as specified in the web pages describing the courses, they are focused on content related to the concept of research data and FAIR data (10 of the 11 courses), DMP development (8) and data preservation in a repository (8). They also addressed aspects of the lifecycle of the data during their use and utilisation (7) and regarding the requirements of funding agencies (6). To a lesser extent, they address the issue of storage and backup copies (3), data citation (3) and selection of metadata (2). None of the courses provided information on the use of specific tools for processing, managing or visualising the data.

#### Governance of research data

Regarding the existence of a plan for management of the data produced by the institution, just five (10.42 %) of the universities have developed one. Many universities have developed an open research data policy or have included them in their open access policies (a total of 16, 33.33 % of universities). It should be noted that these policies have recently been created, or if applicable updated, some since 2017 and others even this year (2022).

Another subcategory reviewed was the service charters of the academic libraries. Just nine (18.75 %) libraries included or mentioned research data in the commitment of the services offered.

As regards the existence of a service dedicated to research data, just one library has a service dedicated to open science that encompasses research data.

#### Discussion

The results indicate that Spanish academic libraries are beginning to implement and provide leadership in RDS at their institutions, with a significant percentage having already launched some type of activity in each of the categories analysed in this study.

A much lower proportion of libraries, in contrast, have a research data support policy compared to the ones that have developed some of the services analysed.

Therefore, and although it was noted that the vast majority of universities have policies to support open access, few have updated their policies to include the concept of open research data or developed a specific policy for them.

These results suggest, echoing other studies (Fearon et al., 2013; Mushi et al., 2020; Yoon & Schultz, 2017), that libraries are taking a leading role and serving as the points of contact when it comes to providing support in data management in their universities even before the institutional policies are put in place. This is what happened at the University of Girona library, whose service charter (approved in November 2020) includes support for research data management as one of its standard services, with the corporate policy documents coming afterwards: the institutional mandate on open access is from 2021 and the policy for research data management is from 2022.

As regards these institutional policies, the date they were updated or created, which coincides with the start of the Open Research Data Plan by the 2020 Horizon Europe Commission, now continued with Horizon Europe (Burgelman et al., 2019), is relevant. This information is consistent with the responses received in the study by Radecki and Springer (2020), where the introduction of the National Science Foundation requirements marked a turning point in RDS implementation. Therefore, it would seem that the need to meet the demands of funding agencies may be a key element driving the creation of these new services.

As noted, libraries are starting to establish RDS, although a significant number still have not started some of the activities analysed in this study and, moreover, the efforts made and the level of maturity of these services vary greatly.

The most commonly implemented category was guides and information on RDS, probably due to the fact that, requiring few resources, these services are the easiest to introduce, existing materials from other libraries can be reused, and they are able to reach a very wide audience (Cox et al., 2017). However, significant differences were detected in the development, informational coverage and web structure of the information, with some libraries offering hardly any information, and much of this in the form of simple links to external resources, and others providing guides and services that supported the entire data life cycle. This section highlights the practices developed at the Pablo de Olavide University library (Fig. 1), whose guide is unique among those analysed in this study in that it included resources related to the use of more technical and specialised tools, such as Open Refine, SPSS or Tableau.

These services were developed as a continuation of existing ones, with no changes found in the organisational structure and without, therefore, the creation of data management support units or specific professional profiles. The main means of contact for the advising is e-mail or a generic form, which on many occasions also seems to be integrated by default into the different sections of the website, making it difficult to assert that advising on research data is really offered. This is the line followed by the majority of the libraries analysed: to assign these tasks to the existing research support service and, mainly, to the institutional repository, thereby maintaining the organisational models and placing RDS under their umbrella.

Few libraries, therefore, have specific staff members dedicated to responding to consultations involving research data. This is the case of the National Distance Education University (UNED), which provides a specific contact for advising on this issue, and the University of Huelva, with two staff members for these requests in addition to offering the repository as a means of contact.

As regards the type of services implemented, the results are in line with the studies conducted at other libraries (Cox & Pinfield, 2014; Tenopir et al., 2012; Tenopir et al., 2017; Tenopir et al., 2019), in which those of a consultative or advisory nature predominated over practical and technological ones, with the latter limited to deposit in the institution's repository (the line between the so-called technical and merely advisory services could be a subject for debate). This aspect corroborates the idea that the new services have been implemented as a continuation or extension of existing services, such as advisory and informational ones and those related to support for preservation and management in repositories. These are activities where libraries feel more comfortable and already have experience, meaning that deployment of RDS would require less effort (Cox et al., 2019; Nahotko et al., 2023).

Another finding related to the type of these services is the polarisation that exists between two types of activities: development of the DMP and preservation of the data in repositories. Based on the procedures encompassed in the different stages in the data life cycle of the UK Data Archive (Eyden, 2013) and the definition of RDM given in the introduction to this document, gaps or deficiencies are detected in activities related to finding/collecting data, capture and creation of metadata, secure storage of data assets, anonymisation and pseudonymisation, validation of the integrity of the data, and in tools for data analysis, interpretation and visualisation.

The root causes for failure to implement these types of services are unknown, but based on the problems identified for the development of RDS in the literature consulted (Andrikopoulou et al., 2021; Chiware & Becker, 2018; Cox et al., 2019; Tenopir et al., 2012; Tenopir et al., 2015; Yu, 2017), they may be related to a lack of institutional commitment, deficiencies in the technological infrastructure, and a lack of technical skills and knowledge on the part of staff to provide these services competently.

Fig. 1. Pablo de Olavide Library guide.

This lack of suitable professional skills may be one of the reasons for the very small number of training activities involving data. This contrasts with the fact that information literacy activities are fully implemented in nearly all academic libraries (Martín-González & Iglesias-Rodríguez, 2022). Their content is, furthermore, focused on aspects such as the concept and definition of research data, open data and FAIR data, creation of the DMP and preservation of data in repositories, with training actions that require more technical knowledge related to data validation, cleaning, anonymisation, deposit, interpretation or visualisation not found.

Another barrier identified in the literature is the lack of adequate technological infrastructure, with libraries' participation in this aspect focused on providing services to support data preservation by means of repositories. This is understandable, as this is an area where they have vast experience, having created, developed and managed their institution's repositories in response to the different policies driven by open access.

The information collected shows how existing institutional repositories are being offered as a resource for storing the data. Nonetheless, as these are repositories originally created to store document-based information, such as articles or academic papers, they are not the best solution, necessitating the use of external resources like Zenodo for hosting large volumes of data. On the other hand, and in view of the total number of datasets they hold, 934 records for a total of 24 repositories, it does not seem that they are being used very much,

suggesting that researchers are resorting to other solutions to facilitate access to their research data, or simply that they are not depositing them in open form.

As for the only commercial platform for hosting data, Research Data ULL, it combines repository functions with others related to discovery by finding datasets that members of the University of Laguna have stored in external repositories. Despite the fact that the tool finds a total of 2142 records of researchers from the institution, only 22 datasets have been deposited in this repository.

The libraries in the Madroño and CSUC consortia, for their part, with the creation of the e-cienciaDatos (Fig. 2) and CORA.RDR repositories, respectively, likely represent the best model for preserving research data without having to resort to commercial solutions while offering an infrastructure for adequately preserving and describing this type of content. Thus, the capacity for cooperation with other institutions may be the right path for addressing preservation of the data and to be able to work on a smaller scale (Gowen & Meier, 2020).

In this section related to collaboration, no solid evidence of inter-departmental activity was found. We can hazard a guess that the very structure of the majority of public universities in more or less siloed units complicates the relationship between their different units. Nonetheless, "invisible" and informal collaboration may exist that is not identified on the websites and, therefore, may have been overlooked in this analysis.

The Carlos III University of Madrid's UniOS operational support unit

InvestigAM e-ciencia Datos

Geolocation Metrics Survey Support English Log In

Metrics 36,947 Downloads Contact Share

Repositorio de Datos del Consorcio Madroño | ([www.consorcio-madroño.es](http://www.consorcio-madroño.es))

Repositorio de Datos UAH Repositorio de Datos UAM Repositorio de Datos UC3M Repositorio de Datos UNED Repositorio de Datos UPM Repositorio de Datos URJC

Search this dataverse... Advanced Search

Dataverses (18)  
 Datasets (700)  
 Files (3,935)

**Dataverse Category**  
 Organización o Institución (6)  
 Research Project (6)  
 Research Group (4)  
 Proyecto de investigación (2)

**Publication Year**  
 2022 (114)  
 2021 (109)  
 2020 (30)  
 2019 (173)  
 2018 (275)  
 More...

**Author Name**  
[Álvarez Pérez, Xosé Afonso \(coord.\) \(322\)](#)  
[Federico, Giovanni \(163\)](#)  
[Tena Junquito, Antonio \(163\)](#)  
[Cid Tortuero, Consuelo \(33\)](#)

1 to 10 of 718 Results Sort

**Informante 1 (San Silvestre de Guzmán). Lengua**  
 Oct 4, 2022 - [Frontera España - Portugal: documentación lingüística y bibliográfica \(FRONTESPO\)](#)  
 Álvarez Pérez, Xosé Afonso (coord.), 2019, "Informante 1 (San Silvestre de Guzmán). Lengua", <https://doi.org/10.21950/83GXSP>, e-cienciaDatos, V2  
 Entrevista a informante 1 en San Silvestre de Guzmán. ¿Cómo es el andaluz que se habla aquí, qué diferencias hay con otros pueblos? En Villablanca usan el diminutivo -iño. En Villanueva de los Castillejos y en Ayamonte la prosodia es muy diferente. Diferencias lingüísticas gene...

**Informante 1 (San Silvestre de Guzmán). Relaciones con Portugal**  
 Oct 4, 2022 - [Frontera España - Portugal: documentación lingüística y bibliográfica \(FRONTESPO\)](#)  
 Álvarez Pérez, Xosé Afonso (coord.), 2019, "Informante 1 (San Silvestre de Guzmán). Relaciones con Portugal", <https://doi.org/10.21950/HE8AGH>, e-cienciaDatos, V2  
 Entrevista a informante 1 en San Silvestre de Guzmán. La abuela de la informante era hija de portugueses. Nació en Barcialonga (España) al poco de cruzar ellos la Raya. Conocía las dos lenguas, pero hablaba sobre todo en portugués. En el campo todas las familias eran de origen po...

**Informante 1 (San Silvestre de Guzmán). Vida social. El cuerpo**  
 Oct 4, 2022 - [Frontera España - Portugal: documentación lingüística y bibliográfica \(FRONTESPO\)](#)  
 Álvarez Pérez, Xosé Afonso (coord.), 2019, "Informante 1 (San Silvestre de Guzmán). Vida social. El cuerpo", <https://doi.org/10.21950/D63PQB>, e-cienciaDatos, V2  
 Entrevista a informante 1 en San Silvestre de Guzmán. Las fiestas del pueblo. La procesión del día de San Silvestre y las romerías. El potaje que sirven en las celebraciones. Dulces que se comen en las fiestas (pestiños, roscos, etc.); no hay ninguno típico de la localidad, a dif...

Fig. 2. The Consorcio Madroño's e-cienciaDatos repository.

(Fig. 3) is a model and example of transversal collaboration between different university units: it aims to support, promote and drive development of open science at the UC3M at different levels and, therefore, is made up of staff from different university units and research staff and coordinated by the library.

As for collaboration between institutions, this is primarily focused on the activities of consortia, with CSUC and Madroño being the most active academic library consortia in activities related to research data management. These consortia, besides implementing the data repositories discussed above, have developed interesting initiatives, including a declaration of support for open science by the members of the Madroño consortium—which includes a Data Management Policy for consortium members—(Consorcio Madroño, 2017) and other projects, such as the guide for managing the data, PaGoDa, with its PGDonline. CSUC, on the other hand, has developed a proposal for establishing a policy of open access to research data in Catalan universities (CSUC, 2016) and Model Data Management Policy for the university (CSUC, 2018).

## Conclusions

In Spain, there have been partial studies to determine the degree of implementation and development of RDS focusing on certain university

libraries or on specific parts of the research data life cycle, but there have been no global studies that analyse these services in the Spanish university context.

The results of this investigation provide a comprehensive view of the development of RDS in Spain, contributing to enhancing knowledge about them and helping the different stakeholders, both internal (university authorities and governance bodies) and external (government at the regional or national level), to take more efficient decisions by focusing their efforts on the most deficient areas.

Likewise, these results can generate and foster in academic library science a discussion of the degree of implementation of RDS in Spain and the essential changes that no doubt need to be undertaken in academic libraries in coming years.

Academic libraries have served as great allies for the advancement of open access by providing informational, support and advisory services, and by creating the technological infrastructure necessary for their development through institutional repositories. Now that attention is centred on research data, libraries are taking the lead in supporting these new activities in their institutions, thanks to their experience and the commitment to open access gained over the years.

The findings of this study have shown that some Spanish academic libraries are starting to deploy RDS, but they are not being established in a generalized way and there are gaps and differences between



uc3m | Universidad Carlos III de Madrid  
OPEN SCIENCE

PRINCIPLES / POLICIES | TRAINING | **SUPPORT / UNIOS** | NEWS | FOS-YUFE | OPEN ACCESS | F/

CITIZEN SCIENCE

SUPPORT / UNIOS  
open science / Support / UniOs

Inglés ▾  
Con la tecnología de Traductor de Google

**UniOS**  
Universidad Open Science  
Unidad Open Science  
Unidad para la Ciencia y el Conocimiento en Abierto

What is Unitos? ⤴

UniOS is the open science and knowledge unit for an Open Science University. Initially, UniOS was created as a stable working group to reflect on the implementation and practice of Open Knowledge and Science at the Carlos III University of Madrid. Now UniOs is an operational support unit for all activities related to open knowledge practices.

UniOs is coordinated, from a strategic point of view, by the Office of the Vice-Rector for Scientific Policy and, from a technical point of view, by the Library Service, but it is a working and transversal support group, which includes staff from different services of the University (Research Service, Entrepreneurship and Innovation Service, Human Resources Service, Information Technology and Communications Service and Library Service) as well as teaching and research staff from the University.

Fig. 3. UniOS unit for collaboration on open science (UC3M).

institutions in the number of services implemented, their type, and in the development of standards and policy to support them.

In addition, the services are concentrated mainly in two activities: advising on the creation of the DMP and on preservation of the data. These unquestionably represent an important part of the services needed, but there are different activities in the data lifecycle that are not receiving sufficient or even any support, such as active data deposit,

curation, analysis and visualisation, management of metadata, training, and direct participation in research projects. It is true that it is not necessary to offer the full range of services in order for libraries to get involved in RDS and, furthermore, that the development of certain missions could be part of the debate over what Pinfield et al. (2014) call professional jurisdiction: should they be led by the library or by other university units, such as IT Services? In any case, there is little question

that participation in these activities would represent an opportunity for libraries to position themselves as strategic units within their institutions.

There is no doubt that a professional trained in both the technical and the advisory aspects is needed in order to address these challenges and take advantage of the opportunities they represent, which means going beyond the functions that have been developed in academic libraries: this figure is the data librarian, an essential element in these new RDS but one that still does not exist in Spain. According to [Martín-González and Iglesias-Rodríguez \(2022\)](#), the data librarian must be the one responsible for these new services, providing support to researchers in aspects related to management of their research data and to the institution they serve by designing an institutional management plan.

It is necessary to pay special attention to the development of activities for training and capacity-building of library staff with respect to RDM-related skills, as well as to take into account these new skills, so necessary in this new *datified* environment that encompasses all of society, in developing the subject matter and selection examinations for filling vacant posts in future public employment offers.

Collective effort seems to be the ideal formula for undertaking these services, as the Catalan and Madrid-based consortia have shown both in the launch of shared data repositories and in the development of support documentation. Collaboration is not unknown in the context of libraries, with there being many examples of networks and consortia being created in order to take advantage of resources and offer better services. This culture of collaboration to drive these new services needs to be continued through partnerships with like-minded institutions, but also with other units within the same university or even with research groups with which to share knowledge and take advantage of experience in other aspects of RDM or even their greater technical capacity.

Spanish academic libraries do not have to walk this road alone, rather they can take advantage of the projects and experiences that are being developed in their environment. For example, *The EOSC Association Advisory Groups* and the work carried out within their different Task Forces, such as Metadata and Data Quality or Data Stewardship Curricula and Career Paths (<https://www.eosc.eu/advisory-groups>). And LIBER, which promotes, gives recommendations and the best practices in Open Science for Europe's Research Library Network ([Ayris et al., 2018](#)).

Further progress is to be expected in coming years, driven by changes in the Spanish legislative environment aimed at boosting open science. Firstly, Spain's Science, Technology and Innovation Act ([LEY 17/2022](#)), which was recently amended to follow European recommendations on support for open science, including the obligation to share research data according to FAIR principles (art. 37), and government plans for scientific, technical and innovation-related research, which require projects receiving public funds to disseminate their data openly whenever possible and that they be FAIR data.

The lack of knowledge about metadata and preparation of the DMP and the need for training identified by [Arias-Coello et al. \(2018\)](#) on the part of Spanish researchers in relation to management of their research data will likewise provide, as in the case of open access, an opportunity for libraries to support, promote and advise researchers to help them fulfill their legal requirements and obligations.

The other legislative reform that directly impacts Spanish academic libraries is the new Organic Spanish University System Act ([LEY Orgánica 2/2023](#)), which dedicates its article 12 to open science and citizen science, expressly citing research data and giving libraries the responsibility to promote the dissemination of open science, both to the university community and to all of society.

### Limitations and future research

Although the type of research conducted has allowed systematic recording of the information available on websites, thereby enabling it to be subsequently interpreted and analysed, there is no question that

there are certain aspects that it was not possible to explore in depth, particularly:

- The coding type based on binary values (yes/no) facilitates the collection of quantifiable data but does not assess the quality of the information or of the services offered.
- There may be interdepartmental collaborations, or even inter-institutional ones, with library participation that are not expressly captured in the websites analysed and, therefore, these are not reflected in this investigation.
- The simple capture of data does not include the opinion or point of view of the staff involved in the creation and implementation of RDS.
- Nor is it possible to know if these services meet their objective, that is, to satisfy the needs of the research community in the management of their research data.

Therefore, this inventory is presented as a first step towards learning the level of RDS implementation in Spanish academic libraries, leading the way to exploring other aspects in greater depth in future studies:

- To learn the perceptions and impressions of the staff providing these services by carrying out complementary studies by means of interviews and surveys.
- To analyse the people who use these services, how they are used and, perhaps most importantly, if they cover needs related to management of research data.
- To learn the needs of the research staff in relation to the provision of these types of services.
- To examine subsequent development of these services and the support policies, and to find out if recent legislative changes have had an impact by repeating this analysis in the future.

### Funding

All of the sources of funding for the work described in this publication are acknowledged below:

This work has been supported by the Madrid Government (Comunidad de Madrid-Spain) under the Multiannual Agreement with UC3M in the line of Excellence of University Professors (EPUC3M02), and in the context of the V PRICIT (Regional Programme of Research and Technological Innovation).

### CRedit authorship contribution statement

We confirm that the manuscript has been read and approved by all named authors.

We confirm that the order of authors listed in the manuscript has been approved by all named authors.

### Intellectual property

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

### Declaration of competing interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

## Data availability

The data used for the development of this research are deposited in the Zenodo repository under a Creative Commons Attribution 4.0 International license: doi:<https://doi.org/10.5281/zenodo.7826082>.

## References

- ACRL. (2018). 2018 top trends in academic libraries: A review of the trends and issues affecting academic libraries in higher education. *College & Research Libraries News*, 79, 6. <https://doi.org/10.5860/crln.79.6.286>
- Andrikopoulou, A., Rowley, J., & Walton, G. (2021). Research data management (RDM) and the evolving identity of academic libraries and librarians: A literature review. *New Review of Academic Librarianship*, 1-17. <https://doi.org/10.1080/13614533.2021.1964549>
- Arias-Coello, A., Simon-Blas, C., Arranz-Val, P., & Simon-Martin, J. (2018). Research data Management in Three Spanish Universities. In S. Kurbanoglu, J. Boustany, S. Spirancu, E. Grassian, D. Mizרחי, & L. Roy (Eds.), *Vol. 810. Information literacy in the workplace. ECIL 2017. Communications in Computer and Information Science*. Cham: Springer. [https://doi.org/10.1007/978-3-319-74334-9\\_21](https://doi.org/10.1007/978-3-319-74334-9_21).
- Ayris, P., Bernal, I., Cavalli, V., Dorch, B., Frey, J., Hallik, M., ... Horstmann, W. (2018). *Liber open science roadmap*. The Hague: LIBER. <https://doi.org/10.5281/ZENODO.1303002>
- Bernal, I., & Molina, J. R. (2014). *Prácticas en la gestión, difusión y preservación de datos de investigación en el CSIC*. Madrid: Oficina Técnica de Digital.CSIC. <http://hdl.handle.net/10261/108665>.
- Burgelman, J.-C., Pascu, C., Szkuta, K., Von Schomberg, R., Karalopoulos, A., Repanas, K., & Schoupe, M. (2019). Open science, open data, and open scholarship: European policies to make science fit for the twenty-first century. *Frontiers in Big Data*, 2, 43. <https://doi.org/10.3389/fdata.2019.00043>
- Chiwere, E. R. T., & Becker, D. A. (2018). Research data management services in Southern Africa: A readiness survey of academic and research libraries. *African Journal of Library, Archives and Information Science*, 28(1), 16.
- Consortio Madroño. (2017). *Declaración del Consorcio Madroño en apoyo a la Ciencia Abierta a la información académica y científica* [online]. Madrid: Consorcio Madroño [https://www.consorcio-madrono.es/docs/declaracion\\_ciencia\\_abierta.pdf](https://www.consorcio-madrono.es/docs/declaracion_ciencia_abierta.pdf).
- Cox, A. M., Kennan, M. A., Lyon, L., & Pinfield, S. (2017). Developments in research data management in academic libraries: Towards an understanding of research data service maturity. *Journal of the Association for Information Science and Technology*, 68(9), 2182-2200. <https://doi.org/10.1002/asi.23781>
- Cox, A. M., Kennan, M. A., Lyon, L., Pinfield, S., & Shaffi, L. (2019). Maturing research data services and the transformation of academic libraries. *Journal of Documentation*, 75(6), 1432-1462. <https://doi.org/10.1108/JD-12-2018-0211>
- Cox, A. M., & Pinfield, S. (2014). Research data management and libraries: Current activities and future priorities. *Journal of Librarianship and Information Science*, 46(4), 299-316. <https://doi.org/10.1177/0961000613492542>
- CSUC. (2016). *Proposta per establir una política d'accés obert a les dades de recerca a les Universitats de Catalunya* [online]. Barcelona: Consorcio de Bibliotecas Universitarias de Catalunya [https://www.csuc.cat/sites/default/files/2021-06/1603PropostaPoliticaRDM\\_0.pdf](https://www.csuc.cat/sites/default/files/2021-06/1603PropostaPoliticaRDM_0.pdf)
- CSUC. (2018). *Model de política de gestió de dades de recerca per a una universitat* [online]. Barcelona: Consorcio de Bibliotecas Universitarias de Catalunya <https://www.csuc.cat/sites/default/files/2021-06/1807ModelPoliticaRDM.pdf>.
- European University Association. (2022). *The EUA Open Science agenda 2025* [online]. Brussels: European University Association. <https://eua.eu/component/attachment/s/attachments.html?id=3497>.
- Eyden, V. V. D. (2013). *Data life cycle & data management planning. Looking after and managing your research data (going digital and Esrc Atn events)* [online]. Colchester: UK Data Archive <https://dam.ukdataservice.ac.uk/media/187718/dmplanningdm24apr2013.pdf>.
- Fearon, D., Gunia, B., Lake, S., Pralle, B. E., & Sallans, A. L. (2013). *Research data management services* [online]. Washington, DC: Association of Research Libraries. <https://doi.org/10.29242/spec.334>
- Fu, P., Blackson, M., & Valentino, M. (2022). Developing research data management services in a regional comprehensive university: The case of Central Washington University. *IFLA Journal*, 0(0). <https://doi.org/10.1177/03400352221116923>
- Gowen, E., & Meier, J. J. (2020). Research data management services and strategic planning in libraries today: A longitudinal study. *Journal of Librarianship and Scholarly Communication*, 8(1). <https://doi.org/10.7710/2162-3309.2336>
- Grupo de Repositorios de REBIUN. (2018). *Gestión de Datos de Investigación en las universidades españolas y CSIC: memoria de buenas prácticas de los servicios ofrecidos* [online]. Madrid: REBIUN. <http://hdl.handle.net/20.500.11967/244>.
- LEY 17/2022. de 5 de septiembre, por la que se modifica la Ley 14/2011, de 1 de junio, de la Ciencia, la Tecnología y la Innovación (BOE-A-2022-14581). <https://www.boe.es/buscar/act.php?id=BOE-A-2022-14581>.
- LEY Orgánica 2/2023. de 22 de marzo, del Sistema Universitario (BOE-A-2023-7500). <https://www.boe.es/eli/es/lo/2023/03/22/2/con>.
- Martin-González, Y., & Iglesias-Rodríguez, A. (2022). Alfabetización en Datos en las bibliotecas-CRAI españolas: Análisis descriptivo y propositivo. *Revista Española de Documentación Científica*, 45(2), Article e322. <https://doi.org/10.3989/redc.2022.2.1857>
- Morais, R., Saenen, B., Garbuglia, F., Berghmans, F., & Gaillard, V. (2021). *From principles to practices: Open Science at Europe's universities. 2020-2021 EUA Open Science survey results*. Brussels & Geneva: European University Association. <https://www.eua.eu/resources/publications/976:from-principles-to-practices-open-science-at-europe%E2%80%99s-universities-2020-2021-eua-open-science-survey-results.html>.
- Munafò, M. R., Nosek, B. A., Bishop, D. V. M., Button, K. S., Chambers, C. D., Percie du Sert, N., ... Ioannidis, J. P. A. (2017). A manifesto for reproducible science. *Nature Human Behaviour*, 1(1), 0021. <https://doi.org/10.1038/s41562-016-0021>
- Mushi, G. E., Pienaar, H., & van Deventer, M. (2020). Identifying and implementing relevant research data management services for the library at the University of Dodoma, Tanzania. *Data Science Journal*, 19, 1. <https://doi.org/10.5334/dsj-2020-001>
- Nahotko, M., Zych, M., Januszko-Szakiel, A., & Jaskowska, M. (2023). Big data-driven investigation into the maturity of library research data services (RDS). *The Journal of Academic Librarianship*, 49(1), Article 102646. <https://doi.org/10.1016/j.acalib.2022.102646>
- Pérez García, F. J., & Aldás Manzano, J. (2022). *Indicadores Sintéticos de las Universidades Españolas. 10ª ed. Bilbao: Fundación BBVA; València: Ivie*. [https://doi.org/10.12842/RANKINGS\\_SP\\_ISSUE\\_2022](https://doi.org/10.12842/RANKINGS_SP_ISSUE_2022)
- Pinfield, S., Cox, A. M., & Smith, J. (2014). Research data management and libraries: relationships, activities, drivers and influences. *PLoS One*, 9(12), Article e114734. <https://doi.org/10.1371/journal.pone.0114734>
- Radecki, J., & Springer, R. (2020). *Research data services in US higher education: A web-based inventory. Ithaca S+R*. <https://doi.org/10.18665/sr.314397>
- Si, L., Zeng, Y., Guo, S., & Zhuang, X. (2019). Investigation and analysis of research support services in academic libraries. *The Electronic Library*, 37(2), 281-301. <https://doi.org/10.1108/EL-06-2018-0125>
- Subgrupo de acceso abierto de REBIUN. (2017). Estado de la cuestión del acceso abierto en las universidades españolas: subgrupo de acceso abierto. In *Línea II del Plan Estratégico de REBIUN* [online]. Salamanca: REBIUN. <http://hdl.handle.net/10366/135593>.
- Tenopir, C., Allard, S., & Birch, B. (2012). Academic libraries and research data services: Current practices and plans for the future. In *An ACRL white paper*. Chicago: ACRL. [https://trace.tennessee.edu/cgi/viewcontent.cgi?article=1019&context=utk\\_data\\_one](https://trace.tennessee.edu/cgi/viewcontent.cgi?article=1019&context=utk_data_one).
- Tenopir, C., Allard, S., Frame, M., Birch, B., Baird, L., Sandusky, R., ... Lundeen, A. (2015). Research data services in academic libraries: Data intensive roles for the future? *Journal of Science Librarianship*, 4(2), Article e1085. <https://doi.org/10.7191/jeslib.2015.1085>
- Tenopir, C., Kaufman, J., Sandusky, R., & Pollock, D. (2019). *Research data services in academic libraries: Where are we today?* Middletown: ACRL. <http://choice360.org/librarianship/whitepaper>.
- Tenopir, C., Talja, S., Horstmann, W., Late, E., Hughes, D., Pollock, D., ... Allard, S. (2017). Research data Services in European academic research libraries. *LIBER Quarterly: The Journal of the Association of European Research Libraries*, 27(1), 23-44. <https://doi.org/10.18352/lq.10180>
- Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., ... Mons, B. (2016). The FAIR guiding principles for scientific data management and stewardship. *Scientific Data*, 3(1), Article 160018. <https://doi.org/10.1038/sdata.2016.18>
- Yoon, A., & Schultz, T. (2017). Research data management services in academic libraries in the US: A content analysis of libraries' websites. *College & Research Libraries*, 78(7), 920. <https://doi.org/10.5860/crl.78.7.920>
- Yu, H. H. (2017). The role of academic libraries in research data service (RDS) provision: Opportunities and challenges. *The Electronic Library*, 35(4), 783-797. <https://doi.org/10.1108/EL-10-2016-0233>