

Scientific production by universities

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Abstract. The purpose of this paper is to test the hypothesis that there is a link between the input distribution of students by educational programs in universities to their scientific output and to show the nature of it. Our analysis evaluates the research performance of universities considering the multi-disciplinary nature of institutions and the sustainability of teaching-research nexus. It is innovative in taking this perspective on higher education in Russia.

This study can be used to recognize for instance the weak and strong scientific fields and this information can enrich the knowledge about HEIs in Russia. The findings of this research can be used in several ways by HEI administrators: for redistribution of existing funding system of universities, for restructuring universities teaching programs and for identification of universities' mission. Our findings are not only informative on the individual institutional level but as well as on the HEI system on the whole.

Keywords: Bibliometric analysis, Research performance, Higher education, University missions, Teaching-research nexus.

1 Introduction

In this paper, we will address shortcomings of the assumption that universities are "homogeneous institutions with equal capacity to perform" [1, 2]. The question of the scientific output of the overall higher education system stays less researched and deeply connected to the issue of heterogeneity of HEI in whole.

In contrast to other papers about Russian universities, we will assess the research productivity of the whole populations with special regard to the diversity. Our goal is to test the hypothesis that there is a link between the input distribution of students by educational programs in universities to their scientific output using data about Russian universities the horizontal differentiation in terms of disciplines taught [3] and their publication output as a measure of the production of scientific knowledge. In this paper, we will try to answer questions such as:

- Diversity of students: What is the distribution of students by educational programs?
- Diversity of publication: What is the distribution of published paper?
- Is there any connection?

2 Data

We have two main data sources and the main ones are the Russian Science Citation Index (RSCI) which is a national citation database and the Monitoring of Performance of Educational Organizations. Initially, we had sample size=823 universities that have been registered as an organization in the RSCI. In this paper, we focused on bibliometric indicators such as the number of publications by scientific fields. As for the Monitoring of performance it was used to obtain information about the number of students by study programmes.

3 Methods

For our analysis, we will use fields of science consisting of the following high-level groupings: Natural sciences, Engineering and Technology, Medical and Health Sciences, Agricultural Sciences, Social Sciences and Humanities. We transformed numbers of students and publications to percentages. We used k-Means clustering algorithm for distributions of students and publications by scientific fields. To address our second question about the connection between distributions of students and publications by fields, we calculated the Herfindahl-Hirschman Index (HHI) for educational programs and categories of papers.

4 Results

First, we used the cluster analysis for the distribution of students by scientific fields, then for publications. Second, we suggest types of profiles for universities which are based on HHI computed for students and publications and cluster assignment for universities employing these two measures as dimensions of differentiation. Finally, we present possible configurations of profiles of universities in the connection between the distribution of students and publications by scientific fields.

We would like to show whether those profiles of universities based with different approaches have great consolidations among them or only universities with a specific body of students and publications have an inherent propensity to a specific configuration. Using flow diagram we present connections between different cluster solutions (see Fig. 1). You clearly can see that cluster assignments for universities based on dominating scientific field by students and by publications are in close concordance for universities oriented towards agricultural, medical, technical-classical sciences and less for social, humanities and social-classical, so to speak it is the “great divide” between natural and social sciences.

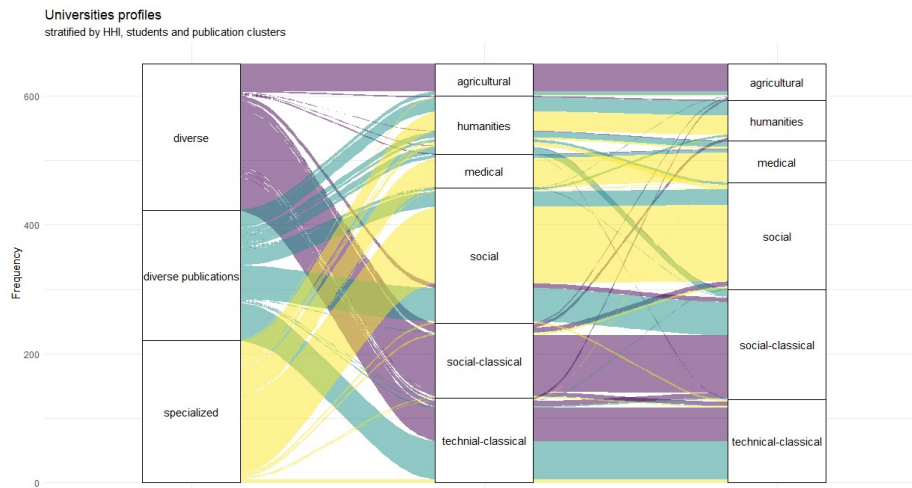


Fig. 1. Scientific production profiles.

5 Summary

To sum up the overview of the insights we gained from our analysis are:

- The high number of universities with the social field as the main profile with specialization in it.
- The universities with different study programmes and publications concentrated only in one field are rare. External links can be detected (for example, technical universities publishing a paper in medicine).
- Migration to publish in close scientific fields (technical universities generate research in fundamental sciences, researchers in social sciences and humanities are also easily cross the border between scientific fields).

References

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