Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 146 (2019) 142–155

Procedia Computer Science

www.elsevier.com/locate/procedia

14th International Conference on Current Research Information Systems, CRIS2018

Using Current Research Information Systems (CRIS) to showcase national and institutional research (potential): research information systems in the context of Open Science

Sophie Biesenbender[a]*, Sabrina Petersohn[a], Christoph Thiedig[a]

[a]*German Centre for Higher Education Research and Science Studies (DZHW), Schützenstr.6a, 10117 Berlin, Germany*

Abstract

This paper analyzes the factors that contribute or hinder the (joint) adoption of current research information systems (CRIS) and Open Access repositories (OAR) as manifestations of the Open Science principle. Given the significance attached to Open Science principles such as transparency and accessibility, we ask whether CRIS are able to reflect these priorities by providing technical interfaces or integrating OAR into the CRIS structure. We suggest that the interplay of national and institutional governance structures and policies is crucial for the adequate and efficient integration of CRIS and Open Science. To account for variances in both national and institutional context factors, we compare research institutions in three countries: Italy, the Netherlands and Germany. The qualitative exploratory analysis suggests that the consistent adoption and implementation of CRIS and Open Access policies in a science system are facilitated by national evaluation or quality assessment policies. In addition, the integration of Open Access repositories into CRIS is furthered by an institutionalized, efficient and flexible CRIS infrastructure.

Peer-review under responsibility of the scientific committee of the 14th International Conference on Current Research Information Systems, CRIS2018.

Keywords: current research information systems; institutional repositories; open access; open science; research governance; research information management

* Corresponding author. Tel.: +49-30-2064177-37.
E-mail address: biesenbender@dzhw.eu

Peer-review under responsibility of the scientific committee of the 14th International Conference on Current Research Information Systems, CRIS2018.
10.1016/j.procs.2019.01.089

1. Introduction

High quality data about research activities and processes, so called research information (RI), are of strategic relevance and vital importance for both science communication and for research governance and policy. They can be used in multiple contexts, ranging from public relations and networking to monitoring and reporting activities as well as performance-based funding.[1] Research information comprises information on a research institution's (scientific) staff and structure, projects, third-party funding, publications, patents etc. The efficient processing of institutional research information in higher education and research institutions is a complex task, which in many cases involves the implementation and use of integrated current research information systems (CRIS).

Current developments suggest that the strategic and communicative value of CRIS is on the rise:[2,3,4] On the one hand, CRIS are of importance for institutional marketing and outreach purposes, such as reporting to the general public. On the other hand, efficient communication and cooperation between researchers requires visibility and traceability by their peers, which in turn can be supported by publicly available information on both the scientists themselves, their projects as well as interests and their scientific output, such as research data or publications.

Projects aiming at an integration of institutional CRIS with research data archives, research data management services ("Open Data") or institutional repositories ("Open Access"–OA) are readily conceivable as part of the Open Science movement. Open Science represents an umbrella term used to designate scientific practices of knowledge creation and dissemination that are based on the principle of openness.[5,6] Nevertheless, an explicit reference to CRIS forming part of the Open Science movement is often lacking.[7,8,9,10]

Against this backdrop, our contribution aims to critically assess which factors contribute or hinder the adoption of CRIS and Open Access repositories (OAR) as manifestations of the Open Science principle. Given the significance attached to Open Science principles such as transparency and accessibility, we ask whether CRIS are able to reflect these priorities by providing technical interfaces or integrating OAR into the CRIS structure.[3]

We suggest that there are two factors that provide an important context: First, the governance structure and policies of science systems at the national level. We observe different rationales for the introduction and use of CRIS in different national science systems which affect the propensity for a possible integration of CRIS and OAR. Second, governance structures and policies at the institutional level determine the management, processing and provision of research publications as metadata only or OA full texts in institutional CRIS.

We therefore aim to investigate the following questions:

1. How do governance structures and policies of science systems at the national level influence research institutions to pursue an integrated Open Access strategy?
2. Do these factors foster or inhibit the use of CRIS as part of institutional Open Access policies or strategies?

To account for variances in both national and institutional context factors shaping the adoption of CRIS and Open Access policies, we compare research institutions in three countries: Italy, the Netherlands and Germany. The three countries were selected based on a most-different-system design.[11] They differ on several dimensions, such as the differentiation of the research sector and the modes of quality control in those systems.

The qualitative exploratory analysis suggests that the consistent adoption and implementation of CRIS and Open Access policies in a science system are facilitated by national evaluation or quality assessment policies. In addition, the integration of Open Access repositories into CRIS is furthered by an institutionalized, efficient and flexible CRIS infrastructure.

The remainder of this paper is structured as follows. In the next section, we first briefly review the literature on the phenomenon of Open Science and explore possible linkages to CRIS. We then explain our theoretical framework with regard to the role CRIS play in the national and institutional governance of research. Subsequently we describe the methods of our study. Section four introduces the major governance mechanisms present in the national science systems of the three countries explored and links them with the respective CRIS landscapes and OA policies. In addition, we present the findings with regard to the institutional level concerning the reflection of OA

principles in the use of CRIS. Finally, in the closing section we discuss the practical implications of our exploratory qualitative study along with an outlook on future research.

2. Literature and theoretical framework

The phenomenon "Open Science" is difficult to grasp conceptually and has subsequently been described as an umbrella term[6], a movement,[12,13] a discourse or several schools of thought[5] or a social and communicative practice.[6,14]

"Open Science" encompasses related concepts and movements such as "Open Access", "Open Data", "Open Source", "Open Metrics" and "Open Review", "Citizen Science" or "Open Participation" and "Science 2.0". These terms refer to the production, use, dissemination and valuation of publications, research data, materials, methods and tools in a way that fosters the principles of openness, transparency and accessibility, thereby increasing collaborative efforts, enhancing both efficacy and societal relevance as well as a democratization of scientific knowledge production.[6,12,15,16,17]

Most of the "Open Science" literature does not allude directly to the role of CRIS within this discourse although the aims of accessibility, publicity and the facilitation of collaboration and (alternative practices of) evaluation are in line with the associated benefits of CRIS.[18] Although not mentioned as one of the integral building blocks of the movement, CRIS are linked to "Open Science" in several ways: On the one hand, Open Access and Open Data initiatives provide linkages to CRIS via the interoperability of institutional repositories and data archives with CRIS or the provision of Open Access performance indicators based on metadata retrieved from CRIS.[10,19,20] On the other hand, scientists might benefit from CRIS solutions that allow for an efficient re-use of information, such as a researcher's record of (Open Access) publications.[18] Therefore, CRIS can be readily conceived of as part of the "Open Science" concept. However, it remains unclear which factors contribute or hinder the adoption of CRIS and OAR as manifestations of the Open Science principle.

Several studies have identified factors that represent barriers to the adoption of "Open Science" in general.[12,13,17] These can be distinguished into individual, institutional, disciplinary, and systemic factors.

They highlight the factors inhibiting the adoption of Open Science in general without distinguishing in more detail between different Open Science initiatives such as Open Data or Open Access, and least of all the role of institutional CRIS policies. According to these studies an important underlying aspect affecting organizational missions and policies, i.e. the 'institutional factor', are the dynamics and mechanisms of the scientific reward and career system. At the macro level, systemic factors such as EU and national policies regarding Open Science and corresponding funding mechanisms influence the adoption of Open Science measures.[12,13,17]

We suggest that organizational policies operate in the context of and interact with national research governance and legislation. This web of policies and governance tools influences the use of CRIS as tools for increasing the accessibility, publicity and openness of research.

The notion of governance broadly refers to mechanisms and strategies of coordination of interdependent actors and organizations.[21] Governance instruments such as research funding and quality control procedures are central to steering research systems and organizations. However, also policies on commercialization, research priorities and Open Science form part of governance arrangements.

Higher education and research is a sector consisting in most countries mainly of publicly funded public sector organizations. These organizations have been subject to modernization pressures and reforms in the past 30 years, including significant budget cuts. Three major changes to the governance of public sciences have been observed: First, an increasing state steering of research priorities especially with a view to increase societal relevance and impact of research, second, increasing state guidance through competitive resource allocation and performance monitoring and third, the enhancement of organizational autonomy of public research organizations.[22] The "intensification of competition for resources and reputation has also become a significant factor enhancing organizational identities".[23]

The latter development has been discussed as part of an "organizational transformation" of universities entailing the development of a well-defined identity, a hierarchical structure and capacity for rational action.[24]

These two theoretical points of departure, the changes in the governance of public sciences and the organizational governance of research, inform our conception of national and institutional factors concerning the adoption of CRIS in the context of the Open Science discourse.

For the governance of national research, especially for setting research priorities, funding allocation and performance monitoring, CRIS are needed to provide the necessary information on which to base decisions. However, what qualifies as relevant RI for inclusion in CRIS, how it is to be processed and presented publically, differs across science systems. Sometimes, a formal RI policy exists, in most cases it does not. This does not necessarily mean that the use and handling of RI is not regulated at all; often times, the collection, processing and management of RI follows different 'indirect' policies (such as general data protection or higher education laws).

On the institutional level, higher education institutions develop distinct organizational identities by enhancing organizational autonomy and formulating specific missions.[25] Here as well do CRIS play a pivotal role in displaying the specificity of a university. Related to the increasing degrees of autonomy, universities also need to set preferences, goals and corresponding courses of action as well as monitor and assess outcomes and performance.[25] CRIS serves as intelligence to motivate and justify managerial decisions.

In our country-specific analysis, we investigate first, the use of CRIS against the backdrop of national governance policies with a focus on quality control and monitoring, second, the Open Science discourse as it manifests itself in (national) Open Access policies and third, whether and how research institutions implement linkages between CRIS and OAR systems and policies.

3. Data and methods

The core of our explorative qualitative case study consists of semi-structured expert interviews with representatives from national and institutional RI stakeholders in the Netherlands and Italy, including national associations, science academies, users of CRIS, governmental representatives and others. Interview data is further complemented by desk research and secondary document analysis as well as systematic documentation and interactions with various stakeholders of the German Science system during the course of two research projects concerning the development and implementation of a standardized specification of research information – the Research Core Dataset (RCD).[1,49,50,53]

4. Analysis

4.1. Structure and governance of the Italian, Dutch and German science system

The HEI (short for higher education institution) sector and science systems of the three countries differ in terms of their structure, the "vertical" governance structure of the science system with regard to the relationship between universities and the state and the "horizontal" governance structure with regard to the self-governance structures of the HEI sector (major advisory bodies, committees and institutions for intra-sectoral cooperation and communication). These governance arrangements influence both policies on quality control as well as management of research and Open Access.

The Italian science and higher education system has a long tradition of top-down central governance,[26] which combines a strong state bureaucracy with a historically strong chair system within universities.[27] The Italian science system is characterized by comparatively little structural horizontal differentiation.[28,29] Out of almost 100 universities in Italy, 68 are public research institutions that fall under the jurisdiction of the Italian Ministry of Education, Universities and Research (MIUR).

Only since the late 1980s, the state has conferred more and more financial and personnel autonomy to universities along with greater accountability and structural requirements that encourage institutional specialization

(e.g. through the introduction of institutional *Nuclei di valutazione*, internal units for institutional evaluation of research). Other reform measures, such as for instance the strengthening of the university governing boards (the administrative councils) in the early 2000s did not have the expected effects. Nevertheless, rectors of Italian public universities still have a key function[30] with strong horizontal communication and coordination networks through the Italian rectors' conference (CRUI). The CRUI is a private organization, which cooperates strongly with the government in its attempts to reform and professionalize university government through adequate legal and policy reforms.

Dutch research governance is characterized by top-down state regulation accompanied by strong academic self-governance up to the mid-1980s.[31,32] The adoption of the so-called "steering at a distance-approach" in 1985 has changed the vertical governance structure and regulatory regime by entrusting universities with higher degrees of organizational autonomy, for example in terms of decisions regarding the management of university budgets and staff. In return, the establishment of systems of performance monitoring and quality control geared towards increasing national and international impact and performance of research is expected.[33] Both modes of governance are embedded in a political culture which is marked by consensual decision-making.[34]

The science system has a densely populated "intermediary layer" consisting of committees, councils, programming bodies and other actors that provide multiple venues for horizontal coordination and communication.[35] Central intermediary organizations are the Association of Universities in the Netherlands (VSNU) which facilitates the inter-university coordination and consultation and represents the universities interests towards the Ministry of Education, Culture and Science.[36] As a learned society with advisory functions in science policy, the Royal Netherlands Academy of Arts and Sciences (KNAW) provides a major scientific forum for horizontal communication and coordination.[37]

Responsibility for legal regulation and funding of the German HEIs lies primarily with the sixteen states, with the federal government exerting comparatively minor influence over HEI regulation. The two most important funding sources for HEIs are block funding provided by the states and third-party funding, with growing importance of the latter in recent years.[38] As part of new public management (NPM) reforms introduced in the mid-1990s, most states now award funding to HEIs via a global budget, allowing more spending flexibility, and introduced target and performance agreements. These developments have increased competition between as well as within HEIs.

Important national bodies of horizontal HEI governance and communication are, first, the German Rectors' Conference (GRC), a voluntary association of currently 268 state and state-recognized universities as well as other higher education institutions. Second, the German Council of Science and Humanities (WR), an important advisory body to both federal and state governments comprised of scientists and representatives of federal and state government, which issues recommendations on the developments of the higher education and science system on an institutional and system-wide level.

4.2. Quality control and performance monitoring in Italy, the Netherlands and Germany

To unfold their regulatory capacity, instruments of research governance rely on an informational basis to be able to formulate and enforce incentives, rules and controls, irrespective of their degree of formality or whether they are promulgated or enforced by dominant groups hierarchically or horizontally.[22] The array of instruments spans across the setting of research priorities, the competitive allocation of research funding or quality control and performance monitoring. We focus on the last two aspects since CRIS play a particularly prominent role in both the internal and external assessment of research as well as research funding.[39]

Next to attempts to improve the Italian university system through structural reforms and measures to strengthen institutional capacities for strategic governance and steering (see above), the Italian government has recently passed reform measures to enhance competition between universities – mainly through distributing a certain share of the public budget for research based on the research institutions' publication performance. Since the early 2000s, the Italian evaluation agency (ANVUR) has carried out different kinds of evaluations that have an immediate effect on the distribution of public funding between universities based on the quality of research.

The latest edition of the VQR (short for *Valutazione della qualità della ricerca*, i.e. research quality assessment) covering the years 2011 to 2014 focuses mainly on the quality of so-called academic 'products', i.e. publications that are assigned to fields of research and evaluated with either quantitative bibliometric or qualitative peer-review instruments. Comparisons between universities and their performance are being made based on the two most important publications as selected and reported by each researcher for the period of interest. The VQR with its focus on academic publications has been the main driver for the standardization of RI in the Italian science system. Other existing standards, such as the classification of academic disciplines are set and modified through ministerial decrees.

Around 20% of public university funding is currently being allocated to public universities based on their respective VQR performance (2016: 23%). The allocation of the remaining 80% among universities is based on existing financial commitments of universities (salaries, pensions, number of students etc.).

The first evaluation exercise of this kind was carried out in 2004, with most of the universities still without any CRIS infrastructure,[40] while for the second evaluation exercise in 2012, almost 50% of Italian public universities had (different) CRIS solutions in place, most of them already interoperable with LoginMIUR, the national Ministerial closed publication database which is administered by researchers and institutions and being used for different evaluation instruments (including the VQR). The communication of publications for the third evaluation exercise (VQR 2014) requires the use of software developed by Cineca – an Italian inter-university consortium for the development of CRIS, which in 2013 was further strengthened after the unification with the hitherto competing consortia Cilea and Caspur. Through a ministerial decree (Nr. 458 of 27 June 2015, Art. 7) the development and provision of the software and technical infrastructure for the third evaluation exercise was commissioned to Cineca along with a financial compensation of 7.5 Mio euros. As a result and following Cineca's subsequent release of IRIS – a CRIS platform based on DSpace-CRIS – more than 65 Italian universities currently use this software solution, which next to the functionalities for carrying out the VQR includes other functionalities such as institutional Open Access repositories.

Apart from this convergence of research institutions in terms of technical infrastructure and the documentation of publications, however, quality problems with regard to the LoginMIUR database remain: researchers feed the database without any central quality assurance or data validation mechanisms. In other words, while the central evaluation exercise has led to a professionalization and harmonization of institutional software infrastructures, organizational processes are still quite heterogeneous, which has strong criticism within the academic community.[41]

A general requirement to implement a regular system of quality control is stipulated in the Dutch Higher education and Research Act (*Wet op het hoger onderwijs en wetenschappelijk onderzoek*, WHW) from 1992.

In 1993, the Dutch university association VSNU developed a national system of research evaluation in consultation with KNAW and the main Dutch research funder NWO in the form of a series of protocols that set up the general aims, scope and procedures of a national research evaluation system encompassing all 14 Dutch universities. The standardized procedure aimed at institutional quality control, improvement of research management and leadership and accountability to the government and society at large without any immediate funding implications for universities.[42]

The evaluation protocol was conceived of as part of VSNU's information policy concerning the exchange of information about research performance within the HEI sector as well as towards the Ministry of Education, Culture and Science. It contains self-assessment reports in a standardized format including information on university staff, basic institutional and third party funding as well as publications (distinguishing PhD theses, scholarly and professional articles and patents).[43] In this context, the development of in-house CRIS solutions took place[44] among which Metis, developed by Radboud University Nijmegen, was eventually adopted by all Dutch universities. Metis contains information about researchers and research institutions, research programs and projects as well as bibliographical information of research output.

After two evaluation cycles (each covering 5 years), the VSNU protocol was evaluated and modified substantially into the Standard Evaluation Protocol (SEP) in 2003, which is still in place. While RI on staff and funding remained comparable to the previous protocols, publications are differentiated more widely into book chapters, monographs, refereed and non-refereed journal articles, as well as software.[45,46] Institutional CRIS are therefore firmly integrated into procedures of quality control both at the national and institutional level.[47] In 2014,

Dutch universities attempted to switch from the commonly used Metis to a national license for Elsevier's CRIS solution Pure. The common approach failed, however, which led most Dutch universities to purchasing individual licenses for Pure as of 2015.

Due to the federal structure of HEI governance, no comprehensive national evaluation scheme exists in Germany. Instead, assessment exercises of varying scope, duration and level of standardization exist at national, state, disciplinary or institutional level.

Following a recommendation in 2004, the WR has conducted various national "Research Rating" pilot studies at disciplinary level – evaluation exercises based on peer review informed by qualitative and quantitative indicators that were aimed to assess the research performance of universities and non-university research institutions funded by federal and state government.[48,49,50]

A prominent example of a national funding scheme with a strong evaluative character is the Excellence Strategy (formerly the Excellence Initiative). Intended to identify and foster "excellent" universities, strengthen interdisciplinary collaboration and improve graduate education and international competitiveness, 4.6 billion euros in additional funds were distributed between 2006 and 2017.[51]

The heterogeneous evaluation and reporting landscape entails high levels of administrative burden. The implementation of institutional CRIS is perceived as a solution to increase both quality and efficiency of managing and reporting RI. The adoption and implementation of CRIS takes place at a varying pace and scope: Many existing solutions have been developed in-house, but there is a trend to utilize commercial software amongst institutions planning or implementing research information systems in more recent years.[52] In the states of Hesse and North Rhine-Westphalia, collective initiatives exist for the coordinated acquisition, implementation and use of CRIS and the standardization of RI amongst participating universities.

To enable a more efficient and responsible use and exchange of RI and to reduce reporting burden the WR recommended a standard for RI in 2013, the so-called Research Core Dataset (RCD).[49] This specification of RI definitions and data formats is currently being implemented on a voluntary basis by German HEIs and non-university research organizations.[1,53] It specifies the contents, concepts and the format of research information on staff, promotion of early-career researchers, third-party funding and finances, publications, patents and spin-offs, and research infrastructures.[53]

The RCD is currently being utilized in preparation for the upcoming funding period of the Excellence Strategy beginning in 2019, where a number of indicators necessary for the funding application process need to be reported according to RCD definitions. In its recommendation for the voluntary implementation of the RCD in the German Science system, the WR further recognizes the benefits of implementing CRIS in order to fully reap the benefits of using the RCD in collecting and linking data to support processes of quality assurance and reduce work load.[49]

4.3. Open Science – Open Access Policies in Italy, the Netherlands and Germany

Although there is no dominant school of thought in Open Science, the provision of free access to scientific publications has a long tradition dating back to the early 1990s even before the term "Open Access" (OA) was coined. The movement gained institutional momentum based on several influential declarations such as the Budapest Open Access Initiative (2002) and the Berlin Declaration on Open Access (2003).[54,55] The provision of access to and information about scientific publications constitutes a central link between the world of Open Science and CRIS. We therefore focus on Open Access to scientific publications as a manifestation of the Open Science principle in the following section.

Open Access in Italy is regulated based on law nr. 112 of 2013, the first Italian law to deal with the topic of OA. It refers to the recommendation of the European Union of July 2012 to encourage the dissemination of research results. The law makes a number of provisions that focus on the protection and valorization of Italian cultural heritage in general. The law recommends OA for scientific publications if the following criteria are met: (1) the publication is based on research that is financed by at least 50% through public funds, and (2) the publication venue has at least two issues per year (excluding books). Free access in these cases should be provided through the publisher's website or an (institutional or disciplinary) repository.[56] However, the provisions stated in the national

law are not (yet) mandatory. Still, the law encouraged the Italian rectors' conference to discuss and work on a position statement in March 2013 to support and coordinate the institutional implementation of OA and the introduction of institutional repositories. The position statement, which so far has been signed by 17 (out of 96) universities includes amongst others the creation of open institutional repositories and initiatives to encourage researchers to publish in OA venues. So far, around 130 Italian institutional repositories are registered with OpenDOAR (a worldwide directory of academic Open Access repositories) and 322 OA journals are listed with DOAJ (an international directory of Open Access journals). In addition, 71 universities have signed the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities.

Increased institutional awareness for Open Access coincided with the technical development of Cineca's IRIS – the CRIS solution focusing on the management of publication data, which is OpenAIRE and CERIF compliant. The technical flexibility of IRIS to integrate institutional repositories into the CRIS along with the adoption institutional Open Access policies has had a strong effect on the diffusion and implementation of institutional OA repositories in Italy in general. 22 universities have so far published institutional Open Access policies in the IRIS web portal.

Like many other research institutions worldwide, all Dutch research organizations including the NWO and KNAW endorsed the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities, resulting in a wide variety of measures such as general support to Open Access publishing by funding new OA journals, setting up institutional OA policies and fostering OA repositories which have become an established part of the institutional repositories of Dutch universities as of 2003/2004.

In 2014, the State Secretary for Education, Culture and Science concluded that these measures have not yet led to a clear-cut OA system with commonly shared targets. In addition, the European Commission's OA policy introduced in 2014, requesting mandatory OA to all publications funded under the Horizon 2020 program, underlined the necessity of an integrated OA strategy on a national level. The government therefore supports a full switch to OA by 2024, with an interim goal of 60% of refereed publications being freely available by 2018.

To achieve this goal, the Dutch OA policy is based on three pillars: International cooperation with a focus on countries that also host major scientific publishing houses such as Germany and the United Kingdom, the negotiation of new subscription deals with scientific publishers and regular annual reporting of the share of OA publications in the different OA categories (gold route, green route, hybrid route).[57] The ministerial policy constitutes a soft form of regulation that relies on horizontal coordination between the major stakeholders. Only if the proclaimed targets are not met or progress is very slow, would the policy become mandatory under the WHW Act.

Following these national OA objectives, NWO has taken up OA publications into its funding requirements as of 2015 and many universities have set up institutional OA policies that stipulate the archiving of authors versions of manuscripts in institutional repositories. During the Netherlands' EU presidency in 2016, OA assumed a high policy priority, leading to the Amsterdam Call for Action,[58] which recommends that each Member State should draw up a national plan for Open Science. The Netherlands issued their national plan in February 2017, which tightened the objective towards the provision of OA publications to achieve 100% OA in 2020.[59]

German research organizations have been involved in Open Access developments from the early beginning, with the German Council for Science and Humanities, the German Rectors' Conference, the German Research Foundation, all four non-university research associations, the Berlin-Brandenburg Academy of Sciences and Humanities, the German Initiative for Network Information and the German Library Association being initial signatories of the Berlin Declaration on Open Access in 2003. Involvement and support has continued on collective and institutional levels in the form of policy creation, support for repositories and OA publishing, provision of forums for professional discussion as well as engagement to raise awareness of OA topics.

As a consequence, a number of German universities have implemented voluntary institutional OA policies which recommend utilizing existing leeway concerning secondary publication rights and publisher agreements. The German Research Foundation (DFG) also set up a funding scheme supporting the establishment of institutional Open Access publishing funds in 2009. As part of the federal government's digital agenda of 2014-17, the Federal Ministry of Education and Research (BMBF) presented its Open Access Strategy in 2016 and set up an OA funding scheme in the following year.

National OA mandates do not exist, but currently elected government parties have declared their intention to develop a national OA strategy and to make OA publishing mandatory for publications resulting from federal project funding. Further national coordination activity includes the OA2020-DE project with the aim of creating a large-scale Open Access transformation of scientific journals.

4.4. Assessing the integration of CRIS with OA measures in Italy, the Netherlands and Germany

The previous sections have charted first, the governance of research in Italy, the Netherlands and Germany with a focus on the established measures of quality control and research funding and how these systems and procedures are linked to CRIS policy and uses. Second, the major lines of the OA policies of the three countries have been presented. This section moves from these national context factors to the institutional level to explore how the implementation and use of CRIS at the institutional level reflects Open Science principles. The latter are focused on the provision of OA to scientific publications. Linkages between CRIS and OA can take multiple forms such as the creation of interfaces and interoperability between OARs and CRIS.

The Italian governance and regulation of RI management and institutional CRIS on the one hand and OA on the other follow different logics and paths.

While the harmonization of RI and institutional CRIS is clearly advanced by the central evaluation scheme (VQR), the regulation of Open Access is strongly reliant on research institutions passing OA policies in the absence of a national mandate to pass binding regulation. Institutional OA policy-making, however, has benefited from horizontal coordination and communication (e.g. through the rectors' conference). Moreover, the temporal coincidence of the national initiatives with regard to both RI/central evaluation and OA has contributed to advance Open Access in Italy.

The introduction of the central evaluation scheme in the early 2000s increased pressure in universities and research institutions to introduce efficient organizational and technical solutions for the management and reporting of publications and other scientific products of individual researchers and institutions. Therefore, the unification of the two university consortia Cilea and Caspur and the foundation of Cineca in 2013 and the subsequent development of a uniform CRIS solution (IRIS) in 2015 that would meet the requirements of the evaluation instrument (with the help of government funding) not only facilitated the implementation of the evaluation instrument but created a favorable environment for the development and implementation of institutional OA policies, which were recommended just in time by the OA law and the subsequent resolution by the rectors' conference in 2013.

On the one hand, the possibility to link institutional publication repositories to the institutional CRIS (IRIS) easily provided a technical solution to introduce institutional OA policies and publication repositories. It thus created a favorable environment to implement the provisions of the national OA law and the position statement on OA of the Conference of Italian University Rectors (CRUI). This coincidence in a way mitigated the limited impact of the national OA law of August 2013 and the lack of a national OA mandate.

On the other hand, the central evaluation policy also created a potential barrier for Open Access because it entails a potentially negative incentive for researchers to publish in OA journals. This is due to the fact that the evaluation scheme (VQR) is based on closed lists of journals that are taken into account for the bibliometric valuation of publications. These lists are compiled by discipline-specific expert groups in a process that makes it impossible to quickly update the lists and to include new journals. It usually takes time for new (OA) journals to be considered for the central evaluation policy (VQR). Interviews with various stakeholders of the Italian science system (representatives of ANVUR – the agency responsible for carrying out the evaluation exercise – and researchers) show that these circumstances constitute indeed barriers for researchers to publish in OA journals.

In the Netherlands, CRIS and OAR are intertwined in multiple ways. First, institutional CRIS and repositories are part of a national research portal called National Academic Research and Collaborations Information System (NARCIS). NARCIS provides access to a wide range of Dutch scholarly information, including (Open Access) publications. The information is harvested from distributed repositories, including OAR and CRIS of all Dutch universities, KNAW, NWO and a number of research institutes.[60,61] The rationale of NARCIS is that the provision of Open Access to data and publications benefits greatly from the connection to a controlled database with

information about (current) research, researchers and research institutes, which helps to contextualize both research data and publications.[61] The research portal thus brings together the hitherto separate worlds of CRIS and OAR via the technique of harvesting information and the usage of identifiers. In sum, the OA movement constituted one of the driving forces behind the NARCIS project

Second, in the wake of the governmental appeal to increase coordination and effort of Dutch OA measures in 2014, a regular monitoring of OA publications and institutional OA policies has been set up.

The monitoring of the share of OA publications is coordinated by VSNU and is based on peer reviewed articles registered in institutional CRIS. By 2015, all Dutch universities, KNAW and NWO research institutes had implemented institutional OA policies that request researchers to self-archive the author's versions of their accepted publications in the institutional repository. With the decision of most Dutch universities to acquire individual Pure licenses, the interoperability between CRIS and IR has been increased: Pure routinely provides functions to upload full texts together with publication metadata. This way, compliance with the institutional OA policy can be technically implemented. While all Dutch universities have both CRIS and IR systems, the integration of these systems is not complete, yet on the rise: around 50 percent of the universities use their CRIS to deposit OA publications. This is enhanced by the organizational setting in which both CRIS and IR are embedded: The library hosts both systems as a neutral service provider. However, both organizational location and the technical possibility alone do not automatically imply a high motivation of researchers to deposit their publications as OA versions. The costs and values of providing OA to publications are assessed against disciplinary and institutional reputational rewards.

While the hitherto separate "worlds" of CRIS and IR/OAR assumed the form of a loose coupling in the research portal NARCIS in 2004, a decade later a mutual reinforcement can be observed based on a major modification through the SEP, which focuses on societal impact of research rather than scientific productivity. As a consequence, a consistent incentive was created to increase valorization and openness of research which may have informed the universities' choice to acquire Pure with its OAR functionalities and the possibility to broadly register various forms of research output and activities. As has been described above, Pure subsequently provides the technical platform for a further integration of CRIS and OAR.

In Germany, OA and CRIS developments are shaped by the federal governance structure of the higher education and science system and, for the most part, constitute separate worlds that are only slowly beginning to merge. In the absence of a comprehensive national evaluation scheme, the harmonization of RI as well as the implementation of CRIS have largely been subject to institutional discretion and have only in recent years been furthered by coordinated political efforts and state-level initiatives. CRIS implementation is first and foremost driven by the desire to capture institutional research activity and to subsequently reduce reporting burden.[52]

On the other hand, institutional OA repositories (OARs) have been implemented since the 1990s. While survey data indicates that about 40 percent of universities currently maintain an OAR[62], interoperability with CRIS has only become part of the debate in more recent years.[63] Some institutions have integrated their institutional repository or higher education bibliography in their CRIS solution,[52,64,65] but, so far, integration has been sparse.

While support for OA has traditionally been very strong and the broad support by all major research institutions and academic societies has been conductive to establishing OA measures at the institutional level, policy development has most notably gained momentum in recent years. Against the background of EU and national OA policy frameworks, some states have passed (or are in the process of developing) OA strategies as well.[64] The state of Baden-Württemberg has further inscribed OA regulation into state law, which provides a strong incentive for the implementation of OA policies at university level.[66] There is, however, still legal dispute regarding the compatibility of compulsory secondary publishing with constitutionally granted freedom of research and teaching,[67] which might shift future OA intentions away from strong regulation of Green Open Access publishing and towards other OA measures, such as the establishment and support of new OA journals.[68] Support for these measures is already being provided, e.g. by funding lines of the DFG, whose *Open-Access Publishing Programme* has also been the main driver in the development of permanent OA publication funds at German universities.[69,70] Thus, while the specific ways of furthering OA in Germany are still very much subject to debate, both horizontal engagement and support structures as well as recent federal intentions to develop a national OA strategy provide fertile ground for the future implementation of OA measures. Future integration of these measures and RI will likely result from the increasing

institutional implementation of (commercial) CRIS and their integrative capabilities concerning OARs and the use of OA indicators along with standardized RI in federal and/or state funding and evaluation exercises.

5. Discussion and Conclusion

This paper analyzes the factors that contribute or hinder the integrated adoption of CRIS and OAR as manifestations of the Open Science principle in three different science systems – Italy, the Netherlands and Germany. We have discerned factors at the national and institutional level that shape the possibilities and dynamics of integration in the form of interoperable systems or technical interfaces of these two hitherto rather separate worlds.

First, the integration of OAR into CRIS is facilitated by an institutionalized CRIS infrastructure. As the Italian and Dutch cases show, the creation of such an infrastructure is closely related to national governance mechanisms of research performance monitoring and competitive research funding. Whereas in Italy the coupling of VQR with research funding models as well as financial support regarding the development of IRIS provide the incentives for the institutionalization of CRIS, the Netherlands build up an established CRIS landscape as a consequence of horizontal coordination efforts led by the VSNU.

Second, the integration of OAR into CRIS is facilitated by the technical capacities and functionalities of CRIS. In Italy, the national CRIS platform IRIS offers OAR functionalities as an additional benefit. Since the main rationale for setting up IRIS is the provision of RI for VQR, the integration of OAR functionality into IRIS takes the form a "trickle down" effect, supported by the development of institutional OA policies. The Dutch case indicates a stronger influence of the OA movement on the integration of CRIS and OAR. The establishment of NARCIS in the wake of the Berlin declaration fosters an integration of CRIS and OAR in the form of a national research portal. The linkage represents a loose coupling of the two systems since integration only takes place via the mechanism of harvesting at the research portal and not at the level of institutional CRIS and OAR. This level of integration gains in strength and becomes bidirectional due to mutually reinforcing and consistent policy developments at the level of the national evaluation system (i.e. modification of the SEP to strengthen societal relevance) and the national OA policy (ministerial appeal) leading to stronger institutional OA policies. These developments provide incentives for the acquisition of Pure licenses and therefore an institutional CRIS with OAR functionalities.

Fig. 1 summarizes the empirical picture. Both countries – Italy and the Netherlands – are characterized by centrally governed and less differentiated or small science systems which forms an important background for the observed integration dynamics. In comparison, the German case displays different patterns. By contrast, there is no institutionalized CRIS landscape due to a much more heterogeneous and multi-level setting of evaluation and reporting procedures. OA developments are characterized by a federated development of policies and measures at the national, state and institutional level. Therefore, these two "worlds" remain relatively separate, although possibilities for integration are likely due to technical interfaces provided via commercial CRIS.

Institutional OA policies and technical possibilities alone do not suffice as necessary preconditions for the integration of CRIS and OAR. Rather, the firm establishment of a CRIS infrastructure is vital. The institutionalization of CRIS, however, seems to be closely connected to national and institutional governance mechanisms of quality control.

All three countries show similar patterns in terms of hindering factors towards the integrated adoption of CRIS and OAR: reputational and institutional incentives may strongly hamper researchers' motivations to publish in OA journals or to make available their publications through OA.

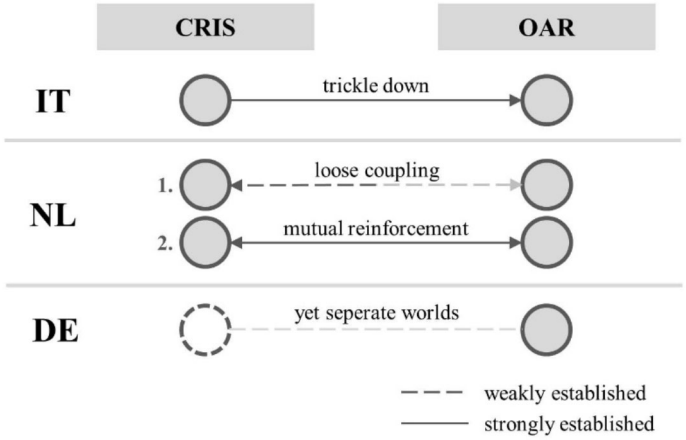

Fig. 1. CRIS-OAR relationships in Italy, the Netherlands and Germany

Acknowledgements

Research for this analysis was partly conducted in the context of the „Helpdesk to support the implementation of the Research Core Dataset" – a support structure, which is jointly funded by the German Federal Government (through the Federal Ministry of Education and Research) and the 16 state governments (project period: 2017-2019; grant number: KDS2016). It is located at the German Centre for Higher Education Research and Science Studies (DZHW).

References

1. Biesenbender S, Hornbostel S. The Research Core Dataset for the German science system: Challenges, processes and principles of a contested standardization project. *Scientometrics* 2016;106(2):837–47.
2. Herwig S, Schlattmann S. Eine wirtschaftsinformatische Standortbestimmung von Forschungsinformationssystemen. In: Mayr HC, Pinzger M, editors. *Informatik 2016 - Tagung vom 26.-30. September 2016 in Klagenfurt*. Bonn: Gesellschaft für Informatik e.V; 2016. p. 901–914.
3. Schöpfel J, Prost H, Rebouillat V. Research Data in Current Research Information Systems. *Procedia Computer Science* 2017;**106**:305–20.
4. Walters D, Ritchie M, Kilb M. CRIS Power!: Taming the Reporting Requirements of Open Access. *The Serials Librarian* 2016;**70**(1-4):229–35.
5. Fecher B, Friesike S. Open Science: One Term, Five Schools of Thought. In: Bartling S, Friesike S, editors. *Opening Science*. Cham: Springer International Publishing; 2014. p. 17–47.
6. Kulczycki E. Rethinking Open Science: The Role of Communication. *Analele Universitatii din Craiova* 2016;**37**(1):81–97.
7. Clements A, Reddick G, Viney I, McCutcheon V, Toon J, Macandrew H, et al. Let's Talk – Interoperability between University CRIS/IR and Researchfish: A Case Study from the UK. *Procedia Computer Science* 2017;**106**:220–31.
8. Castro P de, Shearer K, Summann F. The Gradual Merging of Repository and CRIS Solutions to Meet Institutional Research Information Management Requirements. *Procedia Computer Science* 2014;**33**:39–46.
9. Khokhar M, Schwamm H, Krug J, Albin-Clark A. Data Management Administration Online (DMAOnline). *Procedia Computer Science* 2017;**106**:291–8.
10. Simons E, Jetten M, Messelink M, van Berchum M, Schoonbrood H, Wittenberg M. The Important Role of CRIS's for Registering and Archiving Research Data. The RDS-project at Radboud University (the Netherlands) in Cooperation with Data-archive DANS. *Procedia Computer Science* 2017;**106**:321–8.
11. Seawright J, Gerring J. Case Selection Techniques in Case Study Research: A Menu of Qualitative and Quantitative Options. *Political Research Quarterly* 2008;**61**(2):294–308.
12. Gagliardi D, Cox D, Li Y. Institutional inertia and barriers to the adoption of open science. In: Primeri E, Reale E, editors. *The transformation of university institutional and organizational boundaries.* Rotterdam: Sense Publishers; 2015. p. 107–133.
13. Levin N, Leonelli S, Weckowska D, Castle D, Dupré J. How do scientists define openness? Exploring the relationship between open science policies and research practice. *Bulletin of science, technology & society* 2016;**36**(2):128–41.

14. Smith ML, Seward R. Openness as social praxis. *First Monday* 2017;**22**(4).
15. Arza V, Fressoli M. Benefits of open science: An analytical framework illustrated with case study evidence from Argentina. In: Chan L, Loizides F, editors. *Expanding Perspectives on Open Science: Communities, Cultures and Diversity in Concepts and Practices: Proceedings of the 21st International Conference on Electronic Publishing*; Amsterdam: IOS Press BV; 2017. p. 153-173.
16. Franzen M. Open Science als wissenschaftspolitische Problemlösungsformel? In: Simon D, Knie A, Hornbostel **S,** Zimmermann K, editors. *Handbuch Wissenschaftspolitik:* Wiesbaden: Springer; 2016. p. 279–296.
17. Friesike S, Schildhauer T. Open science: many good resolutions, very few incentives, yet. In: Welpe I.M**,** Wollersheim J, Ringelhan S, Osterloh M, editors. *Incentives and Performance:* Switzerland: Springer; 2015. p. 277–289.
18. Sitek D, Bertelmann R. Open Access: a state of the art. In: Bartling S, Friesike S, editors. *Opening science: The Evolving Guide on How the Internet is Changing Research, Collaboration and Scholarly Publishing.* Cham, Heidelberg, New York, Dordrecht, London: Springer; 2014. p. 139–153.
19. Ntini-Kounoudes A, Zervas M. The Transformation of the Ktisis Repository into a Current Research Information System (CRIS). In: Chan L, Loizides F, editors. *Expanding Perspectives on Open Science: Communities, Cultures and Diversity in Concepts and Practices: Proceedings of the 21st International Conference on Electronic Publishing*; Amsterdam: IOS Press BV; 2017. p. 227-234.
20. Olsbo P. Measurement of Open Access as an Infrastructural Challenge: The Case of Finland. In: Chan L, Loizides F, editors. *Expanding Perspectives on Open Science: Communities, Cultures and Diversity in Concepts and Practices. Proceedings of the 21st International Conference on Electronic Publishing.* Amsterdam: IOS Press BV; 2017. p. 217-226.
21. Jessop B. Multilevel governance and multilevel metagovernance. Changes in the EU as integral moments in the transformation and reorientation of contemporary statehood. In: Bache I, Flinders M, editors. *Multi-Level Governance*. Oxford: Oxford Univ. Press; 2004. p. 49–74.
22. Whitley R. Changing governance and authority relations in the public sciences. *Minerva* 2011;**49**(4):359–85.
23. Whitley R, Gläser J. The impact of institutional reforms on the nature of universities as organisations. In: Whitley R, Gläser J, editors. *Organizational Transformation and Scientific Change: The Impact of Institutional Restructuring on Universities and Intellectual Innovation.* Bingley: Emerald Group Publishing Limited; 2014. p. 19–49.
24. Brunsson N, Sahlin-Andersson K. Constructing organizations: the example of public sector reform. *Organization studies* 2000;**21**(4):721–46.
25. Seeber M, Lepori B, Montauti M, Enders J, Boer H de, Weyer E, et al. European universities as complete organizations? Understanding identity, hierarchy and rationality in public organizations. *Public Management Review* 2015;**17**(10):1444–74.
26. Degli Esposti M, Geraci M. Thirty Years of Higher-education Policy in Italy: Vico's Ricorsi and Beyond? *Bulletin of Italian Politics* 2010;**2**(2):111–22.
27. Dobbins M, Knill C. Higher education governance in France, Germany, and Italy: Change and variation in the impact of transnational soft governance. *Policy and Society* 2017;**36**(1):67–88.
28. Schimank U, Winnes M. Beyond Humboldt?: The relationship between teaching and research in European university systems. *Sci. and Pub. Pol.* 2000;**27**(6):397–408.
29. Goglio V, Regini M. Processes and stages of differentiation in European higher education. *Higher Educ Q* 2017;**71**(4):320–37.
30. Capano G. The re-regulation of the Italian university system through quality assurance. A mechanistic perspective. *Policy and Society* 2014;**33**(3):199–213.
31. Enders, J., De Boer, H., & Leisyte, L. On striking the right notes: Shifts in governance and the organisational transformation of universities. In: Amaral A, Bleiklie I, Musselin C, editors. *From governance to identity;* Dordrecht: Springer; 2008. p. 113–129.
32. Goedegebuure LCJ, Westerheijden DF. Changing balances in Dutch higher education. *Higher education* 1991;**21**(4):495–520.
33. Enders J, Boer H de, Weyer E. Regulatory autonomy and performance: The reform of higher education re-visited. *Higher education* 2013;**65**(1):5–23.
34. Westerheijden DF, Boer H de, Enders J. Netherlands. In: Paradeise C, Reale E, Bleiklie I, Ferlie E, editors. *University Governance: Western European Comparative Perspectives*. Dordrecht: Springer Netherlands; 2009. p. 103–125.
35. van der Meulen B, Rip A. Mediation in the Dutch science system. *Research Policy* 1998;**27**(8):757–69.
36. Luttikholt H. Universities in the Netherlands: in search of a new understanding. *European Journal of Education* 1986;**21**(1):57–66.
37. van Steen J. *The science system in the Netherlands: An organisational overview.* Den Haag; 2012.
38. Hüther O, Krücken G. *Higher Education in Germany—Recent Developments in an International Perspective*. Cham: Springer International Publishing; 2018.
39. Glaser, J., Lange, S., Laudel, G., & Schimank, U. Informed authority?: The limited use of research evaluation systems for managerial control in universities. In: Whitley R, Gläser J, Engwall L, editors. *Reconfiguring Knowledge Production: Changing Authority Relationships in the Sciences and their Consequences for Intellectual Innovation*. Oxford: Oxford University Press; 2010. p. 149–183.
40. Galimberti P, Mornati S. The Italian Model of Distributed Research Information Management Systems: A Case Study. *Procedia Computer Science* 2017;**106**:183–95.
41. Franceschini F, Maisano D. Critical remarks on the Italian research assessment exercise VQR 2011–2014. *Journal of Informetrics* 2017;**11**(2):337–57.
42. van der Meulen B. Interfering governance and emerging centres of control. In: Weingart P, Whitley R, Gläser J, editors. *The Changing Governance of the Sciences*. Dordrecht: Springer Netherlands; 2007. p. 191–203.

43. VSNU. *Quality Assessment of Research Protocol 1994*; 1994.
44. Homburg V. The Political Economy of Information Management. In: Khosrow-Pour M, editor. *Advanced Topics in Information Resources Management*. Hershey, London, Melbourne, Singapore; 2005. p. 285–303.
45. VSNU, NWO, KNAW. *Standard Evaluation Protocol 2003-2009 for public research organisations*. Utrecht, Den Haag, Amsterdam; 2003.
46. Koninklijke Nederlandse Akademie van Wetenschappen (KNAW), Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO), Vereniging van Universiteiten (VSNU). *Kwaliteit verplicht: Naar een nieuw stelsel van kwaliteitszorg voor het wetenschappelijk odnerzoek*. Rapport van de werkgroep Kwaliteitszorg Wetenschappelijk Onderzoek en standpuntbepaling KNAW, NWO en VSNU; 2001.
47. Fondermann P, van der Togt, Peter L. How Wageningen University and Research Centre managed to influence researchers publishing behaviour towards more quality, impact and visibility. *Procedia Computer Science* 2017;**106**:204–11.
48. Wissenschaftsrat. *Empfehlungen zu Rankings im Wissenschaftssystem: Teil 1: Forschung*. Hamburg; 2004.
49. Wissenschaftsrat. *Empfehlungen zu einem Kerndatensatz Forschung*. Berlin; 2013.
50. Wissenschaftsrat. *Empfehlungen zur Spezifikation des Kerndatensatz Forschung*. Berlin; 2016.
51. Gläser J. German universities on their way to performance-based management of research portfolios. *Sociologia Italiana* 2016;(8):151–76.
52. Sticht K. *Einsatz von Forschungsinformationssystemen an Universitäten und Hochschulen mit Promotionsrecht in Deutschland. Dokumentation und Forschungsdaten*; 2015.
53. Biesenbender S, Hornbostel S. The Research Core Dataset for the German science system: Developing standards for an integrated management of research information. *Scientometrics* 2016;**108**(1):401–12.
54. Haider J. Openness as Tool for Acceleration and Measurement: Reflections on Problem Representations Underpinning Open Access and Open Science. *Open Divide* 2018:17–30.
55. Laakso M, Welling P, Bukvova H, Nyman L, Björk B, Hedlund T. The development of open access journal publishing from 1993 to 2009. *PLoS ONE* 2011;**6**(6):e20961.
56. Marra M. The recent Italian regulations about the open-access availability of publicly-funded research publications, and the documentation landscape in astrophysics. *arXiv preprint arXiv:1407.6296* 2014.
57. Dekker S. *Open Access to publications*. Parliamentary document; 2014.
58. NLU. *Amsterdam Call for Action on Open Science*. Amsterdam; 2016.
59. Ministry of Education, Culture and Science (MOCW). *National Plan Open Science (NPOS)*. Available at: https://www.openscience.nl/en/national-plan-open-science/national-plan/index; 2017 [accessed 13.07.2018].
60. Dijk E, Baars C, Hogenaar A, van Meel M. NARCIS: The Gateway to Dutch Scientific Information. In: *Digital Spectrum: Integrating Technology and Culture - Supplement to the Proceedings of the 10th International Conference on Electronic Publishing.* 2006. p. 49–58.
61. Dijk E, Doorn P. Providing access to research data, publications and current research information at Data Archiving and Networked Services-DANS. *Grey Journal Special Issue* 2014;11:18-23
62. Vierkant P, Kindling M. Welche Institutionen betreiben Open-Access-Repositorien in Deutschland? *LIBREAS. Library Ideas* 2014;(3):52–64.
63. Scholze F. Forschungsinformationssysteme in Deutschland und die Rolle der Bibliotheken. *Zeitschrift für Bibliothekswesen und Bibliographie* 2014;**61**(4/5):243–6.
64. Meinecke I. Hamburgs Weg zu einer Open-Access-Strategie. *Bibliotheksdienst* 2018;**52**(6):443–54.
65. Scholze F, Maier J. Establishing a Research Information System as Part of an Integrated Approach to Information Management: Best Practice at the Karlsruhe Institute of Technology (KIT). *LIBER Quarterly* 2012;**21**(2):201.
66. Oberländer A. Förderung von Open Access über institutionelle Infrastrukturen, insbesondere Repositorien. In: Söllner K, Mittermaier B, editors. *Praxishandbuch Open Access*. Berlin, Boston: de Gruyter; 2017. p. 137-145.
67. Löwisch M. Streit um die Zweitveröffentlichungspflicht geht zum Bundesverfassungsgericht. *Ordnungen der Wissenschaft* 2018;(1):43–4.
68. Löwisch M. Förderung statt Zwang – Neue Open Access Strategie in Baden-Württemberg. *Ordnungen der Wissenschaft* 2017;(1):59–60.
69. Fournier J, Weihberg R. Das Förderprogramm »Open Access Publizieren« der Deutschen Forschungsgemeinschaft. Zum Aufbau von Publikationsfonds an wissenschaftlichen Hochschulen in Deutschland. *ZfBB* 2013;**60**(5):236–43.
70. Deppe A. *Ansätze zur Verstetigung von Open-Access-Publikationsfonds*. Berliner Handreichungen zur Bibliotheks- und Informationswissenschaft – 403; 2015.