Research Information Management in the Context of Open Science

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Abstract

Purpose/Thesis: The aim of this paper is to discuss the mutual relationship between open science and theory and practice in RIM (Research Information Management), especially apparent in CRISs (Current Research Information Systems), with an emphasis on the context of research assessment requirements, open science policies and CRIS interoperability.
Approach/Methods: The study has been based on the critical review of the newest literature (2015–2019) presenting international studies of chosen aspects. Institution-centric and researcher-centric approaches has been presented.
Results and conclusions: The emerging new ecosystem of open science changes the way research is done and modifies the monitoring and evaluating of it. CRIS must take into account the new transformation processes and research evaluation measures. This allows more transparency and more interaction with the individual researcher, as well as with the institutional, national and international stakeholders. Full interoperability and open standards are desired to improve the discoverability and reusability of research outputs and metadata for different purposes.
Originality/Value: The study shows the significance of new tendencies in RIM/CRIS for researchers and research-performing organizations at institutional, national and international level.

Keywords

Current research information system (CRIS). Open Science. Research information. Research information management. Scholarly communication.

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1. Introduction

Researchers, managers, funders, publishers, libraries, and other stakeholders in scholarly communications seek to foster greater research access, transparency, collaboration, use, and innovation. Analysis from practical study emphasizes that:

> 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 (Biesenbender et.al, 2019, 143).

Decision makers and managers from Research Performing Organisations (RPOs) and Research Funding Organisations (RFOs) alike increasingly depend on indicators, reports and studies that draw data about research activities from research information systems

(Science Europe, 2016). Research information systems (RIS) are used to support the collection, integration, processing, storage and presentation of research information. In the light of the increased significance of RIS, it is pertinent to ask how the new ways of managing and reporting RI adopted in CRIS can foster the development of Open Science, and how the idea of Open Science shapes the CRIS infrastructure.

A German study observes that these questions have not received the attention they merit:

> an explicit reference to CRIS forming part of the Open Science movement is often lacking (Biesenbender et al., 2019, 143).

Until now the impact of open science on the development of Research Information Management and implementation of CRISs has been described with an emphasis on the role academic (research) libraries and information professionals play in supporting open access, copyright, metadata entry and validation, training and support with research data management (Clements & Proven, 2015; Bryant et al. 2017a; Bryant et al., 2018; Brennan, 2018).

2. Research Information Management and development of the basic RIM infrastructure

One of the most important components of information management in science is research information management (RIM). RIM refers to the integrated management of information about the research life-cycle, and about the entities which constitute it (e.g. researchers, research outputs, organizations, grants, facilities etc.)[1].

When thinking about RIM, we usually consider information regarding research activities and research results associated with institutions and their scientists, gathered from different units of the university (different HEIs[2]) or other research institutions. The information consists of continually updated data about researchers and their affiliations, research outputs (publications, datasets, and patents), grants and projects, academic service and honors, media reports and statements of impact. RIM is defined as information about research activities, not research data generated by researchers. Research information can be collected, curated and processed by research institutions for different internal and external purposes, and for various recipients (Biesenbender & Herwig, 2019; Stvilia et al., 2019).

In the new digital era RIM is defined as:

> the aggregation, curation and utilization of metadata about research activities (Bryant et.al, 2017a, 6).

Usually two main database components of the Research Information Management are indicated – Institutional Repositories (IRs) and Current Research Information Systems (CRISs), with the increasing attention to the latter (Ribeiro et al., 2016). The rising strategic importance of CRISs has been confirmed in several international studies, surveys and

[1] It is worth noticing that RIM is distinct from research data management (RDM), a similar-sounding term that is used to describe the processes researchers and institutions use for organizing, securing, archiving, and sharing research data throughout the research lifecycle. A data management plan (DMP) provides information on the data the research will generate, i.e., how to ensure its curation, preservation and sustainability and what parts of that data will be open (and how).

[2] Higher Education Institutions.

statements during the last four years (e.g. Ribeiro et al., 2016; Science Europe, 2016; Bryant et al., 2017b, Bryant et al., 2018) and the national projects like "Research Core Dataset" (RCD)[3] for the German science system (Riechert et al., 2017).

The term CRIS indicates a software system or solution to manage research information. Current Research Information Systems, now sometimes shortened to Research Information System (RIS), have different names, especially in North America where they are described as Research Networking System (RNS), Research Profiling System (RPS)[4], or Faculty Activity Reporting (FAR) (Bryant et al., 2018, 12, 19). Europeans are most familiar with the term "CRIS" or "RIS"[5]. The origins of CRIS systems in Europe date to the beginning of the 90s of the twentieth century, when they were principally used by the research offices (Bryant et al., 2018, 9). Gradually more and more university units were reported to the system. But for many years no regulations or standards for research information were implemented, which made the comparison of RI across different institutions, disciplines and countries impossible..

New challenges and technological possibilities have led to the creation of the new generation of CRIS (with more efficient and flexible infrastructure) to showcase institutional and national research (as well as research potential) (Biesenbender et al., 2019). Gathered in one place (one platform), RI does not only provide greater visibility and discoverability of institutional research activity, synchronise these data, and reduce burden to all involved of collecting and managing data about the research process, but it also facilitates internal and external data exchange, reporting and reuse. CRIS collects information by automatically synchronizing existing data volumes with various data sources (with different data formats and structures), so that this qualified RI is easily available to the end users (management) and gives them a better basis for decision making.

Among institutional CRIS software widely used in Europe in XXI century there are Pure (Elsevier), Converis (Clarivate Analytics), Elements (Symplectic), DSpace-CRIS (open source), VIVO (open source). Polish (local) system is Omega-Psir.

Institutional repository (IR) is the second main component of RIM. It "is a digital collection of research outputs (mainly publications and datasets) aiming to collect, preserve and disseminate the intellectual output of a higher education or research institution" (Ribeiro et al., 2016, 7). The analysis of the results from the CRIS/IR survey conducted by EUNIS[6] and euroCRIS[7] in 2015 revealed the complementarity of these two systems with repositories for managing research publications, and with CRISs for managing the institutional research information as a whole (Ribeiro et al., 2016, 5). In turn, *Practices and Patterns in Research Information Management. Findings from a Global Survey* report (Bryant et al., 2018) documents a tendency to merge functionalities of RIM systems and institutional repositories.

[3] The RCD is a standard for the collection, provision and exchange of research information.

[4] As RIM is treated here as an institutional information management (rather than personal), independent researcher profile systems (social networking platforms) like Research Gate or Academia.edu are not considered here. It is worth noting that some functionalities of RPS are taken into account by the creators of Omega-Psir, as an element of researcher-centric approach (Rybinski et al., 2018).

[5] Both terms will be used in this article interchangeably.

[6] EUNIS – the European University Information Systems Organization.

[7] EuroCRIS – an international not-for-profit association founded in 2002 to bring together experts on research information in general and research information systems (CRIS) in particular.

Rybinski et al. (2017) describe connecting IR with CRIS as a novel researcher-centric (not research-cenric) approach integrating the conflicting functionalities of IR and CRIS.

As we can observe an increasing tendency towards the adoption of wider CRIS functions, the following chapters of this paper are devoted to these systems.

3. Research Information Management in the context of new research assessment requirements and open science policies

New interest in RIM arose around 2010 when research institutions had to respond to national-level assessment policies, new policies on open access (open access mandates) and the demands of research funders. Therefore, it is obvious that CRIS had to be adopted to the emerging new ecosystem of open science, which changes the way research is done and modifies the way it is evaluated (Ribeiro, 2016, 11).

Open Science encompasses numerous components of the research life cycle, including open access to publications, research data, peer review, source software, standards, collaboration, educational resources, citizen science and more. It is based on the idea that scientific knowledge of all kinds should be openly shared as early as is practical in the discovery process (Nielsen, 2012). This systemic change is strongly emphasised in European Commission documents:

> Open Science represents new approach to the scientific process based on cooperative work and new ways of diffusing knowledge by using digital technologies and new collaborative tools (European Commission, 2015, 33).
> Open Science goes hand in hand with research integrity, and requires legal and ethical awareness on the part of researchers (O'Carroll et al., 2017, 5).

Open Science idea has a significant impact on scholarly communication models and new methodology of research assessment[8], in which it breaks with an assessment dependent on the place of publication (and "principle of inheritance of prestige"). National research assessment requirements and the resulting need for reporting of institutional research activity are indicated as the most significant driver of CRIS adoption.

Open Science policy impacts scientific practice on different levels – the individual (career assessment, grant awarding), local (institutional), organisational, national and international. CRIS must be able to monitor, evaluate and otherwise react to these new features to fulfil demands open science creates on all these levels. More recently, open-access mandates are also beginning to directly influence research output and publication management priorities, as supporting institutional compliance[9] with open science policies is another important incentive for pursuing RIM activities (Bryant et al., 2018, 31–32).

[8] A report written by the EC *Working Group on Rewards under Open Science* provides a matrix for the evaluation of research careers fully acknowledging open science practices. It proposes a large number of possible evaluation criteria for the assessment of six domains and 24 open science activities (European Commission, 2017).

[9] "Institutional compliance may mean different things from one country or institution to another, and may relate to satisfying mandates requiring research assessment reporting, open access, or research data management (...) [It] might also refer to individual funder requirements or to local institutional policies" (Bryant et al., 2018, 40).

4. CRIS interoperability – protocols, standards, identifiers

Research information workflows increasingly demand greater interoperability between internal and external systems. As research information systems proliferate, the issue becomes highly relevant, regarding interoperability both between CRISs themselves and with other, complementary systems, such as institutional repositories, systems at a national level and with other external stakeholders such as OpenAIRE.

> The growing need for improved interoperability between managing open access workflows and the curation of institutional research outputs metadata is giving rise to the increasing functional merging of RIM systems and institutional repositories [into hybrid platforms] (Bryant et al., 2018, 9–10).

To enhance the interoperability of RISs, Science Europe provided in November 2016 a set of common principles to guide their development. It invited all research organisations to adopt the following core principles for research information systems: flexibility, openness, FAIRness (to be Findable, Accessible, Interoperate, Reusable) and data entry minimisation. FAIR principles should always be implemented with respect to legal and ethical standards (Science Europe, 2016).

To ensure the standardized collection and interchangeability of RI and to be able to integrate as many decentralised stocks of RI as possible, there have been established (inter) national standards for supporting RIS. EUNIS – EuroCRIS survey (Ribeiro et al., 2015) indicated identified three most frequently adopted technologies and standards (in order of popularity): OAI-PMH, CERIF[10] and ORCID. Findings from the global survey *Practices and Patterns* (Bryant et al., 2019) confirmed this claim. This result could be explained by the emphasis placed on Open Access policies, interoperability and data exchange among different systems, and the unique identification of researchers. These three areas are all related not only to technological decisions, but to political ones as well, both at individual institution and at governmental level.

The latest release of the *OpenAIRE Guidelines for CRIS Managers* (Dvořák et al., ed., 2017) is a milestone to achieve interoperability between CRISs and OpenAIRE. Integration of CRISs in OpenAIRE is of mutual benefit. As a pan-European technical infrastructure with a strong support of Open Science experts network, OpenAIRE is harvesting metadata about research outputs from data sources across Europe and beyond. Defining interoperability guidelines it enables CRIS managers and other stakeholders to make the open scholarly communication environment much more efficient, innovative and creative.

In January 2018, the fourth project phase of OpenAIRE, *OpenAIRE-Advance*, started. Its aim is:

> making Open Science the default in Europe, reshaping the scholarly communication system towards openness and transparency serving as a trusted pillar of the European Open Science Cloud (EOSC) (OpenAire, 2018).

In this sense the OpenAIRE infrastructure can be itself considered a global CRIS system.

[10] The Common European Research Information Format (CERIF) has been developed as a standard to facilitate interoperability of CRIS systems within Europe. Today CERIF is being maintained by euroCRIS, its use is recommended across the EU.

5. Conclusion

Diversified research landscape with the diverting goals of the stakeholders makes RIM a serious problem in information management. RIM has received more attention in the recent years and various initiatives have been introduced in several countries to address issues related to research information.

The growing interest in research information systems (CRISs and institutional repositories) and increase in their strategic importance for higher education and research institutions come from their wide functionality and applicability in research governance and policy (e.g. sharing and monitoring institutional and national research potential, ensuring the quality of research information, fostering research and innovation, discovering and evaluating research, facilitating performance-based funding and generally augmenting excellence in research).

The national research assessment framework and open science policies are the key drivers strongly shaping priorities of RIM activities (in those countries and regions where they exist). CRISs are evolving to incorporate activities beyond research administration, and are increasingly used to support the FAIR communication, sharing and profiling of research through open access linkages and compliance tracking for publications, and to a lesser degree, research datasets (Bryant et al., 2018). Pablo de Castro highlights that the value of the institutional Open Science implementation strategy lies in the fact that CRIS is able to provide the required links between publications, projects, persons and affiliations (de Castro, 2018). The awareness that an institutional repository can be a tool supporting the implementation of Open Acces and Open Science is growing (see for instance de Castro, 2018; Rybinski et al., 2018).

RIM represents growing resource allocations by research institutions worldwide. We can observe evolving roles of CRIS – disambiguation, de-fragmentation, de-duplication; interoperability; links between publications, projects, persons and affiliations; new collaborative tools. All this shows that:

> a closed RIS in an environment of open science makes no sense (Azeroual at al., 2018, 36).

Given the richness of interlinked (meta)data on research present in CRISs, these systems could substantially contribute to the FAIRness of research and its products and as such become important building blocks for an open science infrastructure (Bryant et.al., 2018, 9). CRISs aggregate many types of data, harvest publications from a growing number of external sources, and serve as an important node interoperating within a large, complex scholarly communications landscape. Systems interoperability, and adoption of the standards, protocols and identifiers, which facilitate interoperability, lies at the heart of RIM (Bryant et al., 2018, 80).

Three main factors contribute to creating the open science ecosystem in which CRIS is developed and implemented: the governance structure and policies at the institutional level, at the national level, and at the international level[11]. The interplay between all these

[11] Governance instruments such as setting of research priorities, research funding, quality control procedures, performance monitoring etc. are parts of mechanisms and strategies of coordination of independent actors and organizations.

levels is crucial for the satisfying integration of CRIS and fulfilment of Open Science goals. National and institutional levels of cooperation suggested by Biesenbender et al. (2019) do not seem to be sufficient. To truly leverage the wealth of information available in CRISs it is of importance that they do not remain isolated resources on a local or national level, but become interconnected on an international scale. It is especially important in the increasingly networked research information, global competitions and rankings, external mandates. Confirmation of this international direction of developing CRISs is the topic of euroCRIS Spring 2019 membership meeting at CSC in Espoo/Helsinki: *Taking steps towards international CRIS systems*. But we should remember that RIM development, practices, incentives, priorities, maturity, scope, and nomenclature vary broadly by region (Bryant et al., 2018).

> Open science is an example of how quickly the context, needs and objectives related to research systems can evolve. The pace, direction and nature of such changes are unpredictable (Science Europe, 2016, 3).

The dynamism of the CRIS/RIM ecosystem creates the necessity of building global research information community.

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Zarządzanie informacją o nauce w kontekście otwartej nauki

Abstrakt

Cel/Teza: Celem artykułu jest omówienie wzajemnych relacji między otwartą nauką a teorią i praktyką zarządzania informacją o nauce, szczególnie widoczną w systemach typu CRIS (Current Research Information System), ze szczególnym uwzględnieniem kontekstu wymagań oceny w nauce, polityki open science oraz interoperacyjności systemów CRIS.
Koncepcja/Metody badań: Temat został opisany z wykorzystaniem krytycznego przeglądu najnowszej literatury (2015–2019) prezentującej badania międzynarodowe w wybranych aspektach. Przedstawiono podejścia skoncentrowane na instytucjach i naukowcach.
Wyniki i wnioski: Wyłaniający się nowy ekosystem otwartej nauki zmienia sposób prowadzenia badań i modyfikuje sposób ich monitorowania i oceny. CRIS musi uwzględniać nowe procesy transformacji i miary oceny badań. Oznacza to większą przejrzystość i większą interakcję z indywidualnym badaczem, interesariuszami instytucjonalnymi, krajowymi i międzynarodowymi. Pełna interoperacyjność i otwarte standardy są pożądane, aby poprawić wykrywalność i możliwość ponownego wykorzystania wyników badań i metadanych do różnych celów.
Oryginalność/Wartość poznawcza: Pokazanie znaczenia nowych tendencji w zarządzaniu informacją o nauce w systemach CRIS dla naukowców i organizacji prowadzących badania na poziomie instytucjonalnym, krajowym i międzynarodowym.

Słowa kluczowe:

Current research information system (CRIS). Informacja o nauce. Komunikacja naukowa. Otwarta nauka. Zarządzanie informacją o nauce.

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