Informačný systém pre vedu a výskum na Žilinskej univerzite
Project Information System at the University of Žilina

Ján Čelko

Abstrakt

V rámci OP Vzdelávanie bol na Žilinskej univerzite v Žiline (UNIZA) riešený projekt zameraný na rozvoj ľudských zdrojov s podporou integrovaného informačného systému na hodnotenie vedeckovýskumných výsledkov. Základným výstupom projektu je vyvinutý a spracovaný Informačný systém pre vedu a výskum (ISVV), ktorý ponúka platformu pre komplexnú koordináciu projektových aktivít a pre podporu vytvárania multidisciplinárnych výskumných tímov na UNIZA. Systém je súčasne základným podporným nástrojom pre sledovanie vedeckovýskumných aktivít pracovníkov, ponúka centralizovanú registráciu dát o projektových aktivitách všetkých domácich a zahraničných grantových i mimograntových schém. Systém zefektívňuje riadenie vedy a výskumu na UNIZA, umožňuje zjednodušenie administratívnych procesov a tiež spracovanie výstupov pre riadiace zložky. Na užívateľskej úrovni slúži na zlepšenie informovanosti vo vnútri univerzity a tiež vo vzťahu k verejnosti. Systém je prepojený s univerzitnou knižnicou, so systémom vzdelávanie, s personálnym a ekonomickým systémom univerzity, čím umožňuje aj personálnu a finančnú kontrolu riadenia. Významnou súčasťou systému je sledovanie vzdelávacích, vedeckovýskumných a publikačných aktivít pracovníkov UNIZA ako jedna z podpôr pri hodnotení pracovného výkonu.

Kľúčové slová: *informačný systém, veda, výskum, univerzita*

Abstract

Within the framework of OP Education of EU, a project focused on the development of human resources with the support of an integrated information system for the evaluation of scientific and research results was developed at the University of Žilina (UNIZA). The main output of the project was developed and elaborated Project Information System (PIS), which provides a platform for comprehensive coordination of project activities and support for the creation of multidisciplinary research teams at UNIZA. The system is also a basic support tool for monitoring employee research activities, offers centralized registration of data on the project activities of all domestic and foreign grant and non-grant schemes. The system streamlines management of science and research at UNIZA, simplifies administrative processes and also processes outputs for management components. At the user level, it improves information within the university and also in relation to the public area. The system is linked to the university library, the education system, the university's personal and economic system; that allows personnel and financial control. The monitoring of the educational, research and publishing activities of the UNIZA staff is an important part of the system as the support for the evaluation.

Key words: *information system, research, science, university*

Úvod

Veda a výskum sú ťažiskovými aktivitami kvalitnej univerzity. Prinášajú celý rad procesov, ktorých riadenie je pre manažment prvkom, podmieňujúcim úspešný rozvoj univerzity. Pre koordináciu projektových aktivít, vytváranie a kooperáciu multidisciplinárnych výskumných tímov, sledovanie výstupov i ekonomické analýzy je výhodné vytvorenie systému, ktorý zahrňuje vzájomne kooperatívne informačné databázy s vysokým štandardom výstupných možností. Za uvedeným účelom sú na univerzitách realizované rôzne formy informačných systémov, ktoré sú pomocnými prvkami manažmentu v rámci procesov riadenia vedy a výskumu. Systémy sú v našich podmienkach zväčša orientované len na databázy projektových aktivít (napr. Univerzita Komenského [1], Technická univerzita Košice [2]), resp. je zahrnutá aj databáza výskumného potenciálu univerzity (napr. Slovenská technická univerzita [3]). Komplexné systémy riadenia vedy a výskumu, ktoré by výraznejšie skvalitnili prácu manažmentu univerzity, resp. pomohli užívateľom, nie sú veľmi rozšírené. Navyše ich dostupnosť je zväčša len v oblasti interných služieb príslušnej organizácie. Na druhej strane sú často prepojené do národných centrálnych systémov, čím je zabezpečené všeobecné využitie ich výstupov. Medzi takéto systémy možno zaradiť napr. Research Information System (RIS) Univerzity Nottingham [4], Research Information System (RIS) Univerzity Twente [5], CRIS UNS Research Information Management System ako výsledok projektu DOSIRD UNS na Univerzite Novy Sad [6] alebo OMEGA-PSIR Current Research Information System, špeciálne vyvinutý na Varšavskej technickej univerzite [7].

Za účelom efektívnejšieho riadenia vedy a výskumu na Žilinskej univerzite (UNIZA) bol v rámci OP Vzdelávanie vyvinutý Informačný systém pre vedu a výskum (ISVV). Systém je hlavným výstupom projektu „Rozvoj ľudských zdrojov s podporou integrovaného informačného systému na hodnotenie vedeckovýskumných výsledkov".

Systém je základným podporným nástrojom pre sledovanie vedeckovýskumných aktivít pracovníkov UNIZA, ponúka centralizovanú registráciu dát o projektových aktivitách grantových i mimo grantových schém. Podporuje riadenie vedy a výskumu na univerzite, zjednodušuje administratívne procesy, uľahčuje a zefektívňuje činnosti pracovníkov univerzity a umožňuje spracovanie výstupov pre riadiace zložky a osobné aktivity pracovníkov. Na užívateľskej úrovni slúži na zlepšenie informovanosti vo vnútri univerzity a tiež vo vzťahu k verejnosti.

Možnosti ISVV

ISVV vo svojej hlavnej funkcionalite ponúka základnú evidenciu projektov na všetkých úrovniach riešenia – od projektového zámeru až po ukončenie riešenia, vrátane základných aktivít administrácie projektov: riešiteľského kolektívu, harmonogramu, kontroly financií a ostatných informácií o projekte.

ISVV pokrýva kompletný postup od zadávania námetov, cez schvaľovanie na univerzite až po ukončenie projektu. Zachytený je celý životný cyklus projektov, evidencia podrobnej dokumentácie a odkazov na prípadné samostatné stránky projektov.

Komplexnosť systému je požiadavka, ktorá objektívne definuje jeho kvalitu a použiteľnosť. Pre riadenie procesov vedy a výskumu nie je postačujúcou funkcionalitou informácia o projekte. Prepojenie s personálnym a ekonomickým systémom univerzity je samozrejmou, základnou vlastnosťou systému, ale nepostačujúcou pre riadiaci proces. Z toho dôvodu bolo v rámci ďalšieho vývoja informačného systému realizované rozšírenie o podsystémy, vyplývajúce z potrieb procesu riadenia výskumu na UNIZA. Podsystémy zabezpečujú prepojenia s ostatnými riadiacimi a informačnými systémami univerzity, predovšetkým:

- systém Sofia – prenos finančných údajov ako rozpočet, čerpanie a náklady presne v súlade s požadovaným členením projektu;
- systém DAWINCI – publikačná činnosť, prepojenie s informačnými zdrojmi univerzitnej knižnice, ktoré umožňuje požadovaný výber dostupných publikácií podľa definovaných požiadaviek;
- systém AIVS – výber údajov o vzdelávacej činnosti ako doplnková funkcionalita pre hodnotenie aktivít pracovníkov UNIZA.

Okrem uvedených napojení na informačné systémy UNIZA ponúka systém aj externú databázu špičkových prístrojov, zariadení a technológií s možnosťou vyhľadávania požadovaného technického zabezpečenia výskumnej aktivity. V príprave je databáza informácií o špičkových vedeckých pracovníkoch a vedeckých tímoch univerzity podľa odborov ich výskumného a vývojového zamerania, ktorá bude rovnako v budúcnosti súčasťou systému.

Popis ISVV

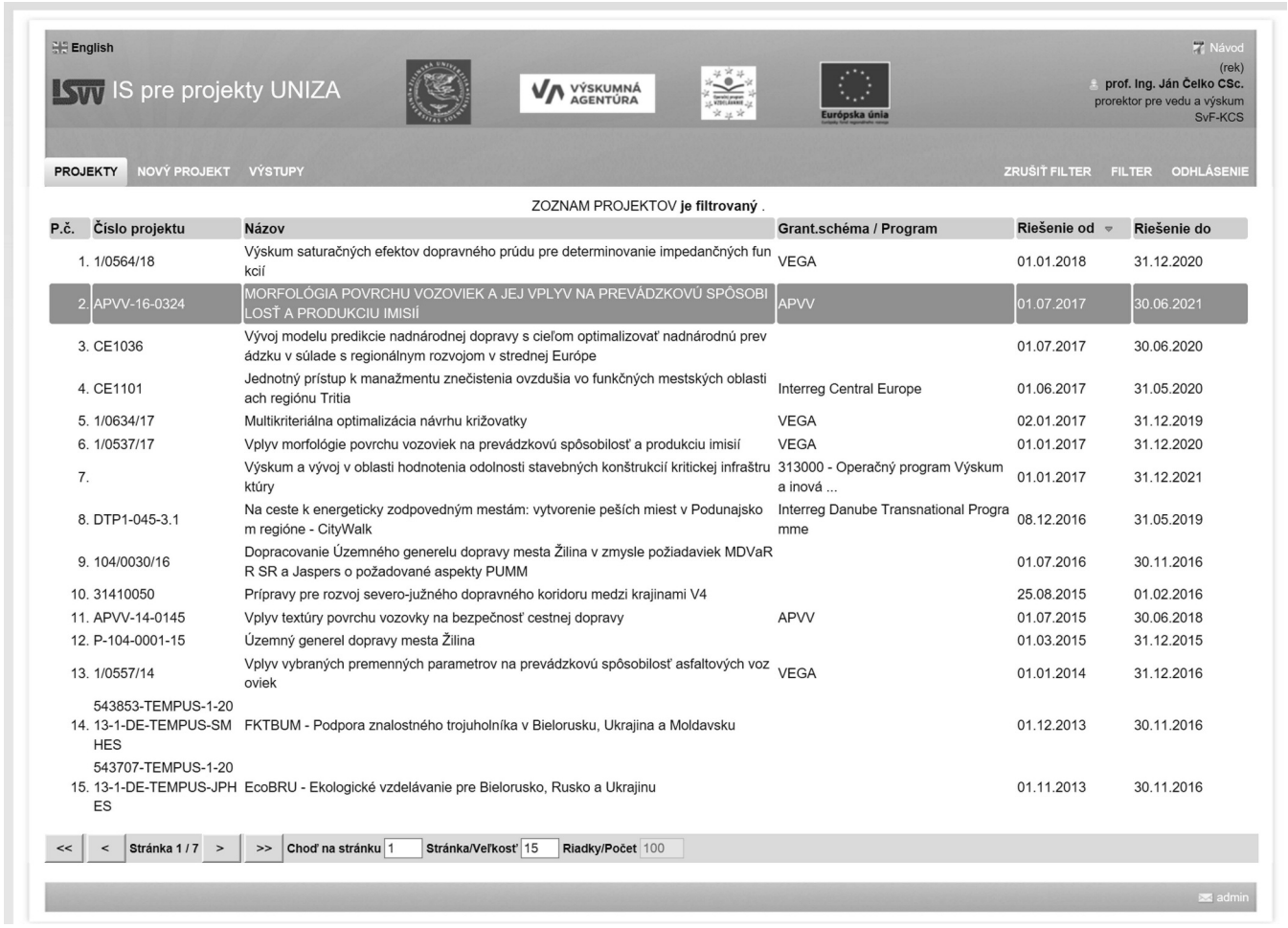
Základné funkcie

Informačný systém nie je uzatvoreným systémom len pre pracovníkov UNIZA. Vzhľadom na zvýšenie informovanosti verejnosti o aktivitách univerzity v oblasti vedy a výskumu je umožnené vstúpiť do systému aj návštevníkom mimo UNIZA. Prístup v režime „Návštevník" je v tomto prípade neautorizovaný a má obmedzenia pri funkcionalite ISVV, ktorá je obmedzená len na základné informatívne údaje o projektoch schválených a ukončených.

Obr. 1 Prihlásenie do systému

Prístup do systému pre pracovníkov UNIZA je autorizovaný cez jednotný prihlasovací systém UNIZA – LDAP server na základe identifikačného čísla pracovníka. Po takomto prihlásení sa zobrazia všetky projekty, na ktorých riešení prihlásený pracovník aktívne participoval (obr.2). Prístup je vo viacerých úrovniach, zodpovedný riešiteľ má plnohodnotný prístup ku všetkých dátam projektu, má možnosť editovať takmer všetky údaje o projekte, riešiteľskom kolektíve a spolupracujúcich organizáciách. Výnimkou je editácia údajov o financiách, ktoré sa importujú zo systému SOFIA.

Obmedzený prístup majú riadiaci pracovníci, úrovne prístupu sú definované podľa stupňa riadenia. V tomto prípade ale platí obmedzenie na úpravu dát, ktorá je k dispozícii v plnom rozsahu len zodpovednému riešiteľovi.



Obr. 2 Zoznam projektov

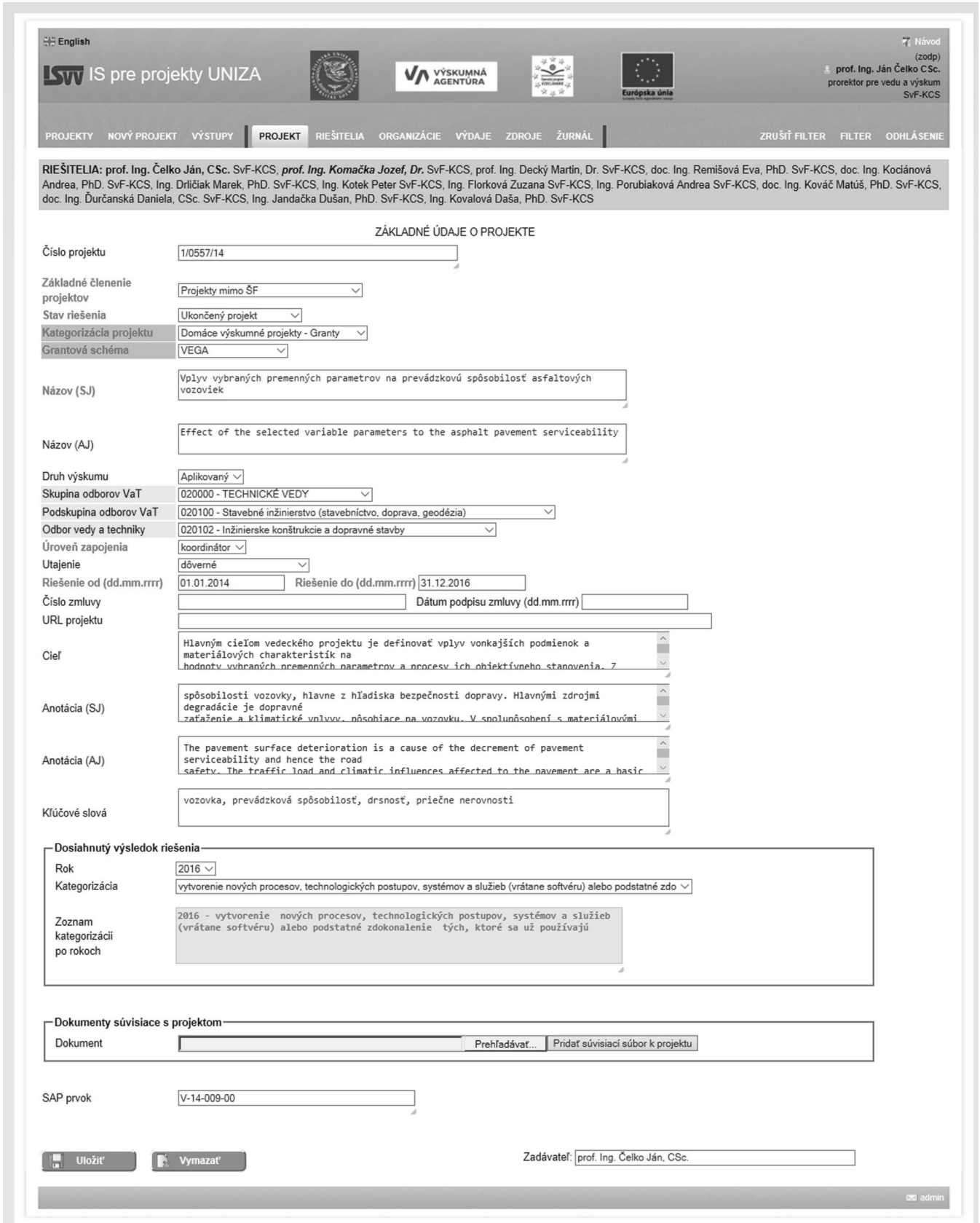
Po výbere konkrétneho projektu je možné sledovať, upravovať a dopĺňať všetky dostupné údaje. Rozsah dostupných údajov je uvedený na obr. 3.

Evidencia nových projektov

Systém umožňuje evidenciu dvoch typov projektov. Sú to projekty zo štrukturálnych fondov a ostatné projekty. Toto základné členenie vyplynulo z rôznorodosti požiadaviek na projekty a predovšetkým z administratívnej náročnosti projektov ŠF. Členenie je ďalej vnútorne ďaleko rozmanitejšie a pre uvedené druhy projektov sú čiastočne odlišné formuláre aj fázy riešenia.

Systém bol spočiatku prioritne určený pre projekty domácich a zahraničných výskumných grantových schém, neskôr bol rozšírený aj o projekty negrantové, resp. nevýskumné a následne o projekty ŠF. V popise sa budeme venovať predovšetkým projektom mimo štrukturálnych fondov EÚ, ktoré sú členené nasledovne:

- projekty domácich grantových schém,
- projekty zahraničných grantových schém,



Obr. 3 Informácie o projekte

- projekty výskumu prostredníctvom hlavnej činnosti nedotačnej na základe objednávok z praxe,
- nevýskumné projekty.

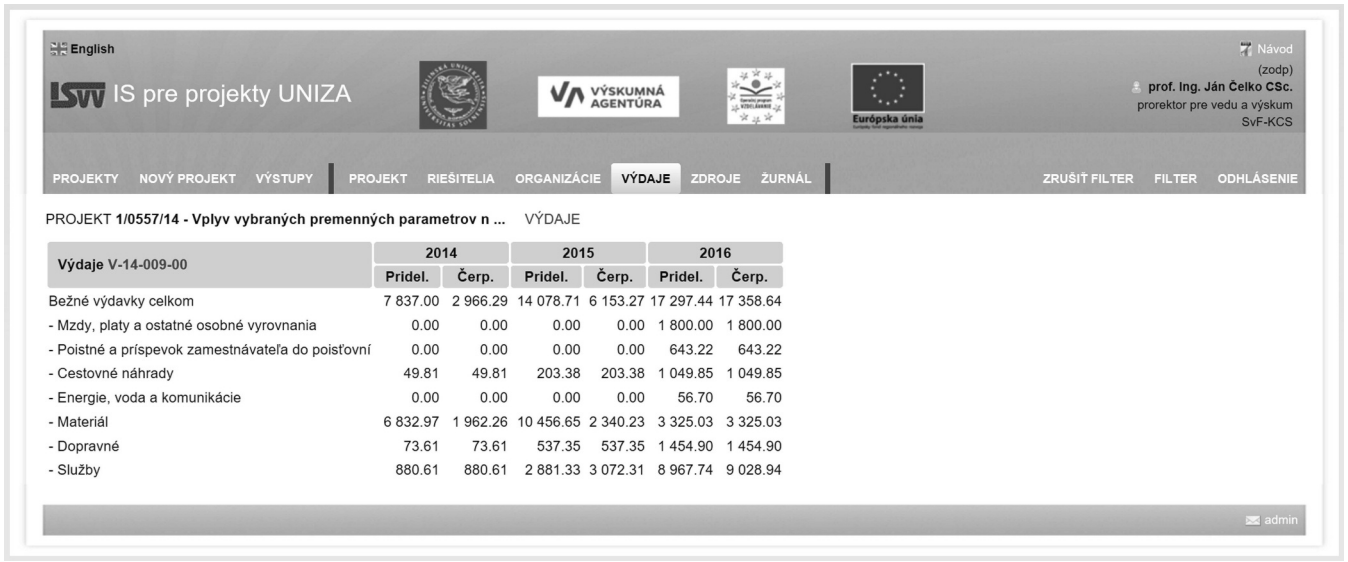
V ponuke sú dostupné všetky známe grantové schémy, domáce i zahraničné. Výber je na základe ponuky (obr. 4). Pri zadávaní nového projektu sú označené povinné údaje, nevyhnutné pre indexovanie projektov a vytváranie požadovaných výstupných zostáv. Pre kompletnú evidenciu je však potrebné zadefinovať všetky požadované údaje, ktoré mimo iného následne umožňujú aj filtrovanie výstupov. Zadávanie údajov je pre užívateľský komfort podľa možností ponúkaným pomocou pop-up menu.

Obr. 4 Ponuka zahraničných výskumných schém

Dôležitým prvkom projektových aktivít sú riešitelia. Systém umožňuje evidenciu riešiteľov podľa pracoviska a počtu hodín v jednotlivých rokoch riešenia, pričom umožňuje aj zadávanie riešiteľov mimo Žilinskú univerzitu (obr.5). Rovnako funguje aj ponuka pre organizácie participujúce na riešení projektu.

Obr. 5 Zadávanie riešiteľov

Jednou z najfrekventovanejších požiadaviek na informácie o projektoch je informácia o financovaní. Systém je prepojený s ekonomickým prostredím SOFIA, odkiaľ preberá finančné údaje o výdajoch (obr.6) a zdrojoch financií projektu. Údaje nie sú editovateľné a ich dostupnosť je definovaná úrovňou prístupu do systému.



Výdaje V-14-009-00	2014		2015		2016	
	Pridel.	Čerp.	Pridel.	Čerp.	Pridel.	Čerp.
Bežné výdavky celkom	7 837.00	2 966.29	14 078.71	6 153.27	17 297.44	17 358.64
- Mzdy, platy a ostatné osobné vyrovnania	0.00	0.00	0.00	0.00	1 800.00	1 800.00
- Poistné a príspevok zamestnávateľa do poisťovní	0.00	0.00	0.00	0.00	643.22	643.22
- Cestovné náhrady	49.81	49.81	203.38	203.38	1 049.85	1 049.85
- Energie, voda a komunikácie	0.00	0.00	0.00	0.00	56.70	56.70
- Materiál	6 832.97	1 962.26	10 456.65	2 340.23	3 325.03	3 325.03
- Dopravné	73.61	73.61	537.35	537.35	1 454.90	1 454.90
- Služby	880.61	880.61	2 881.33	3 072.31	8 967.74	9 028.94

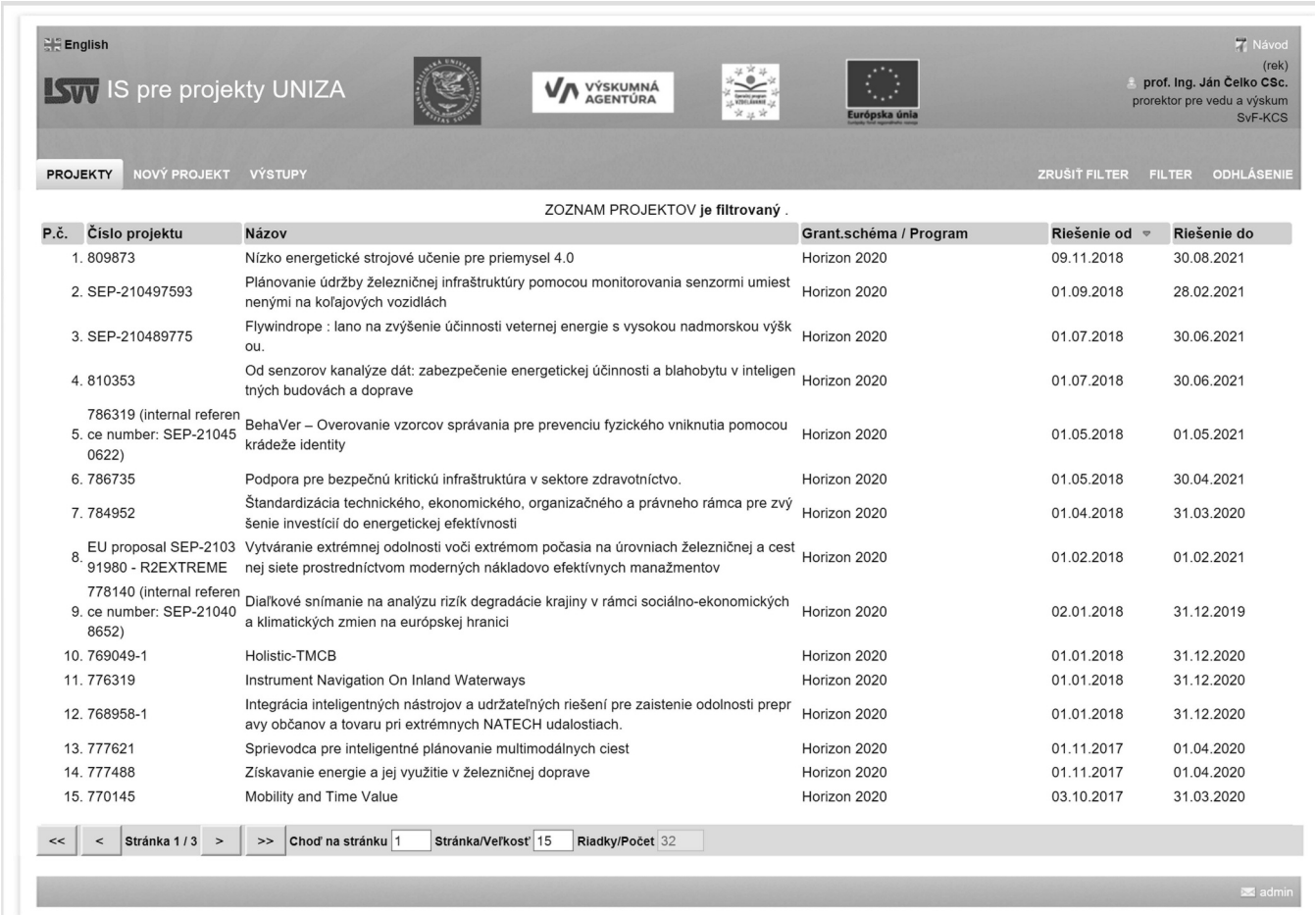
Obr. 6 Výdaje projektu

Vzhľadom na možnosti zásahu do systému zo strany riadiacich pracovníkov a samozrejme aj systémového administrátora, ISVV ponúka možnosť kontroly prístupov k projektu. V ponuke Žurnál sú uvedené všetky zásahy do zápisu projektu, okrem sledovania času a typu zásahu je k dispozícii aj identifikácia počítača, z ktorého bol zásah realizovaný.

Výstupy

Jednou z najpodstatnejších funkcionalít systému je generovanie výstupov. Umožňuje vytvárať výstupné zostavy podľa zvolených kritérií a v požadovanom rozsahu. Pre tvorbu výstupných zostáv je implementovaný filter, pomocou ktorého sa definuje obsah výstupu. Pre vyhľadávanie podľa položiek sa zadáva požadovaný údaj

Obr. 7 Filter



Obr. 8 Výsledky filtrovania pre projekty schémy H2020

v zmysle obr.7. Výstupná zostava obsahuje údaje o všetkých projektoch, zodpovedajúcich zvolenému filtru (obr.8). Systém ponúka pre štatistické účely aj nefiltrovaný zoznam všetkých zadefinovaných projektov v základnom členení vo formáte MS Excel a tiež vo formáte .xml, určenom pre ďalšie spracovanie.

Integrovanou súčasťou ISVV je ako pridaná hodnota generovanie hodnotiaceho hárku pracovníkov UNIZA. Hárok slúži ako pomocné kritérium pre riadiaceho pracovníka na hodnotenie pedagogických, vedeckovýskumných, publikačných a iných aktivít pracovníka. Prepojenie na vyššie uvedené podporné systémy UNIZA umožňuje automatizované preberanie väčšiny dát o aktivitách pracovníkov.

Obr. 9 Výstupy systému

Záver

Cieľom príspevku je informovať o základných prvkoch ISVV UNIZA a naznačiť možnosti jeho ďalšieho rozvoja. Nebolo účelom porovnávanie s inými systémami doma a v zahraničí. Otvorený prístup do systému v jeho základnej funkčnosti je k dispozícii na adrese ***http://vav.uniza.sk***. Systém je stále priebežne upgradovaný a doplňovaný o nové funkcionality, aby vytvoril efektívnu platformu pre riadenie procesov vedy a výskumu na Žilinskej univerzite v Žiline.

Zámerom autorov je do budúcnosti rozšíriť systém aj mimo rámec Žilinskej univerzity v Žiline, boli realizované rokovania o možnej implementácii jeho časti do platforiem centrálnych systém v SR.

Použitá literatúra

https://uniba.sk/veda/

https://www.tuke.sk/wps/portal/tuke/research/projekty-site

https://www.stuba.sk/sk/vyskume/sluzby-vyskumu.html?page_id=641

https://www.nottingham.ac.uk/it-services/research/applications/ris.aspx

https://research.utwente.nl/

Ivanović, D.: Developing of Software Infrastructure for Research Domain at University of Novi Sad. euroCRIS Strategic Membership Meeting Autumn 2017 (CVTI SR, Bratislava, Slovakia, Nov 20-22, 2017)

Rybiński, H. - Skonieczny, Ł. – Koperwas, J. – Struk, W.: OMEGA-PSIR: Institutional CRIS at Polish Universities. euroCRIS Strategic Membership Meeting Autumn 2017 (CVTI SR, Bratislava, Slovakia, Nov 20-22, 2017).

http://vav.uniza.sk

Čelko, J. – Tabak, M: Evidencia projektov v informačnom systéme Žilinskej univerzity v Žiline. Používateľská príručka.

Čelko, J.: Project Information System at the University of Zilina. euroCRIS Strategic Membership Meeting. Bratislava 11/2017.

J Celko (2018), "Project Information System at the University of Žilina". IT*lib.Informačné technológie a knižnice* Special Issue 2018: pp 7 – 14
https://dx.doi.org/10.25610/itlib-2018-0001

Ing. Ján Čelko
(Žilinská univerzita v Žiline) ■

The Information System for R&D in the Context of R&D Environment in the Slovak Republic

Lukáš Zendulka

Abstract

The research and development (R&D) environment in Slovakia is comprehensive and envisions the interaction of several key players, such as the universities, Slovak Academy of Sciences, etc., and several funding schemes with funds coming from various sources at the national and European level. The basic settings of R&D in Slovakia are regulated mainly by the Act no. 172/2005 Coll. on the organization of state support for research and development, and the main governing body in the domain of R&D is the Ministry of Education, Science, Research and Sport of the Slovak Republic (MESRS). The individual organizational processes at the ministerial level often require a support of information and communication technologies. In the context of Slovakia, the Central Information System for Research, Development and Innovation (CIS RDI) has been established in order to provide services and information on R&D to the decision makers, as well as to the scientific community. Another role of the CIS RDI is to popularize the science and technology to the general public. The main aim of the paper is to explain the need for such an information system resulting from the interconnections between the key players and processes, and to deal with various organizational aspects of its operation.

Key words

funding schemes; Central Information System for Research, Development and Innovation; information and communication technologies; information system; Ministry of Education, Science, Research and Sport of the Slovak Republic; research and development

Introduction

The contribution of the use of information systems to the effectiveness of the organization's activities has already been discussed in the scientific community (Lucas, 1975) and even nowadays the necessity of their implementation in view of prompt and efficient fulfilment of the organization's tasks and the availability of the necessary information is demonstrated. The availability of the necessary information and constant insight is particularly important in the management of science and technology, which themselves serve to gather information and knowledge and to mediate them to the professional and the general public. The aim of this article is to briefly characterize the R&D environment in the Slovak Republic and also to describe the existing R&D information support resulting from its specificities.

R&D Environment in the SR

The Slovak Republic is a centralised state where the central government has all competences in science and technology policy and higher education (Baláž et al., 2018). The key advisory body for coordination of the Slovak science and technology policies is the Slovak Government Council for Science, Technology and Innovation, set up by the government in 2013, which consists of the representatives of the central government ministries, higher education institutions (hereinafter referred to as "HEIs"), research institutions and industry and employer associations. According to the Statutes of the Council, the latter is an advisory body of the Slovak Government in matters of science, research and innovation.

The competences in the implementation of research and innovation are divided between the Ministry of Economy and Ministry of Science, Education, Research and Sports (hereinafter referred to as "MESRS"), and their directly managed bodies and agencies.

According to the Act No. 575/2001 Coll. on the organisation of the activity of the government and the state authorities, MESRS is the central authority for the science and technology. MESRS participates in the creation of a unified state policy in the various fields of science and technology, and implements it within the scope of its activity. MESRS also creates the conditions for the development of science and technology, takes responsibility for the efficient utilization of state budget funds spent on science and technology, and coordinates the activities of central state administration bodies, the Slovak Academy of Sciences and universities in the preparation and implementation of state science and technology policy, and in the preparation of the draft budget of public administration for science and technology for the relevant budget year.

Based on available statistical data, 29,671 R&D employees worked in Slovakia in 2016 (MESRS, 2017). This number of employees worked at HEIs, the Slovak Academy of Sciences, sectorial research institutions and other entities entitled to carry out R&D, including business entities and non-profit sector entities.

According to the data of MESRS (2017), there were 35 HEIs in Slovakia in 2016, 20 of which were public HEIs, 3 State HEIs and 12 private HEIs. Of this number, 18 HEIs had the status of university.

The Slovak Academy of Sciences is a separate legal entity with its own budget chapter, whose activity is governed by Act No. 133/2002 Coll. on the Slovak Academy of Sciences, as amended by Act No. 40/2011 Coll. The main mission of SAS is to implement basic and applied research in technical sciences, natural sciences, social sciences and humanities. In 2016, The Slovak Academy of Sciences carried out research activities through its 60 organizations (MESRS, 2017).

As of April 2018, MESRS records 414 legal entities from the business and non-profit sector who hold certificates of competence to carry out R&D. On the basis of this certificate, these entities may apply for funding of R&D activities from the state budget within the public calls. According to the Act No. 172/2005 Coll., the HEIs and organizations of the Slovak Academy of Sciences are awarded this certificate automatically based on the results of their accreditation.

Within its competencies, MESRS manages and coordinates the implementation of several public R&D funding schemes. The most important funding schemes under the Division of Science and Technology of the MESRS are the State Programs of R&D and Incentives for R&D.

State programs of R&D constitute an effective system for solving key problems of development and increasing competitiveness of the Slovak economy. They focus on approved R&D priority areas and technological priorities that accept the needs and requirements of the Slovak economy, approved pro-growth activities and the need to support the least developed regions, natural resources and intellectual capital of the Slovak Republic. Their intention is to address the key issues of developing and meeting the needs of society. State programs of R&D are one of the key instruments of providing targeted financial support for R&D, with a direct view of the results of their implementation in the economic practice of the Slovak Republic. MESRS is currently preparing the State programs of R&D to be implemented in 2018-2023 with a view up to 2028, focusing on the following areas: materials and related technologies; biomedicine, biotechnology, environment and agriculture; energy; information and communication technologies; and social sciences and humanities.

Incentives for R&D represent a form of state support for R&D, which is implemented through subsidies from the state budget in accordance with Act No. 185/2009 Coll. on the Incentives for R&D. The scheme of Incentives for R&D is an important tool of the state budget for the support of R&D in general and focuses on supporting R&D in the business sector, supporting the development of cooperation with the academic sector (HEIs, institutes of the Slovak Academy of Sciences), supporting the development of R&D cooperation between business sectors in the Slovak Republic and in the EU with the aim of increasing the level of competitiveness of the Slovak business sector in international markets by increasing the quality of products and applying all types of innovation in manufacturing and other business processes. For these reasons, the provision of the Incentives for R&D focuses primarily on applied (industrial) research and experimental development, promotes cooperation with HEIs and institutes of the Slovak Academy of Sciences, primarily in defined priority areas of industry in the Slovak Republic, which are also linked to R&D priority areas. An important aspect of the provision of the Incentives for R&D is the expansion of existing research and development centres, and creating new jobs for highly qualified R&D staff. In accordance to the Act No. 185/2009 Coll., these workplaces and jobs must be active for at least 5 years after the end of the incentives. Another important aspect is the fact that incentives are obliged to invest their own funds in R&D at a certain level and at least during the monitored five-year control period after the end of the incentives.

The implementation of various funding schemes necessarily requires relevant information support.

Provision of Information on R&D in the Conditions of the SR

Coordination and management of various R&D activities and tasks requires constant insight into the current situation and available resources – whether financial, human or organizational. Individual processes running at the level of ministries and other governing bodies require substantial information support and coordination. The optimal information flow management tool is the information system. *"Information systems are combinations of hardware, software, and telecommunications networks that people build and use to collect, create, and distribute useful data, typically in organizational settings."* (Valacich, Schneider, 2009). Exactly in accordance with this definition, MESRS created in 2009 an information system to ensure the necessary flow of information in the field of research and development in the conditions of the Slovak Republic.

In general, the issue of the provision of information in R&D in the Slovak Republic is primarily enshrined in Act No. 172/2005 Coll. on State Support for Research and Development. This law determines the existence of an information system and a central information portal, which ensure the *"acquisition, processing and provision of information on research and development for which funds have been provided from the state budget"*. In this context, the Act No. 172/2005 Coll. requires the funders, administrators of budget chapters and entities that have received funding for research and development from the state budget, to provide data for the information system and for the central information portal on a yearly basis. Another important role of the central information portal is the popularization of science and technology between the professional and the general public.

The information system and the central information portal jointly support the provided public administration services and services in the public interest, and thus represent an information system of public administration (Act No. 275/2006 Coll.). In addition, the data obtained in the information system are an important input for the needs of the state and European statistics in the field of science and technology (Act No. 540/2001 Coll.).

The information system and the central information portal are managed by MESRS, which is responsible for their creation, regular updating of the information and their accessibility via the Internet. The operation itself of the system and related issues are ensured by the Slovak Center for Scientific and Technical Information (SCSTI), which is directly managed by MESRS. In the framework of the administration and operation of the information system, MESRS and SCSTI cooperate primarily with the following tasks:

- developing the concept of IS development,
- ensuring the quality and sustainability of the IS, the effectiveness and adequacy of the use of the information obtained,
- running the IS and providing the software and hardware support,
- regularly updating information and making it available through the information portal,
- adjustment of the performance of the information system and the information portal,
- ensuring the protection of the IS and of the information processed in it,
- eliminating technical deficiencies,
- archiving of all received information.

Further details regarding the information system and the central information portal are specified in the Decree of the Ministry of Education of the SR No. CD-2009-18616/1291-1:11 on the details of the structure, procedure and time limits for the provision of information and operation details of the R&D information system of the Ministry of Education of the SR (hereinafter referred to as „decree"). This decree further specifies the structure of the information system. In the information system, the processed information is categorized into individual modules, which are separate parts from the point of view of the contents, and the information system makes their interrelations. Individual modules are designed to reflect the logical structure of the life cycle of R&D activities.

Central Information System for Research, Development and Innovation

It is necessary that MESRS, as the central state administration body for science and technology, has information on research and development, the implementation of which was supported by the state budget. At the same time, it is also necessary for the information obtained to be presented in an appropriate manner to the professional and general public and to popularize science and technology in society. On the basis of the aforementioned decree, the Central Information System for Research, Development and Innovation (hereinafter referred to as "CIS RDI") was therefore established in 2009, consisting of both the information system for collecting and processing and archiving data (accessible at www.skcris.sk), and the Central Information Portal, representing a publicly accessible interface for presenting acquired data and information (accessible a*t www.vedatechnika.sk*).

This information system is one of so called current research information systems (CRIS), which are in general *"designed to store and manage data about research conducted at an institution or organization and to extract useful knowledge for research management"* (Jeffery, 2004). There are similar CRIS systems operated on the national level in Belgium – Flanders, Czech Republic, Estonia, the Netherlands, Norway, and Slovenia. Moreover, there are several CRIS systems operated at the institutional level in many countries across Europe, for example Austria, Denmark, Germany, Greece, Italy, Portugal, Spain, United Kingdom, etc. (euroCRIS, 2018).

The CRIS systems (including CIS RDI) use a common data format called CERIF – the Common European Research Information Format, which distinguishes between persons, units and projects, with regard to the research outputs, such as publications, patents, and other products (Schöpfel et al., 2017). From the technical point of view, CERIF is a XML data format based on the data model, which allows metadata representation of research entities, their activities, interconnections and their outputs (Turňa et al., 2012).

In line with the abovementioned technical details, the structure of the information system has been designed to cover the required areas of information. The structure of the information system is illustrated in Figure 1, where each rectangle represents one information module, and the arrows indicate the relationships between them within the life cycle of the R&D activities.

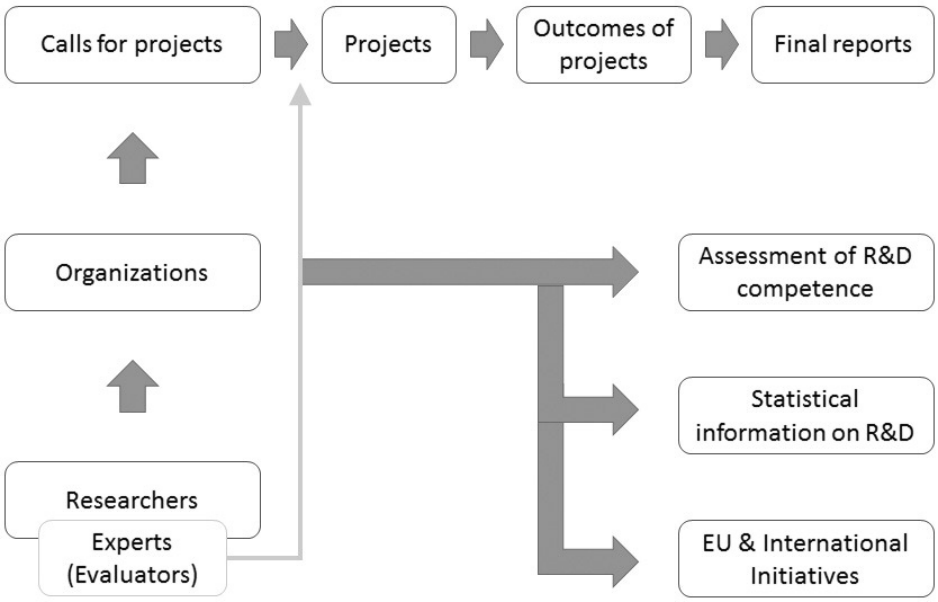


Figure 1 Structure of the CIS RDI about here

Source: Own processing.

The module of Researchers includes a register of R&D personnel in various R&D organizations. The registry includes members of research teams of individual R&D projects as well as those researchers who themselves registered on the portal. A part of the Researchers module is a register of domestic and foreign experts in science and technology, which is used to select professionals involved in the preparation and creation of conceptual materials, to assess projects under individual calls according to the law, as well as other activities.

The module of Organizations contains data on R&D organizations. These include HEIs, organizations of the Slovak Academy of Sciences, sectorial research institutions as well as businesses, natural persons – entrepreneurs and non-profit sector organizations. Each R&D organization submits in accordance with Act No. 172/2005 Coll. an annual statistical report on R&D activity. The module of the Statistical Information on R&D contains these data characterizing the state of the research and development potential, including that used in international scientific and technological cooperation.

In accordance with Section 26a of the Act no. 172/2005 Coll., organizations may also apply for a certificate of assessment of competence to carry out R&D. This certificate is a prerequisite for organizations to apply for funding from the state budget to carry out R&D activities. The module of the Assessment of R&D Competence enables organizations to submit a request for evaluation, upload all required documents, and subsequently allows members of the evaluation committee to access them and submit a rating. The information about the obtained certification is then displayed in the module of Organizations amongst the organization data.

The module of Calls for Projects contains information on public R&D calls funded from the state budget. In accordance with the decree, the provider of the funding is responsible for the content of a public call. Thus, the public can find clear information about the calls from individual providers at one point.

The module of Projects contains information on the individual R&D projects that are being updated during the life cycle of a project by the funding bodies, including information on its results for three years from the end of its project. Updating this data is done on the yearly basis. In addition to basic information on the matter, time and financial framework of the project activities, the information on the projects includes data on the team of researchers (interconnection to the module of Researchers), the organizations involved (interconnection to the module of Organizations) and the results and outputs of the projects (interconnection to the module of the Outcomes of the projects). At the end of the project, the final report is stored within the information system (interconnection to the module of Final reports).

The module of the Outcomes of the projects contains information about project outputs. These include publication outputs, patent and utility model applications, as well as an overview of the technical and laboratory infrastructure procured. This module is directly linked to the module of Organizations and the module of Researchers as well.

The development of the Internet and Information and Communication Technologies as an *"effective channel for sending information and fostering collaborations on a global scale"* (Blanchard, 2011) has greatly contributed to new trends in science and its presentation (Borgman, 2007). For this reason, the CIS RDI, especially its publicly accessible part, plays an important role in popularizing science and technology within the Slovak Republic. At www.vedatechnika.sk, visitors can find up-to-date information from the field of science and technology, information on events held to popularize science and technology, and other important information.

Conclusion

R&D environment in the Slovak Republic is quite complex and contains a large number of players and their interrelations. The need for a constant review of current R&D data, funding sources, as well as the need to present R&D results to the professional and general public has led MESRS as the central authority in the field of science and technology to establish a Central Information System for Research, Development and Innovation. Through this information system, MESRS goals and objectives in the field of R&D information management and provision are met. The system makes it easy to process, present and archive the required information, as well as to spread the information on science and technology amongst the public.

Due to the ever-increasing number of activities, the demands for the provision of information are increasing. The information system is a living organism that is constantly evolving and adapting to current needs. MESRS is constantly striving for its update in terms of contents and technology so that it represents a modern information system that meets all the demands placed on this system from the external environment.

Bibliography

Act No. 172/2005 Coll. on the organisation of R&D State support and on amending the Act No. 575/2001 Coll. on the organisation of the activity of the government and the state authorities, as amended.

Act No. 185/2009 Coll. on the Incentives for R&D and on amending the Act No. 595/2003 Coll. on the Income Tax, as amended.

Act No. 275/2006 Coll. on the information systems of public administration and on amending certain acts.

Act No. 540/2001 Coll. on the State statistics.

Act No. 575/2001 Coll. on the organisation of the activity of the government and the state authorities, as amended.

Baláž, V., Frank, K., Ojala, T. (2018). *RIO Country Report 2017: Slovak Republic.* Luxembourg: Publications Office of the European Union, 2018. 29 p. ISBN 978-92-79-81482-2.

Blanchard, A. (2011). Science blogs in research and popularization of science: why, how and for whom?. In Cockell, M., Billotte, J., Darbellay, F., Waldvogel, F. (dirs.). *Common Knowledge: The Challenge of Transdisciplinarity*. EPFL Press, 2001, pp.219. ISBN 978-2-940222-32-2.

Borgman, C. L. (2007). *Scholarship in the digital age*. Cambridge: The MIT Press, 2007. 360 p. ISBN 978-0-262026-19-2

Decree of the Ministry of Education of the SR no. CD-2009-18616/1291-1:11 on the details of the structure, procedure and time limits for the provision of information and operation details of the R&D information system of the Ministry of Education of the SR.

euroCRIS. (2018). *Directory of Research Information System (DRIS)*. Available online at: <https://dspacecris.eurocris.org/cris/explore/dris>

Jeffery, K. G. (2004). The new technologies: can CRISs benefit? In *CRIS2004: 7th International Conference on Current Research Information Systems*, Antwerp, May 13-15, 2004. Available online at: <http://hdl.handle.net/11366/311>

Lucas, H. C. (1975). Performance and the use of the information system. In *Management Science*, 1975, 21 (8), pp. 908-919, ISSN 0025-1909.

Ministry of Education, Science, Research and Sport of the SR. (2017). *The Report on the state of R&D in Slovakia and its comparison with foreign countries 2017*. Available online at:

<https://www.vedatechnika.sk/SK/VedaATechnikaVSR/Rada%20vldy/11.%20rokovanie%20Rady%20vl%C3%A1dy%209-11-2017/Sprava%20o%20stave%20VaV%20v%20SR%20za%20rok%202016.zip>

Schöpfel, J., Prost, H., Rebouillat, V. (2017). Research Data in Current Research Information Systems. In *Procedia Computer Science*, 2017, 106, pp. 305 – 320. ISSN 1877-0509.

Statutes of the Slovak Government Council for Science, Technology and Innovation.

Turňa, J., Noge, J., Zendulková, D. (2012). The System SK CRIS, Scientific Publications and Theses – Mirror of Slovak Science. In Jeffery, K. G., Dvořák, J. (eds.), *e-Infrastructures for Research and Innovation Linking Information Systems to Improve Scientific Knowledge Production: Proceedings of the 11th International Conference on Current Research Information Systems*, 2012, pp. 211-220. ISBN 978-80-86742-33-5. Available online at: <http://hdl.handle.net/11366/111>

Valacich, J., Schneider, C. (2009). *Information Systems Today: Managing the Digital World.* 4th Edition. Upper Saddle River: Prentice Hall Press, 2009. 624 p. ISBN 978-01-36-07840-1.

L Zendulka (2018), "The Information System for R&D in the Context of R&D Environment in Slovakia". IT*lib.Informačné technológie a knižnice* Special Issue 2018: pp 15 – 20
https://dx.doi.org/10.25610/itlib-2018-0002

Lukáš Zendulka
(Ministerstvo školstva, vedy, výskumu a športu SR)

The Role of Current Research Information Systems (CRIS) in Supporting Open Science Implementation: the Case of Strathclyde

Pablo de Castro

Abstract

CRIS systems are playing an increasingly relevant role in the implementation of Open Access and Research Data Management (RDM) policies at research-performing organisations. This is not just because of the deep insight these systems provide into the workflows that underpin the institutional research activity, but also because they allow an effective teamworking across institutional research support units, which critically include research libraries.

This article describes the way the institutional Pure CRIS is used at the University of Strathclyde in Glasgow to support the implementation of Open Science in collaboration with the researchers themselves and with the institutional Research Office. In terms of training, which is in itself an important and often challenging part of the effort towards Open Science implementation, the key objective is to make researchers aware that all the seemingly independent processes they're being asked to carry out on top of their research activity are interconnected and are part of the same drive towards openness and digital science.

Finally, the paper describes the international collaboration networks for the realisation of Open Science that the University of Strathclyde is involved in and some of the areas where this cross-institutional collaboration is taking place.

Keywords

Open Science; Research Information Management; Open Access; Research Data Management; Scholarly Communications; Current Research Information Systems (CRIS); Institutional case studies

Introduction

A euroCRIS Strategic Membership Meeting was held at CVTI SR in Bratislava on November 21-22, 2017 under the banner 'Research Information and Open Science' [1]. Several contributions to the event addressed the use of Current Research Information Systems (CRIS) for Open Science implementation at research-performing institutions, such as "From data collection to FAIR use in CRIS. The case of University of Vienna" [2] or "OMEGA-PSIR: Institutional CRIS at Polish Universities" [3]. The various case studies presented during the meeting highlighted the increasingly relevant and frequent role that CRIS systems are playing in this domain. By implementing the appropriate workflows for Open Access and Open Research Data policy compliance on top of the often already existing mechanisms for research output reporting to ministries or funders for research assessment purposes, these systems are effectively supporting the advocacy strategies at institutions and specifically at research libraries.

CRIS systems are widely implemented in the UK, where they've become key elements for the institutional reporting to research funders and for the Government's Research Assessment Framework (REF). Partially because of the fast-changing nature of the landscape, there is currently no national-level CRIS directory in the country, but the UK is likely to be the European country with the largest number of fully operational CRIS systems at institutions. There are UK Pure, Converis and Symplectic Elements user groups for the major platforms plus a number of smaller vendors like Worktribe, all focused on delivering the best possible REF reporting features to institutions[1].

Fig 1. Communications around the wcork of User Groups are often informally held over social media

[1] With rare exceptions like this 2014 Converis UK User Group meeting reported at *https://imathull.wordpress.com/2014/03/31/cris-at-thomson-reuters-the-converis-uk-user-group/*, work conducted within these User Groups for vendor-provided CRIS solutions tends to be internally run and not openly reported, even if vendors are gradually staging more open and international user group meeting as their customer base widens, see for instance the recently held Symplectic European User Conference 2018, *https://symplectic.co.uk/events/european-user-conference-2018/.*

These institutional solutions for research information management often coexist with institutional repositories aimed to expose the institutional research outputs to the outside world. The different and complementary character of both kinds of systems has been documented elsewhere [4], so it suffices to say here that the CRIS+IR configuration, with an embedded 'connector' that typically enables the metadata transfer between both systems, is both the most widely implemented and the most effective solution. The University of Strathclyde is running an EPrints-based institutional repository (Strathprints) since 2006, while the institutional Pure CRIS was launched in 2011.

Open Science policies, both for Open Access and for Research Data Management, are typically being issued by research funders like the European Commission or the UK Engineering and Physical Sciences Research Council (EPSRC), which then rely on institutions for their implementation. This is because institutions lie much closer to funded researchers and are ideally placed to design and carry out an advocacy strategy that addresses an increasingly complex policy scenario where different funders have different requirements. With a deep knowledge of the policy landscape and having access to institutional CRIS systems for – at least – metadata validation purposes, institutional research libraries become then the key contact point for Open Science policy compliance. By designing a strategy towards policy implementation that relieves researchers of as much of the administrative burden as possible, libraries find themselves in a privileged position to become the institutional entry point for the Open Science agenda. Furthermore, the kind of research support services being presently delivered in the UK for Open Science implementation rank among the best-valued library services among researchers. At a time when academic libraries are looking for a meaningful role to play in an increasingly electronic future [5], these considerations are worth being kept in mind.

Open Access policies in the UK: a complex landscape

The Open Access policy landscape in the UK and its specific approach to Gold Open Access as per the recommendations of the 2013 'Finch Report' [6] are often perceived to be out-of-synch with the policies and implementation strategies followed elsewhere in Europe. There is however some degree of misunderstanding in this perception. While research funders like the Research Councils UK have financially supported the widespread payment of Open Access publishing fees over a 5-year initiative (2013-2018) whose outcome will soon be assessed, the main driver for this initiative is the conviction that immediate Open Access is the most suitable mechanism for ensuring the highest possible social and economic impact for the results of their funded projects and the most suitable means for enabling an effective knowledge transfer between Academia and Industry [7].

When assessing how much of an outlier the British position on Open Access represents within the wider European landscape, it's worth bearing in mind however that beyond the 'Gold rush', the UK is possibly the European country where Green Open Access is simultaneously being implemented in the most efficient fashion. This is a direct result of the Open Access policy issued by the Higher Education Funding Council for England (HEFCE) in 2014 [8]. This national-level policy is aligned with the recommendations of the EU-funded PASTEUR4OA project [9] with regard to coupling the Open Access policy requirements to the research assessment exercise (the UK Research Excellence Framework or REF). The HEFCE Open Access policy is being implemented in a coordinated way across research-performing institutions in the UK with remarkably high compliance rates since it officially started being implemented in Apr 2016. The University of Strathclyde is for instance registering close to 95 % compliance rates these days in the HEFCE OA policy compliance reports that are produced on a monthly basis to monitor the progress in its application.

This HEFCE Open Access policy states that for a journal article or conference paper to be eligible for the research assessment exercise, its full-text accepted author manuscript must be deposited in an institutional system as soon as possible upon manuscript acceptance and no longer than three months since the actual date of acceptance. The strength of the policy arises from its link to the research assessment exercise – which every Head of Department and Director of Research at the University is extremely well aware of since it directly impacts both the institutional funding and its prestige. This policy means that a sustained effort from the research library to raise awareness of the publications failing to meet the HEFCE policy requirements can result in the gradual integration of this fairly uncomplicated step – the deposit of the full-text accepted author manuscript as soon as possible upon acceptance – into the standard publishing workflow. The goal of an effective dissemination strategy becomes thus to make researchers aware that the publishing process does not finish when a paper is finally published, but when this full-text post-print has been deposited.

Other Open Access policies issued by research funders applicable in the UK include the European Commission's policies for FP7 and H2020 projects and the Wellcome Trust's (see a summary for the main applicable policies in the table below). Both the EC and the Wellcome require Open Access to all research outputs stemming from their funded projects, and both of them offer a two-pronged compliance workflow covering Green and Gold Open Access, making funding available for the payment of Open Access publishing fees or APCs.

Research funder	OA flavour	Brief policy description
Higher Education Funding Council for England (HEFCE)	Green	In operation since 01/04/2016 (implemented since 2014 at Strathclyde). Mandatory deposit of full-text accepted author manuscript no longer than three months since manuscript acceptance. Linked to the UK Research Excellence Framework (REF2021)
Research Councils UK (UK Research and Innovation since 01/04/2018)	Green & Gold	Mandatory OA availability of funded outputs either via the Green or the Gold OA routes. Block grants delivered to research-intensive HEIs to fund Open Access fees for eligible publications (those that acknowledge RCUK-funded projects)
Charity Open Access Fund (COAF): coalition of UK charities led by the Wellcome Trust	Green & Gold	Mandatory OA availability of funded outputs either via the Green or the Gold OA routes. Block grants delivered to research-intensive HEIs to fund Open Access fees for eligible publications (those that acknowledge RCUK-funded projects). Green OA publications need to be deposited in EuropePMC
European Commission – FP7 programme	Green & Gold	Mandatory deposit of full-text accepted author manuscript for projects under Clause 39. Gold Open Access funding available for finished FP7 projects under the OpenAIRE FP7 Post-Grant OA Pilot
European Commission – H2020 programme	Green & Gold	Mandatory deposit of full-text accepted author manuscript for all H2020 projects (plus associated datasets). Gold Open Access funding may be claimed from project grant

Table 1. Main Open Access policies by research funders at the University of Strathclyde

Research funders like the RCUK and the COAF provide block grants for Gold Open Access funding to research-intensive institutions in the UK, under a policy that – as opposite to most Open Access policies issued by national funders in Europe – does not ban the provision of funding for manuscripts accepted in hybrid journals. On top of this, a number of UK universities also have institutional Open Access funds which are often managed under a fully-Open-Access-only or 'no-hybrid' policy.

Libraries typically try to summarize this complex policy landscape and its implications for Open Access funding in their research support websites, often together with the pre-payment agreements that they have signed with specific publishers to simplify the always complex APC payment procedures [10]. There is little chance however that researchers will be able or willing to take the time to explore the implications of this array of policies for a specific publication of theirs. Unsurprisingly, they tend instead to contact their library about a specific accepted manuscript in order to find out what workflow they should follow in order to both comply with the applicable policies and benefit from any of the multiple funding opportunities these offer.

In the absence of an institutional Open Access fund (as it is the case at Strathclyde) that can create a level playing field, a key aspect to bear in mind when examining this landscape is the fact that Open Access funding as offered by the above-mentioned research funders is typically restricted to manuscripts that acknowledge a funded project by any of such funders. This limitation in eligibility automatically creates a significant divide across funded and unfunded disciplines, departments and authors at institutions. Strathclyde being a technical university focused on Engineering and the Sciences, it has very strong research funding streams from stakeholders like the Research Councils UK (and specifically the Engineering and Physical Sciences Research Council or EPSRC), while the amount of funded projects in areas like Biomedicine or – especially – the Social Sciences and Humanities is much lower. The disciplinary bias that this uneven distribution of funded projects creates is very evident on the statistics on number of funded publications and the distribution of funded publishers at the institution.

The situation at non-research-intensive institutions in the country is also worth being separately examined, as these universities where teaching has a higher priority than research are usually not eligible for any block grant that funders typically restrict to research-intensive institutions. The HEFCE Green Open Access policy becomes then a life-saving instrument for research support services at these smaller players, which usually also lack any institutional Open Access funding. Smaller institutions are then unable to exploit the significant value of the Open Access funding opportunities for an optimal researcher engagement strategy as described below. This inevitably results in far lower rates of policy compliance for these institutions.

Open Access implementation at Strathclyde

The Strathclyde strategy for Open Access implementation places the need to comply with the HEFCE Green Open Access policy at its core. This means that for all publications covered by the policy – i.e. journal articles and conference contributions for proceedings with an ISSN – researchers need to create a record in the appropriate institutional system in which the date of manuscript acceptance and the full-text accepted manuscript are included. Since the policy is coupled to the national-level research assessment exercise (REF2021), authors are constantly reminded that in order for their publications to remain eligible for this assessment exercise, they need to be made available in the system as soon as possible upon manuscript acceptance and no longer than three months since the date of acceptance.

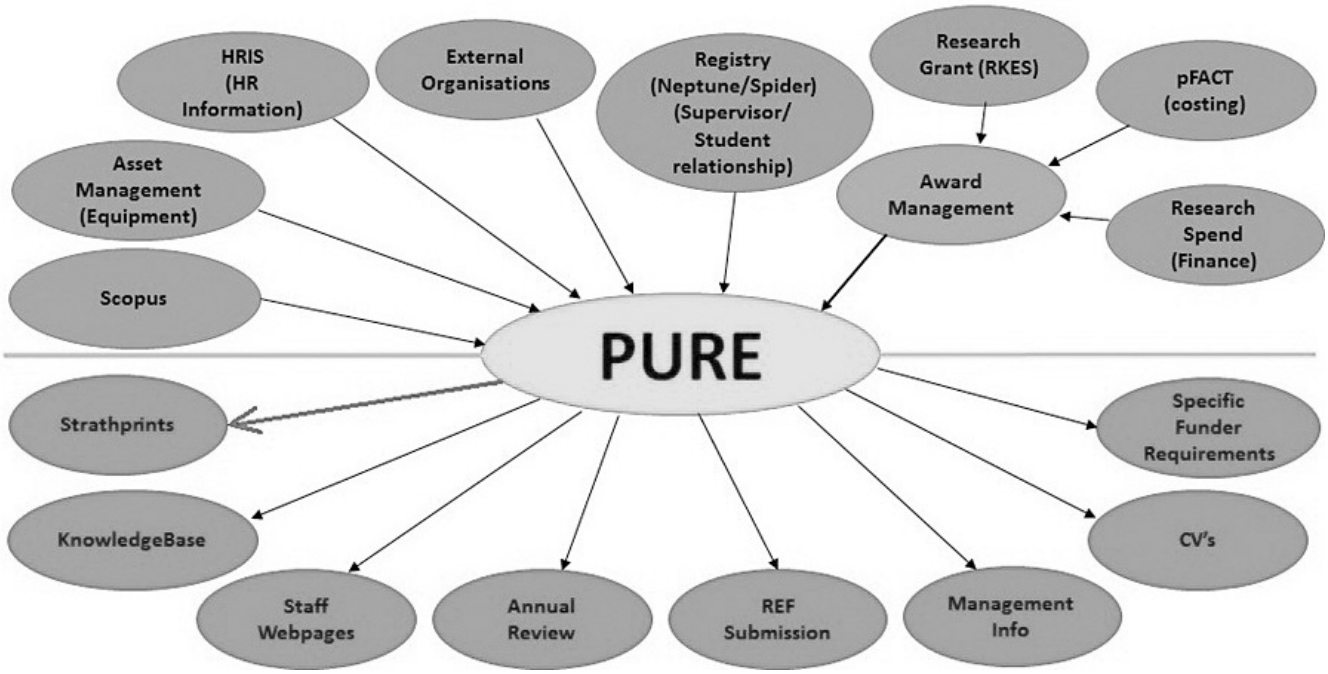


Fig 2. Pure CRIS at the centre of the institutional system configuration at Strathclyde

The institutional system that Strathclyde uses for deposit purposes is its Pure CRIS system. In fact, as shown in the figure above, Pure sits at the centre of the institutional system configuration at Strathclyde. The fact that a CRIS system is used as the default deposit platform both for publications and for research data instead of the Eprints-based institutional repository Strathprints or a data repository has its upsides and its downsides, but the former tend to outweigh the latter ones. Some of the advantages of using Pure as the default system for institutional authors to deposit all their research outputs are:

- By unifying the deposit system for publications and research data, the CRIS system becomes the *one-stop-shop for researchers* to deal with all the administrative requirements to meet the research funders' policies with regard to Open Science;
- Keeping in mind that the CRIS offers additional features well valued by authors such as citation counts, automatic linking between research outputs and funded projects or the possibility of directly selecting the publications to be returned for the REF, researchers clearly see the value of using this system for their regular research administration tasks;
- The Pure user interface is rather friendly and it includes numerous fields where pre-populated information is available, especially in areas like co-authors, affiliations, journals and their deposit policies, projects or related items such as datasets. This, together with the possibility to automatically import metadata from Scopus, makes the process for creating a new record very simple;
- Training on the use of Pure for newly arrived researchers is delivered on a monthly basis via sessions where the Strathclyde Research Office and the Scholarly Communications team collaborate in order to jointly cover all the institutional workflows supported by the platform;
- Pure is not an Open Access platform: this means that researchers needn't worry about depositing an accepted manuscript in it that hasn't been published yet. Every record that gets created needs to be

validated by the library staff before a given Open Access status is assigned to it according to the specific publisher permissions. While the record reaches its turn in the validation queue, it typically remains in 'For validation' status, which does not mean Open Access;

- An accepted manuscript does not get openly released at the institution while it's awaiting validation, but its full-text can be accessed by the Open Access team at the library, who are able to check the funded project acknowledgements it contains and get back to the Strathclyde researcher if the manuscript is eligible for funding;
- Pure also contains specific fields for typing in the APC fees paid for a specific publication. This allows the Gold Open Access-related expenses to be stored in the system;
- There is a large number of institutions running Pure, both in the UK and abroad. This has significant implications both in terms of the cross-institutional workflow re-usability and also for interoperability purposes with regard to third-party solutions like the research funders' ones.

Not everything is optimal though, and a few disadvantages in this configuration can also be mentioned:

- Pure is neither an institutional repository nor a data repository, which means that another system must be used for Open Access (and Open Research Data) policy compliance purposes: this is typically achieved by coupling the CRIS system to an institutional repository (Strathprints in the case of Strathclyde [11]), but the interoperability mechanism (or "connector") that automatically transfers both metadata and full-text from Pure to an Eprints-based repository has numerous issues at the moment [12];
- Fedora-based repositories have it even worse in this regard: there is no operational connector with Pure for them; these connectors are typically only made available for the mainstream solutions;
- Pure is not OpenAIRE compatible, or not yet. While the euroCRIS-led METIS2OpenAIRE project [13] aims to progress in the implementation of the OpenAIRE Guidelines for CRIS Managers, this will still take some time. In the meantime, if the institutional repository is not OpenAIRE-compliant, EU-funded authors may face issues when trying to comply with the EC Open Access policy via the standard workflows at the institution;
- Pure acts as a master system while the repository acts as a slave: this means that the content in the latter is regularly overwritten, making it very difficult to maintain independent collections in it for instance for grey literature;
- While there is a UK Pure User Group where discussions take place regularly among institutional representatives, the requests for functionality enhancements tend to take a long time to be fulfilled due to the very large customer base for the product.

In terms of the role played by the CRIS system for supporting the researcher engagement strategy at Strathclyde the key advantage is its ability to display the links between publications, projects and persons. Because the library is able to match the details for a specific funder policy against the funded project information contained in the manuscripts, it is ideally placed to reach out to institutional authors warning them about an opportunity to have Gold Open Access funded from the library for their manuscript.

This effectively offers an opportunity to couple Green and Gold Open Access implementation strategies: by offering authors a service they value very much (Open Access funding), it is possible to integrate all the Open Access-related advocacy activity, and researchers who have previously received APC funding or are expecting to receive it in the future are far more likely to reply to requests to please upload a missing accepted manuscript or provide a specific date of acceptance that's not in the record for a publication.

Once a conversation begins to take place with a researcher – and these typically start with notifications for possible eligibility for Open Access funding – the chances that any subsequent Open Access-related exchange will be integrated into this conversation are very high. Especially if the library staff are able to get an insight into the specific project funding workflows and publication history for the author. CRIS systems are perfect tools for these latter tasks, since their highly-structured and interconnected data model is precisely designed for this purpose.

It´s also worth mentioning that notifications on Open Access funding eligibility are occasionally turned down by researchers due to issues with high APC fees or simple preference towards Green Open Access, much to the satisfaction of the research support team. It's not so much that there's a widespread support for APC-based Gold Open Access, but rather a question of exploiting the potential benefits it offers for Open Access advocacy purposes.

Institutional Research Data Management workflows

The conversations with Strathclyde researchers that often start with a notification for Open Access funding eligibility will also frequently cover the area of research data management. At Strathclyde the workflows around

publications and research data are processed in a separate way by different members of the scholarly communications team, but they are all sitting together in the same office.

This means that two different conversations that a researcher would need to have with the research support team – on Open Access compliance for an accepted manuscripts and on adequately formatting and having a DOI minted for a supporting dataset – can frequently be merged into a single one, see figure below. This integrated research support for all aspects related to scholarly publishing is highly valued by researchers, who, as they frequently state, are typically too busy doing the research, writing the papers, dealing with the peer-reviewers and arguing with the publishers at manuscript processing stage to be able to take one more layer of issues related to licensing, eligibility for Open Access funding, processing of supporting research data, issuing a data statement or navigating the frequently very complex workflows for APC payment. There is much value in a reliable, efficient service that allows them to transfer the responsibility of these last stages of the publishing cycle onto their research support team. Getting all this extra support in return for just a simple request to please create a record into the system as soon as possible upon manuscript acceptance with the full-text accepted manuscript and a link to any associated datasets in it sounds like a fair deal, and most authors acknowledge this.

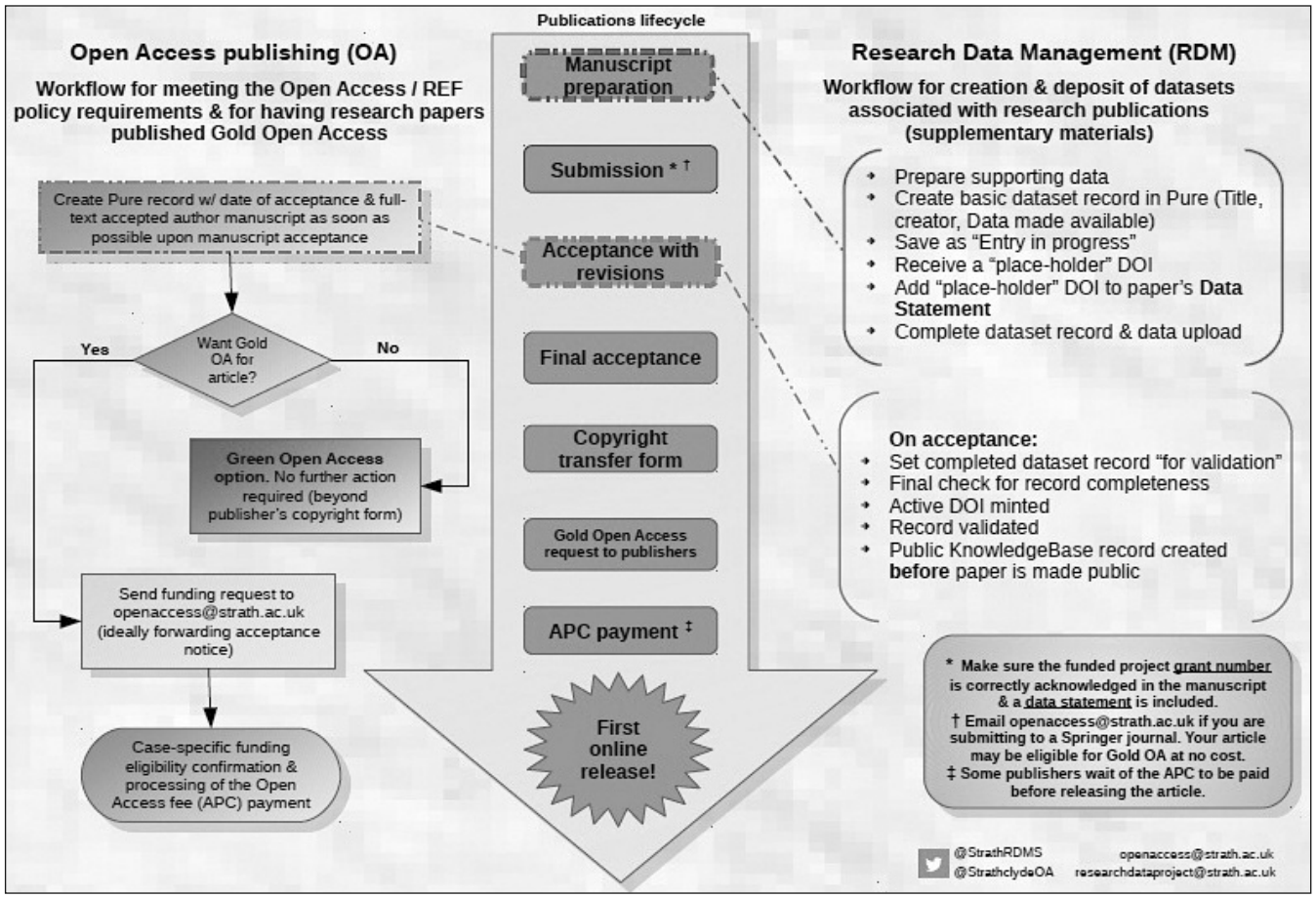


Fig 3. Integrated OA/RDM workflows at the University of Strathclyde

The research data management activity at Strathclyde is again strongly driven by the research funders' policies on the matter. Both the EPSRC at a national level and the EC at European one have clear deposit requirements for research data underpinning a publication [14]. A specific RDM advocacy strategy towards researchers is permanently running at the institution, and it's not unusual that researchers aware of the need to comply with the policies will request specific meetings with the institutional RDM team to discuss the specific approach to Data Management Plans (DMPs) and the wider RDM issues for a specific work. These are perfect opportunities for providing all the necessary information and training to ensure that researchers will in the future be able to deal with the workflows on their own – otherwise the support activity both for publications and for datasets would hardly be sustainable with over a thousand active researchers at the institution.

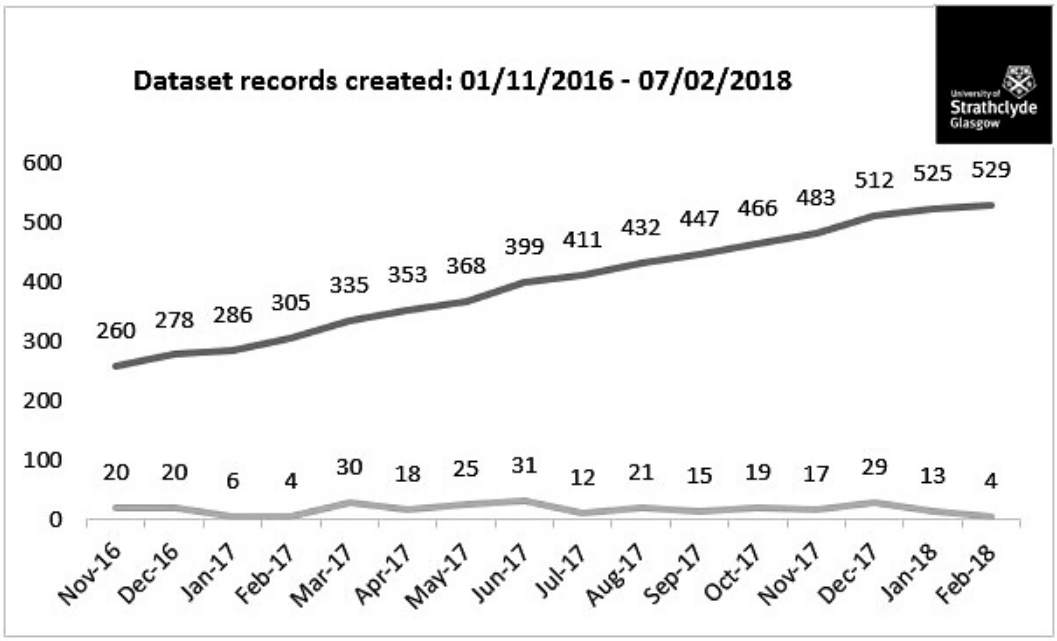


Fig 4. Growth in the number of deposited datasets at Strathclyde (as of Feb 7th, 2018)

The internal coordination within the scholarly communications team at the library is then seen as a key requirement for the research support service towards institutional authors to be as simple and as comprehensive as possible. This is not always easy with a frequent work overload in terms of the sheer number of support requests to cater, but the results provide sufficient evidence for the value of this integrated approach: it's not just that hundreds of datasets have already been stored in Pure and linked to the relevant publications and funded projects (see figure 4 above), but that researcher awareness is steadily growing both on their expected behaviour in the domain and on the existence of a support team ready to help with any query. These include for instance how to proceed with regard to data deposits in external, typically subject-specific data repositories, how to make sure the requirements issued by international funding bodies such as the EC are met or how to deal with sensitive data arising from collaborations with industry.

The emphasis currently made by research funders on aspects such as data deposit or issuing of DMPs and data statement policies remains much lower than for their Open Access-related counterparts. As a consequence, the rates of data policy compliance are also significantly lower than for publications. The figures – for instance for the EPSRC policy – are still fairly healthy and there is a constant monitoring of EPSRC-funded publications to check if there have associated datasets that may not have been deposited in Pure and if there are missing data statements in them. All the notifications and reminders that get subsequently sent to authors of non-compliant items are gradually increasing the awareness and making researchers realise that same as the publishing cycle does not end with the online release of their paper but with the deposit of the accepted manuscript into Pure, the cycle also needs to include an adequate data management practice.

While research funders' policies for Open Access to publications and for data management prove extremely helpful for awareness-rising purposes, the actual goal in both areas is to turn this 'Open Science policy compliance' advocacy mantra into the gradual conviction that *researchers need to do this by default because it's the right thing to do regardless of whether they happen to be funded by a specific funding body or not*. This is quite a challenge and is very much a work in progress, but it's good to know that many institutions are jointly pushing for this in a reasonably well coordinated way, not just in the UK but across the whole of the EU.

Other research support tasks in the scholarly communications area

The main additional research support area that the scholarly communications team at Strathclyde are addressing at the moment is institutional publishing. While there is yet no Open Journal Systems (OJS) platform to support the institutional journals published from the various departments, this is very much part of the plans for the short-term future. In the meantime, the support is targeting publications such as reports, white papers or similar 'grey literature' outputs that are being published by research teams at the institution without meeting fairly basic publishing standards in the areas of licensing or persistent identifiers [15].

This is closely linked to the attempts to gradually raise awareness of the value of alternative metrics and to promote a regular dissemination of research outputs on social media by researchers and departments themselves. Without the appropriate standards of publishing, the potentially very large impact of highly valuable institutional publications becomes impossible to monitor, and such publications get condemned to a certain degree of 'digital obscurity'.

These are particularly useful aspects to raise with researchers in the Social Sciences and Humanities, who remain otherwise cut off (to some extent at least) from the general advocacy efforts around Open Access to publications and research data management. Because of the specific publishing patters in these disciplines, and because there are far fewer funded projects in the domain, researchers in the HaSS often tend to feel detached from the very Engineering- and Sciences-focused advocacy strategies for scholarly communication, and do subsequently feel they're being dragged down a research evaluation path that should not be applicable to their research fields.

The institutional research support team at Strathclyde is well aware of these disciplinary differences, and also of the fact that very valuable research outputs are constantly arising from the work in them – the advocacy around early deposit of full-text manuscripts in the institutional Pure CRIS again helps in their early identification. It is important then to have the right workflows in place to ensure that these publications achieve the kind of visibility and research impact they deserve to have.

Cross-institutional collaboration around policy implementation

When looking at the activity being carried out around Open Science implementation beyond a strictly institutional perspective, one of the most exciting developments that can be seen taking place is the gradual arising of a distributed research support network across institutions (at a national level) and also across countries. This is particularly valuable for dealing – as we all typically do – with multi-institutional, international research outputs at a time when researcher mobility is at a historical maximum. While this distributed research support network is clearly a very ambitious objective in view of the massive differences across institutions and countries in areas like staffing, institutional system availability or the level of support provided by national-level policies, we are gradually getting there.

As an institution running a CRIS system and implementing the integrated approach to Open Science implementation described above, Strathclyde can easily act as a hub in a cross-institutional network. Because the institutional scholarly communications team is able to see the links between funded-project acknowledgements and institutional affiliations, it can provide valuable information to colleagues at other institutions – either national or international – on accepted manuscripts with co-authors "of theirs" in them. Furthermore, online funded project databases like CORDIS for the EC or the RCUK's Gateway to Research [16] allow research support services to draw the links between funded projects and all the external institutions that the team of researchers behind a given project is affiliated with. A well-oiled network of institutional research support services could be able to constantly exchange bits and pieces of information on accepted manuscripts, their deposit for Open Access policy compliance purposes and the payment of their APC fees.

The University of Strathclyde is privileged in this sense to be part of the Open Access Scotland Working Group [17]. This is a rather informal group of Open Access practitioners across Scottish institutions with representation from nearly every university and research centre in Scotland. Members of this group hold 'plenary' face-to-face meetings twice a year where all things Open Access are discussed with a particular emphasis on the implementation of the key HEFCE Open Access policy. A working group mailing list and additional smaller meetings to discuss specifically relevant areas such as research data management or the implications of data protection policies add to the value that this group offers in terms of ensuring an effective communication of research support services and staff across institutions in Scotland.

Besides being a member of this national/regional group, Strathclyde is currently holding the Presidency of the CESAER network of European technical universities [18]. This is an international network of over 50 disciplinary-aligned institutions – a very interesting feature when it comes to Open Access implementation – in 26 countries, mostly European ones. There are several CESAER task forces to allow cross-institutional work on different areas, one of these being the CESAER Task Force for Open Science (TFOS). An Open Access Working Group jointly coordinated from TIB Hannover and the University of Strathclyde runs under the umbrella of this CESAER TFOS. With 15 institutions from 11 countries represented in the group, the monthly coordination calls offer a precious opportunity to explore the kind of collaboration that could be carried out across the all-European network of research support services mentioned above. Also, because of the similarity across institutional research profiles in the group, there are potential opportunities for joint advocacy and technical work in areas like supporting the negotiations around an Open Access clause with big publishers, like OpenAIRE compliance or like analysing and jointly addressing very different national-level policy scenarios [19].

In the framework of the current negotiations around Open Access being held in Germany, one of the key worklines this CESAER working group on Open Access implementation is addressing is the identification of institutional researchers involved in journal editorial committees and the subsequent advocacy strategies to be jointly adopted in this regard. CRIS systems like Pure again offer very interesting features for this identification of members of journal editorial committees at institutions – as long as researchers have delivered that kind of information into their institutional system.

It's also worth pointing out in this regard that although CRIS systems may seem to be all about cross-institutional competition (for funding, for research impact, for the best researchers out there), they can also become extremely valuable tools to support cross-institutional collaboration when appropriately used for the purpose. This tension between competition and collaboration actually underpins the whole current discussion on how to best support higher education and research from institutions and specifically from research libraries, for which collaboration is traditionally one of their strongest assets if not the strongest altogether.

The potential role for a national-level CRIS system

While the description of the institutional Open Science implementation strategy above includes plenty of references to the Pure system at Strathclyde, it is important to highlight that the value of the institutional system lies rather in the fact that it's able to provide the required links between publications, projects, persons and affiliations. This is something that any CRIS solution should be able to do, and while Pure does very effectively cover these relations among different entities, it's far from being the sole solution available.

There's in fact a lot of ground that a national CRIS may also be able to cover in terms of implementing Open Science, especially if backed by the appropriate policies regarding Open Access and research data management. A mandatory deposit of the metadata for publications in order for them to be eligible for national-level research assessment purposes is a valuable asset to start with, even if works much better – as demonstrated above – when reinforced with a policy aligned with the one the European Commission issued for H2020 projects.

Even in the absence of specific Open Science policies and even if the network of institutional systems were partially missing that should support any mandatory deposit at a level much closer to researchers, the main value that a CRIS provides – namely the link between different entities and especially between publications and funded projects – is still there for a carefully populated national CRIS. The effectiveness of the research support effort may obviously be affected by the above-mentioned shortcomings, but such cross-entity link allows lists of publications per project to be produced, and allows the simple identification of research outputs that acknowledge EU-funded projects and should subsequently be deposited into an institutional repository or into Zenodo [20].

Under such conditions, the main area to address in the gradual development of a more functional infrastructure would be system interoperability, both across institutional systems at a national level and with external stakeholders like OpenAIRE. The presence of the Slovak Centre of Scientific and Technical Information next to the German Research Foundation and the Chilean CONYCIT on the list of research funders about to exchange their funded project information with OpenAIRE is in fact excellent news in this regard [21]. Emerging tools to enable an automatic transfer of records across systems based on the co-authors' affiliations such as the OpenAIRE Broker service [22] or the Jisc Publications Router in the UK [23] will significantly simplify the content management side of the equation. The key missing piece will then be to bring the research information management activity as close to the actual research practitioners as possible.

References

[1] Autumn 2017 euroCRIS Strategic Membership Meeting (CVTI SR, Bratislava, November 21-22, 2017), *https://dspacecris.eurocris.org/cris/events/events00976*

[2] Clemens Miniberger, Steve Reding (2017), "From data collection to FAIR use in CRIS. The case of University of Vienna". Autumn 2017 euroCRIS Strategic Membership Meeting, *http://hdl.handle.net/11366/610*

[3] Henryk Rybiński et al (2017), "OMEGA-PSIR: Institutional CRIS at Polish Universities". Autumn 2017 euroCRIS Strategic Membership Meeting, *http://hdl.handle.net/11366/618*

[4] Pablo de Castro (2014), "7 things you should know about… Institutional Repositories, CRIS Systems, and their Interoperability". COAR Repository Observatory, *https://bit.ly/2JhT0KE*

[5] Stephen Pinfield, Andrew Cox, Sophie Rutter (2017), "Mapping the future of academic libraries: A report for SCONUL", *https://sconul.ac.uk/sites/default/files/documents/SCONUL%20Report%20Mapping%20the%20Future%20of%20Academic%20Libraries.pdf*

[6] Janet Finch (ed) (2012), "Accessibility, sustainability, excellence: how to expand access to research publications", *https://www.acu.ac.uk/research-information-network/finch-report-final*

[7] Research Councils UK (2005), "RCUK Position Statement on Access to Research Outputs", *http://www.rcuk.ac.uk/documents/documents/2005statement-pdf/*

[8] HEFCE Open Access policy, *http://www.hefce.ac.uk/rsrch/oa/Policy/* (accessed Apr 3rd, 2018)

[9] Alma Swan (2015), "Open Access policy effectiveness: A briefing paper for research funders". PASTEUR4OA project factsheet, *http://pasteur4oa.eu/sites/pasteur4oa/files/resource/Policy%20effectiveness%20-%20funders%20final.pdf*

[10] University of Glasgow Library (2018), "Open Access to Research Publications", *https://www.gla.ac.uk/myglasgow/openaccess/howdoimakemypublicationsopenaccess/* (accessed Apr 3rd, 2018)

[11] Strathprints institutional repository at the University of Strathclyde, *https://strathprints.strath.ac.uk/*

[12] George Macgregor (2013), "ePrints and PURE : Discussion Paper". University of Strathclyde Discussion paper, *https://strathprints.strath.ac.uk/60311/*

[13] METIS2OpenAIRE project, *https://www.eurocris.org/projects*

[14] European Commission, Directorate-General for Research and Innovation (2015), "Open Research Data as the default: Frequently Asked Questions about the extension of the Open Research Data Pilot", *https://ec.europa.eu/research/openscience/pdf/openaccess/ord_extension_faqs.pdf* (accessed Apr 3rd, 2018)

[15] Pablo de Castro (2018), "Best practices in 'internal' scholarly publishing by Strathclyde researchers", Open Access @ Strathclyde blogpost, *http://strathoa.tumblr.com/post/171628182750/best-practices-in-internal-scholarly-publishing*

[16] UKRI 'Gateway to Research', *http://gtr.ukri.org/* (accessed Apr 3rd, 2018)

[17] Open Access Scotland Group, *https://oascotland.wordpress.com/* (accessed Apr 3rd, 2018)

[18] CESAER Task Force for Open Science (TFOS), *http://cesaer.org/en/projects/task-force-open-science-tfos/* (accessed Apr 3rd, 2018)

[19] A presentation of the collaborative work carried out within this CESAER Open Access Working Group will be delivered in Sep 2018 at the Open Access Tage 2018 event in Graz, *https://open-access.net/community/open-access-tage/open-access-tage-2018-graz/* (accessed Aug 29th, 2018)

[20] Zenodo repository at CERN, *https://zenodo.org/* (accessed Apr 3rd, 2018)

[21] Gwen Franck at al (2017), "OpenAIRE Services and Tools for Open Research Data in H2020". Presentation at the OpenAIRE workshop at the IDCC17, *https://www.slideshare.net/OpenAIRE_eu/idcc-workshop-openaire-services-and-tools-for-open-research-data-in-h2020* (accessed Apr 3rd, 2018)

[22] Pedro Príncipe, Paolo Manghi (2017), "OpenAIRE Dashboard for Content Providers: literature broker service and dashboard demo for repository managers". OpenAIRE webinar, *https://bit.ly/2q2eByL* (accessed Apr 3rd, 2018)

[23] Jisc Publications Router, *https://pubrouter.jisc.ac.uk/about/* (accessed Apr 3rd, 2018)

P De Castro (2018), "The role of Current Research Information Systems (CRIS) in supporting Open Science implementation: the case of Strathclyde". IT*lib.Informačné technológie a knižnice* Special Issue 2018: pp 21 – 30
https://dx.doi.org/10.25610/itlib-2018-0003

Pablo de Castro
(University of Strathclyde) ■

From Data Collection to FAIR Use in CRIS. The Case of University of Vienna

Clemens Miniberger

Steve Reding

Abstract

Current Research Information Systems (CRIS) have been implemented at Austrian Universities, as in many other European countries, with the incentive to account for scientific conduct of Universities. The CRIS at the University of Vienna – u:cris – has been implemented starting with 2012-2013, as a follow-up project of the previously deployed CRIS. It was the main aim of the project to reflect the critique the former system encountered – poor maintenance of profiles, missing options for the presentation of academic profiles.

In addition to the more advanced options for maintenance and presenting of academic profiles, u:cris is used since 2016 as tool for the administrative accompaniment of applications for external funding and the documentation of research projects and related research outcomes. The introduction of a module tracking the activity of applications for external funding and documenting successful applications for research projects at University of Vienna, needs to be considered as a major shift in University of Vienna's governing of academic activities. With the introduction of the module individual researchers can take full responsibility for the representation of the life cycle of their academic research projects, from the application to published research outcomes and media coverage.

In this paper we will briefly introduce the organizational structure of University of Vienna and the position u:cris as a system for the organization and documentation of academic activities takes herein. This will help us elucidate how individual researchers take action in u:cris and how data in u:cris is validated and made available for reporting and presentational purposes at intra- as well as inter-institutional level.

Introduction

University of Vienna, founded in 1365, is amongst the universities with the longest academic tradition in Europe. As of 2018 University of Vienna covers nearly all scientific disciplines excluding Human and Veterinary Medicine, organized along 15 faculties, 4 centers and 19 research platforms that are scattered in 65 addresses all over Vienna. Until April 2018 more than

138.000 research publications have been registered in University of Vienna's institutional CRIS – u:cris. Since 2007 University of Vienna attracted 44 ERC Grants and yearly extramural funds sum up to approx. 80 Mio Euro (as of 2016).

Universities in Austria are run as public institutions mostly financed by governmental block grants. With the introduction of the University Act 2002 (UG 2002) universities in Austria have been endowed with a high degree of autonomy, especially with regard to the structural, functional and epistemic organization of the research they carry out, to the repertoire of research problems that are addressed and concerning the economic autonomy (cf. Estermann, Nokkala, & Steinel, 2011).

Autonomy of Universities in Austria and CRIS

As institutions mainly financed via federal block grants, universities in Austria take the full responsibility for their inner organization and have full control over budgets and tenure of research and teaching staff. Although no formal Research Evaluation System (RES) like in other European countries and most prominently Research Assessment Exercise (RAE) and Research Excellence Framework (REF) in the United Kingdom (cf. Burrows 2012; Felt, Glanz 2002; Wouters, Thelwall, Kayvan, Waltman, de Rijcke, Rushforth, Franssen 2015) or the indicator based system in Australia (Butler 2017, 2003) the autonomy granted to universities goes in hand with full accountability of universities for their financial conduct and scientific performance.

It is only with the implementation of UG 2002 that universities in Austria are required to deliver a yearly report on their financial and academic conduct through an annual Capital report (UG 2002, §13 Abs. 6 and§ 16 Abs. 6) to the federal government. This intellectual capital report aims at providing a complete overview on the structure and activities of Austrian Universities (cf.

Wissenbilanzverordnung 2016), including main research focus, human resources, number of degree programs, number of students, knowledge and technology transfer to society and industry, cooperations with national and international partners and number and character of research achievements in form of publications and academic activities. A further important constituent of university autonomy in Austria is that universities have the opportunity and associated responsibility to contend for extramural funding – beneath basic funding guaranteed by Austrian government.

Thus – beneath the transition of the university from a 'hollow organization' under the governance of the federal ministry for Science and Research (BMWF) towards an organization with increased intra-organizational central managerial control and authority (Gläser, Lange, Laudel, Schimank 2010) – universities see themselves faced with the necessity to compile data on the organization of their research. The secondary purpose of such a system is to inform decision making regarding research goals on an organizational level. Albeit earlier Current Research Information System (CRIS) projects have been initiated at Austrian universities, the use of these has not been mandatory for researchers and in consequence extensive and comprehensive research achievement data was not readily available to university management. Thus, Universities in Austria started implementing a second generation of CRIS, in which from that period on research staff was obliged to register their research achievements, with the incentive to account for their scientific conduct (cf. e.g. Estermann, Nokkala, & Steinel, 2011; Felt & Glanz, 2002; Hug, Ochsner, & Daniel, 2013; Lunn et al., 2012; Sivertsen, 2016).

In 2006 the University of Vienna's institutional CRIS has been deployed as an in-house- development under the acronym RAD (Research Activities Documentation) in order to guarantee for the reporting imperatives against the federal government and to serve as source of data for informed strategic decision-making processes at University of Vienna. RAD has been operated as a system in which individual researchers are held to register their research outcomes in form of publications and academic activities. But otherwise RAD did not offer the opportunity to users to monitor, present or re-use the registered data through a user-friendly interface. Thus RAD – missing intuitive means of maintaining and presenting academic profiles for individual researchers and research entities such as faculties, centers, research platforms of departments – needs to be considered as a black-boxed system that by large has been perceived as a machinery of surveillance by researchers.

Reasons for choosing a commercial CRIS and challenges during the process of implementation

Mainly due to the reasons mentioned above the former system RAD has been replaced in 2013 in favor of a more user friendly and technologically advanced CRIS. Furthermore, the in-house development team could not guarantee for ongoing development and product enhancements because of scarcity of resources. This resulted in the situation that the CRIS developed in house at University of Vienna could no longer either hold up to the expectations of its users nor reach the level of technological refinement that the younger generation of commercially available CRIS were able to provide. In the process of market exploration for an up-to-date CRIS, the central management of University of Vienna favored a readily available vendor system over the (in-house) development of a customized system, as this not only makes allocation of needed resources more plannable but has also been regarded as a booster of acceptance amongst researchers at University of Vienna. The high degree of standardization that comes along with a vendor CRIS was regarded as an important asset by the team responsible for surveying the youngest and most promising developments in the domain of Research Information and Management Systems.

The now deployed CRIS at University of Vienna – u:cris – has been implemented starting with 2012-2013, as a follow-up project aiming at reflecting the main points of critique of the previously deployed RAD building up on the Research Information Management (RIM) software PURE by Atira/Elsevier[1]. University of Vienna has licensed following Modules of PURE: Administration Module, CV Module, Import Module, Custom Portal and Award Management Module.

The process of implementation has been accomplished within four years and was organized along two major phases. First the core modules (Publications/Activities/Master Data) have been taken into operation within October 2012 to November 2013. In the second phase, from 2015 to 2016, the Award Management Module – allowing the monitoring of research projects from the stage of application through the documentation of granted awards and project outcomes – was successfully implemented. The challenges University of Vienna had to cope with have been the scale and complexity of the institution, the unpopularity of the former system - which on the other hand might be considered as helpful – high expectations of involved stakeholders and final users as well as the extensive amount of legacy data stemming from RAD that has been integrated into the new platform.

Nevertheless, the implementation has been successful due to an early and narrow involvement of both management stake holders and individual researchers right from the start of the project. From our perspective

[1] https://www.elsevier.com/solutions/pure

involving all concerned stakeholders – from university management, over researchers to administrative staff at department level – and sensitivity and adaptability to different academic cultures within the project is essential for the success of any institutional reporting tool. This assessment does not only hold for the phase of implementation of a CRIS but is at least as vital for the sustainable operation of the system, that in the end aims at preserving comprehensive information on research processes and achievements. Second the communication strategy – which guaranteed for a high degree of transparency throughout all phases of implementation – has been crucial for the success of the project. It has also been helpful throughout the process that the implementation team could rely on the experience and expertise of team members – from University of Vienna as well as on the side of the software partner – stemming from heterogeneous fields.

Responsibilities within u:cris & primary usage(-s) of the data

Due to reasons related to substantial content of the registered data two different administrative units are responsible for the RIM at University of Vienna. On one side 3,75 FTE at Vienna University Library are handling the central RIM coordination, incident management, the coordination of communication with the software vendor as well as editorial tasks related to Master Data, publications and academic activities. On the other hand side 1,25 FTE at the Research Service and Career Development are responsible for the administration of the Award Management Module within PURE. Finally the Vienna University Computer Center is managing and maintaining the synchronization of staff data from the Campus Management System as well as guaranteeing for the integration of u:cris into the informational environment at University of Vienna.

At large individual researchers themselves are held responsible for registering data in the RIMS and the accuracy and completeness of data. Due to the extensive number of entries and the complexity of the University of Vienna it is necessary to distribute the responsibility for the validation over the university's sub units rather than to implement a central quality management facility at the university level. Our experience has shown that allotting the responsibility for the validation to persons that are in proximity – as well as contentwise as institutionally – of actual research processes is beneficial for the overall quality of data registered in RIMS. In addition to researchers themselves guaranteeing for the entry and validation, specially trained administrative staff located at departments or faculties is in charge of administering data in u:cris. In total about 250 persons are in charge of the validation workflow for publications. About 150 colleagues act as contact points for initial registration of publications and academic activities. Finally approximately 70 persons are in charge of documenting the life cycle of research projects in u:cris.

Primarily the data stored in u:cris are used for reporting purposes and the public presentation of research outcomes – which is deemed a central instrument for increasing the visibility of research carried out at University of Vienna. For all formalized reporting needs University of Vienna runs a central data warehouse including a reporting system building up on IBM Cognos as frontend.

Presentation tasks for the larger part are taken over by the presentation tool built in into PURE and a plug-in tool allowing to display data from u:cris in websites of organizational units of University of Vienna. With u:cris it is possible for users to re-use data once stored in u:cris for multiple purposes and requirements - like generating individual CVs, representation and display of scientific output on diverse platforms. This led to a growing awareness of the importance to actively use u:cris as a resource in scientific processes and not purely as a monitoring tool deemed at satisfying the needs of research managers. This shift might be considered as one of the most important changes within the perception of Research Information Systems in the youngest time. These are no longer perceived as mere tools for the monitoring and surveillance of researchers but actively integrated in research strategies. This switch from an anonymized registry to a productive tool enhancing research processes has also been an important feedback we got from a study about increased visibility in the Social Sciences and the Humanities at University of Vienna (Bayer, Gorraiz, Gumpenberger, Mitterauer, Reding 2017)[2].

Added value of u:cris

In addition to the more advanced options for maintaining and presenting of academic profiles, u:cris is used since 2016/2017 as tool for the administrative accompaniment of applications for external funding and the documentation of research projects and related research outcomes. The introduction of such a tool for the administration and documentation of extramurally funded research projects needs to be considered as a major shift in the governance of University of Vienna as this allows the university's management to assess research processes on an institutional level in form of readily available bits of information that otherwise would remain buried and only available to research collectives directly involved in the disciplinary scientific practices (Gläser, Lange, Laudel, Schimank 2010). Nevertheless, we have to be alert to the fact that while information on

[2] Study available at Zenodo: [1] Increased Visibility in the Social Sciences and the Humanities (SSH). Results of a survey at the University of Vienna. Executive Summary 2017 EN° https://doi.org/10.5281/zenodo.401039

research processes stored in RIMS are a valuable source for the comparative assessment of research entities, the actual practices underlying academic research remain blurred. Instead RIMS transforms information on research processes and outputs into bibliometric indicators which Björn Hammarfelt and Alexander Rushforth identify as decontextualized judgement devices that enable research assessment beyond the boundaries of academic disciplines (Hammarfelt, Rushforth 2017).

Since 2017 the complete lifecycle of third-party funded research projects are stored in u:cris, which means projects are documented and monitored throughout the three core phases of a project – application, grant and project – in u:cris. Here the two initial phases – application and grant – are administrated by research managers at each faculty and the personnel of the departments of Research Services and Career Development, and the facility for Finance and Controlling. Principal investigators have the opportunity to manage and enrich project records, enhancing public display of research projects the research portal of University of Vienna[3].

Next endeavors and Open Access Monitoring

Even if we have highlighted some of the advantages of running a commercial vendor CRIS in the introduction, being relatively standardized and stable tools, also vendor CRIS are not exempt from ongoing adaptation and transformation due to technological and institutional development/change. Some of the next challenges are the development and implementation of an automated interface with SAP – for the moment data for migration into SAP is compiled manually – finalization of the implementation of the Award Management Module and the redesign and relaunch of the university's research portal.

Since 2017 the u:cris team has been involved in a project related to Open Access Monitoring in Austria – which is a sub-project of "Austrian Transition to Open Access AT20A" funded by the Federal Ministry of Science, Research and Economy[4]. One of the main challenges of this project will be the integration of multi-platform CRIS data from Austrian universities into one national monitoring and discovery tool for Open Access research in which CERIF-XML as a technical resource could take an eminently important position (cf. de Castro 2018a, 2018b). From our point of view, it will be institutional CRIS that in the future will play an eminently important role in elucidating the complex and multiple organization of research on a supra-institutional level (van Leeuwen, van Wijk, Wouters 2016) as these need to be considered as only resources able at underpinning the description of the complete research life cycle in any academic discipline with data. Whereas large scale bibliometric databases like Web of Science or Scopus have been extensively used for inter-organizational monitoring and benchmarking in the past, these have clearly been focused on research publications and skewed towards the natural and exact Sciences (van Leeuwen 2013). Hence, if we want to come to terms with a more diverse and rich description of academic processes – including financial data and considerations of societal impact – we will need to rely on data originally registered through institutional CRIS (e.g. van Leeuwen, van Wijk, Wouters 2016; van Leeuwen 2004) in the future.

Literature

BAYER, Florian, GORRAIZ, Juan, GUMPENBERGER, Christian, MITTERAUER, Lukas and REDING, Steve, 2017. *Sichtbarkeitssteigerung In Den Geistes-, Sozial- Und Kulturwissenschaften (GSK). Ergebnisse einr Befragung an der Universität Wien. Report 2017*.

BURROWS, Roger, 2012. Living with the h-index? Metric assemblages in the contemporary academy. *The Sociological Review*. 15 May 2012. Vol. 60, no. 2, p. 355–372. DOI 10.1111/j.1467- 954X.2012.02077.x.

BUTLER, Linda, 2003. Explaining Australia's increased share of ISI publications—the effects of a funding formula based on publication counts. *Research Policy*. 2003. Vol. 32, p. 143–155.

BUTLER, Linda, 2017. Response to van den Besselaar et al.: What happens when the Australian context is misunderstood. *Journal of Informetrics*. 2017. Vol. 11, p. 919–922. DOI 10.1016/j.joi.2017.05.017. vwv@ pl9li kiln

DE CASTRO, Pablo, 2018a. A few thoughts on OA Monitoring and CRISs (I) | euroCRIS. [online]. 2018. [Accessed 4 April 2018]. Available from: https://www.eurocris.org/blog/few-thoughts-oa-monitoring-and- criss-i

DE CASTRO, Pablo, 2018b. A few thoughts on OA Monitoring and CRISs (II) | euroCRIS. [online]. 2018. [Accessed 4 April 2018]. Available from: https://www.eurocris.org/blog/few-thoughts-oa- monitoring-and-criss-ii

ESTERMANN, Thomas, NOKKALA, Terhi and STEINEL, Monika, 2011. *University Autonomy in Europe II. The Scorecard*. Brussels.

[3] https://ucris.univie.ac.at/portal/

[4] http://at2oa.at/

FELT, Ulrike and GLANZ, Martina, 2002. *University Autonomy in Europe I: Changing paradigms in higher education policy. Special Case Studies Decision-Making Structures and Human Resources Management in*. Vienna.

GLÄSER, Jochen, LANGE, Stefan, LAUDEL, Grit and SCHIMANK, Uwe, 2010. Informed Authority? The Limited Use of Research Evaluation Systems for Managerial Control in Universities. In: *Reconfiguring Knowledge Production. Changing authority relationships in the sciences and their consequences for intellectual innovation*. New York: Oxford University Press. p. 149–183.

HAMMARFELT, Björn and RUSHFORTH, Alexander D., 2017. Indicators as judgment devices: An empirical study of citizen bibliometrics in research evaluation. *Research Evaluation*. 20 May 2017.

Vol. 18, no. 5, p. 319–26. DOI 10.1093/reseval/rvx018.

HUG, Sven E., OCHSNER, Michael and DANIEL, Hans-Dieter, 2013. Criteria for assessing research quality in the humanities: a Delphi study among scholars of English literature, German literature and art history. *Research Evaluation*. 8 August 2013. Vol. 22, no. 5, p. 369–383. DOI 10.1093/reseval/rvt008.

LUNN, Brian Kirkegaard, MELCHIORSEN, Poul Meier, THIDEMANN, Nils, KRUUSE, John, HOJ, Anne Lyhne, JENSEN, Sabine Dreier Elgaard, HALADYN, Maria Abildgaard and GREVEN, Anne Marya, 2012. *Research performance management in a CRIS environment: Does research evaluation affect publishing activity?* 2012. Prag: Agentura Action M.

SIVERTSEN, Gunnar, 2016. Publication-Based Funding: The Norwegian Model. In: *Research Assessment in the Humanities*. Cham: Springer International Publishing. p. 79–90.

VAN LEEUWEN, Thed, 2004. Descriptive Versus Evaluative Bibliometrics. In: *Handbook of Quantitative Science and Technology Research*. Dordrecht: Springer Netherlands. p. 373–388.

VAN LEEUWEN, Thed, 2013. Bibliometric research evaluations, Web of Science and the Social Sciences and Humanities: a problematic relationship? *Bibliometrie - Praxis und Forschung*. 2013. Vol. 2, p. 1–18.

VAN LEEUWEN, Thed N, VAN WIJK, Erik and WOUTERS, Paul F, 2016. Bibliometric analysis of output and impact based on CRIS data: a case study on the registered output of a Dutch university. *Scientometrics*. 2016. Vol. 106, p. 1–16. DOI 10.1007/s11192-015-1788-y.

WISSENBILANZVERORDNUNG, 2016. *Verordnung des Bundesministers für Wissenschaft, Forschung und Wirtschaft über die Wissensbilanz*. 2016. Vienna.

WOUTERS, Paul, THELWALL, Mike, KAYVAN, Kousha, WALTMAN, Ludo, DE RIJCKE, Sarah,

RUSHFORTH, Alex and FRANSSEN, Thomas, 2015. *The Metric Tide: Literature Review (Supplementary Report I to the Independent Review of the Role of Metrics in Research Assessment and Management)*.

C Miniberger, S Reding (2018), "From Data Collection to FAIR Use in CRIS. The Case of University of Vienna". IT*lib.Informačné technológie a knižnice* Special Issue 2018: pp 31 – 35
https://dx.doi.org/10.25610/itlib-2018-0004

Clemens Miniberger, Steve Reding
(Vienna University Library, University of Vienna, Austria) ■

Omega-Psir – Institutional CRIS at Polish Universities

Henryk Rybinski
Weronika Kubrak
Łukasz Skonieczny
Jakub Koperwas
Wacław Struk

Abstract:

OMEGA-PSIR is an institutional Current Research Information System, originally developed at the Warsaw University of Technology (WUT). The system is used for presenting the University research in various aspects. It is also used for internal research assessment purposes and is able to report to the Polish Ministry. Since 2013 OMEGA-PSIR has been used as University Knowledge Base[1]. The system has been adopted by 12 Polish institutions. A special User Group has been launched for coordinating the system development. At the universities OMEGA-PSIR operates as institutional repository thus being able to support the implementation of Open Access and Open Science. In addition, it is used as institutional CRIS. In the paper we briefly present the main system architecture and its features. We also focus on the experience of WUT, discussing the organizational matters that have to be solved for heterogeneous sources of information, such as distributed data entry for the bibliographic materials, staff activities and achievements, and theses on one side, and information about the research projects on the other side.

Keywords: *Research management, Knowledge base, CRIS, Digital library, Institutional repository*

Introduction

In 2010, a dedicated project (SYNAT) was launched in Poland in order to address deficiencies in the national scientific information infrastructure. The main SYNAT construction is based on two levels of distributed knowledge bases - with a central database at the highest level, and university databases at lower levels. The ultimate goal of the research knowledge network was to ensure the nationwide dissemination of Polish scientific achievements, and to improve the integration and communication of the scientific community, while also leveraging existing infrastructure assets and distributed resources. The task of finding a solution for the university level in Poland was given to the team of the Warsaw University of Technology (WUT). One of the outcomes of SYNAT was the software OMEGA-PSIR (in the sequel Ω-Ψ^R), designed and implemented by a team of Warsaw University of Technology.

In 2013 the system started working at WUT. In addition, it has been deployed at other eleven academic institutions in Poland[2]. In the paper we briefly present the main system architecture and its features. We also focus on the experience of WUT, discussing the organizational matters that have to be solved for heterogeneous sources of information, such as distributed data entry for the bibliographic materials, staff activities and achievements, and theses on one side, and information about the research projects on the other side. We also present how the organizational problems are solved at other Polish universities with running and developing the system.

Motivation

One of the first steps of the WUT team was to analyze what kind of the system, in terms of functionality, and then software solutions, should be taken into account. Observing contemporary information systems dedicated for institutional research knowledge bases, one can see two main different solutions: (1) on one side, an approach represented by systems like Fedora-Commons or D-space (see e.g. Berman (2008)), which focus mainly on the repository functions, such as storage and indexing of research-related documents, including also aspects of long term durability; (2) on the other side, an approach represented by systems, which are very well suited to the research-centered model of Current Research Information Systems (CRIS).

Institutional repositories are actually a dominating way for building institutional research knowledge bases. The systems within this approach provide rather simple end-user functionality, mainly limited to browsing and

[1] http://repo.bg.pw.edu.pl/index.php/en/

[2] Additional four universities start deploying the system, planning the regular exploitation for beginning of 2019 till mid of 2019.

querying the repositories. They are bibliography oriented, usually document-centric ones, and do not provide end users with any analytical functionalities, or with sophisticated presentation capabilities. Additionally, the data acquisition procedures are rather straightforward, based on human work, or harvesting data from well-defined resources. According to Russell and Day (2010) the main motivations for building institutional repositories are *inter alia*:

1. to provide a showcase for scholarly output from an institution (e.g. facilitating increased visibility; generating indicators of academic quality);
2. to improve dissemination of research output;
3. to ensure the long-term preservation of resources; and
4. to break down access barriers to content (i.e. reforming the scholarly communication system).

However, many authors indicate that achieving these goals with the current repository systems is very problematic. Aschenbrenner et al. (2008) claim that dissemination fails, mainly because the current journal system is seen as the most reliable way towards the academic career. Similar problems with the acceptance level of institutional repositories among researchers have been reported by Davis and Connolly (2007). Salo (2008) has noticed that an IR is "*like a roach motel – data gets in but never gets out*."

A lot of attention has been put recently to the institutional CRIS systems. Nabavi et al. (2016) define CRIS as Research Management Information System, which main goal is to provide a tool for supporting research decision makers (institutional or national, respectively) to carry out the following tasks:

1. Defining research priorities;
2. supporting and automating the process of assigning budgets for research groups, teams, faculties (at the institutional level);
3. evaluating and ranking research institutes based on defined criteria.

This view of institutional CRIS requires that the research be assessed, so, as noted by Bittner and Müller (2011), CRIS systems are very formal – "bureaucratic".

Yet another group of scientific information systems can be observed. Since 2008 one can development of the systems like ArnetMiner, Microsoft Academia, Vivo, or a bit later ResearchGate or Academia.edu. Among those systems, only Vivo can be seen as an institutional one, nevertheless all of them have something common – namely they are researcher-centric, rather than research-centric. In this context one should accept the view of Nabavi et al. (2016), which distinguishes Research Profiling Systems (RPS) from CRIS.

Having in mind all these tendencies, we have decided to integrate within Ω-Ψ^R as many functionalities of all the kinds of the above considered system types, as possible. Fig. 1 shows how the system types evolved into the nowadays scientific information systems. Our motivation has resulted from the first goal, which was to provide a functionality of an institutional system that would cover needs of as wide group of users as possible.

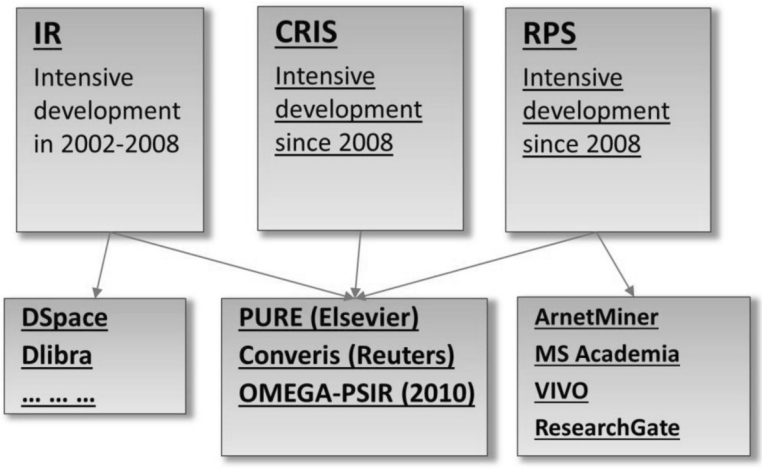


Figure 1 The ways of integrating various types of scientific information systems

From the point of view of data structures, the system is thought to store all the data representing various outcomes of research performed by the researchers. It is compatible with CERIF. The main objects covered

currently by the system are:

1. information about researchers and their affiliations
2. publications (books, articles, etc.),
3. patents,
4. diplomas (B.Sc., M.Sc., Ph.D.),
5. research projects, along with the project documents,
6. multimedia presentations, as well as research data, benchmarks, etc.,
7. other scientific documents (reports, reviews, etc.),
8. other external and/or internal activities),

Functionality of Ω-Ψ^R

The planned functionality was focused to cover needs of all the actors within the university, but also to take into account the needs of external users. For internal users, we took into account the following groups:

1. researchers;
2. students (graduates, undergraduates);
3. university administration;
4. scientific bodies (faculty councils, senate, promotion commissions, etc.); and
5. university managers responsible for research strategies.

Obviously, the needs of these groups vary essentially, and in many cases are even contradictory. For a researcher, one of the important functionalities is to provide access to the published materials (as IR does), but also

to support preparing bibliometric analysis of his/her research activities for promotion (as CRIS does), or for a grant;

to promote his/her research activities to the peers (as RPS does)

Students mainly search for *open access* manuals, whereas the administration is concerned about the completeness of the database and the production of reliable evaluation reports of the researchers, and/or university units, like faculties or institutes.

Yet another functionality is needed for the top management of the university, especially:

1. financial reports concerning research projects;
2. looking for most successful research domains at the universities, best teams, rising stars, etc., but also the weaker research domains, so that a proper development strategy can be worked out for the university (CRIS);
3. visualization of trends in research at the university (CRIS, RPS).

For external users, the role of the system is also multifold, though slightly different. We have taken into account not only academia users, but also:

1. entrepreneurs
2. regional and governmental administration,
3. judiciary
4. regional

To this end, the system should integrate various functions, but special importance should be given to the functions promoting researchers, university units and informal research teams. In this context, the idea researcher-centric approach, especially with the functionality of profiling researchers and university units is of very high importance. In the figure below the profiling functionality is illustrated.

As one can see, various aspects of the researcher activities are presented on the researcher profile. In addition, in order to strengthen cooperation of the university with external world we have implemented the following functions:

1. discovering experts in a given domain, based on their research achievements registered in the knowledge base;
2. finding networks of cooperating researchers.

Figure 2 Visualization of the researcher activities

An example sequence of the steps aiming at discovering best teams involved in research in "data mining" is illustrated in Figure. Here, in the first step a query – "data mining" – is formulated and submitted. As a result, the system provides a list of experts ordered according to a selected criterion (step 2). For the retrieved experts one can see the cooperation graph, which shows a history of coauthoring and/or working in common projects.

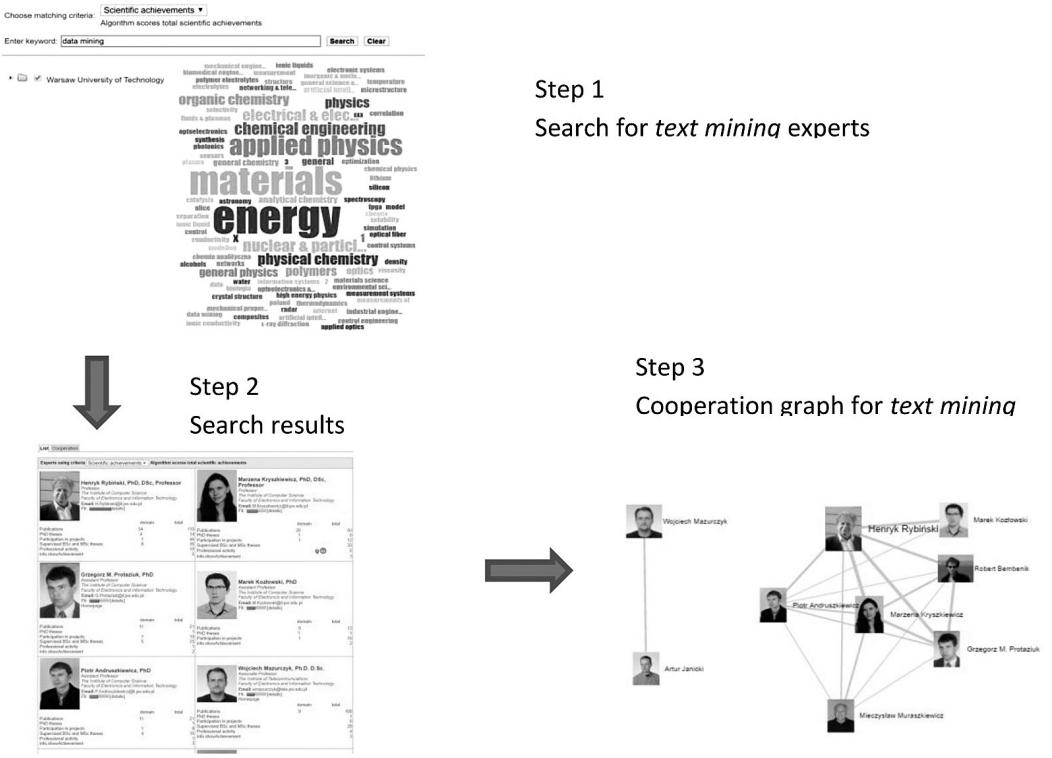


Figure 3 Looking for "text mining" researchers

Technical details concerning the algorithms implementing the above functionalities are presented in more detail by Rybinski et al (2017).

There are also other functionalities that we have taken into account, which aim at reducing costs of maintaining the system exploitation. These are *inter alia*:

1. Interoperability with other systems (Crossref, Scopus, Google Scholar, JCR, OA directories, etc.)
2. Acceptance of various import formats (OAIPMH, BibTeX, XML based formats, etc.)
3. Simple data entry procedures, including autoarchivin
4. Simple data control procedures

One of the main features of the software is its flexibility, so that so that demands for new object types and new relationships can be fairly easy to implement. The flexibility is reflected in providing administrative tools that enable defining new data structures, and then for the new objects make it easy to define new data entry worksheets and new search screens. As a result of a thorough evaluation of the needs of various levels of the academic community, the fundamental features of the implemented software are as follows:

1. the system provides an easy way for:
   a. storing any typed metadata along with digital content
   b. defining custom types of stored metadata
   c. defining relationships between records of different types
2. with the defined data structures (rich in relationships between various objects), there are simple yet powerful means for the maintenance and control of the semantic data network stored in the knowledge database,
3. the system is able to preserve 'historical values' of linked objects in the course of changes,
4. the system provides multiversioning of the data,
5. an efficient full-text search capabilities in both metadata and digital objects is available,
6. the system provides means for automatic generation of highly ergonomic and customizable GUI,
7. the system provides means for an easy integration with external systems, such as SherpaRomeo, Scopus, Web of Science, Scholar and exposure for external search engines,
8. the system provides means for extensive access control mechanisms,

With all the features above, the last but not least, is the multilinguality of the system.

Implementation of OMEGA-PSIR in Poland

The Ω-Ψ^R system has been built iteratively over the period of three years. It was installed in production environment in its early development stages – at the beginning only at Institute of Computer Science, with functionalities limited to the basic repository functions. In the course of the development of new functionalities the system was providing more functions, and was delivered to wider range of users, first, in 2011 at Faculty of Electronics and Information Technology, and then in 2013 to the whole Warsaw University of Technology, still being subject of further development.

Such approach caused that the system was confronted with its users form the very beginning, and the developers were confronted with real user needs, so that when the system was finally ready to be shared with other universities in the form of a complete Ω-Ψ^R package, it was already mature, well-tested and well-documented.

Already in 2013 the functionality of Ω-Ψ^R went beyond the typical functionality of institutional repository towards the functionality of CRIS, additionally the functionalities of RPS have been also implemented. Due to applied intelligent tools (acquisition tools, reporting functionalities), the maintenance efforts of Knowledge Base are essentially reduced compared to the typical solutions. The process of moving the system to the University level was already simpler, as the team had experience with organizational and training issues at the faculty level.

As a matter of fact, at the beginning there was a skepticism coming from the researchers group. In the course of the knowledge base development the researchers could immediately observe their profiles, so that they gradually turned to be more and more keen to contribute to the process of the database maintenance. The main trigger for the staff involvement was the fact that they have noticed correlation between the way the system was presenting their own profiles, and their achievements in the knowledge base. Getting familiar with the integration of repository functions, visualization of research, and reporting the university staff became the first beneficiary of the research knowledge base.

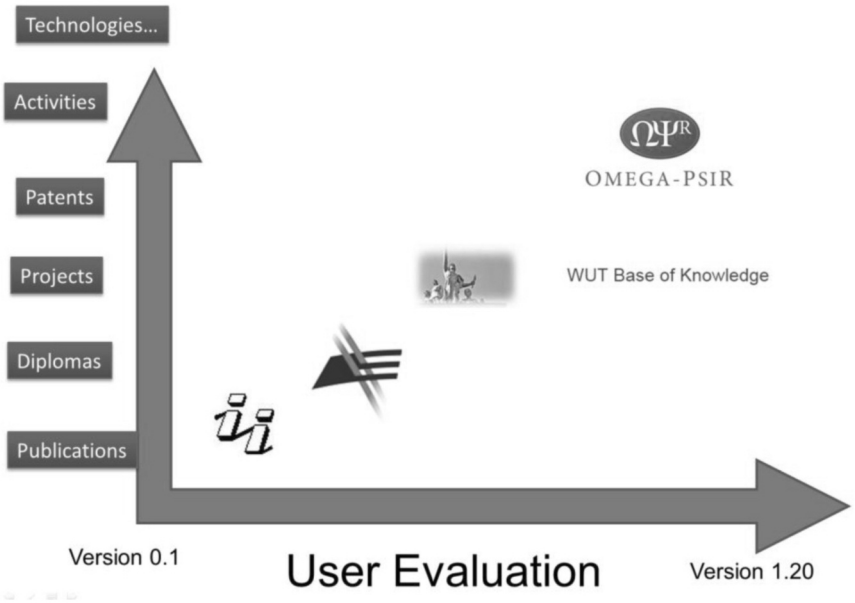


Figure 4 User-driven Development of OMEGA-PSIR

What is important to notice, the cost of the system running is not much higher than the cost of a typical IR. This is mainly because of simplifying the data entry procedures. The data entry processes are performed at the locations where the new information emerges. So, the new publications are registered either by scientists or by faculty editors, the projects are maintained by the relevant university offices.

On the other hand, the effects resulting from using the system just for reporting purposes are quite noticeable. The time gained by using the system reporting features can be efficiently used by the system users for more valuable activities.

In addition, now the system works at 11 other universities in Poland. The main functionalities that have been implemented refer to running the bibliographic data and theses. The database maintenance processes are usually organized in a different way than at WUT, namely the tasks for data entry are performed centrally by the main libraries. In most of the cases, the system is used for reporting to the national evaluation system. There are however steps undertaken towards implementing other "system modules', especially the research projects module.

System usability

Having experienced three years of running the system at WUT, i.e. at the end of 2016, we have decided to verify the system usability thoroughly. To this end, we have performed two types of research:

1. we have prepared a survey research among the active and potential users;
2. in addition, taking advantage of using Google Analytics since May 2013 we have analyzed the Google Analytics data.

Survey research

The background for the research has been provided by Kedzierska (2013). One of the main defined group of the system recipients are research workers from scientific units, research and development units and universities. That is why the questionnaires were distributed among Polish scientific institutions (156 scientific and research and development units, 73 scientific institutes of the Polish Academy of Sciences and 411 public and private higher education institutions). 197 completed questionnaires were sent back (60% from public higher education institutions, 30% from scientific institutes, 4% from private higher education institutions, 4% from research and development units, 1% - others).

Other groups of the academic community were also asked about their opinion. 500 students and 180 doctoral students of the Warsaw University of Technology received the questionnaires and 45 students and 19 PhD students sent back their completed questionnaires. Entrepreneurs, identified at the beginning of the study as an important separate group of stakeholders, were very difficult to analyse. The list of companies cooperating

with the WUT Careers Office was used to create the mailing list and it was possible to collect 20 opinions of entrepreneurs.

Public administration employees were also an important surveyed group. The questionnaires were sent out to representatives of various Polish ministries and municipalities, 314 addressees in total. 22 public administration employees filled in their questionnaires.

In total, 424 opinions were collected. When asked which group will find the data provided by the OMEGA-PSIR system most useful, the respondents indicated that it is mainly employees of Polish and foreign scientific units and universities.

A high level of relevance and usefulness of such data to Polish and foreign entrepreneurs was also indicated. It is worth noting that each group of surveyed beneficiaries declared that the resources would be very useful for them.

All target groups selected in the analysis differ in the way they would use the provided data. Particular attention should be paid to the following groups: universities and scientific units, students and PhD students, media representatives and university management staff.

The results of the survey can be summarized as follows:

1. The largest group of the system recipients are academic staff of Polish and foreign universities and scientific institutions. Open access to full-text scientific publications brings many benefits to both scientific entities and to the whole scientific community. It is important to mention the possibility of multi-criteria search and automatic generation of information about the achievements, areas of interest of individual scientists, units, and teams. All these criteria have a positive effect on intensifying the exchange of scientific ideas and establishing new cooperation between institutes.
2. Another group of recipients are entrepreneurs who, with help of the OMEGA-PSIR system, can cope with the existing barriers impeding the establishment and effective cooperation of science and business. The biggest problem in this area is insufficient knowledge of the entrepreneurial sector related to the areas of expertise of Polish universities, which is also related to the lack of experience and good practices in effective presentation of the university academic achievements and research.
3. PhD students, undergraduate and graduate students, but also and candidates to study, are also an important group. The system is particularly helpful in recognizing the character of the unit and the quality of its services.
4. The system is also helpful for media representatives who can have access to information about experts in various fields, which is necessary to get professional comments on current events.
5. And last but not least important group is the university management staff. Having the OMEGA-PSIR system with the CRIS elements, they have an important tool for assessing the work of individual scientists and teams, and also a tool for developing a scientific policy of the unit.

In addition to identifying the potential stakeholders, the survey also enabled identification of the key needs of potential recipient groups and identification of data types and analytical services in the systems with open access to scientific information. The most important issue for the respondents using these types of systems is free access to the data. They also pointed out that in this context, it is important for them to have open access to as many scientific publications as possible as well as to raw research data. In addition, we have asked for the opinions concerning especially those non-typical ones:

1. graphical visualization of cooperating teams;
2. graphical visualization of profiles of individual researchers or university units;
3. search for experts.

It turns out that researchers evaluate equally high the functionalities of visualizing cooperation between units, researchers, as well as, visualization of the research areas of units and individuals, which is provided in the form of terms clouds.

An overall view of the users preferences is summarized in Table 1:

Google Analytics statistics

The GA data for the WUT Knowledge Base are available since 2013. They show a growing interest for Data in the WUT Knowledge Base. In 2016, some 1,000 sessions per month (10 % of total traffic) were started by users out of Poland, now (2018) the number of sessions started out of Poland reaches 3,000. The geographic distribution shows that the traffic from USA, and EU countries is significant (now more than 15 %).

Services / Groups	Interactive graph of cooperation between faculties	Interactive graph of cooperation between researchers	Visualization of research areas of the university and its units	Visualization of research areas of researchers	Multicriterial search for experts and teams in a given domain
Researchers	7,32	7,43	7,41	7,57	**8,57**
Business	5,15	4,8	6,05	6,2	**8,15**
Public admin.	4,00	3,73	3,95	4,00	5,05
PhD students	6,84	6,89	6,84	**7,37**	**8,21**
Students	6,93	6,67	6,82	6,82	**8,09**

Table 1 Preferences of Ω-Ψ^R services by various user groups

With GA we can assess the statistics for the users' behavior. In particular, we have analyzed the types of the starting screens, and the distribution of the functions used by the users. It turns out that quite a meaningful number of users start their session with the screens that are not available within typical repositories, such as viewing researcher profile (17 percent), the screen for searching experts by domain (10 percent), or the screens with profiles of the university units, such as faculties, institutes, etc. (7 percent).

As an example, Figure 5 below shows behavior of the users from USA in 2013-2016. One can see that in addition to the standard repository functions, users often refer to the function of looking for experts.

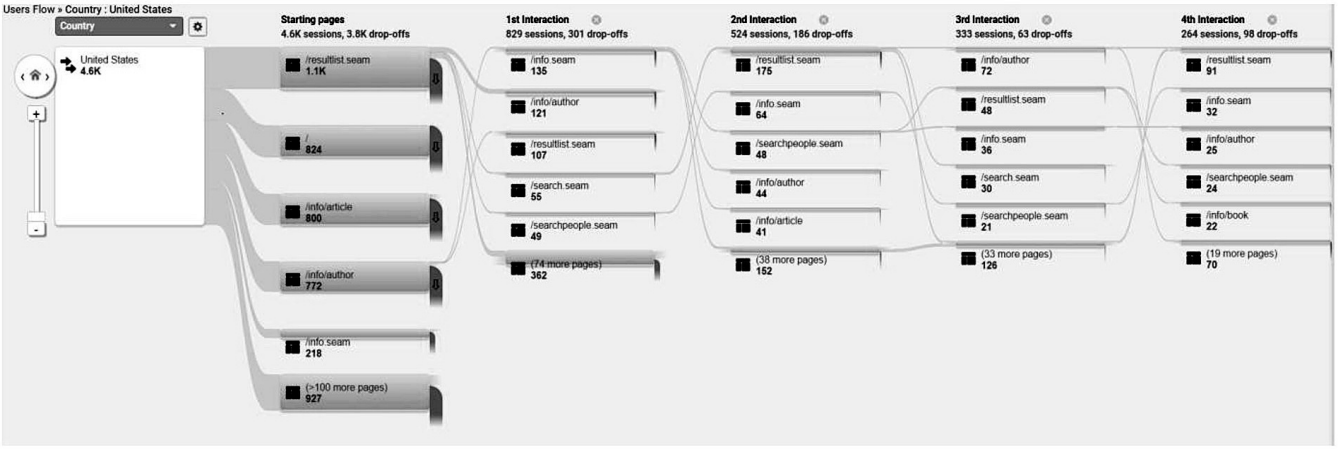


Figure 5 Site-flow for OMEGA-PSIR users from USA

Unfortunately, with the GA data we cannot decide, which groups of users generate requests for these functionalities, but the analysis confirms the results of the survey research concerning high interest in those functions that are not typical for institutional repositories, and result from the researcher-based approach.

Conclusions

One of the lessons learned was that with building an information system, for the first glance looking as a fairly typical one, we have encountered many interesting real-life research problems in such areas like knowledge acquisition and discovery, text mining, or information retrieval.

The Ω-Ψ^R platform has been successfully implemented at WUT as the research knowledge base, and its acceptance level is now very high among various users groups at the University.

A positive evaluation of the system resulted in a high interest of deploying Ω-Ψ^R at other universities. In addition to WUT, the system has been deployed at 11 Polish universities.

What is important, we continue developing the system. Recently we have developed interoperability with Scopus. Also the reporting functionality is subject of further extensions – we aim at providing such tools that administration staff is able to define statistical tables without any intervention from the IT people.

Also, some new functions for the University management are planned. In particular, we plan adding the functionality for looking for "rising stars" (some research in this direction has been already performed.

Acknowledgement

The authors would like to thank Dr Keith G. Jeffery for his constructive comments.

References

Aschenbrenner, A., Blanke, T., Flanders, D., Hedges, M., & O'Steen, B. (2008). „The Future of Repositories?" D-Lib Magazine, 14(11/12), 1082-9873.

Berman, F. (2008). „Got data?: A Guide to Data Preservation in the Information Age", Comm. of the ACM, Vol. 51 No. 12, pp. 50-56

Bittner, S., & Müller A. "Social networking tools and research information systems: Do they compete?" (2011): 1-4.: WebSci '11, June 14–17, 2011, Koblenz, Germany

Davis, P.M., & Connolly, M.J.L. (2007). Institutional repositories: Evaluating the reasons for non-use of Cornell University's Installation of DSpace. D-lib Magazine, Vol. 13, No. 3/4

Kędzierska, E. (2015). Wzmocnione publikacje: nowy model wsparcia komunikacji naukowej. Zagadnienia Informacji Naukowej, (1).

Nabavi Majid, Jeffery Keith, Jamali Hamid R., (2016),"Added value in the context of research information systems", Program, Vol. 50 Iss 3

Rybinski, H., Skonieczny, L., Koperwas, J., Struk, W., Stepniak, J., & Kubrak, W. (2017). Integrating IR with CRIS–a novel researcher-centric approach. Program, 51(3), 298-321.

Russell, R., & Day, M. (2010). Institutional repository interaction with research users: a review of current practice. New review of academic librarianship, 16(S1), 116-131.

Salo, D. (2008). Innkeeper at the Roach Motel. Library Trends, Vol. 57, No. 2, pp. 98-123

H Rybinsky, W Kubrak, J Koperwas, Ł Skonieczny, W Struk (2018), "Omega-Psir – Institutional CrIS at Polish Universities". IT*lib.Informačné technológie a knižnice* Special Issue 2018: pp 36 – 44
https://dx.doi.org/10.25610/itlib-2018-0005

Henryk Rybinski, Weronika Kubrak, Łukasz Skonieczny, Jakub Koperwas, Wacław Struk
(Warsaw University of Technology · Faculty of Electronics and Information Technology, Poland) ■

The Added Value of a CRIS in Archiving Research Data and Registering Data Management Plans
A Case Study of Radboud University and the National Data Archive DANS, the Netherlands

Mijke Jetten

Inge Slouwerhof

Abstract

In 2016, Radboud University (Nijmegen, The Netherlands) and national data archive DANS initiated a project to extend Radboud University's CRIS (METIS) to allow researchers to register and archive their research data in the CRIS, at the same time making data available for reuse at the DANS archive. As we speak (spring 2018), a data management plan (DMP) module is being added, allowing researchers to draft and register DMPs via the CRIS. All modules together offer a one-stop-shop for researchers: data registration and archiving combined with registration of DMPs and articles, uploading full text to the publication repository, linking between results and the creation of researcher's profile pages.

The paper will explain the technical adjustments to the CRIS and DANS systems, and the services guaranteeing FAIR data archiving. This latter also includes services on data curation processes, which secure the quality of the metadata and documentation of the archived data. We use Radboud University as a good practice of the use of CRISs in the research data life cycle. It will be demonstrated that both for researchers and research institutes, a CRIS oriented approach to research data management brings added value.

Keywords

CRIS, Metadata, Research data management, FAIR, Data management plans, Archiving data, DANS data archive

Rationale: the benefits of incorporating research data management in the CRIS

The scientific environment nowadays experiences a shift, prompted by the urge for implementing an open science policy. Proper registration and archiving of data sets resulting from research has become an important issue in the last decade, both for the reason of scientific integrity and potential reuse of data. Key aspects of open science are storage, curation and sharing of research data, and, even more importantly, the FAIRness of research data, based on the FAIR Guiding Principles (Findability, Accessibility, Interoperability, and Reusability of data) (Wilkinson et al. 2016)[1].

Metadata is a highly important aspect of making data FAIR, allowing data to be findable ('data are described with rich metadata', F2 of FAIR) and reusable ('meta(data) are richly described with a plurality of accurate and relevant attributes', R1 of FAIR). Potential re-users can only find, interpret and reuse data based on a rich set of metadata, which describe for example the content, nature, format, language, location and authors of the data set. On the contrary, data lacking proper metadata is hard to trace and difficult to value. Thus, rich metadata is a necessary condition for open science (Mons et al. 2017; Prosser 2003)[2 3].

For researchers, however, providing metadata for research data may be considered a time-consuming administrative task, especially when this implies introducing 'yet another administrative system or interface'. Thus, at Radboud University, the idea was born to incorporate research data management in the university's CRIS, hence creating a one-stop-shop for researchers to register and upload both publications and data sets. This process is described in detail in the paper by Simons et al. (2017).[4] The benefit of incorporating research data management in the university's CRIS is that it is placed in a much broader context, integrating the open science aspects of open access publishing and open data, without having to introduce researchers to yet another system; at Radboud University, at least part of the research staff was already familiar with or even using the RIS interface for researchers.

There are other benefits of incorporating research data management in the university's CRIS, in addition to using only one administrative system. This includes the external visibility of research output, making metadata and linked publications and data sets visible on the researcher's profile page. But it also entails linking to

contextual information, such as research projects and programs, funder information and professional employment history (Schöpfel et al. 2017)[5]. Research output, including data sets, can thus easily be included in the reports of the university's research institutes. Furthermore, a one-stop-shop CRIS solution will help Radboud University's recently appointed data stewards with implementing a FAIR data policy, making open science as feasible as possible.

Overview: the one-stop-shop CRIS solution

Radboud University's executive board stimulated to use the institutional CRIS as the central system and resource for registering and archiving research data. This decision was part of the university's central research data management policy.

Radboud University's CRIS, called Metis, has a long history. About 25 years ago, it was developed by Radboud University itself and it has been used for many years by most Dutch universities, functioning as a kind of national CRIS. With the dawning of Elsevier's PURE CRIS system, the number of other universities using Metis has dropped. Despite apparent financial and collaboration-oriented drawbacks, a benefit is the prospect of modifying Metis at a faster pace, as lesser stakeholders reduce the time spend on discussion and fine tuning between those stakeholders. That allowed Radboud University to modernize Metis over the past few years, adjusting it to the requirements of proper research data management, more specifically making research data FAIR, and during the last year, registering data management plans using the CRIS as well.

In addition to an administration and service desk module, Metis has a separate online interface for researchers. This interface, called RIS (Research Information Services), gives researchers direct access to the registration and management of their research results, among others monographs, articles, annotations, dissertations and lectures. Since 2015, this includes the possibility to register data sets in the CRIS, and, at the same, archiving the accompanying data files at the national DANS archive, without having to enter metadata twice or having to access the separate DANS EASY interface. Relations between data sets and other results, such as articles and dissertations, are part of the CRIS as well. These relations are made visible in the Dutch national publication database Narcis (see https://www.narcis.nl/), via the university's publication repository (Radboud Repository, see http://repository.ubn.ru.nl/).

For the newest feature, drafting data management plans, basic project registration and a data management plan module were added to the CRIS system, allowing researchers to register data management plans and completing the questions posed by funders and the university's research institutes.

In summary, the already existing online RIS interface for researchers was expanded with several functions to provide services for the whole research data life cycle:

- Registration of metadata of data sets
- Uploading data files for sustainable archiving at the national DANS EASY archive
- Linking data sets to publications, and vice versa
- Registration of projects and metadata of data management plans
- A data management plan module allowing researchers to fill in their research data management plans in the CRIS, including a collaboration and feedback function

As will be explained further below, the CRIS not only includes a RIS researcher module, but was extended with a RIS service desk as well. This way, researchers only have to use one administrative system (RIS) and request help, have data curated and ask questions about publication and data management at one service desk (RIS service desk, see http://ris.ru.nl), instead of having to use different systems and different communication channels.

Thus, over the past few years, at Radboud University, the CRIS was developed to act as a central system in the research information landscape. This position of the CRIS as a central pin is depicted in figure 1.

Extending the CRIS: technical and functional aspects

Metis is a Java-based application, including a relational database management system (RDBMS) based on Oracle. There are interfaces with local systems, such as the personnel system, Radboud University's publication repository, the personal profile portals, Web of Science and, for data sets, the DANS EASY data archiving system.

Tools used are Bootstrap, a widely used HTML-, CSS-, and JS-framework for developing responsive web applications/mobile projects; iBATIS, a framework that automates the mapping between SQL databases and objects in Java, .NET and Ruby on Rails; and jQuery, a cross-platform JavaScript library created to simplify the client-side scripting of HTML.

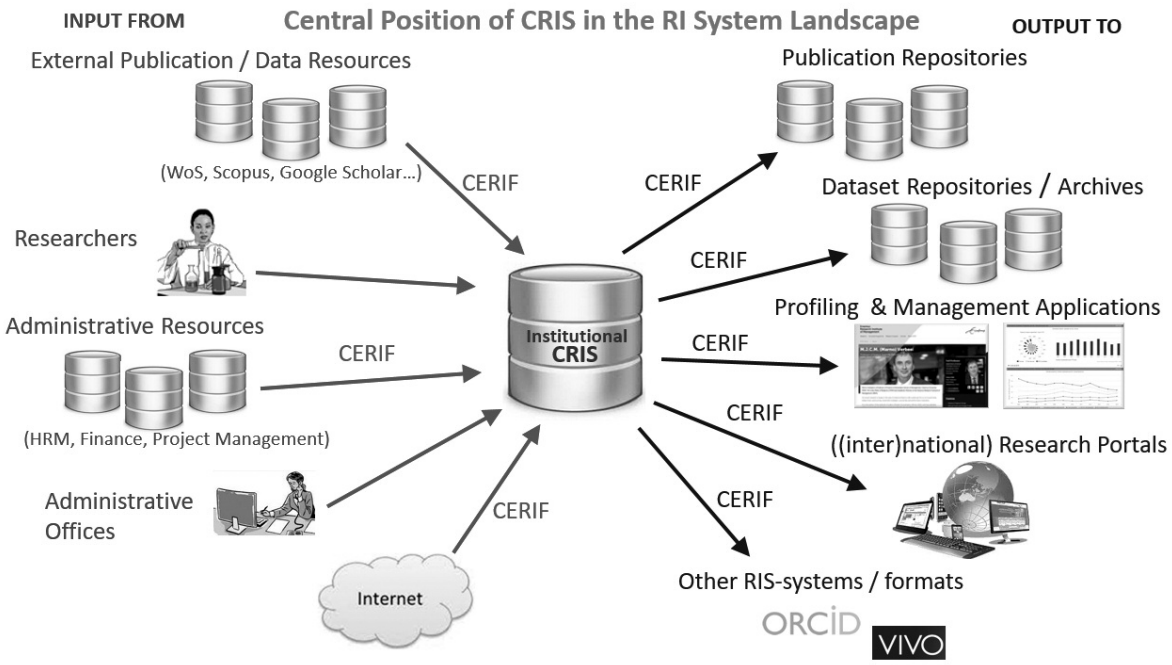


Figure 1 The central position of CRIS in the research information landscape.

The data files are uploaded from the CRIS, using the so-called SWORD-protocol (Simple Web-service Offering Repository Deposit), a lightweight protocol for depositing content from one location to another. It is a profile of the Atom Publishing Protocol, known as APP or AtomPub (see http://swordapp.org/about).

Data is stored in EASY (Electronic Archiving SYstem), the certified long-term preservation archive of DANS (see https://easy.dans.knaw.nl/). EASY offers functionalities for manual uploading data sets as well as bulk import of data. EASY is built upon the Fedora platform and maintained and developed by DANS' technical staff. Currently, EASY contains more than 52 thousand data sets, mainly originating from the humanities and social sciences, but increasingly from other scientific disciplines as well. Principally, data files in EASY are being curated by the DANS data managers, although for the SWORD ingested data files by Radboud University another agreement applies, involving curation by the front office of the archiving institution, i.e. Radboud University's RIS service desk.

A researcher registers the metadata of the data set via the RIS interface and uploads the data files. The files are not directly uploaded to EASY, but in a first stage stored on a local server at Radboud University. The front office at Radboud University Library (RIS service desk) checks the metadata and data files and, if necessary, communicates with the researcher for corrections/additions. Subsequently, the front office initiates the upload to DANS through the upload function in the CRIS. Since data curation is done by the front office, all data sets deposited from the Radboud University's CRIS are published almost directly, with only incidental checks by the DANS data managers.

Metis has a standard (generic) metadata schema for describing the various aspects of a data set. As point of departure, the international DataCite metadata schema combined with Dublin Core (used at the DANS EASY archive) were chosen. Because relevant metadata fields vary between the different disciplines, a wide variety of metadata fields were included in the CRIS, while making only basic metadata mandatory for all researchers.

For the newest feature, drafting data management plans, a question and answering module was added to the CRIS system. It works pretty straightforwardly, but the data management module has all the functionalities the DMP online tool (see https://dmponline.dcc.ac.uk/) has as well, including a collaboration and feedback function. Its strengths are its extensive functions, the connection to Radboud University's personnel system, the option to request feedback from the RIS service desk or the data steward within the tool, and the fact that data management plans are registered in the CRIS. This latter allows researchers to show the metadata on their profile page (in the future, if requested, publishing the plan itself as well) and link it to data sets. Additionally, it enables research institutes and their data stewards to monitor research data management via the content of the registered data management plans.

Support services and workflows

A centralized service desk

A central service desk is an elementary success factor of a CRIS based online interface as a one-stop-shop solution. At Radboud University, it is an expert team at the university library that operates the central service desk. Tasks of the service desk are service level management, quality management, call handling and reporting. It also includes research data management training of researchers and curating archived data sets. Thus, the original publication management services that the library has been providing for many years already have recently been supplemented with the new data management tasks mentioned before; such as, support in the registration of metadata of data sets, assisting researchers in uploading data files for sustainable archiving at the national DANS EASY archive, linking data sets and publications, and offering feedback on data management plans via the new data management plan module in the CRIS.

The front office back office model

An agreement has been made with the DANS archive, in which data sets are archived for the long term. Radboud University Library functions as front office, while the DANS national data archive serves as back office. The front office gives support to system users and trains the researchers in using the system and proper research data management. This also includes curation of the archived data sets. The back office ensures sustainable archiving of research data, provides persistent identifiers and guarantees the availability of research data, including exposure and the findability of research data.

The role of Radboud University Library as a front office has several benefits. First of all, by centralising research data management support, a stable and future-proof solution is created, building expertise in a fast-growing environment of research data management and open science. Additionally, a clear image is formed about the questions and needs that are present in the current research environment at research universities. Lastly, a central support desk could act as a linking pin, having contact with researchers and other stakeholders, and being involved in (almost) all research data management projects at a research university.

As part of the front office back office model, below, we sketch two workflow examples: data management plan checks and data curation. They demonstrate the variety of tasks of the RIS service desk and the embedded role of the CRIS in the research data life cycle.

Workflow example: data management plan checks

Early in the research data life cycle, the university library assists researchers in writing data management plans. For the researcher, drafting a data management plan is generally the first step in the awareness of proper data management and the FAIRness of data. Reflecting on research data management at the start of a research project helps researchers to comply to funder mandates, to make research reproducible, and to comply to privacy laws. Moreover, thinking about research data management in an early stage of the data life cycle helps to make a research project more efficient, and above all, enhances the FAIRness of data.

Radboud University Library, together with the research institutes' data stewards, functions as a central hub in supporting researchers from all disciplines (and more and more often, students as well, as they are the future generation of researchers) in writing data management plans, reading along and giving feedback on the plans written.

At the moment of writing this paper, a data management plan module is being added to the CRIS. Consequently, from this moment onwards, feedback on the plans written will be given using the CRIS, and it also allows for monitoring research data management via the data management plans by the institutes' data stewards

Templates included in the CRIS are the funders' formats and Radboud University's format. All research institutes at Radboud University have a disciplinary research data management policy, supplemental to the university's central policy. To align the data management plan formats to the demands of the various research institutes, we are currently implementing a cross-fertilization of the standard university format with the various research institutes' policy criteria. We assume this will make the drafting of data management plans easier and less time-consuming, and, at the same time, we expect it to enhance awareness of the data management criteria set by the research institutes.

Workflow example: data curation

Researchers at Radboud University use the CRIS based RIS system to archive research data at the national DANS archive. This includes uploading the data files and documentation and entering the accompanying metadata. Before the data set is uploaded to the DANS archive, the metadata, documentation and data files are checked by the RIS service desk. Criteria for that are based upon the before mentioned FAIR Guiding Principles.

As making research data findable is a first step towards FAIRness of data, the metadata are always checked by the RIS service desk. The metadata should be rich, understandable and complete in order for other researchers to find it, understand it and to be able to use it. Furthermore, the data set itself is curated by the RIS service desk. This includes checks and adjustments on the aspects of privacy-protection of the respondents, participants or subjects involved in the data set. Files that are open access accessible to others may not by any means contain privacy-sensitive information which can lead to identification of an individual.

Additionally, it entails rich documentation, as data should be well documented in order for potential other researchers to reuse the data. Variables should be explained in a codebook, syntax files have to be added, questionnaires should be included, and the context, content and structure of the data should be clear to a potential re-user.

FAIR data also entails reusability, and thus data curation by the RIS service also includes checks on the used software and preferred and accepted formats to ensure the preservation and future access of research data.

Feedback by the front office (RIS service desk) to the researcher is communicated and processed, before the dataset is sent to the back office (DANS archive). When the RIS service desk and the researcher are satisfied about the data set to be archived, the metadata and data files are transferred to the DANS EASY archive. A persistent identifier (DOI) is automatically assigned by the back office, including a DOI landing via the DANS EASY interface. The DANS data manager checks data sets incidentally and publishes data sets. The metadata, including the DOI and the access level, is made findable via the DANS EASY archive as well as via the university's publication repository (Radboud Repository). This process is visualized in figure 2. A potential re-user can access the dataset via the DOI landing page at DANS EASY.

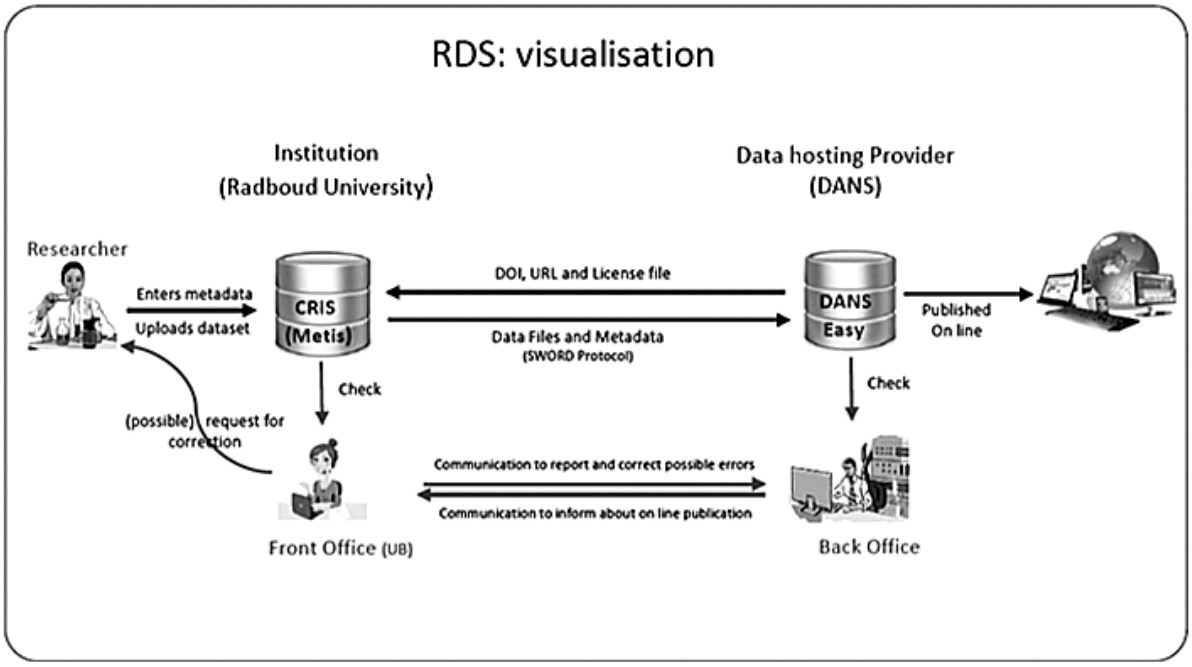


Figure 2 Front office back office model in data archiving at Radboud University

Future plans

At Radboud University, over the past years, steps have been taken to integrate research data management into the CRIS. In figure 1 we sketched the central position of the CRIS in the research information landscape. Adding a data archiving possibility in collaboration with the national DANS archive and the extra data management plan module have been major steps. In the context of the research data life cycle, further steps involving the CRIS can and will be taken over the coming years.

The data management plan module emphasizes the importance of extending the registration of project and funder metadata in the CRIS, allowing the data stewards and research support staff to monitor research data management using the CRIS. Concerning metadata, the main principle is register-once-use-many, and thus efforts are made to connect the local CRIS to the database of one of the major Dutch funders, KNAW-NWO, as well as connect it to the project databases of Radboud University's various research institutes.

For this, we will introduce CERIF (Common European Research Information Format) as XML format to send metadata from and to the CRIS. Ideally, in the near future, all communication between the CRIS and other stakeholders/systems (such as the DANS archive and the KNAW-NWO database) will be built upon the CERIF exchange model of research object and relations.

As part of the research data life cycle, Radboud Faculty of Medicine and the Radboud University Medical Centre have developed a Digital Research Environment (DRE), a cloud-based ICT platform which helps researchers to handle their data and create dedicated and secure workspaces for any kind of data project. Furthermore, the Donders Institute for Brain, Cognition and Behaviour (Radboud University) has created a data repository for internally archiving and publicly sharing research data for the long term. Both systems will surely benefit from exchanging metadata with the CRIS, as it guarantees that data is registered as research output as well. They will benefit from the connection between the local CRIS (Metis) and the national CRIS (Narcis) as well, as data stored in these two systems is or can be made visible and findable through the wider internet as well via the CRIS.

Although making data reusable is a main aspect of the FAIRness of data and a CRIS certainly assists in doing this, internally archiving data for scientific integrity could benefit from the connection to the CRIS as well. This for instance concerns data that can't be made public for privacy or legal reasons, or student thesis data. At Radboud University, in the near future, we will be registering this type of data in the CRIS as well, without making it available for reuse. Using the CRIS enables us to monitor this data over the ten years that it has to be stored, according to the university's central research data management policy.

In all these processes, Radboud University Library plays a central role, as it organizes the service desk for CRIS users as well as helps to further develop the CRIS system to the needs of researchers and policy staff. Researchers as well as data stewards are actively involved in the future plans just presented. As stated before, we benefit from the fact that Radboud University's CRIS (Metis) is self-developed; adjustments can be made relatively fast. Building a one-stop-shop for researchers in the evolving field of research data management requires an adjustable CRIS and iterative processes of discovering flaws and finding solutions.

Bibliography

1. Wilkinson, M.D. et al. (2016). The FAIR guiding principles for scientific data management and stewardship. *Scientific Data, 3*(1). doi: 10.1038/sdata.2016.18
2. Mons, B., Neylon, C., Velterop, J., Dumontier, M., da Silva Santos, L. & Wilkinson, M. (2017). Cloudy, increasingly FAIR; revisiting the FAIR Data guiding principles for the European Open Science Cloud. *Information Services & Use*, *37*, 49-56.
3. Prosser D. (2003). Institutional repositories and Open Access: The future of scholarly communication. *Information Services & Use*, *23(2)*, 167-170.
4. Simons, E., Jetten, M., Messelink, M., Berchum, M. van, Schoonbrood, H. & Wittenberg, M. (2017). 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, 106*, 321-328. doi: 10.1016/j.procs.2017.03.031.
5. Schöpfel, J., Prost, H. & Rebouillat, V. (2017). Research Data in Current Research Information Systems. *Procedia Computer Science*, *106*, 305-320. doi: 10.1016/j.procs.2017.03.030.

M Jetten, I Slouwerhof (2018), "The added value of a CRIS in archiving research data and Registering Data Management Plans. A Case Study of Radboud University and the National Data Archive DANS, the Netherlands". IT*lib.Informačné technológie a knižnice* Special Issue 2018: pp 45 – 50
https://dx.doi.org/10.25610/itlib-2018-0006

Mijke Jetten, Inge Slouwerhof
(Radboud University, Scotland) ■