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CHAPTER SIX

Recommendations, Statements, Declarations and Activities of Science Policy Actors on Shaping the Scholarly Communication System

Ulrich Herb

1 Introduction

1.1 Assignment

During the past ten years, different actors from the science policy sector have made different statements on the future design of the scholarly communication system. Moreover, they have been active in trying to change the design. The goal of this text is to give an overview of the different forms of those statements for Germany, the United States and Europe, and to summarise the content of the statements in the form of a synopsis in which the major similarities and differences can be fleshed out. In addition, experts have to determine the most important fields of activity and describe concrete measures and activities. The object of this chapter is to discuss the scholarly communication system through which research results are disseminated and exchanged within the scientific community.

1.2 Scope

The basis of the synopsis is a list of institutions from the context of science policy and science funding, supplemented by the research funding association Knowledge Exchange. The list was developed by the Future of the Scholarly

Communication System working group. The institutions are mainly from Germany, with some from Europe and the United States:

- Allianz der Deutschen Wissenschaftsorganisationen (Alliance of German Research Organisations)
- Gemeinsame Wissenschaftskonferenz des Bundes und der Länder (General Science Conference of the Federal Government and the States)
- Commission on the Future of Information Infrastructure
- Deutsche Forschungsgemeinschaft (German Research Council)
- Max Planck Society/Max Planck Digital Library
- Alexander von Humboldt-Stiftung
- Fraunhofer-Gesellschaft
- Helmholtz-Gemeinschaft Deutscher Forschungszentren (Helmholtz Association of German Research Centres)
- Leibniz-Gemeinschaft – Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz (Leibniz Association – Science Association Gottfried Wilhelm Leibniz)
- Deutsche Akademie der Naturforscher Leopoldina (German Academy of Sciences Leopoldina)
- German Rectors Conference
- Wissenschaftsrat(Science Council)
- Deutscher Akademischer Austauschdienst (German Academic Exchange Service)
- Börsenverein des Deutschen Buchhandels (German Publishers and Booksellers Association)
- European Commission
- Soros Foundation/Open Society Foundations
- National Science Foundation
- National Institutes of Health
- Scholarly Publishing and Academic Resources Coalition
- Wellcome Trust
- Knowledge Exchange

Sources of information were primarily journalistic publications, reports, recommendations, comments, statements, websites, as well as funding lines of the listed organisations.

Relevant issues were identified through reading and analysis, the selected organisations made statements and are active in these issues. Joint projects/ collaborations that comprise especially coordinated or differentiated activities will be briefly described in the next section.

1.3 Information on selected organisations and collaborations between organisations

1.3.1 Allianz der Deutschen Wissenschaftsorganisationen (Alliance of German Research Organisations)

The Alliance of German Research Organisations acts as an association of the following research organisations to coordinate their activities in the context of scientific information systems (Allianz der deutschen Wissenschaftsorganisationen 2008b: 1):

- Alexander von Humboldt-Stiftung
- Deutsche Akademie der Naturforscher Leopoldina (German Academy of Sciences Leopoldina)
- Deutsche Forschungsgemeinschaft (German Research Council)
- Deutscher Akademische Austauschdienst (German Academic Exchange Service)
- Fraunhofer-Gesellschaft (FhG)
- Helmholtz-Gemeinschaft Deutscher Forschungszentren (Helmholtz Association of German Research Centres)
- German Rectors' Conference
- Leibniz-Gemeinschaft – Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz (Leibniz Association – Science Association Gottfried Wilhelm Leibniz)
- Max Planck Society
- Wissenschaftsrat (Science Council)

The alliance mainly advocates the creation of an integrated information infrastructure within the Digital Information focus area (2008–2012). This infrastructure should be characterised by 'free accessibility to publications, primary data of research and virtual research and communication environments' (Allianz der deutschen Wissenschaftsorganisationen 2008b: 1). The goal is to 'create a sustainably integrated digital research environment in which every researcher has access from anywhere in Germany to the entire published knowledge and relevant research data' (Allianz der deutschen Wissenschaftsorganisationen 2008b: 1). In order to achieve these goals, the Alliance is active in the following areas, which are each coordinated in an individual working group:

- open access;
- research data;
- virtual research environment;

- national licensing;
- National Hosting Strategy;
- legal framework conditions; and
- cross-cutting issues on the above.

The German Research Council (DFG) in part stimulates the realisation of the recommendations of the alliance via respective funding programmes.

1.3.2 General Science Conference of the Federal Government and the States (GWK)
In 2009, the GWK assigned the Gottfried Wilhelm Leibniz Society to develop a concept on specialised information infrastructure. A working group developed a framework (Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz 2009) that was presented to the GWK in September 2009 and which suggested the establishment of an extensive concept of scientific information infrastructure for Germany. The overall concept was developed by the newly created commission Future of the Information Infrastructure (KII) (2011), which was coordinated by the Leibniz Society, and presented to the GWK in April 2011. The overall concept of the KII is basically a well-founded formulation of the WGL framework concept by expert groups.

1.3.3 Commission on the Future of Information Infrastructure (KII)
The work of the KII involved representatives from government, the states, research institutions, academic publishers, user groups from different academic disciplines as well as industrial research. Moreover, representatives from the GWK took part as permanent guests. The commission comprised approximately 135 people from about 60 institutions, which partly overlapped with the Alliance partner organisations,[1] and the steering group consisted of 19 people.

The KII considers eight areas as essential for the information infrastructure, for each of which working groups were created:

1. licensing (corresponding to the Alliance agenda);
2. hosting/long-term archiving (corresponding to the Alliance agenda);
3. non-textual material;
4. retro-digitisation/cultural heritage;
5. virtual research environment (corresponding to the Alliance agenda);
6. open access/electronic publishing (corresponding to the Alliance agenda);
7. research data (corresponding to the Alliance agenda); and
8. information competence/training.

1 DFG, Fraunhofer-Gesellschaft, HRK, Leibniz Society as well as the Max Planck Society (represented by the Max Planck Digital Library) were represented in both groups.

At local level, information infrastructures, such as, for example, individual research institutions or disciplinary infrastructures (KII 2011: 15) were excluded from the analysis of KII. Even though the topics of the Alliance and KII are mostly identical and personal overlaps exist in the working groups and steering committees, there are different objectives. While the Alliance initiative strives for the coordinated collaboration of the partner organisations in six defined fields of action and all working groups should name and implement concrete tasks, the KII wants to create an overall concept, which summarises the optimised landscape of the information infrastructure in Germany and describes the required framework conditions as well as synergies, concepts and options for collaboration (Lipp 2010).

1.3.4 German Publishers and Booksellers Association

The German Publishers and Booksellers Association criticised the overall concept of the KII harshly, stating that it lacks 'important participants, for example, scientific societies, higher education associations, academic publishers and providers of libraries'. Accordingly, the concept suffers from obvious 'deficits', which is why 'the implementation of central results of the KII paper would rather worsen Germany's chances in the international competition of knowledge societies than improve them' – this concerns especially the 'fields of licensing and Open Access' (Börsenverein des Deutschen Buchhandels 2011b: 1).

1.3.5 German Research Council (DFG)

The projects of the DFG in the context of science communication were previously bundled in the interdisciplinary initiative Digital Information, which described the major funding areas until 2015. The objectives of funding in the area of scientific literature and information systems were already formulated in 2006 in their position paper (DFG 2006). By the beginning of 2016, the following relevant funding programmes were developed:

- cross-regional licensing;
- infrastructure for electronic publications and digital science communication;
- OA publishing;
- virtual research environments; and
- information infrastructures for research data.

1.3.6 Knowledge Exchange (KE)

Knowledge Exchange is an active collaboration since 2005 between the funding organisations Danish Electronic Research Library (DEFF, DK), Joint Information Systems Committee (JISC, UK), SURF Foundation (SURF, NL)

and the DFG, as well as, since 2013, the IT Center for Science (CSC, FIN). The goal is to make scientific content freely available on the web.

The KE home page lists as primary fields of activity the advancement of open access as well as accessibility of research data.[2] Within these fields, the organisation of workshops, the commissioning of studies and the creation of reports are especially relevant.

1.3.7 Max Planck Society (MPG)/Max Planck Digital Library (MPDL)

In 2006, the Max Planck Society founded the Max Planck Digital Library,[3] which guarantees the basic provision of information (with publications and databases) and supports the institutes in developing digital and Internet-based research environments as well as in processing scientific raw data. In the following section, the activities of the MPG as well as the MPDL will be mentioned.

1.3.8 General information on other institutions

Some organisations provide few statements on the design and future of the scholarly publication system and are therefore not mentioned in the synopsis. This mainly concerns the Alexander von Humboldt-Stiftung, the Academy of Sciences Leopoldina, the German Rectors' Conference and the German Academic Exchange Service. Since all of these institutions are represented in the Alliance of German Research Organisations, however, their positions are noted by the description of the Alliance activities. The case of the General Science Conference of the Federal Government and the States is similar, and its contribution can be seen mainly as the establishment of the framework concept for the KII and its assignment to develop an overall concept for information infrastructure in Germany.

2 Access to scientific publications

2.1 Open access and electronic publishing

The following institutions have signed the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003) and support open access:

- German Research Council (DFG)
- Max Planck Society (MPG)/Max Planck Digital Library (MPDL)
- Fraunhofer-Gesellschaft (FhG)

2 See http://www.knowledge-exchange.info/projects.

3 See http://www.mpdl.mpg.de/.

- Helmholtz-Gemeinschaft Deutscher Forschungszentren (HGF) (Helmholtz Association of German Research Centres)
- Leibniz Association – Science Association Gottfried Wilhelm Leibniz e. V. (Leibniz-Gemeinschaft – Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz) (WGL)
- Deutsche Akademie der Naturforscher Leopoldina (Academy of Sciences Leopoldina)
- German Rectors' Conference (HRK)
- Science Council (Wissenschaftsrat)
- Scholarly Publishing and Academic Resources Coalition (SPARC)

As a member of the G8 Academies of Science, the Academy of Sciences Leopoldina signed the joint G8+ Science Academies' Statement on education for a science-based global development, which emphasises the advantages of open access for networking and collaboration. It further demands the free accessibility to publications and databases, especially in view of the needs in academic education: 'Support international collaboration to set up quality e-learning facilities, accessible to all, including students worldwide, and promote open access to scientific literature and databases' (G8+ Science Academies 2011: 2).

The DFG, MPG, HGF, HRK, FhG and WGL moreover support the information platform Open Access,[4] which provides information on open access for authors, editors of journals, operators of repositories, university leadership, libraries, funding organisations and publishing companies.

The Alliance of German Research Organisations intends to 'politically advance and implement open access to texts, primary data and other digital objects' (Allianz der deutschen Wissenschaftsorganisationen 2008b: 4) – in the case of green open access by developing institutional and disciplinary repositories further and also by strengthening their networking (Allianz der deutschen Wissenschaftsorganisationen 2008b: 4). Of relevance – with respect to institutions – are standardisation, networking and quality assurance, and regarding scientists, the necessity to create incentives in order to publish documents in repositories. Regarding gold open access, the Alliance emphasises the development of business and funding models as well as the general financing of these models (Allianz der deutschen Wissenschaftsorganisationen 2008b: 4). For this purpose, it is suggested to redeploy subscription fees into publication fees (Allianz der deutschen Wissenschaftsorganisationen 2008a). These models should be tested taking into account specificities of different disciplines. The Alliance emphasises however that the funding of OA publications must not be

4 See http://open-access.net/.

to the detriment of the research budget. The testing of new funding models is reflected in the participation in sponsoring by the Consortium for Open Access Publishing in Particle Physics (SCOAP³) of Helmholtz, MPG and DFG as well as by the establishment of publication funds for original OA publications (for example, in the FhG and HGF).

The KII considers the removal of barriers that hinder the promotion of open access as relevant. This concerns the establishment of funding models, questions of inter-operability and networking with disciplinary local services. From a legal point of view, the reusability of content in other contexts (virtual research environment) needs to be ensured in order to guarantee efficient scientific exchange. The KII calls for the establishment of a coordinating institution on the further development and adjustment of national and international collaboration (KII 2011: 41). It especially recommends the development of publication funds in the model of gold open access as well as (cf. the issue of licensing) innovative subscription contracts that allow OA options. Furthermore, the KII states the need for sufficient resources at technological and organisational level and demands the establishment of a sustainable repository infrastructure. The OA infrastructure should make networking and inter-operability possible in order to allow an integration of the contents into virtual research environments. From a legal perspective, it (like the Alliance) calls for an unconditional right of secondary publication for authors in the German Copyright Act (UrhG) (KII 2011: 51). In this context, KII suggests coordination with the MPG or the MPDL (KII 2011: 55).

In a position paper, the German DFG (2006: 3) states on open access:

> The DFG supports a free access to all published research results (open access). The freedom of information for research and teaching should neither be restricted by copyright laws nor through technological barriers or prohibitive fees. At the same time, intellectual property needs to be appropriately protected, for example, by using Creative Common licences in electronic forms of publication.

In the context of electronic publishing, the DFG emphasises the 'necessity to pay heed to the growing importance of informal scientific communication, which provides the special opportunity to shape electronic publishing. Precisely in the context of this new form of publishing the aspect of quality assurance is of key importance' (DFG 2006: 5).

Through the Open Access Publishing programme, the DFG supports universities in the development of publication funds from which article processing charges

(APCs) in OA journals can be paid.[5] In this context, the DFG provides a grant that decreases throughout the funding period (DFG 2014a: 4):

> Grant proposals can only be approved if the proposing university provides a clearly defined amount from its own budget for the financing of articles in open access journals. In the first and second year of funding, this amount is 20%, in the third and fourth year 40% and in the fifth and sixth year 60% of the calculated funds needed for publication.

This line of funding is considered an initial sponsoring as the goal is to 'establish permanent and reliable structures for the financing of open access publications' (DFG 2014a: 1). The approval is subject to certain conditions.[6]

Moreover, the DFG demands reliable information of the proposing university on 'how it initiates the necessary *redeployment of parts of its own budget for publication fees*' (DFG 2014a: 6) (emphasis in original).

In the guidelines on the use of funds, the DFG urges scientists of funded projects to publish project-related works via open access: either directly at an OA publisher or by reserving the necessary rights (and if necessary after an embargo period) in an OA repository (DFG 2014b: 18).

In addition, the DFG also supported the establishment of OA journals, among others, recipients of funds were the journals *Business Research*,[7] which publishes articles including OA data, as well as the GIGA Journal Family,[8] an association of journals, which was transformed from the print-subscription model to open access. In the green open access field, the DFG funded the establishment of disciplinary-based repositories such as the Social Science Open Access Repository[9] or peDOCS[10] for pedagogical research.

Currently, the funding options for gold and green open access are part of the programme called Infrastructure for Electronic Publications and Digital Science Communication.

The funding of the arXiv-DH project, which is supposed to develop a model for German participation in the financing of the OA repository arXiv, was also assigned to the area of green open access. Other funded projects included:

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5 Non-university institutions cannot apply for funding.

6 Costs can only be reimbursed for publications in pure OA journals (not hybrid journals) that use quality assurance in the form of peer review. Reimbursement occurs only if the publication fees do not exceed € 2 000.

7 See http://www.business-research.org/.

8 See http://hup.sub.uni-hamburg.de/giga/journal-family/index.

9 See http://www.ssoar.info/.

10 See http://www.pedocs.de/.

- the Open Access Information Platform, which provides extensive information on open access; and
- Open Access Policies – What rights do German publishers grant their authors? A database through which the OA policies of academic publishing companies can be downloaded.

The Max Planck Society (MPG) operates an OA portal,[11] which informs MPG employees about OA activities and provides practical tips on OA publishing and relevant copyright guidelines. The position of the MPG manifests itself in an OA policy that encourages scientists to publish that way. The portal moreover provides information on the MPG's gold open access offers[12] as well as their own repository,[13] OA projects[14] and the OA network of internal OA experts.[15] At the end of 2015, the MPG entered into an agreement with Springer according to which scientists of Max Planck institutes can publish their research results in more than 1 600 of Springer's subscription journals open access and at the same time receive access to all subscription content in these and 400 other Springer journals.[16] The Max Planck Digital Library,[17] founded in 2006, organises the majority of the MPG's OA projects.

Like the MPG, the Fraunhofer-Gesellschaft (FhG) also supports an OA policy[18] for its authors. In addition, the FhG actively promotes open access. It further operates a blog, which provides information on open access, especially with reference to the FhG. Other services include the OA Repository ePrints,[19] the publication database Publica,[20] which is connected to the repository, a newsletter, which informs FhG employees about new developments in open access,[21] as well as an OA team which provides support on questions of scientific publishing and OA.[22] At the end of 2015, the FhG passed an OA strategy which includes as measurement the establishment of a central publication fund for the financing of gold open access articles, the creation of an infrastructure for

11 See http://oa.mpg.de/.

12 See http://openaccess.mpg.de/1431088/Open-Access-Publishing---Initiativen.

13 See http://openaccess.mpg.de/3635/repositorium.

14 See http://openaccess.mpg.de/201884/Projekte.

15 See http://openaccess.mpg.de/3583/MPG-Open-Access-Netzwerk.

16 See http://openaccess.mpg.de/2151888/Open-Access-Abkommen_mit_Springer-Verlag.

17 See http://www.mpdl.mpg.de/.

18 See http://www.openaccess.fraunhofer.de/wp-content/uploads/2015/12/Fraunhofer_Open_Access_Policy_2008_dt.pdf.

19 See http://publica.fraunhofer.de/starweb/ep09/index.htm.

20 See http://publica.fraunhofer.de/starweb/pub09/index.htm.

21 See http://publica.fraunhofer.de/starweb/ep09/newsletter.htm.

22 This offer is especially aimed at librarians in the institutes, which, in turn, consult authors.

OA publication of research data and the increased support of FhG researchers in keeping relevant rights for green OA publication of already published works.

In 2005, the Helmholtz-Gemeinschaft (HGF) introduced the Helmholtz Open Science Coordination Office for supporting the Helmholtz Centres and their researchers in the implementation of open access. This is understood as an open science portal.[23] The office promotes open access through, for example, workshops, talks, mailing lists and a newsletter and consults the Helmholtz Centres in OA issues. The HGF, too, passed an OA policy.[24] Several of the Helmholtz Centres also operate OA repositories.[25] The HGF calls for the Helmholtz Centres to support the green and gold pathway of open access. Much more than the other actors, the HGF is also engaged in issues concerning open access to research data, through the Webinar offers, for example. The HGF has framework contracts with different OA publishers, such as BioMed Central, Copernicus Publications, *Multidisciplinary Digital Publishing Institute*, PLOS, Springer Open and Wiley as well as with the *New Journal of Physics* in order to be able to invoice author fees in a bundle.[26] Moreover, it is engaged in the Compact for Open-Access Publishing Equity (COPE) project, with which mechanisms for measuring appropriate publication fees should be determined. It also participates in the already mentioned SCOAP project.[3] Due to the structure of the HGF, there is no central fund for reimbursing OA publication fees. The Helmholtz Centres, however, have developed appropriate mechanisms for taking over publication fees. These are different for each centre, however.

The Leibniz Association (WGL) operates an open access working group,[27] encourages its employees and stipend holders to make publications openly accessible, and promotes open access in its OA policy.[28] This includes the establishment of an own infrastructure (Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz 2011a: 62 f.). Another working group has the goal of advancing the establishment of a Leibniz repository and of supporting institutions in making publications available. The LeibnizOpen[29] repository does not have full texts itself but only metadata on texts that are deposited in OA repositories of the Leibniz infrastructure institutions. Each of these institutions is supported by a specialised repository and can deposit its publications there. This repository then provides the metadata to LeibnizOpen. In order to support the services

23 See http://oa.helmholtz.de/open-science-in-der-helmholtz-gemeinschaft.html.

24 See http://www.helmholtz.de/wissenschaft_und_gesellschaft/helmholtz-gemeinschaft-verankert-richtlinie-1977/.

25 See http://oa.helmholtz.de/open-science-in-der-helmholtz-gemeinschaft/open-access-der-gruene-weg.html.

26 See http://oa.helmholtz.de/open-science-in-der-helmholtz-gemeinschaft/open-access-der-goldene-weg.html.

27 See http://www.leibniz-gemeinschaft.de/ueber-uns/organisation/arbeitskreise/arbeitskreis-open-access/.

28 See http://www.leibniz-gemeinschaft.de/fileadmin/user_upload/downloads/Organisation/Arbeitskreise/AK_Open_Access/OpenAccess-Leitlinie.pdf.

29 See http://www.leibnizopen.de.

of the distributed institutions in the form of author counselling/assistance and the acquisition of documents for the repository, special courses on the Leibniz repository and on open access are offered. The working group on open access works closely with the working group Libraries and Information Institutions (Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz 2011a: 62 f.). LeibnizOpen began its official operation in the summer of 2011 (Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz 2011b). Individual Leibniz institutions operate their own OA offers.[30] In green open access, these include:

- EconStor:[31] OA repository of the German National Library of Economics (Deutschen Zentralbibliothek für Wirtschaftswissenschaften [ZBW]) for publications in economics;
- NEEO:[32] Establishment of full-text collections in economics (europaweiter Aufbau von Volltextkollektionen für die Wirtschaftswissenschaften), Leibniz partner: ZBW;
- peDOCS: OA repository of the German Institute for International Educational Research for pedagogical publications, in particular in collaboration with specialised publishers; and
- SSOAR:[33] Social Sciences Open Access Repository of GESIS – Leibniz Institute for Social Sciences.

Institutions of the WGL are active in the following gold OA activities:

- Economics:[34] OA journal of the Institute for the World Economy and the ZBW;
- German Medical Science:[35] OA publication platform of the German National Library of Medicine for medical science;
- GIGA journal family:[36] OA journal of GIGA – Leibniz Institute for Global and Regional Studies;
- ISI – Information Service Social Indicators:[37] OA journal of GESIS – Leibniz Institute for Social Sciences;

30 See http://open-access.net/de/oa_informationen_der/leibniz_gemeinschaft/.

31 See http://www.econstor.eu/.

32 See http://www.neeoproject.eu/.

33 See http://www.ssoar.info/.

34 See http://www.economics-ejournal.org/.

35 See http://www.egms.de/dynamic/en/index.htm.

36 See http://hup.sub.uni-hamburg.de/giga/journal-family/index.

37 See http://www.gesis.org/soziale-indikatoren/service/isi/.

- Methoden, Daten, Analysen. Zeitschrift für Empirische Sozialforschung:[38] OA journal of GESIS – Leibniz Institute for Social Sciences;
- PsychOpen:[39] OA publication platform for European Psychology of the Leibniz Institute for Psychology;
- different gold open access offers of Schloss Dagstuhl/Leibniz Center for Informatics;[40] and
- SCOAP³:[41] Partner: Technische Informationsbibliothek.

Since January 2016, the WGL has a central publication fund,[42] which is subject to certain conditions.[43] For example, costs exceeding € 2 000 are only partially reimbursed.

The Scholarly Publishing and Academic Resources Coalition (SPARC) was founded by libraries in the United States in 1998. The goal is to ensure high-quality and low-price opportunities for publication for scientists. To achieve this goal, SPARC also supports authors and recommends that they should not accept any transfer of exclusive rights of usage on behalf of the publishers.[44] SPARC operates an OA working group, which has the objective of creating awareness of the benefits of open access among civil society stakeholder groups (for example, patient organisations), funders of research, politicians, research institutions as well as support of academic institutions in the implementation of open access and OA-friendly employment interviews.[45] In order to advance OA and cost-efficient scientific publishing, SPARC provides a large amount of information, for example, on

- financing models (Crow 2009b);
- the establishment of OA funds (Tananbaum 2010);
- non-profit publication infrastructures across campuses and within disciplines (Crow 2006a; 2009a);
- sponsorship of academic non-profit journals (Crow 2006b);
- information on the operation of an OA repository and a checklist on the operation of an OA journal;[46]

38 See http://www.gesis.org/publikationen/zeitschriften/mda/.

39 See http://www.psychopen.eu.

40 See http://www.dagstuhl.de/de/publikationen/.

41 See http://www.scoap3.org/.

42 See http://www.leibniz-gemeinschaft.de/infrastrukturen/open-access/open-access-publikationsfonds/.

43 See http://www.leibniz-gemeinschaft.de/infrastrukturen/open-access/open-access-publikationsfonds/foerderbedingungen/.

44 See http://www.arl.org/sparc/publications/opendoors_v1.shtml as http://www.arl.org/sparc/author/addendum.shtml.

45 See http://www.arl.org/sparc/advocacy/oawg.shtml.

46 See http://www.arl.org/sparc/partnering/planning/index.shtml.

- information on the pricing structure in the journal subscription model;[47]
- an OA information portal;[48]
- information on OA; and
- innovative publication models and sponsorship for cost-efficient subscription journals or development of publication services at libraries (Crow et al. 2012).

SPARC also offers consultation[49] on developing and operating scientific communication infrastructures in order to make these financially effective and innovative with respect to technology. SPARC cooperates with academic publishers in order to test new publication models. The three programmes for this purpose are:[50]

- SPARC Alternative: supports cost-efficient subscription journals that can be a direct alternative in disciplines in which the provision of information depends on high-priced journals.
- SPARC Leading Edge: supports projects that test OA or other innovative business models. Partnerships among others with BioMedCentral and PLOS.
- SPARC Scientific Communities: supports the establishment of non-profit services that provide the academic discipline with peer-reviewed literature and other scientific content. These communities consciously take innovative electronic information into account and go beyond classic forms of publication such as journals.

The Soros Foundation/Open Society Foundations has supported open access since 2002. Their main argument refers to the advantages of maximising public accessibility to information, making societal communication easier, protecting civil societies and the freedom of communication in digital environments. The perspective is therefore characterised by civil society aspects rather than the science internal argument of research institutions or research funders. The hope is that open access and open science will accelerate scientific progress, especially in the neglected border areas of science. Emphasis is also put on citizen science, which involves non-scientists in research activities.

Central guidelines for research funding by the National Institutes of Health (NIH) are listed in their Grants Policy Statement under the section 'Availability

47 http://www.sparc.arl.org/resources/journals.

48 See http://www.sparc.arl.org/theme/open-access.

49 See http://www.sparc.arl.org/resources/publishers/consulting.

50 See http://www.arl.org/sparc/partner/benefits.shtml.

of research results: Publications, intellectual property rights, and sharing research resources'.[51] Here, it calls for making results of NIH-funded research accessible. It also concerns the accessibility of data:

> Rights in data also extend to students, fellows, or trainees under awards whose primary purpose is educational, with the authors free to copyright works without NIH approval. In all cases, NIH must be given a royalty-free, nonexclusive, and irrevocable licence for the Federal government to reproduce, publish, or otherwise use the material and to authorize others to do so for Federal purposes.[52]

According to NIH policy, text publications have to be made accessible by a publisher in the open access repository PubMed Central[53] – at the latest 12 months after formal publication. In addition, NIH-funded projects of more than USD 500 000 are bound to OA data sharing,[54] and OA needs to follow publication of relevant results. Exceptions are possible due to legal reasons, for example, data protection. Model organisms and data from genome-wide association studies funded by the NIH should also be made publicly accessible.

Scientists receiving funds from the National Science Foundation (NSF) are also obligated to make publications in peer-reviewed journals or conference proceedings accessible via open access at the latest 12 months after formal publication. A corresponding policy was passed in 2015 and became effective in January 2016.

Researchers receiving funds from the Wellcome Trust are obligated[55] to make project-related publications freely accessible on one of the two OA repositories PubMed Central[56] or on UK PubMed Central[57] within six months after formal publication. This not only concerns journal or conference articles but also monographs or contributions to anthologies. It is also recommended that authors do not transfer exclusive user rights to publishers, and authors are encouraged, as an alternative to making texts accessible on one of the repositories, to publish directly in OA journals. The Wellcome Trust moreover prefers the use of user licences, such as the CC-By-Licence[58] of Creative Commons, which not only enable the free but also open use analogous to

51 See http://grants.nih.gov/grants/policy/nihgps_2011/nihgps_ch8.htm#_Toc271264947.

52 See http://grants.nih.gov/grants/policy/nihgps_2011/nihgps_ch8.htm#_Toc271264947.

53 See https://www.ncbi.nlm.nih.gov/pmc/.

54 See https://grants.nih.gov/grants/guide/notice-files/NOT-OD-03-032.html.

55 See http://www.wellcome.ac.uk/About-us/Policy/Policy-and-position-statements/WTD002766.htm.

56 See http://www.ncbi.nlm.nih.gov/pmc/.

57 See http://europepmc.org/.

58 See https://creativecommons.org/licenses/by/3.0/de/.

the criteria of open source licences. Publication fees can be reimbursed by the Wellcome Trust. Authors can inform themselves about the implementation of the policy by means of FAQs regarding access.[59] To cover APCs, the Wellcome Trust either makes individual agreements with the researchers receiving funds or it supports OA funds of universities for the administration of APCs.[60] The Wellcome Trust has funded several studies on the sustainability of open access or its financial issues (Wellcome Trust 2003; 2004). In 2011, a report was published in collaboration with the Research Information Network (RIN), the Publishing Research Consortium, the Research Libraries UK and JISC (Research Information Network 2011). The report assesses the cost-benefit effect of different OA variations, for example:

- green open access (without embargo period);
- gold open access; and
- delayed open access (green open access with embargo period, differentiated according to discipline).

The authors conclude that gold open access is the financially most sustainable option and provides the most attractive cost-benefit relationship. The assessment is subject to the condition that publication fees in gold open access do not exceed an average of GBP 1 995. The RIN study additionally recommends that green OA services (that is, repositories) should be used more frequently. Regarding the shortening of embargo periods, it is stated that too narrow time windows could harm the business models of academic publishers.

Both the Wellcome Trust and NIH sanction non-compliance to their OA guidelines. They put a halt to approving new grant proposals if researchers do not publish works on previously funded research open access, and funding for ongoing projects is also occasionally terminated.

Knowledge Exchange (KE) considers the advancement of open access in KE partner countries a key issue: 'We are working on solutions to support the growth of OA and ensure it is sustainable in the long term.'[61] Recommendations are provided, the exchange in expert networks is supported and studies are funded. The issuing of policies by which scientists are encouraged to use OA publishing, monitoring the development of open access, the evaluation of financing options for OA monographs as well as the development of finance models for gold open access are considered appropriate measures.

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59 See http://www.wellcome.ac.uk/About-us/Policy/Spotlight-issues/Open-access/Guides/WTD018855.htm.

60 See http://www.wellcome.ac.uk/About-us/Policy/Spotlight-issues/Open-access/Guides/WTX036803.htm.

61 See http://www.knowledge-exchange.info/projects/project/open-access.

Already in 2009, KE funded studies that were supposed to assess the economic effects of open access for Great Britain, Denmark and the Netherlands (Houghton 2009). The economist John Houghton concludes that open access is a more efficient publishing model than the subscription model (toll access or closed access). If there were a broad transition from toll access to open access, however, there would be a transitional phase in which the benefits of open access would not yet come into effect since the economic returns do not occur simultaneously to the publication.

> This reflects the fact that a shift to open access publishing or self-archiving would be prospective and not retrospective, and that the economic value of impacts of enhanced accessibility and efficiency would not be reflected in returns to R&D until those returns were realised. This has the effect that over a transitional period of twenty years one is comparing twenty years of costs with ten years of benefits (Houghton 2011).

Houghton assesses that, after the transition phase, the savings for a broad implementation of green open access or self-archiving (without cancellation of journal subscriptions) will be as follows: 'Open access self-archiving without subscription cancellations (i.e. 'Green OA') would save around € 30 million per annum nationally for Denmark, € 50 million in the Netherlands and € 125 million in the UK' (Houghton 2009: 9). Gold open access would, according to Houghton, have an even greater savings potential:

> 'Gold OA' open access publishing for journal articles using author-pays might bring net system savings of around € 70 million per annum nationally in Denmark, € 133 million in the Netherlands and € 480 million in the UK (at 2007 prices and levels of publishing activity). (Houghton 2009: 9 f.)

KE also focuses on the provision of research data (data sharing).[62] KE considers the creation of incentives to make data available, for example, through the application of metrics, which inform about impact and further use of provided data in science, of utmost importance. Furthermore, KE considers opportunities to promote infrastructure for the publication of research data and deals with the question of how the habitualisation of data sharing among scientists could be promoted. Some reports on this issue have been published (Costas et al. 2013; Van den Eynden & Bishop 2014).

All funding options of the European Research Council (ERC) (2013) and the framework programme Horizon 2020 (European Commission 2014; 2015)

62 See http://www.knowledge-exchange.info/projects/project/research-data.

contain obligatory OA guidelines. Publications funded by respective ERC grants have to be published in gold open access immediately or be made accessible in the post-print or publisher's version as soon as possible, but at the latest within six months on an OA repository. There are longer periods for publication in the humanities and social sciences; up to 12 months are accepted. OA publication on a repository is also obligatory if the article has already appeared in gold open access. In contrast to the ERC, Horizon 2020 only has a maximum embargo period of 12 months for publications from all disciplines. The ERC recommends the use of the servers Europe PubMed Central or arXiv, if thematically fitting. The guidelines of both the ERC and Horizon 2020 not only aim at journal articles but also at monographs. Regarding research data, the ERC recommends availability in open access. Horizon 2020 additionally demands detailed data management plans from researchers receiving funds. The expected publication costs in gold open access can be applied for at the funders.

Moreover, the European Ccommission (EC) has funded projects[63] on OA research as well as the development of OA infrastructures, such as:

- DRIVER II (Digital Repository Infrastructure Vision for European Research): Networking of repositories;
- LiquidPub (Liquid Publications: Scientific Publications meet the Web – changing the way scientific knowledge is produced, disseminated, evaluated and consumed): Testing of dynamic publication models;
- OAPEN (Open Access Publishing in European Networks): Analysis of OA publication models for monographs;
- PARSE.Insight (Permanent Access to the Records of Science in Europe): Long-term archiving of digital research data;
- PEER (Publishing and the Ecology of European Research; and
- SOAP (Study of Open Access Publishing by Key Stakeholders).

The project OpenAIRE,[64] also initiated by the EC, bundles access to OA publications and data from EC-funded projects. OpenAIRE first formed the technological and organisational implementation of the OA pilot project in the 7th EU Research Framework Programme. Within this pilot, researchers receiving funds from selected disciplines (health, energy, environment, information and communication technology, research infrastructure, social sciences, economics, humanities as well as science in society) were assigned to make project-related publications available in green open access. Scientists can either deposit their

63 The funding period of the projects has ended, but they are mentioned since they are of special importance as model projects.

64 See http://www.openaire.eu/.

publications in a repository of their institution or discipline or in the so-called OpenAIRE Orphan Repository. If an institutional or disciplinary repository is used, documents that stem from ERC-funded projects can be automatically added to the OpenAIRE database.[65] OpenAIRE is supposed to be the basis of an integrated European OA infrastructure. It already contains services such as Helpdesk and bidirectional links of publications and project information. Moreover, documents and other scientific objects, which do not stem from EC funding, are meanwhile also being indexed in OpenAIRE.

The German Publishers and Booksellers Association is against open access and promotes the strengthening of author rights. It especially takes contrary positions with regard to the issues in the copyright law described by the Alliance (Börsenverein des Deutschen Buchhandels 2011a: 9–13), private copies and secondary usage rights for copyright holders of scientific contributions in open access. The argumentation of the Association is mainly of a legal nature. Open access is understood as a reaction to financial shortage, which endangers the freedom of science. The Association is against secondary usage rights of scientific works. It considers the financing of OA business models as insecure and views open access as 'publisher activity of the public sector', which 'due to structural reasons already has to be more expensive, inefficient and less pluralistic than using the services of competing publishers and library services' (Börsenverein des Deutschen Buchhandels 2011b: 3). This especially refers to green open access and the operation of repositories through public institutions (Börsenverein des Deutschen Buchhandels 2011b: 9). The consequence of implementing gold open access would result in a shortage of scientific information due to the cross-subsidisation of subscriptions through the private sector. If they disappear this would lead to increased OA fees. Moreover, the Association emphasises financial burdens for research and publication-intensive institutions following the model of APCs (Börsenverein des Deutschen Buchhandels 2011b: 9 f.). Gold OA models are viewed as rarely financially feasible. It underscores its position with the protection of publishers' business models whose investments in infrastructure and services enable scientific work and scientific provision of information. From the perspective of the Association, reform proposals such as that of the Alliance endanger 'appropriate compensation of authors' and publishers' work and thus the growing and functioning markets in the provision of scientific information' (Börsenverein des Deutschen Buchhandels 2006).

65 This, however, requires the existence of a special interface as well as changes in the database scheme of the repository software.

2.2 Licensing

In the framework of its Cross-Regional Licensing programme,[66] the DFG also supports the free accessibility of scientific information. This information[67] (text publications or databases) can be freely accessed by members and users of scientific institutions throughout Germany. Analogous to the national licence model of the DFG, the partner organisations of the Alliance of German Research Organisations have negotiated licences with academic publishers since 2011. This allows academic users to use scientific documents free of charge. According to each licensed product, usage by a private individual outside of higher education institutions may be possible. Since this rule pertaining to private individuals only grants users from Germany access, it does not concern all products and a registration is just as necessary as the acceptance of special user agreements. However, these licences do not create real OA offers. The Alliance licences pursue the consortia principle and assume a cost sharing of participating libraries, which need to bring in 75% of the financing. The rest is provided by the DFG. In addition, further user rights are acquired. These include, among other things, usage (DFG 2010: 7 f.) for

- the development of value-added services that, for example, are allowed to use data mining;
- aggregation or integration services in virtual research environments; and
- delivering full texts for the purpose of hosting.

The Alliance licences also have an OA clause which, according to the DFG in its basic guidelines for the acquisition of DFG-funded cross-regional licences (DFG 2010: 8), allows authors to deposit their articles soon after they have appeared in licensed journals in an institutional or discipline-specific repository of their choice, usually in the form in which it had been published, and to make it OA at no extra costs. The affiliated institutions have the same right. It can also be agreed that the publisher itself deposits articles of authors in authorised institutions in a repository and to make such licensed content available open access.

With respect to the licensing of scientific information, the KII sees the need to develop models of acquisition for different levels of demand (consortial/national, local, end user/document delivery/pay-per-view). This requires

66 See http://www.dfg.de/foerderung/programme/infrastruktur/lis/lis_foerderangebote/ueberregionale_lizenzierung/index.html.

67 A list can be found at: http://www.nationallizenzen.de/angebote.

flexible business models that have to display the following characteristics (KII 2011: 31):

- nation-wide consortia have to be allowed by the providers (publishers);
- the individual need of an institution is influential in the decision to buy a product;
- negotiations with providers about individually designed packages need to be possible;
- staggered business models that take into account the degree of use and which allow gradual transitions at interfaces should be developed; and
- the transformation process of subscription models to OA models is welcome and has to be taken into account.

In technological terms, non-proprietary, independent platforms are welcome, as well as restrictions due to digital rights management (DRM), and the use of open, standardised interfaces that allow the simple implementation of metasearches.

Moreover, the further development of cross-regional and national licensing models is welcome (KII 2011: 32). This should include a guided and transparent needs assessment, quality assurance (this way experts could approve funding for licensing) and organisation, or administration of consortia through the libraries (which head the negotiations). Financing should be ensured through a combination of local and central funds (KII 2011: 47). KII considers an increase of the acquisition budget necessary in order to continue the task of providing literature. The goal is a connection to the development of research expenditures (KII 2011: 32). In addition, according to the KII, more funds are needed in order to acquire cross-regional and national licences[68] and to cover the costs for organisation and administration. These project-based structures should be transferred to sustainable financing models and regularly evaluated. In this area, KII suggests coordination by the DFG (KII 2011: 55).

The German Publishers and Booksellers Association has doubts with respect to the cost savings, in particular in the area of libraries, which, in the future, will have to do without the services (consultation, design of custom-made programmes, negotiations with providers, payment processing, invoicing, etc.[69]) of the providers. Moreover, national licences endanger the efficiency of the publisher landscape (Börsenverein des Deutschen Buchhandels 2011b: 1 f.). In the Association's view, national and Alliance licences lead publishers

68 KII suggests to at least triple the funds from € 12 million to € 36 million in order to be able to acquire programmes of larger publishers as national or cross-regional consortiums (KII 2011: 33).

69 See Börsenverein des Deutschen Buchhandels (2011b: 5) – in part services are mentioned that do not exist in consortia access.

into an economic dependency on the DFG and the Alliance organisations (Börsenverein des Deutschen Buchhandels 2011b: 6). They are seen as instruments of state control that 'blur the most important signal of competition, the price, and may intervene in a fragile market' (Börsenverein des Deutschen Buchhandels 2011b: 4).

2.3 Intellectual property and copyright

According to the Alliance, there are several legal obstacles with respect to the intended, integrated and open information structure that need to be dealt with at political level, such as the current copyright law as well as different value-added tax (VAT) rates for digital and printed publications. The partner organisations advocate an author right to publish contributions in the sense of a free accessibility of science to information (Allianz der deutschen Wissenschaftsorganisationen 2008a: 8). Furthermore, VAT rates for e-publications should be adapted to the lower level of print publications. In particular, however, they demand 'that scientists are granted an unconditional right of secondary publication for their articles and dependently published works in the same format after an appropriate embargo period' (Allianz der deutschen Wissenschaftsorganisationen 2010: 4). An obligation to exercise this right should not be established. Rather, the scientists' position in negotiations with publishers should be strengthened and should provide them with control over the degree of visibility of their results (Allianz der deutschen Wissenschaftsorganisationen 2010: 4 f.). The Alliance considers an embargo period of six months as sufficient in order to guarantee economic efficiency for publishers (Allianz der deutschen Wissenschaftsorganisationen 2010: 4 f.).

On 1 January 2014, changes in the copyright law became effective, which were actually aimed at strengthening the rights of the copyright owners. They especially concerned section 38(4) of the UrhG, which says that the rights to publications return to the authors twelve months after formal publication. Authors may then re-publish the work at another location, for example, on an OA server. The following restrictions have to be taken into account, however:

- The work has to be published in collections that appear at least twice a year. In general, this rule only applies to journal articles but not to monographs, contributions in anthologies or conference proceedings as well as most other types of publications.
- The authors only regain the rights to accepted manuscript versions, not versions of the publisher. The accepted manuscript version is the final revised version of the authors and in general identical to the publisher's

version with regard to content, but different with regard to formatting and missing pagination.
- Should the authors make this version publicly accessible, then this publication shall not serve any monetary purposes.
- This rule concerns only publications of German publishers.
- The drastic restriction concerns persons who benefit. The restriction to contributions that have emerged in the framework of research that has at least been half-funded by public funds decreases the intended promotion of open access. It only refers to publications that are mainly financed by third-party funds – for example, activities in the framework of DFG projects, the Federal Ministry of Education and Research (Bundesministeriums für Bildung und Forschung) or of foundations. Researchers from non-university research institutions also benefit from this regulation.

3 Conclusion: Open access, research data and integrated infrastructures

The activities and statements of the research institutions, science organisations and science policy actors aim at smooth, ideally cost-free access to scientific information. This especially concerns open access and the free access to scientific texts. The demand for and promotion of open access is mainly underscored by the acceleration of scientific communication and the increased efficiency of academic publishing. Moreover, the taxpayer argument is mentioned according to which scientific publications that are funded by the public sector also need to be publicly accessible. In addition, open access is associated with a strengthening of author rights. The demand for the right of secondary publication of scientific works was, however, not sufficiently taken into account in the 2014 change of copyright laws in the view of OA advocates. Representatives of academic publishing companies (especially the German Publishers and Booksellers Association) take opposing positions. They argue against governmental intervention in the market of scientific publications and the lacking efficiency of OA publication programmes. In addition, they consider the promotion of open access as undermining the internal logistical structures of academic publishing, including the essential services provided by the publishers, such as quality assurance and selection. Legal measures in the form of establishing a documented right of secondary usage are considered as harmful to copyrights by the German Publishers and Booksellers Association.

The institutions represented here apply a diversity of measures in support of open access: these include the further development and networking

of repositories to strengthen green open access as well as the creation of publication funds and own publication infrastructures to strengthen gold open access. On the part of third-party funders, the approval of funds is partly bound to the condition to make project-related publications available open access (for example, NIH, NSF, Wellcome Trust, EC). In general, incentives for using open access as an option in publishing should be created. For this purpose, the testing of alternative metrics or the special consideration of such publications in evaluations is suggested.[70] Open access is also the object of several studies that have been financed by the analysed institutions. These studies focus especially on the economic efficiency of open access by putting the dissemination of scientific information in different scenarios of publishing (OA variations, national licensing, closed access/subscription model) in relation with their costs and economic as well as scientific processing. These studies are subject to several restrictions (for example, unpredictability of the quantitative development of the publication output, effects of feedback in the implementation of different OA strategies) but mostly conclude a much stronger efficiency of open access in comparison to closed access (Houghton 2011; Houghton et al. 2012; Houghton et al. 2010; Research Information Network 2011; Wellcome Trust 2004). With respect to the perspectives of the two OA strategies – green versus gold – there is currently no indication that one of them will be replaced in the mid-term. While green open access was more strongly propagated at the beginning of the discussion, this can probably be explained by the fact that there was a lack of gold OA programmes at the time. In the international OA discussion, there is currently a tendency towards a dominance of gold open access. The Finch Report (Finch et al. 2013) published in 2013, which formulated recommendations for funders of research from Great Britain, received special attention. The report summarises considerations of a working group led by Dame Janet Finch, and clearly advocates a promotion and preference of gold open access in the OA guidelines of funders of research. The guidelines of the Finch Report have already been taken over by funding institutions such as the Research Councils UK and it is expected that others will follow.

Research organisations such as the MPG (Schimmer et al. 2015) show a certain preference for a new form of gold open access, the so-called 'journal flipping', that is, the transformation of subscription journals to OA journals. Following this model, in the Netherlands, corresponding consortia agreements were made with Springer at the end of 2014. The so-called 'Springer deal' not only included the subscription or licensing of 1 500 Springer journals but also

70 Here, especially metrics that take into account OA publications, which have so far been excluded from impact measurements, are addressed (for example, due to the scope of the databases used). This would, among others, concern new journals or document types that are not evaluated in Journal Citation Reports, such as proceedings, monographs, anthologies, contributions in anthologies, etc.

the right of Dutch academics to publish open access in those journals without having to pay any article fees (Vereniging van Universiteiten 2014). On 10 December 2015, the universities announced a similar agreement with Elsevier (Vereniging van Universiteiten 2015). The existing subscriptions for Elsevier journals remain, and, in return, Dutch scientists are able publish open access in selected Elsevier journals without additional costs.

Via licensing procedures (through national or Alliance licences), scientific publications should be added to the lower cost level and free accessibility as well. Since these licences, first of all, grant users at scientific institutions (not everybody) free access, they are not a true OA variation. The licences do, however, provide scientists at licence-giving institutions the possibility to deposit their documents in repositories open access. To ensure smooth and uncomplicated access to scientific objects, the establishment of a national hosting infrastructure is also welcomed.[71] Aside from texts (licensed in open or closed access), research data as well as other types of media are also possibilities for hosting. Independence from the publisher is also strongly considered.

In the area of research data, it is required that server infrastructures be developed in order to ensure the permanent availability, archiving and provision of primary research data for third parties. This offer should be developed in close collaboration with the disciplines. In parallel, funding programmes for the development of model-like solutions were established. The scientific recognition of the provision of data should create incentives for data sharing. As a consequence, these should be subject to quality assurance and peer review and be available consistently and for citation purposes. Funders of research (for example, NIH, Wellcome Trust) require that recipients of funds follow the guidelines on data sharing and data management. The granting of funds partly depends on the presentation of records of measures taken. Moreover, special emphasis is placed on the connection of data to other data storage or information items, such as virtual research environment, full texts, databases, academic CVs and other information storage (such as research information systems).

The open access approach to research data goes one step further and demands free availability of data. In this context, there is still a need for the creation of appropriate licensing models for the provision of information. More so than in open access to text publications, in the area of research data, not only free usage but also open usage of the data is required. In such scenarios, research data should be used and processed according to open source principles. These considerations are elaborated in the Panton Principles[72] and

71 First of all by the Alliance and KII.

72 See http://pantonprinciples.org/.

the Open Definition.[73] According to the Open Definition, knowledge is open if it can be freely

- used (for example, read, analysed);
- processed (for example, newly evaluated, modified, and combined with other data); and
- disseminated and copied, offered for use through others.

There should be only two conditions for the use of data and information: on the one hand, naming the copyright holders and, on the other, using a Share Alike clause. When following this clause, the dissemination of edited or derived work can only happen under the same conditions as those under which the data and information had been accessible originally. Next to the condition of cost-free online use, accessibility in a technically easy-to-handle and changeable form is also to be emphasised. The objective is the use of open data formats (Herb 2012: 33 f.).

While publishers in part strive for new business models that are based on gold open access, academic libraries find new fields of activity, especially in the area of information provision (operators of repositories for publications and data with tasks such as author consultation) and as service providers for publications (for example, if they themselves administrate OA publication environments of green or gold open access or publication funds).

On the level of infrastructures, there are scenarios in which scientific communication can take place and information (texts, data, other media) can be used cooperatively where possible, depending on location and time. Virtual research environments bundle access to research and information infrastructures, publications, data, protocols – all information items that are involved in the work process. As integrative channels, virtual research environments are dependent on the number of items that can be used permanently and persistently within them. Here, open (not only cost-free) availability of contents as well as a smooth usability of research and information infrastructures is ideal.

Measures, which the analysed institutions suggest, plan or implement, aim at the most uncomplicated and ubiquitous access to scientific information. Key elements in these scenarios are open access to texts and data, establishment of data sharing and management, licensing, hosting, strengthening of author rights, (further) development of research and information infrastructures. The conceptual proximity of these considerations to Open Science Workflows (for example, Förstner et al. 2011), whose approach takes the requirements

73 See http://opendefinition.org/.

of open definition more into account than the model of virtual research environments and itself advocates open interfaces and open dissemination of information, is striking.

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