Cooperation in science and the possibilities of its evaluation based on data from the CRIS database

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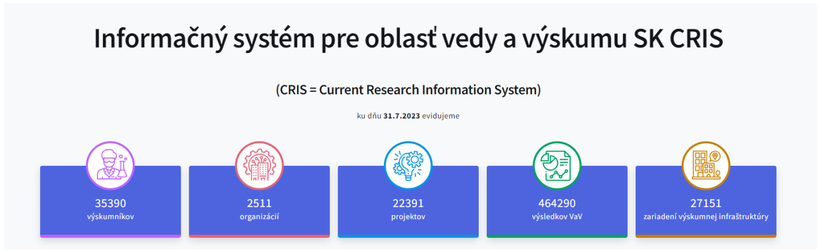

Introduction

Currently, there is no doubt about the importance of cooperation in science and research and its positive impact on the achieved results. Scientific cooperation has become one of the parameters used in science and research evaluation systems.

Cooperation in science is a relatively broad term. Its most frequently used forms are the participation of scientists at international conferences and study stays, the joint solution of research tasks and the presentation of achieved results. If we want to use scientific cooperation for the evaluation of science, then it is necessary to quantify and monitor the mentioned forms of cooperation in science in the form of structured data. This fact is reflected in the parameterisation of indicators focused at scientific cooperation in the evaluation of science.

Aim

We primarily focused on the formulation of indicators for which the data can be obtained from the CRIS system. However, scientific citation databases such as Web of Science and SCOPUS also provide great opportunities for mapping cooperation in science.

The second research task was the evaluation of the obtained information at the national level. Our goal was to identify the extent and directions of cooperation in research between different organisations.

Methodology

In our research, we based our research on available theoretical sources and examples of best practice and established the following procedure:

1. To identify the data about cooperation in available data on science and research. We focused on the information system about science and research SK CRIS, namely on project activities.
2. We focused on the structure, quality and complexity of the available data. The intention was to know whether they are usable for our research.
3. We formulated indicators for the evaluation of cooperation in science:

- Cooperation between two different organisations

- Identification of research consortia

- Academic and private sector cooperation on projects and publications

Data sources

The *Slovak Current Research Information System (SK CRIS)* has the status of an Information system of public administration, defined by Act 275/2006 on information systems of public administration. The Slovak Centre of Scientific and Technical Information (SCSTI) is responsible for operating, maintaining and providing technical support to this system on behalf of the Ministry of Education, Research, Development and Youth of the Slovak Republic. The SK CRIS information system integrates data on research in Slovakia.

For the analysis of publications we decided to use *Web of Science Core Collection (WoS)* which covers the core of the global scientific and scholarly literature.

Results

The result is a case study that clearly characterizes three types of cooperation. The first is the cooperation of organisations on projects and publications in a selected period. The second part of the study identifies research consortia active in solving projects in this period. We have also identified the most active private sector organisations that have collaborated with the academic sector on projects and publications.

We start by identifying a sample of research projects. We chose a period of one year, 2022. The relevant projects had to meet the requirement that their solution started in the monitored year, that it lasted the whole year, or that it ended in the relevant year.

Data from the SK CRIS project database shows that in 2022, Slovak research organisations participated in the solution of 4,266 projects.

Cooperation between different sectors

As the first indicator of cooperation, we chose *the cooperation of the state and private sector* of research and development (including non-profit organisations). Out of the total number of projects solved in 2022, the business and non-profit sector participated in the solution of 322 projects, which is 7.55% of all projects (Table 1).

Identification of research consortia

The identification of research consortia was carried out on the same sample of solved projects, i.e. on projects solved by Slovak research organisations in 2022. The most collaborative projects in 2022 were solved by research consortia where at least one of the partners was from the private sector, shown in Table 2. For comparison, the state sector consortium, which solved the most joint projects, was also mentioned in Table 3

Table 1 Cooperation of state and private sector in research projects

Projects solved in 2022	Number	Percentage share
All	4266	100 %
- **Of this private sector**	322	7,55%
o **One project solver**	190	
o **More solvers from private sector**	9	
o **Cooperation of state and private sector**	123	2,88%
- **Of this state sector**	3944	92,45%

Table 2 Most active research consortia with participation of private sector in 2022

Name of organisations	Number of joint research projects in 2022
Technical University in Zvolen, Faculty of Wood Sciences and Technology, VIPO a. s.	5
First Welding Company, Inc., Slovak University of Technology in Bratislava, Faculty of Material Sciences and Technology in Trnava	4
Slovak Academy of Sciences, Institute of Electrical Engineering, Slovak University of Technology in Bratislava, Faculty of Electrical Engineering and Information Technology	8

For the sake of interest, it can be mentioned that the largest consortium, solving at least one research project in 2022, consisted of 7 organisations.

When evaluating consortia, it is necessary to consider the definitions of a consortium member. In the case of academic organisations a faculty is a member of the consortium. We started assigning the faculty to legal entities in order to better identify the scientific field at the research organisation.

Therefore, let's also look at consortia consisting of (at least) two universities. The evaluation of such cooperation is important in the case of the cooperation of a "traditional" university with a specialized university, for example technical and economic, but also in the case of the evaluation of regional cooperation.

The consortia with the participation of the largest and generally focused Slovak university - Comenius University in Bratislava in 2022 is presented in Table 3.

In order to be able to evaluate the factors influencing the cooperation of universities, it is also necessary to consider their size (i.e. the number of employees) and their overall project activity in the monitored period. These data can be found in Table 4.

Table 3 Most active research consortia of Universities

Universities	The focus of the second university	Number of joint research projects in 2022
UK a STU	Technical sciences	44
UK a EUBA	Economical sciences	13
UK a TUKE	Technical sciences	11
UK a UPJŠ	General focus	23
UK a UMB	General focus	25
UK a UKF	General focus	18
UK a PU	General focus	10

STU- Slovak University of Technology in Bratislava
EUBA- University of Economics in Bratislava
TUKE- Technical university of Košice
UPJŠ- Pavol Jozef Šafárik University in Košice
UMB Matej Bel University in Banská Bystrica
UKF- Constantine the Philosopher University in Nitra
PU- University of Prešov in Prešov
UK- Comenius University in Bratislava

Table 4 Number of employees and project activities of selected universities

Name of University	Number of employees *	Number of research projects in 2022 **
UK	3143	811
STU	1417	524
UPJŠ	1095	279
TUKE	829	319
PU	631	156
UKF	482	151
EUBA	451	129
UMB	415	166

* https://www.portalvs.sk/regzam/ ** https://www.skcris.sk

Table 5 Research projects and publications of selected private organisations

Name of organisation	Number of research projects in 2022	Number of WoS publications since 2019	In this in cooperation with academic sector of Slovakia
VUJE, a.s.	13	38	10
First Welding Company, Inc.	12	2	2
VIPO a. s.	8	16	14
Pulp and Paper Research Institute	7	28	5
MEDIREX GROUP ACADEMY n.o.	5	13	12
GENETON Ltd.	4	93	86
STATON, s.r.o.	3	13	12
ŽP VVC Research and Development Centre Ltd.	2	13	12
REGENMED, Ltd.	2	21	21

Conclusion

When analysing the data, we discovered several facts:

- As part of the evaluation of the cooperation between the state and the private sector, we must note the long-term weak (7,55%) involvement of the private sector in solving research projects. However, the rate of cooperation between the private sector and the state sector reaches around 40%.

- When examining research consortia, we focused on the academic cooperation of universities, but also the intersectoral cooperation of the academic and private sectors. Consortia are formed depending on the overall project activity and size of the university, but also between universities with different focus, as well as between universities with similar focus in different regions. The cooperation between the Comenius University and the Slovak Technical University (44 joint projects: Table 3), which are the two largest universities in Slovakia, dominated. As for intersectoral cooperation, the most intensive in the monitored period was surprisingly in the field of timber sciences (5 joint projects: Table 2). However, given the level of involvement of the private sector in project solutions, we do not have a large enough representative sample, and therefore the results may not be sufficiently informative.

- Looking at the results of the analysis of the project and publication activity (Table 5) of private research organisations, we note that there is no clear correlation between project and publication activity. However, it can be stated that, with a few exceptions, private sector organisations cooperate to a large extent with the academic sector on the publication of research results. It can be concluded that the CRIS system, filled with high-quality and complete data, can also be used for the analysis of cooperation in science and research. Particularly interesting results can be achieved by combining data from the CRIS system and from the scientific publication database, which underlines the importance of the interoperability of different data sources.