

Preparedness for Research Data Sharing: A Study of University Researchers in Three European Countries

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Abstract. Many government and funding bodies around the world have been advocating open access to research data, arguing that such open access can bring a significant degree of economic and social benefit. However, the question remains, do researchers themselves want to share their research data, and even if they do how far they are prepared to make this happen? In this paper we report on an international survey involving university researchers in three countries, viz. UK, France and Turkey. We found that researchers have a number of concerns for data sharing, and in general there is a lack of understanding of the requirements for making data publicly available and accessible. We note that significant training and advocacy will be required to make the vision of data sharing a reality.

Keywords: Research data management · Data sharing · Metadata · Ethics · User education

1 Introduction

Researchers have described data as the glue of a collaboration [1], and the lifeblood of research [2]. Several benefits of research data sharing have been highlighted including for example, economic growth, increased resource efficiency and securing public support for research funding [3, 4]. It is reported that: “in the US, one study estimated the \$13 billion in government spending on the Human Genome project and its successors has yielded a total economic benefit of about \$1 trillion. A British study of its public economic and social research database found that for every £1 invested by the government, an economic return of £5.40 resulted” [5]. Given these benefits, various governments and funding bodies are pushing for OA to research data. However,

take-up of the concept of OA and sharing amongst researchers has been low. This may be attributable to a lack of skills and knowledge in making data discoverable, accessible, and reusable for others' research; or it may be attributed to issues related to trust, reputation, and ethics [5–9].

The exploratory research reported in this paper addresses the following questions:

1. Are university researchers willing to share their research data and what concerns do they have with regard to research data sharing?
2. Are university researchers familiar with various activities and preparation needed to make data shareable and usable?

2 Research Data Management

The UK Data Archive [4] proposes a research data lifecycle that comprises six major sets of activities some of which, such as data creation, data access, analysis and re-use, are undertaken or primarily driven by researchers in a specific discipline. Researchers, therefore, also have some important roles in research data management activities. However, not much is known about how researchers go about managing their data and whether they are willing to share data with others outside of the immediate research collaboration [10]. Often researchers are preoccupied by immediate issues of backing up data rather than the longer term question of preservation [11]. In fact, the sharing of data even within interdisciplinary projects is also highly problematic [12], and incentives to release data are lacking, the adopting of data repositories remain slow and there are questions regarding their design in that they are optimised for performance rather than scientific enquiry [2]. This is especially troublesome as the advent of “big science” and the emergence of the “fourth paradigm” which is a “computational data-intensive approach to science that constitutes a new set of methods beyond empiricism, theory and simulation” [10]. However, this appears to be less of a problem for large well-established and long-lasting collaborations than it is for small-scale, short-lived collaborative projects which is often called the “long tail of science and technology” [10]. In these small teams methods tend to be local and specific to the research at hand, where reusing this data requires a great deal of contextual knowledge about procedure. Without contextual information, where data have been separated from context, reuse can become “difficult or impossible” [13]. Within the “long tail” research projects data sharing is described as a “gift culture” [10] where data is bartered between colleagues in trusted relationships. Therefore, providers of data will overcome problems of context and documentation for trusted others but this is clearly unsustainable in the longer term.

One of the key challenges of data sharing is that it requires standard metadata and documentation to contextualise data sufficiently for re-use [2] and discovery [13, 15] outside of the collaboration for which it was intended. MacMillan [14] notes that, very few researchers (22%) use metadata, preferring to use their own laboratory standards instead, a view supported by Carlson et al. [11]. An underlying technical issue is the decreasing lifespan of data storage formats, which require more sustainable data management practices [14]. Furthermore, researchers lack the data curation skills and these are not addressed at undergraduate level [16]. There is also a lack of academic

credit or reward for data curation [10, 14], and for developing common data structures, metadata formats and ontologies to support data mining [2, 13, 15]. The role of education should not be underestimated here. In a study of researchers in the area of health for example, 77% of researchers reported that they had, “never received any formal training” and reported their expertise as “very low” in data management [17, p. 54]. Another survey amongst over 2000 academics and researchers from around the world noted that, “researchers do not know how open they have made their data - 60% of respondents are unsure about the licensing conditions under which they have shared their data, and thus the extent to which it can be accessed or reused” [18, p.14]. This clearly indicates that there is a significant gap in awareness and understanding which needs to be addressed [11, 19].

3 Research Method

This research is based on an international survey conducted amongst university academics and researchers in three countries. The chosen countries – UK, France and Turkey – are all in Europe but they are different in terms of their current state of development and policies towards RDM.

Amongst the three countries chosen for this study, the UK is arguably the most advanced in terms of research and development of technologies, tools and policies for RDM. Researchers led by agencies like JISC, DCC and specific universities have been engaged in research in different areas of RDM for nearly a decade. A significant move towards management and research data sharing is also evident through various policies recently introduced by government funding agencies in UK. For example, the RCUK (research councils UK) Common Principles on Data Policy states that “publicly funded research data are a public good, produced in the public interest, which should be made openly available with as few restrictions as possible in a timely and responsible manner” [20].

In France, the interest in research data was stated publicly in 2011 when the Ministry of Higher Education and Research implemented a platform for monitoring and providing information about research data, and for raising awareness and encouraging a debate around challenges related to research data. Two years later, under the aegis of the same Ministry, a research infrastructure Huma-Num was created which provides research teams in the Human and Social sciences to facilitate the processing, access, storage and interoperability of various types of digital data. It also offers a platform, NAKALA, to archive and share research data. In 2016, the French URFIST Network that had already organized many national seminars on research data in collaboration with the National Center for Scientific Research and the digital scientific library launched DoRANum project. Many academic libraries created specific services on RDM.

In Turkey, due to lack of necessary policies, strategies and regulations for RDM, the majority of research data is not archived and cannot be accessed and re-used. Neither the national funding agency for scientific research (TUBITAK: The Scientific and Technological Research Council of Turkey) nor other funding agencies or universities have any RDM policy and/or mandate, and do not require a data management plan from research they fund. As a result, none of the research institutions have yet

implemented services for research data storage, analysis and curation. There are no units within research institutions which provides support to researchers who would like to store and share their research data [21, 22]. However, starting from 2012, there have been several initiatives which aim to increase awareness towards the importance of the subject and address the current situation in Turkey.

It is clear that RDM technology and policy developments are at varying levels in the UK, France and Turkey. The choice of the universities was based on a slightly different criterion: the three chosen universities have similarity in their nature such as; emphasis is given both to teaching and research, but all of them has increasing demand for national and international researches in different fields. This approach was employed to gain a sense of the awareness of, and preparedness for, RDM amongst academics and researchers in universities of similar nature but from three different countries that have different levels of progress in overall RDM activities.

The survey was developed by the researchers and a pilot study was carried out first to make sure that all questions were clear and understandable. Based on the pilot study results, the survey instrument was developed. E-mail invitations were sent out to the academics and researchers in the three chosen universities. There were 26 questions to collect data on: researcher information – role, discipline, gender, experience, etc.; nature of data collected, created, etc.; data sharing practices, concerns; familiarity with data management practices and policies/challenges including knowledge of metadata, training, etc. The research reported in this paper addresses only those questions in the questionnaire that are related to data sharing practices, concerns, and researchers' awareness and familiarity with for example, various RDM tools, techniques and policies. SPSS was used to analyse the dataset, and Chi-Square tests, at 0.05 significance level, were conducted to find out correlation between researchers' behaviour in different areas of RDM especially with regard to data tagging and storage, sharing and re-use of research data, etc., and researchers' characteristics such as country, discipline, age, gender and years of experience.

4 Data Sharing

Conducted in the summer of 2016 this survey received a total of 215 completed responses. Tables 1 and 2 present the general demographic data by country and years of experience. The OECD classification of disciplines [23] was provided as a list for the respondents to choose from.

Table 1. Respondents' status by country (%)

Country	Academic staff	Research student	Research staff	Total
France	16	22	69	21
Turkey	35	16	0	27
UK	50	63	31	52
Total	101	101	100	100

Note: The percentage of the total is not 100% due to rounding.

Table 2. Respondents' years of experience by discipline (%)

Years of experience	Science	Social science	Humanities	Total
<5	27	28	31	28
5–10	19	25	19	22
11–15	15	18	13	16
16–20	15	12	12	12
>20	25	18	25	21
Total	101	101	100	99

Note: 1 - The percentage of the total is not 100% due to rounding.
2 - Three respondents did not answer the question related to discipline. Therefore the total is 212.

Table 3. Data sharing behaviour of researchers

Data sharing behaviour	%
Collaboration with researchers in the same team	56
Collaboration with researchers in the same university	40
Collaboration with researchers in other institutions	45
Not shared	29

However, in order to be able to run correlation tests, subject categories were merged under larger groups such as sciences, social sciences and humanities: 53% were from social sciences, 25% from humanities and 23% from sciences. Table 3 shows the user behaviour in relation to data sharing. Statistically significant differences were detected between specific behaviours with regard to *sharing data with others* and *country* ($C-\chi^2_{(2)} = 41,858$; $p = 0,000$, $E-\chi^2_{(4)} = 22,305$; $p = 0,000$, $D-\chi^2_{(2)} = 9,376$; $p = 0,009$), *sharing with researchers in the same university* ($C-\chi^2_{(2)} = 14,382$; $p = 0,001$, $E-\chi^2_{(2)} = 14,931$; $p = 0,005$), *sharing with researchers in other institutions* ($C-\chi^2_{(2)} = 6,419$; $p = 0,040$, $E-\chi^2_{(4)} = 24,445$; $p = 0,000$, $D-\chi^2_{(2)} = 7,108$; $p = 0,029$), and *not sharing data* ($C-\chi^2_{(2)} = 28,539$; $p = 0,000$, $E-\chi^2_{(4)} = 34,924$; $p = 0,000$, $D-\chi^2_{(2)} = 7,171$; $p = 0,028$). A significant difference was detected between researchers' behaviour for *not sharing data* and *country* ($\chi^2_{(2)} = 28,539$; $p = 0,000$). Whilst nearly half (45%) of the UK researchers claim that they do not collaborate in data sharing, this is significantly less for the other two countries: approximately 13% in France and 11% in Turkey. A statistically significant difference was also detected between *sharing data with own team* and *country* ($\chi^2_{(2)} = 41,858$; $p = 0,000$), *sharing data with researchers in the same university* ($\chi^2_{(2)} = 14,382$; $p = 0,001$), *sharing data with researchers in other institutions* ($\chi^2_{(2)} = 6,419$; $p = 0,040$) and *country*.

5 Metadata and Tagging of Datasets

Researchers use different coding or tagging for their datasets (Table 4). However, not all of them are familiar with the concept of metadata, nor do they always use standard metadata (Table 5). Nearly a third of the researchers are either uncertain or are not familiar with the concept of metadata (Table 6). Nearly 95% of the researchers are either uncertain or do not know whether their university has a prescribed metadata set for uploading data onto the repository. However, nearly 60% of researchers feel that a formal training on metadata would be useful for managing research data.

Table 4. Data tagging done by researchers

Type of tag/added information	%
Administrative information (creator, date of creation, file name, access terms/restrictions, etc.)	47
Discovery information (creator, funding body, project title, project ID, keywords, etc.)	31
Technical information (file format, file size, software/hardware needed to use the data, etc.)	24
Description of the data file (file/data structure, field tags/descriptions, application rules, etc.)	29
No assignment	37

Only one metadata related behaviour in relation to data use, viz. *using datasets that are tagged with standard metadata* had a significant correlation with researchers' experience; and no significant correlation was found between researchers' metadata related behaviour and their gender. No significant correlations were found between researchers' status and tagging of datasets. Only one tagging behaviour (*description of the data file*, $\chi^2_{(2)} = 13,048$; $p = 0,001$) correlated with discipline: descriptions of a data file are used more by researchers in science (48%) and least by researchers in humanities (15%). Correlations were also detected between country and some tagging behaviour (such as *no assignment*, $\chi^2_{(2)} = 10,559$; $p = 0,005$; *administrative information*, $\chi^2_{(2)} = 9,318$; $p = 0,009$; *discovery information*, $\chi^2_{(2)} = 13,508$; $p = 0,001$; and *technical information* $\chi^2_{(2)} = 14,434$; $p = 0,001$). The number of researchers who do not assign tags and metadata to their datasets is higher in the UK (46%); and assigning administrative (38%), discovery (20%) and technical (15%) information to datasets is the lowest in UK.

Table 5. Use of standard metadata (%)

Use of standard metadata	Almost always	Often	Sometimes	Rarely	Never
Using metadata standard for tagging data	7	5	13	16	59
Using own/in-house (research team) tags and metadata	12	9	14	11	54
Using datasets that are tagged with standard metadata	5	10	16	15	54

Table 6. Familiarity with metadata (%)

Metadata issue	Yes	Uncertain	No
I am familiar with the term metadata	68	11	21
A formal training on metadata would be useful for managing research data	60	36	5
My university have a prescribed metadata set	5	83	12

Note: The percentage of the total is not 100% due to rounding.

6 Open Access and Data Sharing Issues

Only 23% of researchers agree that their university encourages OA and data sharing, and only 31% of researchers are familiar with the OA requirements (Table 7). Researchers have different views on the potential benefits and challenges of OA and data sharing (Table 8); only 55% of researchers are comfortable and willing to share research data; 67.5% of researchers perceive that data ethics could be an issue for data sharing. Researchers do have a number of concerns for making data available in open access mode (Table 9); and some of the key concerns of researchers include: legal and ethical issues, misuse and misinterpretation of data, and fear of losing the scientific edge (Table 10).

Table 7. Familiarity with OA policies (%)

Familiarity with OA policy	Yes	Uncertain	No
Your university encourage to share data on open access	23	43	34
I am familiar with funding body's requirements with regard to data storage	31	30	39

Table 8. Views on OA policies (%)

Views on OA	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Familiar with the OA requirements	16	38	26	15	5
Comfortable/willing to share research data with others	15	40	26	17	1
Foresee no problems with sharing research data	11	23	31	28	7
Perceive data ethics could be an issue when research data is shared with others	21	47	23	8	2

Table 9. Data sharing practices

Data sharing practices	%
My data is openly available to everyone	20
My data is openly available only to my research team	34
My data is available openly upon request	47
My data has restricted access (e.g. only some parts of the dataset is accessible)	21
My data is not available to anyone else	20

A correlation was detected between researchers' country and familiarity with metadata ($\chi^2_{(4)} = 16,214; p = 0,003$): researchers in Turkey displayed the lowest score for familiarity with metadata (50%). A correlation was also detected between researchers' discipline and their *familiarity with the OA requirements* ($\chi^2_{(8)} = 16,162; p = 0,040$), *willingness to share their research data with others* ($\chi^2_{(8)} = 19,818; p = 0,011$) and *foreseeing no problems with sharing research data* ($\chi^2_{(8)} = 34,266; p = 0,000$). More than half of the researchers in all countries claim to be familiar with OA requirements: combined figures for *strongly agree* or *agree* on this were 61% for France, 56% for Turkey and 50% for UK. Researchers in France seem to be more willing to share their research data (74%) and they see data sharing less problematic (54%) compared to the other two countries.

Table 10. Data sharing concerns

Data sharing concerns	%
No concerns	26
Fear of losing the scientific edge	20
Legal and ethical issues	52
Misuse of data	37
Misinterpretation of data	39
Lack of resources (technical, financial, personnel, etc.)	12
Lack of appropriate policies and rights protection	19

Table 11. Availability and awareness of a DMP (%)

Data Management Plan	Yes	Uncertain	No
Your institution have a DMP	32	59	9
I used a DMP for my research	23	17	61
I have a DMP for my current research project(s)	25	17	59
A DMP helps researchers in managing research data	40	52	8

Table 12. File naming system (%)

File naming system	Yes	Uncertain	No
My research community use a standard file naming system	9	39	53
My university have a standard file naming system	3	50	47

Table 13. Use of standard file naming conventions (%)

Data file management	Almost always	Often	Sometimes	Rarely	Never
Using file naming convention or standard	16	21	14	13	37
Having different versions of the same dataset(s)	15	25	19	14	26
Using systems/techniques for version control to recognise a specific version	18	16	15	14	37

A significant correlation was detected between researchers' discipline and data sharing practices such as making their research *data available to everyone* ($\chi^2_{(2)} = 6,158; p = 0,046$) and making it *available only to own research team* ($\chi^2_{(2)} = 7,264; p = 0,026$). Only 13% of researchers in social sciences are willing to make their data open to everyone and only 19% in humanities are willing to make it available only to their own research team. Some correlations were also detected between researchers' country and certain data sharing practices (*making it available openly upon request* ($\chi^2_{(2)} = 8,716; p = 0,013$), *providing restricted access* ($\chi^2_{(2)} = 7,158; p = 0,028$), *not making it available to anyone else* ($\chi^2_{(2)} = 8,492; p = 0,014$). Researchers in the UK had the highest score for reluctance to share data: 28% for *making data available with restricted access* and 27% for *not making data available to anyone else*. They also show the lowest score for *making data available upon request* (38%).

7 Data Management Plans (DMP): Issues and Awareness

Despite various government and funding body mandates, researchers still appear to be not quite familiar with DMP: two-thirds or more researchers are either uncertain or do not know whether their institution has a DMP, and only a quarter of researchers have or used a DMP for their research (Table 11). However, on a positive note, 40% of researchers believe that a DMP helps researchers manage their data. Tables 12 and 13 show that very few researchers practise or use standard file naming systems which is a key requirement of a good data management system. Very few people had any formal training on different aspects of data management that are essential for research data sharing and use (Table 14):

- Only 6.5% had any formal training on DMP;
- Only 10% had a formal training on metadata;
- Only 2.8% had any training on version control, etc.

However, over 77% of researchers are willing to take formal training on these topics. A significant correlation was observed between the researchers' country and their opinion about the role of the universities for *recommending a standard file naming system* ($\chi^2_{(8)} = 41,927; p = 0,000$). Turkish researchers had the highest score (53%) in this regard. Some correlations were discovered between researchers' country

and the use of standard file naming system ($\chi^2_{(4)} = 15,711; p = 0,003$), use of standard style for citing research data ($\chi^2_{(4)} = 14,214; p = 0,007$), being recommended a specific guideline for citing data by the university ($\chi^2_{(4)} = 29,136; p = 0,000$) and owning a unique researcher ID ($\chi^2_{(4)} = 13,390; p = 0,010$). More than 40% of researchers in UK own a unique researcher ID, while this is only 17% in France. Whilst approximately 60% of researchers in both the UK and Turkey claim that their universities recommend some guidelines for citing data, for France it is only 15%. Nearly half (46%) of the researchers from France also claimed that they do not use a standard style for citing research data.

Table 14. Formal training (%)

Formal training subjects	Have had a formal training	Willingness for a formal training
Data Management Plan	7	58
Metadata	10	51
Consistent file naming	7	39
Version control of data sets	3	44
Data citation styles	23	36
No, I haven't had training on any of the above	71	78

8 Discussions and Conclusion

This study shows that the culture of OA and data sharing is not yet common: only about 40% of researchers do almost always or often use OA data, and only about 23% work with datasets with restricted access. In most cases (80%) researchers have to put in some effort before they can make use of OA data. There may be several reasons such as data may not be tagged properly or standard metadata set has not been used, or for example, researchers may not be familiar with tagging or data management. In general, nearly 80% of researchers do not want to share data with anyone. Less than a quarter of researchers agree that their university encourages OA and data sharing, and only 31% of researchers are familiar with the OA requirements of the funding bodies. Nearly 95% of researchers are either uncertain or do not know whether their university has a prescribed metadata set. Despite various government and funding body mandates, majority (about 80%) of the researchers do not want to share data with others; and the key concerns for OA and data sharing include: legal and ethical issues, misuse and misinterpretation of data, and fear of losing the scientific edge. In total, 40% of researchers do not use a standard data citation style, and only 50% universities have a recommended citation style; 61% are familiar with the concept of DOI, but only a third of the researchers have a unique researcher ID; and researchers do not always find appropriate systems for version control of datasets.

Although UK is ahead of the two other countries in terms of research and development in RDM, the willingness for data sharing is still low: 45% of the UK researchers claim that they do not collaborate in data sharing. UK researchers appeared

to be more reluctant to share data: 28% said they would make *data available with restricted access* and 27% will *not make data available to anyone else*. They also show the lowest score for *making data available upon request* (38%). Researchers in France seem to be more willing to share their research data (74%) and they see data sharing less problematic (54%) compared to other two countries. The number of researchers who do not assign tags and metadata to their datasets is higher in the UK (46%); whilst assigning administrative (38%), discovery (20%) and technical (15%) information to datasets is also the lowest in UK. However, researchers in Turkey displayed the lowest score for familiarity with metadata. More than 40% of researchers in UK own a unique researcher ID, while this is only 17% in France. Nearly 60% of researchers in both the UK and Turkey claim that their universities recommend some guidelines for citing data, but for France it is only 15%; 46% of the researchers from France also do not use a standard style for citing research data. Two-thirds or more of researchers are either uncertain or do not know whether their institution has a data management plan (DMP), and only a quarter of the researchers have used a DMP for their research. Over 70% of researchers did not have any formal training in DMP, metadata, consistent file naming and version control or data citation. This corroborates previous research [17] which noted that 77% of researchers never received any formal training in data management.

Overall, this research demonstrates that a significant number of gaps exist between researchers' perceptions and behaviours with regard to research data creation and sharing, and the ambition of funding bodies and academic institutions with regard to OA data. The gap in the skill sets required for university researchers can be filled by developing data literacy which is broadly defined as, "knowing how to select and synthesise data and combine them with other information sources and prior knowledge" [13, p. 405].

The purpose of this study was to explore whether differences exist amongst countries, disciplines, and years of the experience of the researchers with regard to their awareness and behaviour in relation to RDM. The findings show a range of interesting behaviours in research data sharing and various RDM practices displayed by university academics and researchers that may provide valuable insight for the development of data literacy training programmes. However, given the relatively small sample size and response rate, the results, especially the comparison at country, discipline and experience level, should be taken with some caution. More detailed studies with larger and more representative samples should be undertaken in order to make reliable comparisons amongst these variables.

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