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The role of Open Science in economics. Results report from an online survey among researchers in economics at German higher education institutions in 2019

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The role of Open Science in economics.

Results report from an online survey among researchers in economics at German higher education institutions in 2019

An empirical study by ZBW –
Leibniz Information Centre for Economics
April 2020

Guido Scherp, Doreen Siegfried,
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Abstract

The present quantitative study addresses Open Science practices among researchers in economics at German higher education institutions. In all, the study surveyed 300 scientists from business studies, economics, business informatics, industrial engineering and other economics-related subjects taught at universities, state and private universities of applied sciences, and other higher education institutions such as distance-learning colleges or dual colleges. The study collected information about familiarity, attitude, application, barriers, incentives and support requirements.

The key results are:

- Most economists are familiar with the term “Open Science”. Four out of five economic researchers have heard the term “Open Science” before.
- There is wide agreement with the general principles of “Open Science”, for instance
 - that replicability of research findings is an important criterion for credibility (mean value 1.6, scale 1 (=fully agree) to 7 (=fully disagree)),
 - that findings from publicly-funded research should be freely accessible with a minimum of exceptions (mean value 1.8) or
 - that research findings and the application of methods should be assessed irrespectively of the publication place’s or journal’s reputation (mean value 2.2).
- Economists only view the involvement of societal stakeholders (Community / Citizen Science) sceptically (mean value 3.4).
- Open Source (mean value 2.4, scale 1 (= very important role) to 5 (=no role)) and Open Access (2.5) play the most important role of all Open Science aspects in the working routines of respondents; Community / Citizen Science (3.8) and Altmetrics (4.0) play the smallest role.
- 34 per cent of all economists stated that they have already published in Open Access, for 61 per cent it was a working paper in a repository and for 59 per cent it was an Open Access journal. University professors publish significantly more frequently (59 per cent) in Open Access than research assistants (24 per cent).
- 78 per cent of all economists work with research data and 56 per cent use data from others. 51 per cent use free software for data analysis. 44 per cent have already appended/linked a publication with corresponding research data. Only 15 per cent have made plain data accessible via a repository.
- The most frequently quoted obstacles to using Open Science practices are lack of time (43 per cent), lack of support (32 per cent) and insufficient recognition in the community (30 per cent). These are all values below the 50 per cent mark.

- More visibility and impact are major incentives among economists for implementing Open Science. The most quoted incentives were:
 - if more researchers / lay people showed an interest in their work (54 per cent),
 - if citations would rise through Open Access (52 per cent),
 - if the implementation were recognised by the scientific community (51 per cent),
 - if citations were available for published data (49 per cent).
- Recognition in the scientific community plays a more important role for research assistants (63 per cent) than for professors (39 per cent).
- In general, economists have a great need for support when it comes to the implementation of Open Science. This ranges from an overview of platforms, tools and applications (84 per cent) to the support for an improved replicability of their own research findings (50 per cent).
- There are hardly any significant differences between business studies and economics. Professors at universities of applied sciences appear to be more open towards Open Science practices than professors at universities. They also report significantly more need for support in some areas. Age splits frequently correspond to professional status (research assistant / professor).

Explanatory notice:

This study was carried out among economists at higher education institutions in Germany and reflects the particularities both of the discipline(s) and the institutions. Economic science in Germany is divided into two distinct disciplines: Volkswirtschaftslehre=VWL (historically evolved from national economics) and Betriebswirtschaftslehre=BWL which encompasses business studies. These disciplines have a distinct self-conception. The other distinction must be made between universities (historically the only institutions to offer doctorate studies and habilitation) and the universities of applied sciences, formerly known as Fachhochschulen= FH. Since the study showed significant differences between the professors at these institutions, the distinction is relevant and must be kept in mind when looking at the diagrams. Because space for labelling was at a premium in these diagrams, the abbreviations BWL, VWL and FH have not been changed.

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1 *Introduction*

The importance of empirical research is steadily increasing in economics. The number of empirical contributions in top journals, whose authors used datasets, experimental designs or real data for simulating theoretical models collated either by themselves or others, has risen massively during the last decades (Hamermesh, 2013). Whereas the share of publications in purely theoretically-oriented journals still amounted to 51 per cent in 1963, it had sunk to a share of 19 per cent in 2011. The share of empirically-oriented journals in economics amounted to 81 per cent in 2011 (Vlaeminck/Podkrajac, 2017).

Not only the number of empirical papers is rising; the recognition of empirical economics compared to purely theoretical or model-oriented economics has been rising during the last years. Whereas a few years ago empirical economists were ridiculed as “applied statisticians”, they have now been enjoying more recognition for almost a decade both within their discipline and as political advisers, owing to a “credibility revolution”. (Patzwaldt/Riphahn et al., 2019). The increasing transparency of datasets has been reputation-building for this new generation¹.

The “credibility revolution” currently plays an important role in economics. Besides the scientists themselves, renowned journals or professional associations, such as the German Economic Association (VfS)² or the German Academic Association for Business Research (VHB)³, advocate more credibility and transparency in German economic research. They adopt basic ethical rules demanding “Research must be transparent and reproducible” and “Empirical work should [...] make data and methods available for the purpose of replication”⁴. The call for transparency and replicability in economics has gained in importance during the last years and shows large overlaps with the Open Science movement.

At its core, Open Science aims to improve the transparency and replicability of research in a digitally networked age. The essential instrument for this is openness. On the one hand, research findings and methods are presented comprehensively and accessibly from the first conception of an idea to publication, so that other researchers can verify them or reuse them for their own research. On the other hand, researchers leave their “ivory towers” and research opens up towards societal stakeholders from politics, business, culture and society. Besides communicating research findings directly, this opening up also enables the active involvement of these stakeholders in research processes.

The ZBW has pioneered Open Science in Germany and wants to reinforce these impulses and efforts, improve its services to support Open Science and realign them along the needs of economists in Germany. The present study was carried out in this context and with the aim of gaining an overview of the role that Open Science practices play in the working routines of economists today.

The study was carried out by the ZBW – Leibniz Information Centre for Economics in cooperation with the market research company Meinecke & Rosengarten (Hamburg) and addresses the following questions:

- What do economists know about the topic Open Science?
- What are the attitudes of economists towards Open Science?
- Which Open Science practices do economists apply in Germany?
- What are the incentives and also the barriers to implementing Open Science practices?
- Where do researchers in economics see needs for support regarding Open Science?

The results report is structured as follows:

Chapter 2 presents the methodology of data collection and describes the sample. Chapter 3 presents the findings for the awareness of the term Open Science, its underlying concepts and the attitudes towards Open Science. Chapter 4 looks at the sub-topic Open Access with regard to the aspects of research, assessment and publication. In chapter 5 we present findings on research data management in economics, and look in particular at research, access, processing and publication of research data. We also present findings on the state of openness in teaching, reviewing and methodology. In chapter 6 we present the study’s findings on barriers and incentives for Open Science in economics and in chapter 7 we focus on concrete requirements for support. The report ends with a conclusion and discussion of the results in chapter 8. The questionnaire is included in the appendix.

1 <https://www.vox.com/the-highlight/2019/5/14/18520783/harvard-economics-chetty> [Last accessed: 8.4.2020]

2 <https://www.socialpolitik.de> [Last accessed: 8.4.2020]

3 <https://www.vhbonline.org> [Last accessed: 8.4.2020]

4 https://www.socialpolitik.de/docs/Code_of_Ethics.pdf [Last accessed: 8.4.2020]

2 *Methodology*

2.1 Survey design and sample

For the present baseline study on the implementation of Open Science among economists, a nationwide survey was held as an online questionnaire. It took the form of a structured online interview where some of the questions offered open answers. The sampling focused on surveying researchers in economics as comprehensively as possible at German higher education institutions and research institutions. The sample consists of 300 completed interviews. The sample was recruited based on 8,054 persons invited by email to participate in the survey. The average interview length was 10:58min. The field phase took place from 17 September 2019 until 8 October 2019. At the beginning of the questionnaire, an introductory text about Open Science and the individual concepts was offered optionally.

2.2 Sample description

The sample was drawn by quota method in order to correspond to the population as defined by the Institutions of Higher Education Statistics of the Federal Statistical Office – both regarding status groups and discipline⁵. The sample is composed as follows: 51 per cent research assistants at universities and independent research institutions, 30 per cent professors at universities of applied sciences, 19 per cent professors at universities including junior professors. By their own statement, 73 per cent of respondents belong to the discipline of business studies, 20 per cent to economics, and 7 per cent to other economics-related subjects.

A look at status and age shows that in the group of professors one per cent is younger than 30 years. 41 per cent are aged between 31 and 50 years, and 58 per cent older than 51 years. Among the research assistants, 48 per cent are younger than 30 years old. Half of them are between 31 and 50 years old, and 2 per cent older than 51 years (see fig. 4). In the discipline of business studies, 23 per cent are younger than 30 years, 43 per cent between 31 and 50 years old, and 31 per cent are older than 51 years. Among economists, 24 per cent are younger than 30 years, 56 per cent between 31 and 50 years old, and 20 per cent older than 51 years. In the other economics-related subjects, 20 per cent are younger than 30 years old, 35 per cent between 31 and 50 years old and 45 per cent older than 51 years.

Fig. 1: Distribution by status groups
n= 300

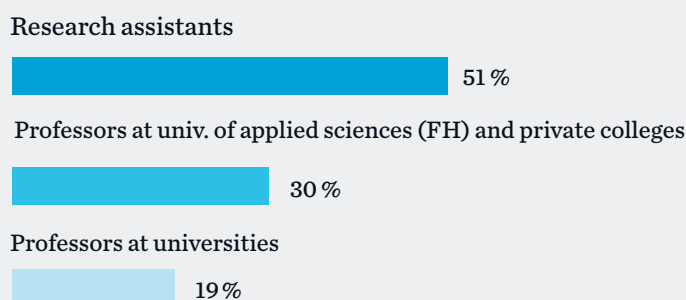


Fig. 2: Distribution by discipline
n= 300

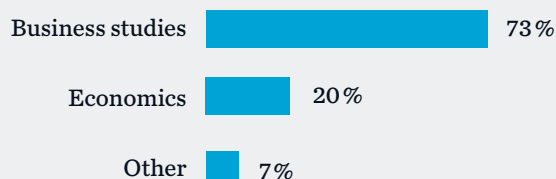


Fig. 3: Age distribution
n= 300

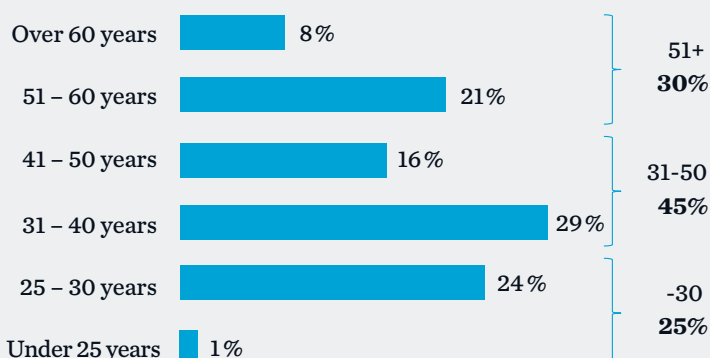
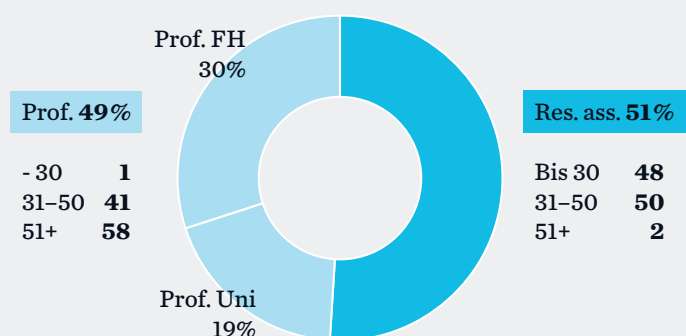


Fig. 4: Age distribution in the status groups (career position) n= 300



⁵ https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bildung-Forschung-Kultur/Hochschulen/_inhalt.html [Last accessed: 8.4.2020]

3 *The role of Open Science in economics*

3.1 Familiarity with the term Open Science

Four out of five respondents stated that they had heard the term Open Science before (see fig. 5).

3.2 Importance of Open Science concepts

The survey asked about the role that eight specified concepts play in the working routines of these economists. These can be either consuming activities (such as using Open Access literature or open research data) or productive acts such as publishing in Open Access or publishing research data as Open Data/FAIR Data⁶. Among these concepts, Open Source and Open Access play the most important role with mean values of 2.4 resp. 2.5 on a scale of 1=very important role to 5=no role at all. 26 resp. 23 per cent assign a very important role to these concepts. For 19 resp. 25 per cent they tend to be unimportant or play no role at all. (See fig. 6 on page 10.)

For 64 per cent of respondents Open Source plays a major role. Around one fifth of respondents are undecided, another fifth see no important role for Open Source in their working routines.

Open Access is similarly important. 62 per cent consider Open Access important to them personally. One in seven is undecided and one in four does not see Open Access as significant for themselves. (More findings about Open Access in chapter 4).

Less than half of respondents find Open Educational Resources relevant, around one fourth are undecided and one third do not consider them important for their own work. It is interesting to see here that university professors consider Open Educational Resources significantly less important than professors at universities of applied sciences and private colleges.

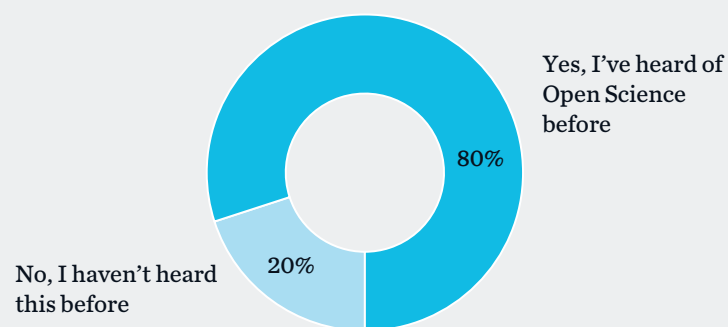
On the topics Open Data/FAIR Data and Open Methodology the camps are evenly divided. That research data and applied methods should be made available and published according to open principles is important for two fifths and unimportant for another two fifths.

A large share of respondents (49 per cent) regard the opening up of the processes and results of peer review and the corresponding replicability and transparency of research findings as mostly or completely unimportant. 28 per cent, i.e. almost one in three, are undecided and only 23 per cent, less than a fifth, regard Open Peer Review as important.

The least relevant of all eight concepts is Community/Citizen Science, i.e. the involvement of members of the civil society, and alternative performance measurement, i.e. the supplementation of classical citation-based indicators (Altmetrics). 57 per cent of respondents consider Community/Citizen Science to be mostly unimportant or unimportant. Only one in seven sees this as relevant. University professors (mean value: 4.1) agree significantly less with this statement than professors at universities of applied sciences and private colleges (mean value: 3.3). Around two thirds of respondents regard Altmetrics as unimportant for their working routines, nearly one third are undecided and only eight per cent state that Altmetrics have an important role for them.

All in all, the eight concepts consistently play a less important role for university professors, twice

Fig. 5: Familiarity with the term Open Science among economists
n=300



significantly less (Open Educational Resources and Community/Citizen Science).

3.3 Attitudes towards Open Science

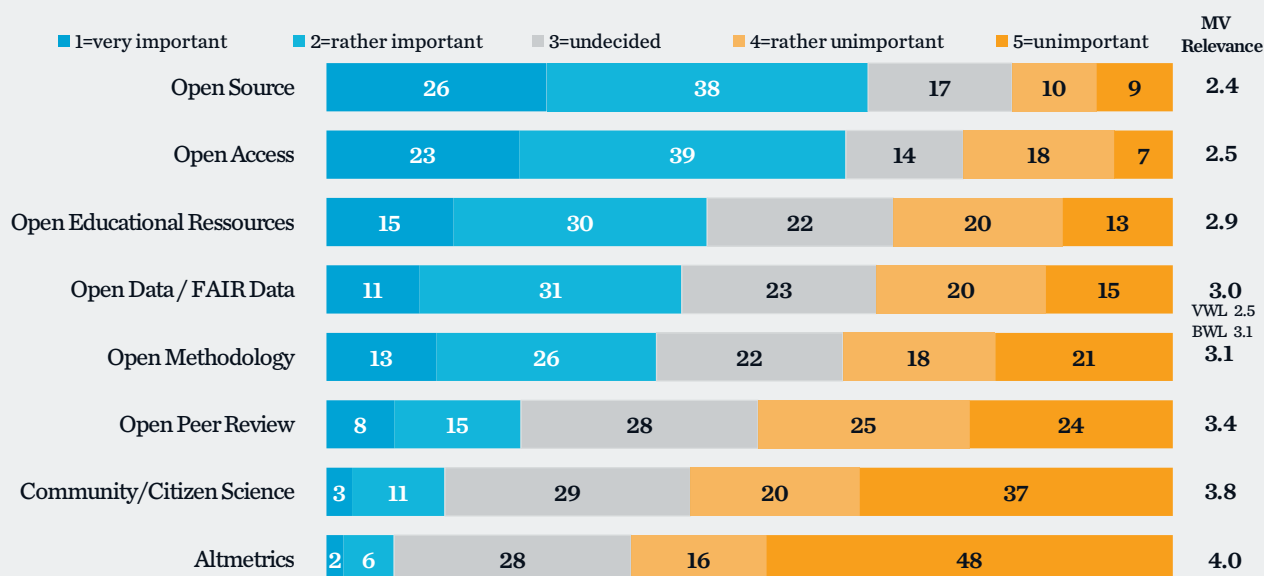
Economic researchers in Germany agree that the replicability of research findings is an important criterion for raising the credibility of science, irrespective of the type of their institution or their discipline. 96 per cent of respondents agree with this statement. The commitment to free access to publicly-financed research is just as high: 91 per cent fully or partially agree with the statement. See fig. 7.

Science communication, the role of reusability and publishing outside of paywalls also meet with high consent.

⁶ FAIR stands for Findable, Accessible, Interoperable and Reusable. These FAIR Principles (<https://www.go-fair.org/fair-principles/> [Last accessed: 8.4.2020]) phrase principles to maximise the sustainable reusability of data. Implementing them ensures cross-disciplinary and cross-country access to data and their utilisation. Since there is overlap between the FAIR principles and Open Data, the questionnaire uses the term FAIR Data together with Open Data at certain points.

Fig. 6: Role of Open Science concepts

n= 300



90 per cent of all respondents agree with the statement that scientific findings should be more accessible to the public and be edited for this audience. This is a clear commitment to knowledge transfer and science communication. Among those 90 per cent almost half say that they fully agree with the statement.

A large majority of respondents, in all 89 per cent, agree that being able to reuse research findings is important for raising the efficiency of science. The visibility of scientific findings is also relevant for economists. 87 per cent agree that publishing and disseminating scientific findings outside of paywalls are useful to enhance the visibility of research findings within and outside the scientific community. Only 6 per cent disagree.

Whereas Open Source played an important role for 71 per cent of respondents when asked about the role of various Open Science concepts (see fig. 7), 88 per cent of respondents agree with the statement that platforms, tools and applications for scientists should follow open principles. They should be Open Source and use open file formats. Two fifths (40 per cent) fully agree with this (see fig. 7), another 48 per cent partially agree.

A large majority of respondents (86 per cent) say that the principles of open scientific working should be embedded more deeply in the curricula of PhD candidates.

85 per cent of respondents endorse the statement that the current evaluation of scientific output – based on impact factor – must be supplemented with additional metrics. Only 9 per cent are undecided about this. Only six per cent do not consent to supplemental output evaluation (see fig. 7). It is remarkable that 43 per cent of the surveyed economists fully agree with this statement. A similar result is returned for the statement that the science system should evaluate research findings and methodology, not the place of publication and the reputation of this place or journal. Fully 85 per cent of respondents give a positive answer to this statement. Again, 9 per cent are undecided and 7 per cent give a negative reply to the statement (see fig. 7).

A totally different picture emerges for the “involvement of societal stakeholders (Community / Citizen Science)”. Less than half (46 per cent) agree that societal stakeholders should be involved more closely in research processes. One in four (23 per cent) are undecided about this question. One fifth see no need to involve the public or lay people in research pro-

cesses. There are significant differences between professors at universities and those at universities of applied sciences or private colleges here. Scientists at universities of applied sciences see significantly more sense (relevance 3.3 versus 4.1) in the involvement of societal stakeholders than their colleagues at universities. The results coincide with the generally small role of Community/ Citizen Science in scientific working routines (see fig. 7). With the exception of the involvement of societal stakeholders, the values for agreement lie between 85 and 96 per cent and thus in a very high range.

Fig. 7: Attitudes towards Open Science (1/2)

n=300

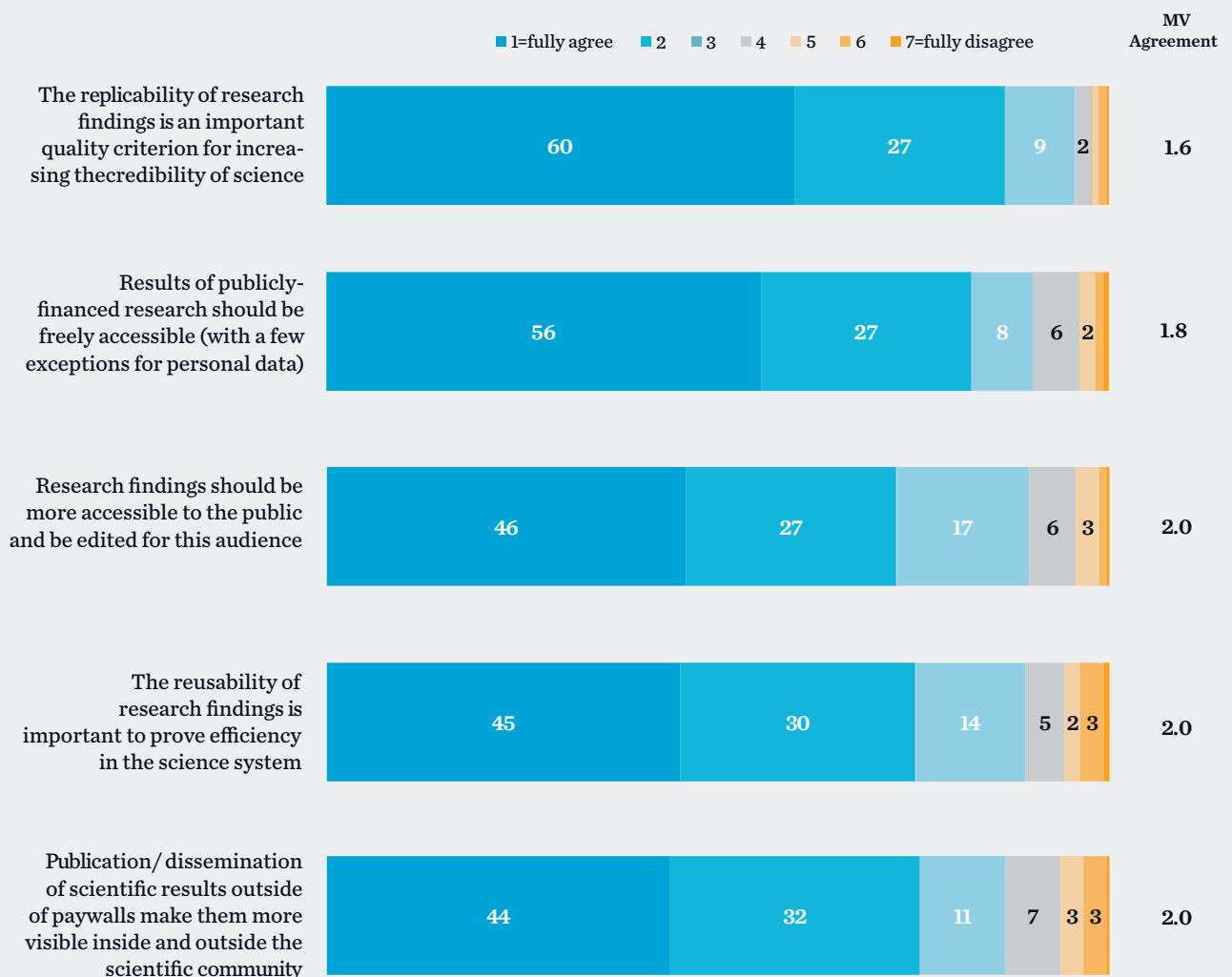
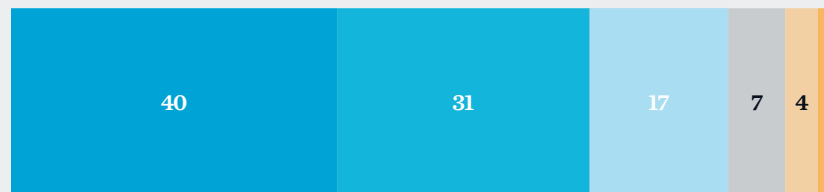


Fig. 7: Attitudes towards Open Science (2/2)

n=300

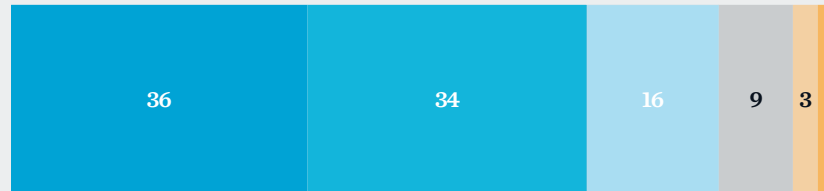
■ 1=fully agree ■ 2 ■ 3 ■ 4 ■ 5 ■ 6 ■ 7=fully disagree **MV Agreement**

Platforms, tools and applications for science should follow open principles, e.g. be Open Source and use open file formats



2.1
Prof. Uni 2.6
Prof. FH 2.0

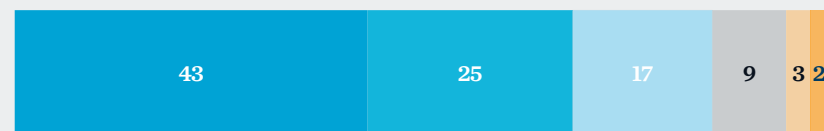
The principles of open scientific working should be embedded more deeply in PhD curricula



2.1

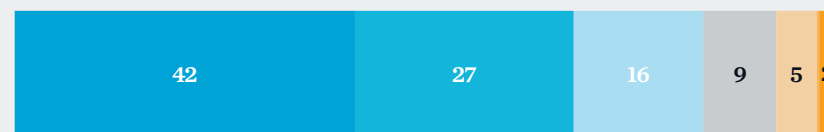
■ 1=fully agree ■ 2 ■ 3 ■ 4 ■ 5 ■ 6 ■ 7=fully disagree **MV Agreement**

The evaluation of scientific output (based on Impact Factor) must be supplemented with additional metrics



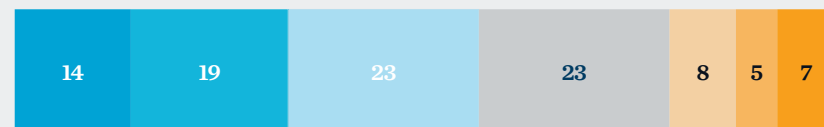
2.1

The science system should evaluate research findings and methodology, not the reputation of the journal or place of publication



2.2

Societal stakeholders should be involved more closely in research processes



3.4
Prof. Uni 4.1
Prof. FH 3.3

4 *Research and publication and the role of Open Access in economics*

4.1 Searching for Open Access publications

In their daily practice, economic researchers neither search specifically for Open Access literature nor do they purposefully use tools such as the Open Access button.

Only slightly more than a third of respondents (38 per cent) say that they search specifically for Open Access literature in their daily work, for instance in special repositories such as EconStor, BASE or others. Around two thirds deny such targeted searches. Among respondents not looking for open literature, differences can be stated between disciplines. Whereas 68 per cent of researchers in business studies say that they do not specifically search for Open Access, only 46 per cent of researchers in economics say so. This means that in economics more than half of all respondents have searched specifically for Open Access publications (see fig. 8).

Secondary or parallel publications are publications that once lay behind a paywall and may be “second-

arily published” on one’s own website or in an Open Access repository after an embargo period. While searching for recent literature, tools such as the Open Access button offer the option to look specifically for such secondary publications if one encounters a paywall on a publisher’s website. Only one in three (29 per cent) researchers actively uses these tools when searching for literature. 71 per cent do not use this option. Again there is a difference between disciplines. 47 per cent of researchers from economics use the Open Access button, whereas only 23 per cent from business studies do so (see fig. 8).

4.2 Evaluation of publications

The number of downloads and bookmarks plays a certain role while evaluating the situative relevance of a publication once found. Social media, however, are unimportant for assessing the relevance of a publication (see fig. 9).

Nearly half of all respondents (45 per cent) say that they pay attention to the number of downloads and

Fig.8 Searching for Open Access publications

n=300

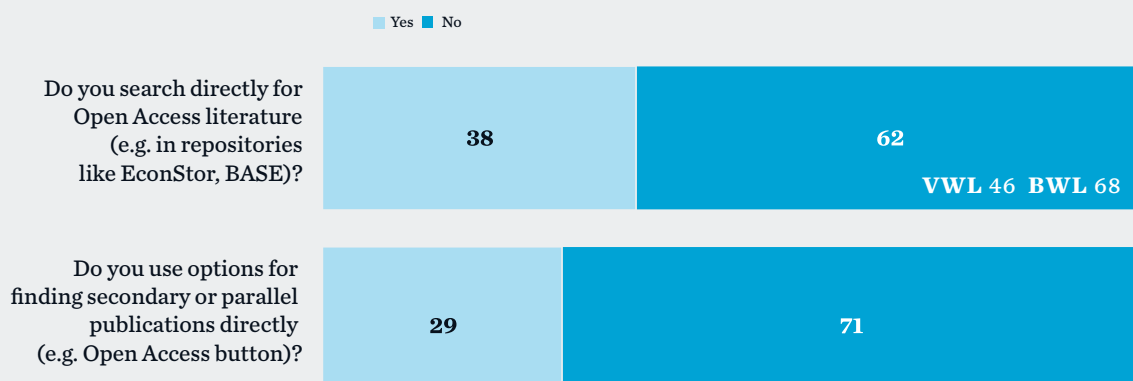
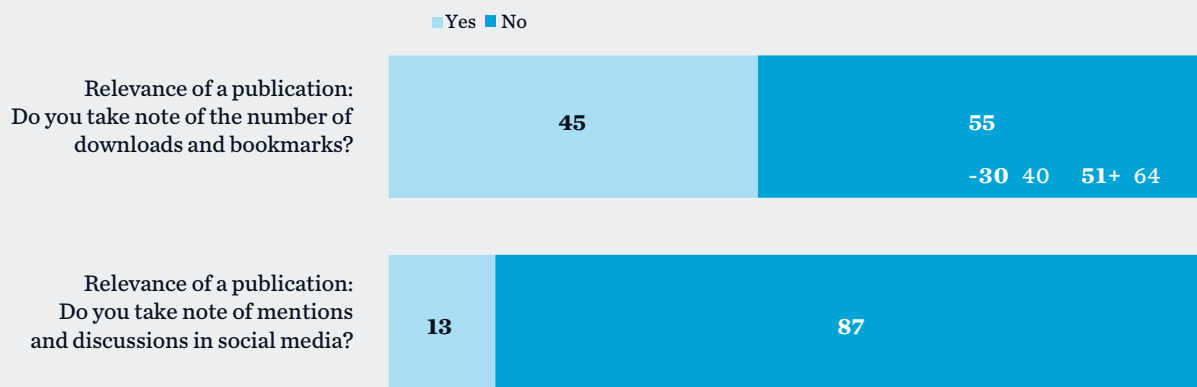


Fig.9 Relevance of a publication

n=300



bookmarks when assessing the relevance of a publication. 55 per cent say no to this question. There are no differences between disciplines here, but between age brackets. 60 per cent of those younger than 30 years say that they take downloads and bookmarks into consideration, whereas only 36 per cent say so in the group of those older than 51 years. Only 13 per cent of respondents say that the evaluation of a research paper in social media counts with them. For 87 per cent, i.e. the overwhelming majority, social media notices are irrelevant.

one third, share their slides and posters, whereas only a fifth of scientists (20 per cent) at universities do so.

Alternative formats such as science blogs (for instance *Ökonomenstimme*, *Herdentrieb*, *Blick Log* etc.) are used by only one in ten (13 per cent), see fig. 12.

4.3 Publishing in Open Access

Among all economists, almost one in three respondents has already published in Open Access (see fig. 10). Here differences can be observed, between status groups and also between types of university. Only a quarter (24 per cent) of all research assistants have published in Open Access already, whereas 43 per cent of professors have done so, i.e. almost two fifths. Looking at the various institutions, noticeable differences appear between professors. Almost two thirds of professors at universities (59 per cent) have already published in Open Access, whereas only a third (32 per cent) of professors at universities of applied sciences have taken this road.

Those persons who have published in Open Access (n=99) were asked about the types of their publications. The majority (61 per cent) publish working papers in a repository (e.g. EconStor, RePEc, institutional repository). There are notable differences between researchers at universities and other higher education institutions. 68 per cent, i.e. more than two thirds, of those publishing a working paper belong to a university; less than two fifths to a university of applied sciences or private college. The majority of economists who publish in Open Access (59 per cent) do so in an Open Access journal. Around half (51 per cent) publish contributions in a compilation or book. Around two fifths (42 per cent) publish their conference papers in an Open Access repository. Almost a third also choose the option of a journal article with secondary publication in Open Access after an embargo period (34 per cent) or of publishing a pre-print in an Open Access repository (e.g. EconStor, RePEc, institutional repository) (33 per cent).

As shown in fig. 12, only one in four makes presentation slides or academic posters publicly available for other researchers on FigShare, Slideshare or other sharing platforms. Three quarters of surveyed economists do not share their presentation materials, with a marked difference between scientists at universities and other higher education institutions. At universities of applied sciences and private colleges, posters and slides are shared more widely. 36 per cent of researchers at these institutions, i.e.

Fig. 10 Publishing in Open Access

n=300

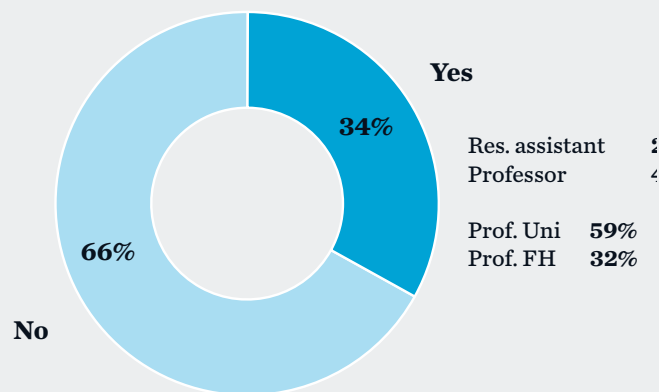


Fig. 11 Types of publication in Open Access

Multiple answers possible, n=99

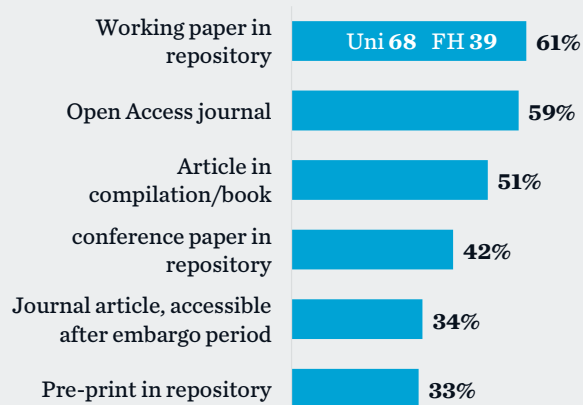
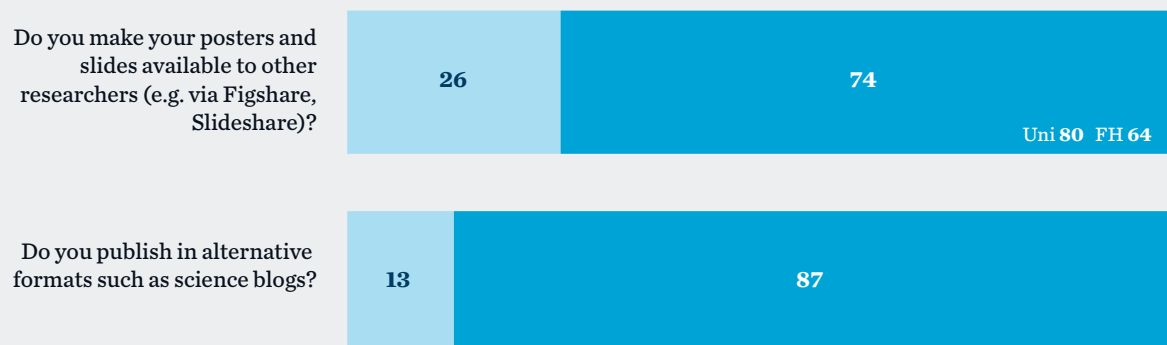


Fig. 12 Publishing outside of journals

n=300



5 *Research data management*

By their own statement, almost four in five respondents work with research data in their research (see fig. 13). In the following, the term “script” refers to executable programmes (e.g. based on the programming language R) used for analysing research data. The percentages mentioned below refer to those 78 per cent of researchers who said they work with research data. We refer to this group as “empiricists” for clarification.

5.1 Research data – research & access

Whereas more than half (56 per cent) of empiricists use the data of other scientists, only a third (32 per cent) visit Open Data portals. Around two fifths (38 per cent) of researchers who work with research data pay attention to supplemental data or scripts while searching for publications (see fig. 14).

5.2 Research data – processing & publication

More than half of the surveyed empiricists use free software for data analysis (e.g. R, PSPP or other) when processing research data (see fig. 15 on p. 20). It must be noted that researchers at universities use Open Source software more frequently than scientists at universities of applied sciences. 58 per cent of economists at universities use free software for data analysis compared to one in three (34 per cent) at universities of applied sciences. Less than half of respondents (44 per cent) appendix or link corresponding data and scripts in their publications, for instance as supplementary material at the publisher's. There is a notable difference between the disciplines here. Whereas 37 per cent of researchers in business studies add data and scripts, almost two thirds – 62 per cent – of researchers in economics do so.

Barely a quarter (23 per cent) of respondents use online platforms such as GitHub or RunMyCode to share their own research data and scripts with other researchers. There are notable differences between researchers at universities and univer-

sities of applied sciences. At universities, 27 per cent of empiricists use online platforms for sharing compared to a mere 10 per cent at universities of applied sciences.

One in five of the economists working with research data uses online platforms such as Open Science Framework (OSF) for collaboration in order to manage research data within their own research team and outside of it (see fig. 15 on p. 20). One in five economists (17 per cent) carries out replication studies.

One sixth of empiricists publish their own research data and scripts in research data repositories such as the Economics & Business Data Center (EBDC)⁷, maintained by ifo, or others. Significant differences can be observed between professors at universities and those at universities of applied sciences and private colleges. Whereas 27 per cent of university professors publish their research data in dedicated repositories, only 7 per cent of those at universities of applied sciences do this.

⁷ <https://www.ifo.de/EBDC> [Last accessed: 8.4.2020]

Fig. 13 Working with research data
n=300

n=300

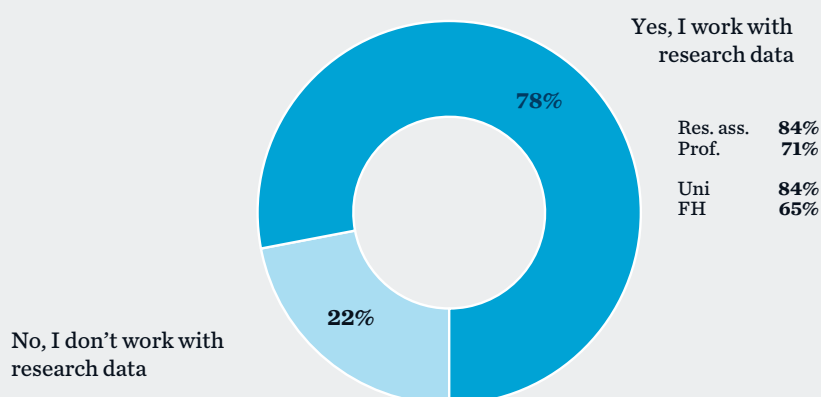


Fig. 14 Secondary use of research data

n=234

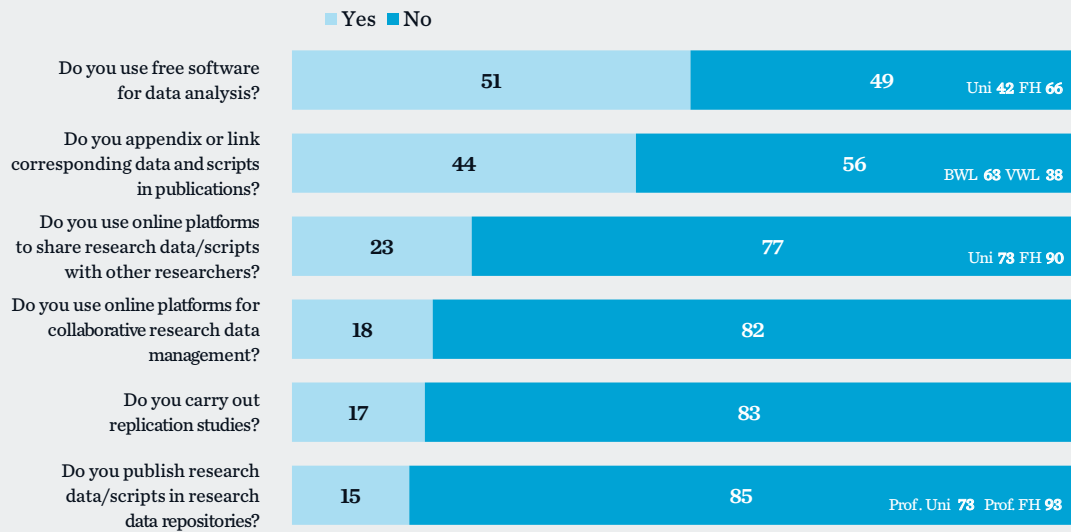
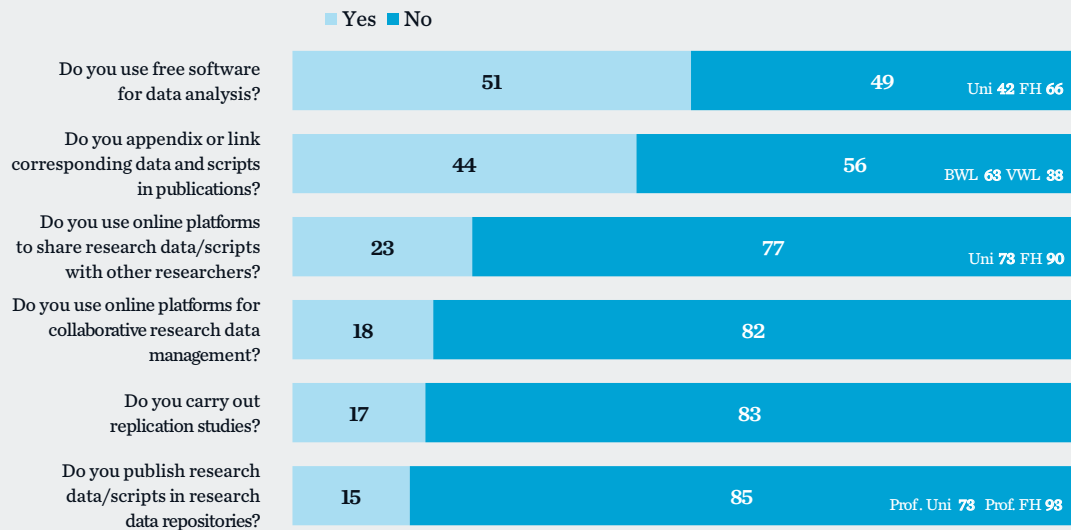


Fig. 15 Processing and publishing research data

n=234



6 *Openness in teaching, reviewing and methodology*

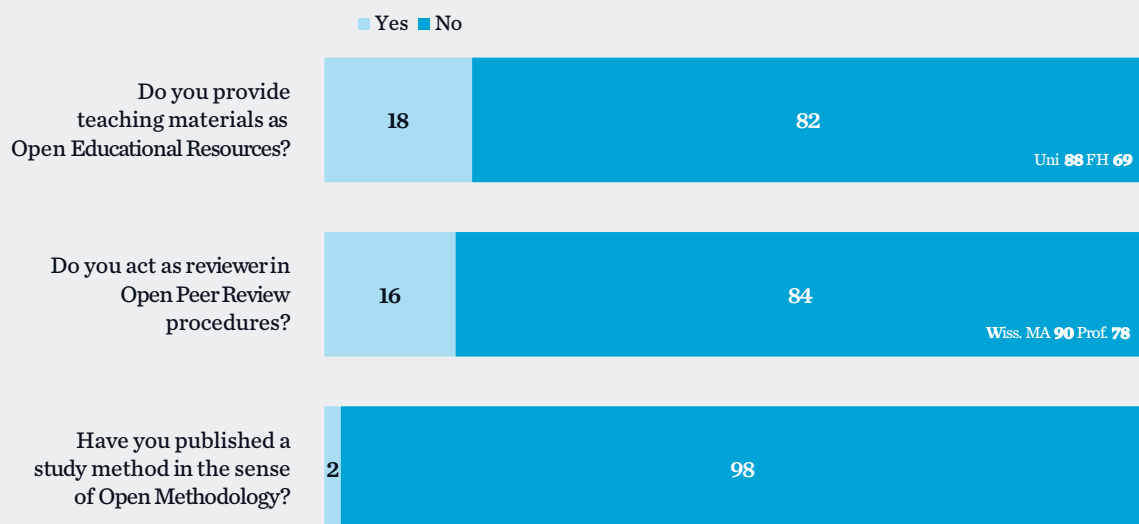
Regarding openness in teaching, it can be stated that only one in six has made teaching materials available as Open Educational Resources (see fig. 16). The share is even smaller at universities: here only one in eight (12 per cent) has done so, whereas at universities of applied sciences almost a third (31 per cent) of respondents have provided their teaching materials as Open Educational Resources.

One in six (16 per cent) has contributed as reviewer to an Open Peer Review procedure (see fig.16). Significant differences exist here between research assistants, only a tenth of whom have been involved in Peer Review procedures, and professors, where this share amounts to 22 per cent.

Only a small share of 2 per cent have published their study method in the sense of Open Methodology (see fig. 16). However, 39 per cent of researchers stated that Open Methodology plays an important role in everyday research (see fig. 6 on p. 10).

Fig. 16 Openness in teaching, reviewing and methodology

n=300



7 *Barriers and incentives for Open Science*

Nearly one in three confirms to have personal reasons that impede the implementation of Open Science (see fig. 17).

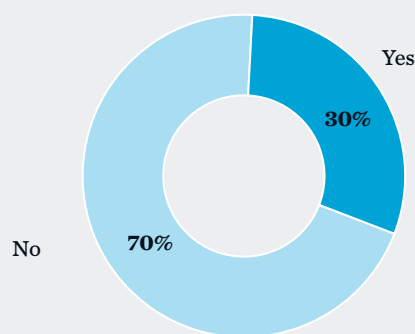
7.1. Barriers

What precisely are the barriers? In an open question, one fifth of respondents (24 per cent) cite lack of reputation or recognition of Open Science as impediment. Almost a fifth are convinced they know too little about Open Science to implement it. Around one in six sees additional costs. One in eight (13 per cent) worries about copyright and also sees the high impact of subscription journals as a reason that impedes the implementation of Open Science (see fig. 18). 9 per cent also cite worries about data protection.

Closed questions also reveal diverse barriers (see fig. 19). Lack of time is the essential issue here. 43 per cent of respondents say they do not have the time to address Open Science. Around one in three says that they would like to engage in it but lack support. Marked differences exist here between professors at universities and those at universities of applied sciences. 44 per cent of the latter say they would address Open Science if they had more support; only 16 per cent, barely a fifth, of professors at universities say this.

Nearly one in three says that Open Science is not recognised in their own community and that this impedes implementation. Whereas 36 per cent of professors at universities name this barrier, only 17 per cent of professors at universities of applied sciences agree. Around one third name as barriers legal obstacles such as data protection or sensitive information as well as lack of demand. One in four fears “theft of ideas” (see fig. 19 on p.26). One fifth

Fig. 17 Personal reasons impeding the implementation of Open Science
n=300



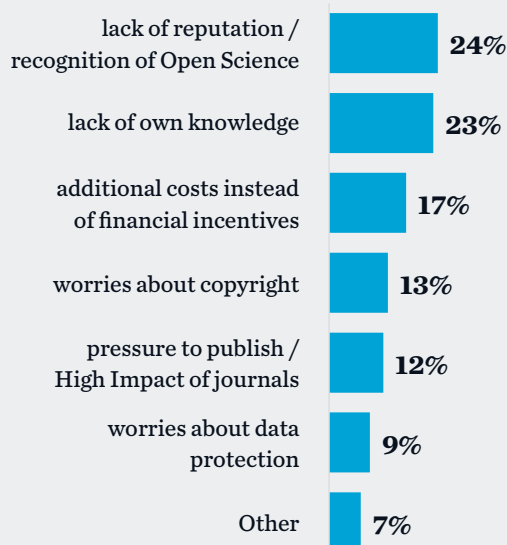
of respondents see no added value for their own academic career in Open Science.

7.2 Incentives

Relevant triggers for Open Science can be summarised under the heading “recognition”. More than half of the respondents could be persuaded by it to implement Open Science. Possible motives for them would be the realisation that more scientists and lay people were interested in their work and their findings. Another relevant motive would be if Open Access increased citation rates for their publications and if generally Open Science practices were accepted in academic career paths. This last incentive is even more powerful among research assistants, 63 per cent of whom agree with this. This is not a strong incentive for professors. Only 39 per cent of them agree here (see fig. 20 on p.27).

Fig. 18 Barriers named in open questions

Multiple answers possible, n=90



Almost half of economic researchers (49 per cent) explicitly desire more citations and better recognition for published data.

The trigger “recognition” is followed by incentives that can be summarised as “workload reduction”. Half of respondents (47 per cent) hope that publishing in Open Access opens up further funding for their research, such as third-party funds, publication funds etc. Two fifths (39 per cent) of all economists desire practical support from Open Science experts (e.g. digital librarians, data scientists etc.). Differences can be noted here between research assistants and professors. Whereas nearly half of the professors (48 per cent) miss practical support, only one in three research assistants (31 per cent) says so. Another two fifth of respondents would be more inclined to share their own data if it gave them easier access to public research data in return.

One quarter of respondents would be willing to be persuaded by the Open Science idea if their superior desired it (see fig. 20). Here the share of research assistants is naturally larger (39 per cent) than that of professors. Only one in ten of those would comply with the wishes of a superior. Six per cent would respond to none of the possible incentives listed.

Fig. 19 Barriers named in closed questions

Multiple answers possible, n=300

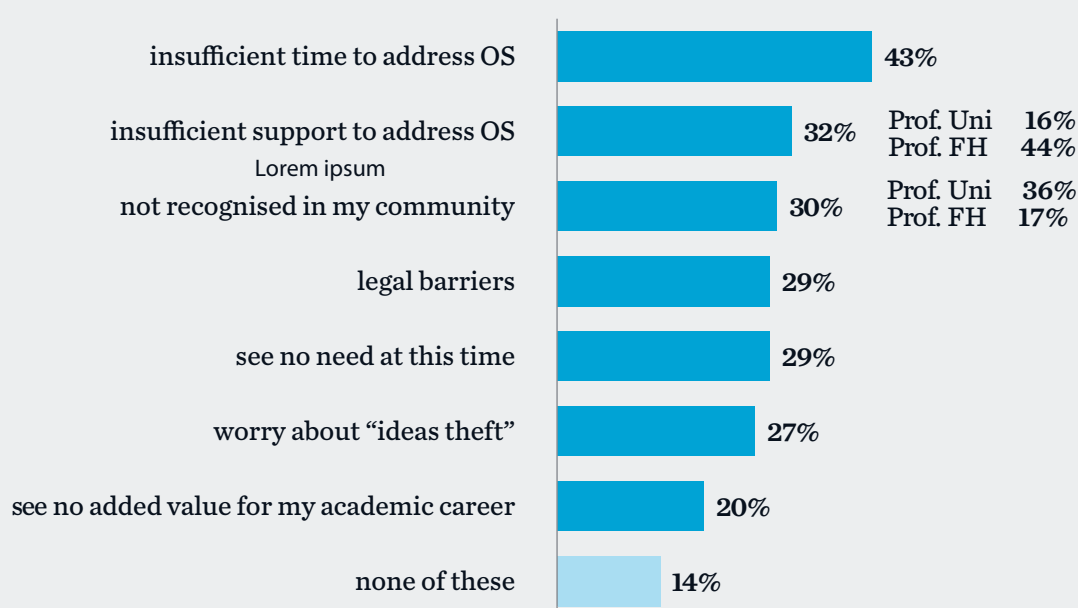
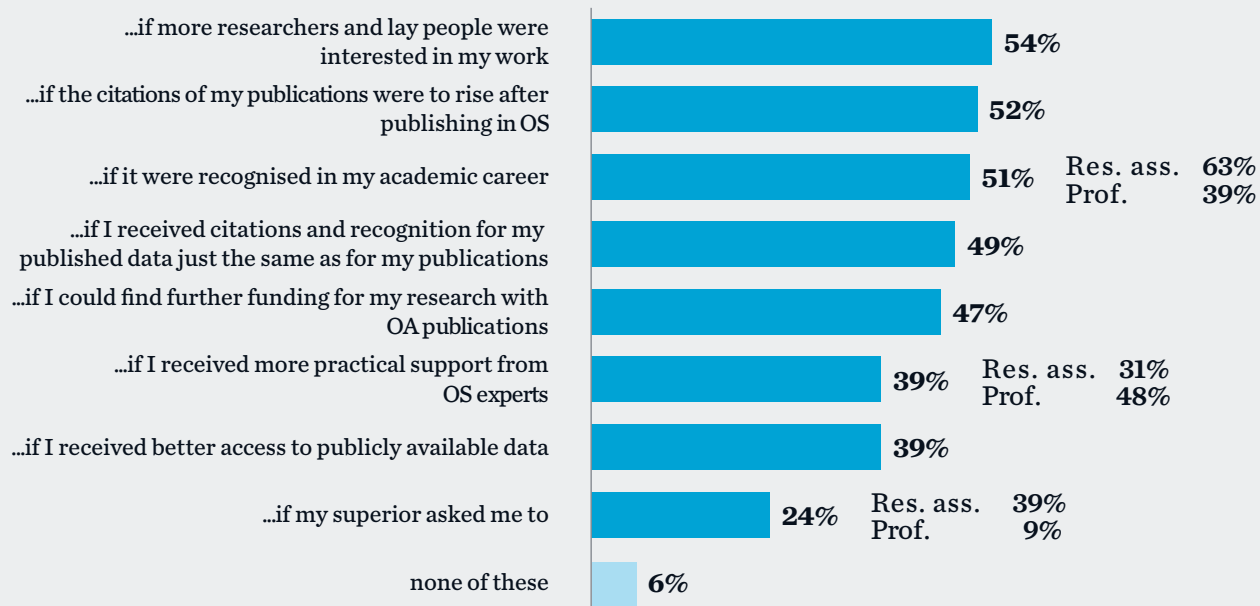


Fig. 20 Incentives named in closed questions

Multiple answers possible, n=300



8 *Needs for support in the context of Open Science*

8.1 Needs for support in the context of Open Science – themes

There is a large requirement for support concerning basic information about Open Science (see fig. 21). A large majority, i.e. more than three quarters of the respondents, want an overview of platforms, tools and applications that support Open Science practices. In addition, researchers obviously need information to improve the finding of open research data, information to improve publishing in Open Access, legal information about Open Science (e.g. licences), and best practice reports to see how other researchers have implemented Open Science. Researchers desire more general information about Open Science in order to have a better overview and orientation. For nearly every theme discussed here, professors at universities of applied sciences demonstrate a greater need than professors at universities (see fig. 21 on p.30).

The more researchers need detailed knowledge about Open Science, the lesser is the concrete need for support with various possible implementations. More than half and less than three quarters of respondents need information about publishing research data according to Open Data / FAIR Data principles; options to make their own research findings accessible to societal stakeholders (politics, business etc.); information to improve the discovery of Open Access publications; information about solutions for collaboration and sharing of research data; information about alternative methods for measuring their own impact (Altmetrics) and exchange with other researchers about Open Science. Significant differences can be observed between the high need for exchange among professors at universities of applied sciences and private colleges (73 per cent wish for more dialogue) and those at universities, only one third of whom is interested in peer-to-peer communication (see fig. 21 on p. 30). 51 per cent express a need for support to improve the replicability of their own research findings. This must be seen in the context of merely 17 per cent of researchers working with research data who also carry out replication studies (see fig. 14 on p. 20). 40 per cent of all respondents desire support for involving societal stakeholders (Community / Citizen Science) which is the more remarkable because 57 per cent of respondents consider this involvement of civil society as partially or totally unimportant, and only one in seven sees this as relevant (see fig. 6 on p. 10).

In all, the need for support for all aspects lies above 50 per cent, with the exception of the involvement of societal stakeholders. Professors at universities of applied sciences appear to have a larger need than professors at universities.

8.2 Needs for support in the context of Open Science – forms

Where support is offered, 83 per cent of respondents wish to have it available around the clock. This means that online materials are wanted which can be consumed flexibly in time and without limitation. In addition, two fifths of respondents consider a teaching format like workshops or online courses an adequate form. One third wishes for one-on-one consultation either off- or online (see fig. 22 on p. 31).

Fig. 21 Needs for support in the context of Open Science
Multiple answers possible, n=300

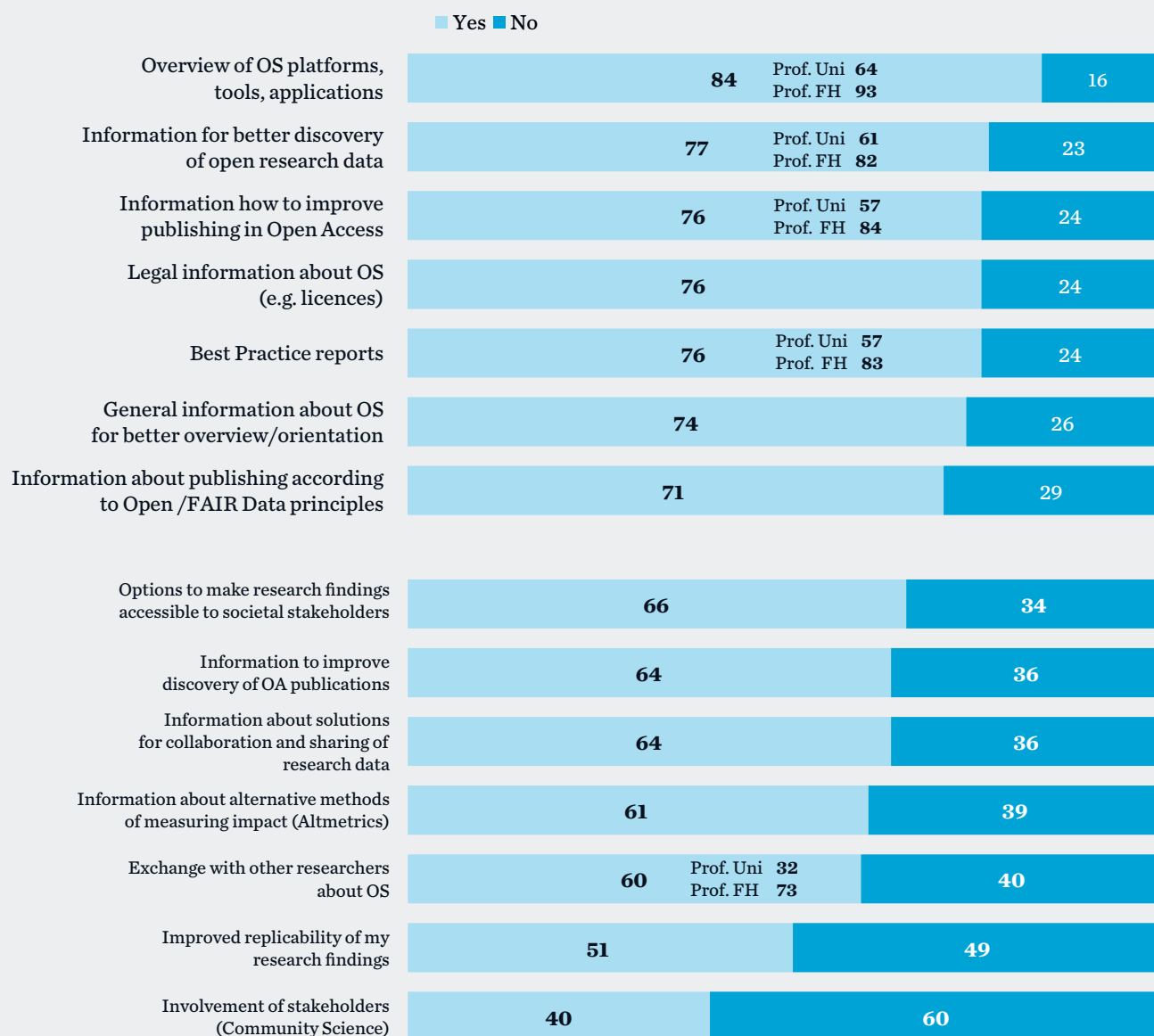
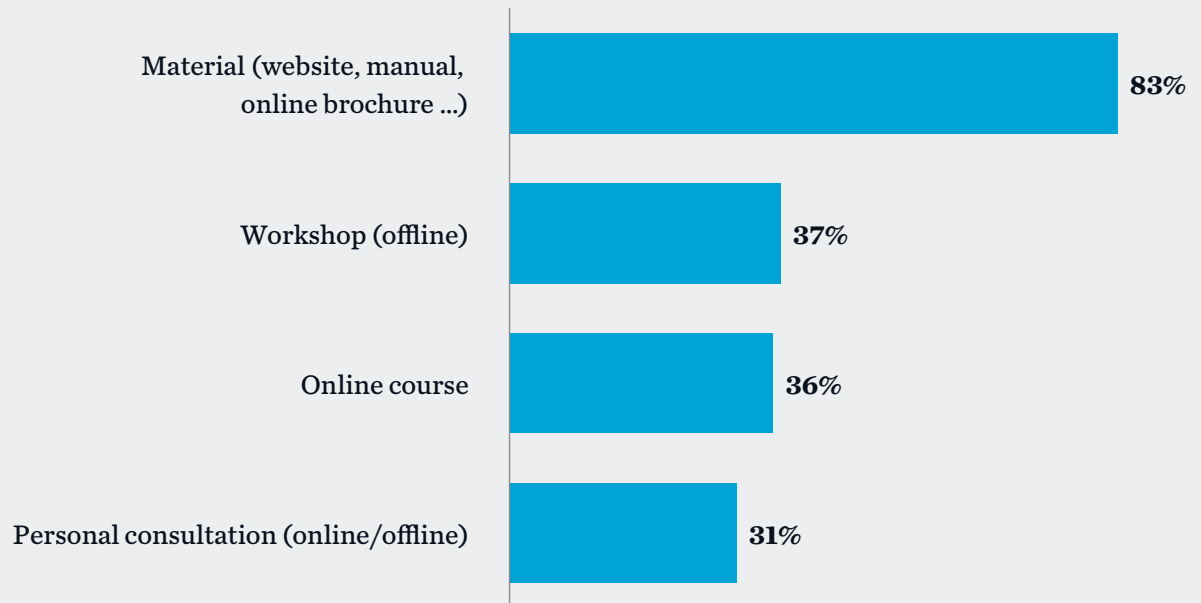


Fig. 22 Wanted forms of support
Multiple answers possible, n=300



9 *Conclusion and discussion*

The term Open Science is well established among economists and there is general agreement with its general principles. However, the significance is often unclear in detail and the variety of possible applications appears to be only sporadically established in the working routines of researchers. This vague understanding of terms and concepts is partially reflected in the answers.

Compared to other Open Science concepts – such as Open Methodology, Open Educational Resources, Open Data or Open Peer Review – Open Source and Open Access are the ones that play the most important roles in the everyday research of economists. The larger role of Open Source surely correlates with a high usage intensity of Open Source solutions. Half of all the economists surveyed who work with research data use free software for data analysis. Open Source solutions are probably well established in other areas, too. In contrast, making their own developments available as Open Source is probably not widespread. This was not part of the questionnaire, but can be deduced from the low incidence of sharing and publishing “research data / scripts” (scripts in the sense of software code).

The role of Open Access must be differentiated in more detail. Previous cross-disciplinary studies showed that publishing in Open Access has positive effects on bibliometric indicators. Open Access publications are associated with higher download numbers, more citations and higher impact on academic debates (see Moritz, 2013).

However, barriers regarding Open Access apparently persist despite the existing benefits (Dahinden et al., 2015). 40 per cent of the scientists surveyed think that Open Access does not play an important role. 35 per cent think that most researchers do not know how to publish their research in Open Access. 20 per cent are even afraid that Open Access publications are detrimental to their reputation. Open Access publications are not seen as detrimental in themselves, but the benefits of publishing in a closed access journal are deemed more advantageous. It is thus assumed that researchers desist from Open Access publications in favour of a higher impact factor (Dahinden et al., 2015).

The present study shows on the contrary that with a share of 64 per cent the broad majority of respondent now considers Open Access important. Only 7 per cent of respondents state that Open Access plays no role and only 18 per cent see Open Access as rather unimportant (see fig. 8). This contrasts with merely 34 per cent of respondents who have already published in Open Access.

Looking at publishing behaviour, it is notable that professors publish more frequently in Open Access than research assistants, which could be explained with the high pressure to publish imposed on young scientists during their qualification phase. Taking into consideration previous studies on this topic (e.g. Dahinden et al., 2015), one possible

conclusion is that Open Access publications are less attractive for research assistants than for professors because they need to concentrate on their academic careers and prefer to publish in journals with high impact factors rather than in Open Access journals.

Other replies concerning Open Access publishing behaviour are also surprising. Economists publishing in Open Access do this to a large degree in Open Access journals (59 per cent) and almost as frequently publish working papers in a repository (61 per cent). This predominance of Open Access journals is remarkable because, according to Björk/Korkeamäki (2019), the share of pure Open Access journals among the journals listed in Scopus in the domain of “Economics, Econometrics and Finance” amounts to a mere 12 per cent. Beyond this there are other Open Access variations, such as secondary publication in “Green Open Access” which may have been counted there but cannot strictly be regarded as Open Access journals. Most researchers have free access to scholarly journals through their institutions which is why the status of Open Access journals could be defined more precisely as Open Access.

Another interesting result is that out of 78 per cent of respondents who work with research data, 17 per cent stated that they carry out replication studies. This appears remarkable and is possibly due to different interpretations of the concept. To our knowledge, there is currently only one journal which exclusively publishes replication studies, namely the International Journal for Re-Views in Empirical Economics (IREE)⁸. Other journals have at least made provision for replication studies but rarely put it into practice (see Mueller-Langer et al.; 2019). Possibly respondents have understood the replication of previous results used for their own work as part of the empirical work and thus as replication study, or they may have mentioned unpublished replication studies.

By their own statement, two fifths of the economists surveyed say that Open Methodology plays an important role in their everyday research. Again the individual understanding of the term Open Methodology is open to debate. The corresponding publication of a study method is barely practised, with only 2 per cent of respondents saying so; and to our knowledge there are only a handful of options for preregistration available, such as the Registry for Randomized Controlled Trials⁹ of the American Economic Association (AEA).

8 <https://www.iree.eu/> [Last accessed: 8.4.2020]

9 <https://www.aeaweb.org/journals/policies/rct-registry> [Letzter Zugriff: 8.4.2020]

Another remarkable finding is that in the present study one in six said to have participated in an Open Peer Review process, since there are currently only very few journals in economics, such as the E-Journal Economics¹⁰ or those of the publisher MDPI¹¹, which offer Open Peer Review in the strictest sense. To our knowledge there exists no systematic study of Open Peer Review in economics journals at this time.

Reputation and recognition are essential triggers for Open Science, as has already been shown by previous studies (see Fecher et al., 2015). The barriers to Open Science show interesting differentiation between open and closed questions: in the open questions (asked first) lack of recognition and reputation is valued higher than in closed questions (asked second) where “lack of time” was cited more often than “lack of recognition within the community”.

There are hardly any differences in perception between members of the disciplines business studies and economics. Representatives of the discipline economics are more active when it comes to directed searches for Open Access literature, usage of discovery options for secondary or parallel publications (via Open Access button) and appending/linking corresponding data and scripts in publications. Differences between age groups or the status groups research assistants and professors seem to be correlated, since research assistants are generally younger and professors generally older. There are, however, significant differences between professors at universities and those at universities of applied sciences. The latter group appears to be more open toward Open Science and desires more support in five areas of implementation. At the same time they are less active in areas such as Open Access publications.

Finally the study shows that economists are very much interested in Open Science practices. There is a large general agreement with the principles of Open Science and the respondents see a great need for support. This must be the starting point for addressing the impediments better and present the benefits more directly by the concrete application of Open Science. This also requires a better explanation of the Open Science concepts. Individual aspects can be examined more closely in future studies. There is potential and economists are ready to see Open Science practices permeate economics more widely.

10 <http://www.economics-ejournal.org/conception/review-process> [Letzter Zugriff: 8.4.2020]

11 <https://blog.mdpi.com/2018/10/12/opening-up-peer-review/> [Letzter Zugriff: 8.4.2020]

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11 *Annex*

Intro:

Open Science is a movement for increased transparency in science, which increasingly affects everyday scientific life in all disciplines.

In the following, we would like to find out the role that Open Science and/or Open Science practices play in your everyday working life. Your answers will help us to improve our services in the context of Open Science and to adapt these better to your requirements. Therefore, we would ask you to take around 12 minutes of your time to answer the following questions.

You're not exactly sure what Open Science is?

The term and the associated concepts are explained in more detail in the info box.

What is Open Science? [approx. 3 mins. reading time]

The core element of Open Science is increasing the credibility and quality of research in an age that is characterised by digital networks. The most important instrument for doing so is openness and transparency. The idea of Open Science is to open up the entire research process, ideally from the generation of ideas stage right up to publication in order to make results and methods transparent. On the other hand, research opens up to other stakeholders in society, such as politics, business, culture and society. In addition to the targeted communication of research results, this opening up also aims to achieve the active involvement of these stakeholders in research processes. Therefore, Open Science follows established principles of good scientific practice and, for example, establishes this practice in the present environment of networked research with the opportunities provided by digitalisation. In order to do so, the corresponding infrastructure for scientific research, teaching and learning, as well as transfer to society, is required.

Open Science is a collective term for various movements. The most commonly-used of these are:

→ **Open Access:** Scientific publications are open to everyone free of charge and are not hidden behind a publisher's paywall.

→ **Open Data /FAIR Data:** Research data is freely accessible and/or is made available and published in accordance with open principles. FAIR stands for Findable, Accessible, Interoperable and Reusable.

→ **Open Educational Resources:** Materials for education and teaching are made available to teachers and students in a way that means they are free to use, edit and distribute.

→ **Open Methodology:** The scientific methods that are used are documented and published (sometimes during the research process).

→ **Open Peer Review:** The processes and results of the peer review can be viewed by anyone and are therefore traceable and transparent.

→ **Open Source:** Open Source technology (in the field of software and hardware) is used and is provided for others to use subsequently free of charge.

There are also movements with a strong connection to Open Science.

- **Altmetrics** is a collection of methods for measuring online reactions to a scientific publication. This includes, for example, downloads and bookmarks, as well as mentions, discussions and likes on social media. Altmetrics are now seen as an addition to traditional bibliometric indicators (based on citations).
- The involvement of stakeholders from society in research processes is also known as **Community Science and/or Citizen Science** (relating to civil society).

1 Prominence of Open Science and attitude

B1: Have you heard the term "Open Science" before at all?

Yes	No
-----	----

B2: What role does each of the following concepts currently play in your personal everyday working life?

	<i>A very important role</i> 1	<i>A somewhat important role</i> 2	<i>undecided</i> 3	<i>A somewhat unimportant role</i> 4	<i>No role at all</i> 5
Open Access					
Open Data / FAIR Data					
Open Educational Resources					
Open Methodology					
Open Peer Review					
Open Source					
Altmetrics					
Community Science / Citizen Science					

B3: To what extent do you agree with each of the following statements?

Statements are listed in a randomised order

	<i>Fully agree</i> 1	2	3	4	5	6	<i>Disagree entirely</i> 7
I think that the evaluation of scientific performance, which is predominantly based on average citations in specialist journals (impact factor) needs to be expanded using supplementary measurement							
I think that research results and the application of methods should be evaluated in the scientific field independently of the reputation of the publication location/journal.							

Scientific publications should become more accessible to the public and be prepared in a more targeted manner.							
The results of publicly funded research should be freely accessible, with just a few exceptions (e.g. personal data).							
I think that the reusability of research results is important for increasing efficiency in science.							
In my opinion, the replicability of research results is an important quality criterion for increasing the credibility of science.							
Platforms, tools and applications for science should follow open platforms, e.g. be Open Source and use open file formats.							
The principles of open scientific work should be anchored more firmly in scientific training, above all amongst doctoral candidates.							
I believe the publication and distribution of scientific results outside paywalls to be a good tool for making research results more visible within and outside the scientific community.							
In my opinion, stakeholders in society should be more closely involved in research processes.							

2 Application of Open Science / Open Science practices

The following relates to the extent to which you have already applied various Open Science practices in your everyday working life.

Scientific literature

A1) Research & access

A1a: Do you deliberately search for Open Access literature (e.g. in repositories such as EconStor, BASE)?

Yes	No
-----	----

A1b: Do you deliberately use opportunities to find secondary and/or parallel publications* (e.g. Open Access Button)?

**Secondary and/or parallel publications are publications that were previously behind a paywall and of which a secondary publication was allowed to be released after an embargo deadline, e.g. on its own website or in an Open Access repository.*

Yes	No
-----	----

A1c: Do you take into account mentions and discussions on social media when evaluating the relevance of a publication?

Yes	No
-----	----

A1d: Do you take into account the number of downloads and bookmarks when evaluating the relevance of a publication?

Yes	No
-----	----

A2) Publishing

A2a: Have you published in Open Access before?

Yes	No
-----	----

A2b: What did you publish in Open Access?

Please select yes or no for each option.

- Open Access journal

Yes	No
-----	----

- Journal article, freely available after embargo

Yes	No
-----	----

- Working paper in a repository (e.g. EconStor, RePEc, Institute repository)

Yes	No
-----	----

- Pre-prints in a repository (e.g. EconStor, RePEc, Institute repository)

Yes	No
-----	----

- Conference paper in a repository (e.g. EconStor, RePEc, Institute repository)

Yes	No
-----	----

- Essays in a collected volume or book

Yes	No
-----	----

A2c) Do you publish in alternative formats, such as scientific blogs?

Yes	No
-----	----

A2d) Do you make your posters and lecture slides available to other researchers (e.g. via FigShare, Slideshare)?

Yes	No
-----	----

A3) Research data

A3a: Do you work with research data in your research?

Yes	No
-----	----

A4) Research & access

A4a) With publications (e.g. journals), do you deliberately check whether data and scripts are also available in addition to the article?

A4b) Do you use Open Data portals when searching for research data?

A4c) Do you use other researchers' data in your work?

A5) Processing & publication

A5a: Do you use open software (e.g. R, PSPP) for data analysis?

A5b: Do you use online platforms for collaboration in your research team and also to manage research data (e.g. Open Science Framework (OSF))?

A5c: Do you use online platforms in order to share your research data and scripts (* insofar as this is legally possible) with other researchers (e.g. GitHub, RunMyCode)?

A5d: Do you publish your research data and scripts (* insofar as this is legally possible) in research data repositories (e.g. EBDC by ifo etc.)?

A5e: In your publications, do you add and/or link the data and scripts on which the research is based (* insofar as this is legally possible) (e.g. as supplementary material with the publisher)?

A5f: Do you carry out replication studies?

A6) Miscellaneous

A6a: Have you ever published study methodology in accordance with open methodology?

A6b: Have you ever worked as a reviewer in an Open Peer Review process?

A6c: Have you ever provided teaching materials as Open Educational Resources?

A6d: Do you apply other open practices in accordance with Open Science?

Yes	No
-----	----

A6e: Which other open practices do you apply?

[open question] Text field:

Option: no other open practices

3) Barriers & incentives / support

B1a: Is there anything that prevents you from applying Open Science?

Yes	No
-----	----

B1b: What prevents you from applying Open Science?

Text field:

B2: Sometimes you don't remember everything on the spot. Which of the following points prevent you from applying Open Science?

Please select all applicable!

- I currently do not have a need.
- I do not consider this to provide any added value for my scientific career.
- I do not have time to get involved with it.
- I would like to get involved but do not have enough support.
- It is not recognised in my community.
- There are legal barriers (data protection, sensitive data)
- I am worried about my ideas being stolen
- None of the above points

B3: Which of the following incentives would convince you to apply Open Science?

Please select all applicable!

- If I received more practical support from Open Science experts (e.g. digital librarians, data scientists etc.).
- If my supervisor wanted me to.
- If I notice more researchers and also non-experts becoming interested in my work/my findings.
- If the number of citations of my publications increases when I publish them in Open Access.
- If I get better access to openly accessible research data, I would be more prepared to also share my data.
- If I can use Open Access publications to find additional sources of funding (third-party funds, publication funds etc.) for my research.
- If this is recognised in my scientific career.
- If I were to get citations and recognition for the data I publish in the same way as for my publications.
- None of the above points

B4: Which other incentives would motivate you to apply Open Science?

[open answer] Text field:

Option: No other incentives

4 Requirement for support

U1: For each of the following application options for Open Science, please state whether you believe that you require support or not. YES/NO

U1a: General information about Open Science for an improvement overview and orientation

U1b: Information for locating Open Access publications more easily

- U1c: Information for improving publishing in Open Access
- U1d: Information for locating open research data more easily
- U1e: Information for publishing research data in accordance with Open Data / FAIR Data
- U1f: Information on solutions for collaboration and sharing research data
- U1g: Overview of platforms, tools and applications that support Open Science practices
- U1h: Best practice reports to see how other researchers have applied Open Science.
- U1i: Opportunities to make my research results accessible to stakeholders in society (politics, business etc.).
- U1j: Involvement of stakeholders in society (politics, business etc.) in my research processes (Community Science / Citizen Science)
- U1k: Information about alternative methods for determining my impact (Altmetrics)
- U1l: Improved replicability of my own research results.
- U1m: Legal information about Open Science (e.g. licences)
- U1n: Exchange with other researchers on the topic of Open Science
- U1o: Are there any other areas in which support is required?
 - Yes, namely:
 - No, there are no further areas in which support is required

U2: In which format would you like support to be provided?

Please select all applicable!

- Online material (website, handbook, brochure etc.)
- Online course
- Workshop / training session (offline)
- Personal support (offline/online)
- Would you like support to be provided in other formats?
 - o Yes, namely:
 - o No, there are no further formats in which I would like support to be provided

5 Conclusion

Are there, in your opinion, any requirements or wishes in the field of Open Science in economic sciences that have not yet been addressed?

Yes, namely:

No.

6 Sociodemographic questions:

A couple of questions for the statistics to finish the survey.

S1: Which department do you work in? (Only 1 answer possible)

- Economics
- Business studies
- Other, and please specify: Text field

S2: Where do you currently work? (Only 1 answer possible)

- University
- University of applied sciences
- Private higher education institution
- Research institute at the Leibniz Association
- Research institute outside the Leibniz Association
- Other, and please specify: Text field

S3: What is your current professional role? (Only 1 answer possible)

- Professor
- Junior professor
- Private lecturer
- Post-doc
- Doctoral candidate
- Research assistant
- Other, and please specify: Text field

S4: How old are you? (Only 1 answer possible)

- under 25
- 25 – 30
- 31 – 40
- 41 – 50
- 51 – 60
- over 60

Many thanks!

Dear colleague,

We at the ZBW would like to thank you for your contribution.

We will publish the findings from this study in 2020 and present them at the [Open-Science-Conference](#) in Berlin.

Are you interested in the study report? If so, please feel free to get in touch with me (D.Siegfried@zbw.eu) or Ms Elisabeth Flieger, E.Flieger@zbw.eu. We would be happy to send you the study report by email.

I hope the rest of your day is successful.

With kind regards from Kiel
Dr Doreen Siegfried

Intro:

Open Science is a movement for increased transparency in science, which increasingly affects everyday scientific life in all disciplines.

In the following, we would like to find out the role that Open Science and/or Open Science practices play in your everyday working life. Your answers will help us to improve our services in the context of Open Science and to adapt these better to your requirements. Therefore, we would ask you to take around 12 minutes of your time to answer the following questions.

You're not exactly sure what Open Science is?

The term and the associated concepts are explained in more detail in the info box.

What is Open Science? [approx. 3 mins. reading time]

The core element of Open Science is increasing the credibility and quality of research in an age that is characterised by digital networks. The most important instrument for doing so is openness and transparency. The idea of Open Science is to open up the entire research process, ideally from the generation of ideas stage right up to publication in order to make results and methods transparent. On the other hand, research opens up to other stakeholders in society, such as politics, business, culture and society. In addition to the targeted communication of research results, this opening up also aims to achieve the active involvement of these stakeholders in research processes. Therefore, Open Science follows established principles of good scientific practice and, for example, establishes this practice in the present environment of networked research with the opportunities provided by digitalisation. In order to do so, the corresponding infrastructure for scientific research, teaching and learning, as well as transfer to society, is required.

Open Science is a collective term for various movements. The most commonly-used of these are:

→ **Open Access:** Scientific publications are open to everyone free of charge and are not hidden behind a publisher's paywall.

→ **Open Data /FAIR Data:** Research data is freely accessible and/or is made available and published in accordance with open principles. FAIR stands for Findable, Accessible, Interoperable and Reusable.

→ **Open Educational Resources:** Materials for education and teaching are made available to teachers and students in a way that means they are free to use, edit and distribute.

→ **Open Methodology:** The scientific methods that are used are documented and published (sometimes during the research process).

→ **Open Peer Review:** The processes and results of the peer review can be viewed by anyone and are therefore traceable and transparent.

→ **Open Source:** Open Source technology (in the field of software and hardware) is used and is provided for others to use subsequently free of charge.

There are also movements with a strong connection to Open Science.

- **Altmetrics** is a collection of methods for measuring online reactions to a scientific publication. This includes, for example, downloads and bookmarks, as well as mentions, discussions and likes on social media. Altmetrics are now seen as an addition to traditional bibliometric indicators (based on citations).
- The involvement of stakeholders from society in research processes is also known as **Community Science and/or Citizen Science** (relating to civil society).

Imprint

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