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

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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 at *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.
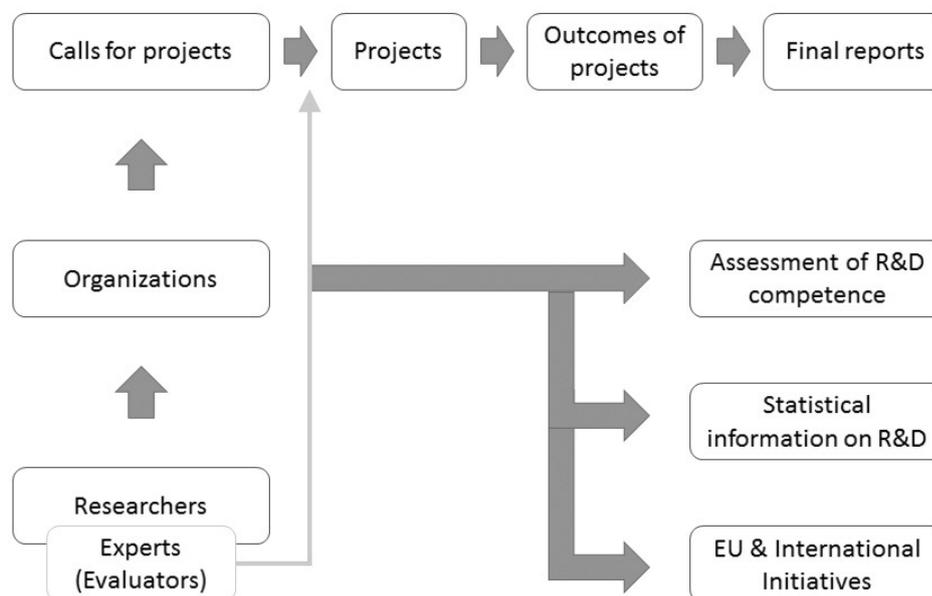

Figure 1 Structure of the CIS RDI about here

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.

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