ISI Fever vs ISI Catatonia in Romania. Global visibility of Romanian academic publishing: policies and practices

Sonia Pavlenko

Babeș-Bolyai University, Centre of University Strategy and Quality Management **Cristina Bojan**

Babeş-Bolyai University, Faculty oh Psychology and Educational Sciences

Abstract:

This paper aims at answering the following question: "What has been the impact of the global ISI trend on the Romanian higher education, and how have Romanian universities understood and implemented it?" Furthermore, we analyse whether the ISI fever has led to an increase in the global visibility of published Romanian research. To this aim, we address both the system as a whole (at national level) and one individual university (Babeş-Bolyai University, BBU, selected because it is one of the biggest universities in the country as well as one of the top performing ones and also because of the availability of data). We will use a mixed-method approach based on a dialectic stance, as this framework will allow us to tackle our research question from three distinct perspectives (global, national and institutional).

Keywords: academic publishing, higher education policy, Romania, Babeș-Bolyai University

Introduction

The "publish or perish" mantra has been widely present in Romania, like elsewhere, especially in the last decade, and has always been accompanied by *key words* such as ISI journals, impact factor and so on. All these words could be included under the wider term "ISI trend". Given the prominence of ISI speak at the global level, it was just a matter of time before national and institutional publication policies in the field of higher education in Romania would come to include provisions referring to ISI, or an ISI-related term, at least.

Romania's relationship with ISI articles and journals could be labelled as "complicated". In 2006, two separate state officials expressed publicly their view that Romania's higher education system was mediocre at best (Frangopol, 2006; 2007). Moreover, at that time there were only 16 journals in Romania indexed in the ISI Web of Science. However, the state of the system slowly began to change, despite the small amount of funding meant to support research.

Romania's universities fare poorly in internationally prestigious rankings, such as the Academic Ranking of World Universities (ARWU – Shanghai), Times Higher Education Ranking or QS World University Ranking, with no universities being ranked in the top 500, considering that the national higher education system includes over 100 higher education institutions (of which slightly more than half are public universities¹).

Nevertheless, data for the decade 2001–2011 published by the National Science Foundation (2014) show Romania performing quite well in fields such as math, chemistry, physics, informatics and engineering, where the number of articles published in the SCI per capita is above the global average (and in math it is even double the

¹Functional analysis of the Higher Education Sector in Romania, available at: http://www.invatamant-superior.ro/wp-content/uploads/2013/08/Analiza-Functionala-a-Sectorului-Invatamant-Superior-in-Romania.pdf, page 56.

global average) and underperforming in fields such as medicine, biology or social sciences, where this indicator is five times smaller in Romania than the global average (according to the calculations made by Corlan, 2015). "The number of articles of any kind has increased in Romania on average by 5.8% per year, from 927 in 2001 to 1626 in 2011, in comparison to a global average of 2.8% per year" (Corlan, 2015:116). In 2012 Romania ranked 41st among 238 countries according to the number of citable documents in SCImago Journal & Country Rank (Sandu, 2013).

Unfortunately, public funding allocation for research has been rather unpredictable, with numerous changes being brought to the legal framework (in a speech made by President of Romania Klaus Johannis in Parliament on 16th September 2015, he mentioned that the Law of Education passed in 2011 had been amended 26 times up to that point).

One could wonder why, despite the obvious lack of predictable funding, publication visibility has increased in such manner as described above over the course of the last decade. These results can be connected with reforms being implemented at several levels and reflected in changes in institutional or national policy that were aimed at mirroring global trends. Many times, however, these changes have proven to be too sudden at both national and institutional levels, causing academics to either adapt quickly to them or to lapse into a state of apathy or catatonia and ignore them altogether.

In this paper we start from the more general context in which publishing policies became relevant in Romanian higher education system, then we analyse their rise in importance and the formal requirements they were accompanied by, and finally we explore the manner in which academics relate to them.

Publishing Policies Context in the Romanian Higher Education System

Publishing Before 1989

Before 1989, the Romanian system of higher education was organised according to the guidelines of the communist regime that was in power. In the extremely centralised system, everything had to be "within the guidelines", including writing and research. Communist restrictions went as far as to stipulate how many hours an academic had to spend on research weekly (12 of the total 40) (Sadlak, 1990: 58).

In the early 1970s, the regime introduced the doctrine of the integration of education, research and production (Sadlak, 1990:58), which viewed all three as a unitary process, and "academic research was required to serve as a source of directly applicable practical solutions to the economy" (Sadlak, 1990: 59), which led to a sharp decrease in fundamental research activities. With programmes detailed per hour, academics were neither supported in nor encouraged to publish competitively. As a matter of fact, Sadlak (1990: 59) mentions that the communist regime required all typewriters to be registered with the local office of the militia.

Romanian higher education institutions were seen as a supplier of trained personnel, in correlation with the needs of the socialist planned economy. Furthermore, Romanian academics' participation and membership in the international academic organisations was found to be the lowest even among the socialist countries of Eastern and Central Europe (Sadlak, 1990: 66).

The predictions made by key decision makers of that time (such as Ministers of Education), for example that Romania was going to catch up with other countries in a period of time ranging from "extremely short" to 20 years, point to the fact that there was awareness of the fact that the system lagged behind.

Publishing After 1989

After the fall of the communist regime in 1989, the Romanian higher education system started again on the path of "catching up" with the Western world. Among many other changes, the freshly conquered academic freedom meant that academics were now free to carry out research in any topic they were interested in, be it fundamental research or applied, or of any other kind. One of the rectors of Babeş-Bolyai University (BBU) stated that the manner in which research was carried out at BBU changed radically after 1989. "Experimental and fact-finding research and theoretical models expanded" (Marga, 2005: 288). Research was no longer directed by the state.

However, during this period, carrying out research did not automatically translate into publishing. Being a researcher could also mean that one would transfer the knowledge gained directly to students through teaching and/or publishing a handbook for the courses one taught, and maybe, by the end of one's academic career, an *Opera Magna* book.

Research Question

This paper aims at answering the following question: "What has been the impact of the global ISI trend on Romanian higher education, and how have Romanian universities understood and implemented it?" To this aim, we address both the system as a whole (at national level) and one individual university, Babeş-Bolyai University, selected because it is one of the biggest universities in the country as well as one of the top performing ones and also because of the availability of data². We use a mixed-method approach (Greene & Caracelli (2003)³ and Teddlie &

²Recently Babeş-Bolyai University has been ranked as the most transparent university in Romania.

Tashakkori (2010)⁴) based on a dialectic stance, as this framework allows us to tackle our research question from several perspectives.

We explore the research question on three distinct levels, namely a global perspective, a national level and an institutional one, in sections organised around one important issue. The global level will serve as a point of reference while the institutional level will provide a case study of a university that has gone went beyond the national requirements in its bid to achieve international prestige. The interplay between the three levels will allow us to highlight a number of key topics that are relevant at both national and institutional levels.

How Did Publishing Become Important?

At a global level, publishing metrics have gained importance (see Blommaert et al., 2005), as they are one of the easiest to quantify in terms of research output. They are also a fundamental component of what is defined as a "World Class University" (WCU). In 2014, Times Higher Education⁵ proposed a list of six characteristics making up the "formula" for a WCU: annual income, student-staff ratio, percentage of international staff, total research income, a high percentage (43%) of its research papers published with at least one international author, and percentage of international students.

"The concept of a world-class university reflects the norms and values of the world's dominant research-oriented academic institutions—especially those of the United States and the major western European countries" (Altbach, 2003), and the easiest-to-quantify indicators

³Greene, J. C., & Caracelli. (2003). Making paradigmatic sense of mixed methods practice. in Tashakkori, A., & C. Teddlie (Eds.), *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, CA: Sage Publications.

⁴Tashakkori, A. and C. Teddlie (2010) *Sage Handbook of Mixed Methods in Social & Behavioral Research*. Thousand Oaks, CA, Sage Publications.

⁵https://www.timeshighereducation.com/world-university-rankings/news/the-formula-for-a-world-class-university-revealed.

related to research are the amount of funding associated with research and publication metrics. Research-oriented universities have two major missions: on the national level, they need to make a contribution to culture, technology and society andat the international level, to make the connection with the global, intellectual and scientific trends (Altbach 2011:65). Altbach (2003; 2011) speaks of a global trend where each country wants its own global university/-ies, even if this goal is next to impossible to achieve.

However, research *per se* is not enough to achieve global visibility or WCU status. "Although the research *quantity* of the top-ranking universities is important, the crucial factors that assure international prominence are the *quality* and the *significance* of this academic research." (Tai, 2007: 41).

At national level, publication-related metrics were introduced only in the last few years. The reasons for this lagging behind could range from the fact that the majority of internationally published articles are in English (and senior academic are most often proficient in French or German rather than English) to the fact that Romanian research output, after a long period of artificial separation because of the communist regime, still needed some time to "catch up".

There have been a number of attempts to evaluate research carried out within universities and to allocate funding according to their research performance. Starting with the year 2000, the universities in Cluj and Iași initiated a process of developing a set of criteria for ranking Romanian universities at national level. These were echoed by a Ministerial Order of 2008, which set up an "Institutional Development Fund", awarded competitively, aimed specifically at the Romanian universities aiming for WCU status. However, due to lack of official support, this instrument has never been adequately implemented (Moraru et al., forthcoming).

In the case of BBU, the university focused on research and publication before any strategy in the field was implemented at national level, by developing an algorithm for a differentiated allocation of

financial resources (according to research performance indicators). At national level, the differentiation of higher education institutions based on performance relied mainly on the inclusion of quality indicators in the funding mechanisms.

At the institutional level, BBU's Strategic and Operational Plans⁶ reveal that publishing quantity and quality slowly became more important as the university attempted to increase its international reputation. Consequently, strategic developments regarding internationalisation, using English as a predominant language of research and publishing, attracting research funding and achieving visibility at global level have been key factors in BBU's attempt to become a contender for the title of WCU.

Formal Requirements

At international level, publication is a natural part of every academic's professional life. Every academic has the chance to showcase their proficiency and scholarship in the field by publishing. Lecturing may be a manner of passing onward information to a limited public (those who attend the lecture), but publishing theoretically has no limits as to how far or wide an audience can be reached.

At the national level, Romanian legislation in the field of education gradually incorporated publications as requirements for applying for an academic position.

The first law of education passed after 1989 was Law No. 84 of 1995; it was accompanied by the Statute of Teaching Personnel. The latter included the requirements for occupying an academic position in a higher education institution, namely a PhD title for the positions of Professor and Assistant or Associate Professor and/or be enrolled as a PhD student for the positions of Lecturer or Assistant Lecturer. Another mandatory requirement was "seniority"/experience in the field, usually

⁶Available in Romanian at: http://www.ubbcluj.ro/en/despre/strategii/strategii.

within the national system of education. Academic positions could be held only by Romanian citizens.

Two other important laws in the field were Law no. 288/2004 which implemented the three cycles of the Bologna process in Romania and Law no. 1/2011 (also known as the National Education Law). The latter stated explicitly that academic positions included teaching hours and research hours, as well as the minimum requirements for holding any academic positions. These made reference to a minimum number of publications (and a number of minimum criteria for these publications, such as being published in a journal indexed in an international database) for each position and stated explicitly that any person, regardless of citizenship, can be hired by the university if adequately qualified. Furthermore, it gave the universities the freedom to set up their own criteria on top of the minimum requirements set at national level.

The National Council for the Certification of Higher Education Titles, Diplomas and Certificates (Consiliul Naţional de Atestare a Titlurilor, Diplomelor si Certificatelor Universitare – CNATDCU), tasked with setting the minimal criteria at national level, only set such requirements for the higher academic positions (Professor and Assistant/Associate Professor)⁷. These criteria are calculated according to an algorithm specific for each major field of study. In comparison, BBU set its own requirements⁸ for the position of Lecturer, for example. Any applicant for such a position has to have published at least eight papers in journals indexed in international databases, alongside having obtained the PhD title (the latter being the requirement of Law No. 1/2011). It might be worth mentioning that, at the time when the current Law of Education was under development, a number of alternatives were being developed for the algorithms used to calculate the minimum criteria by two strategic projects implemented by the

⁷http://www.cnatdcu.ro/wp-content/uploads/2012/05/OMECTS_3697.pdf

http://www.ubbcluj.ro/ro/despre/info/files/legislatie/Metodologie_ocupare_posturi_2015_2016.pdf.

Executive Unit for the Funding of Higher Education, Research, Development and Innovation (Unitatea Executivă pentru Finanțarea Invățământului Superior, a Cercetării Dezvoltării și Inovării – UEFISCDI)⁹.

Publications gradually became an important element to be taken into consideration when trying to develop a national ranking. The first system of university ranking in Romania was drafted in 1999 (Nica, 2000) and included seven indicators, but none of them assessed research individually (neither the quality nor the quantity of it). These seven indicators were: academic prestige, selectivity of students and university attractiveness, human resource management, scientific research and advanced studies (MA and PhD), undergraduate and graduate performance, financial resources and facilities for carrying out didactic processes and university strategic management, with weights between 10% and 20% each. However, some of these ranking indicators were subsequently used by the National Higher Education Funding Council (CNFIS) to build four groups of indicators that were to differentiate funding between institutions, based on quality. One group (among the four suggested, alongside teaching staff, infrastructure and university management) assessed the impact of scientific research on the didactic process, i.e. the level of performance achieved in scientific research and the means of disseminating the research results. Nevertheless, this was rather linked to teaching and did not assess the impact of research in terms of its visibility in the field of study.

A later proposal for a national ranking of universities (put forward in 2006-2007) included an entire class of indicators related to research (Agachi, 2007: 231). "Results of scientific research" (alongside quality of teaching staff, quality of education size of the institution and academic reputation of the institution) weighed 30% in the overall importance of the five classes and included the following three indicators: articles published in *Nature* or *Science*, publications in SCI and SSCI, arts and humanities (articles, proceedings, books, ISI patents) and results of the

⁹http://www.edu2025.ro/ and http://www.ecs-univ.ro/.

National Council for Scientific Research in Higher Education (CNCSIS) evaluation. Within the class, the last indicator weighed 50%, and the other two weighed 25% each.

A widespread perception among Romanian academics is that at national level there is a high requirement for formal documents, of meeting formal indicators, etc., but there is not an equal importance given to the quality of the items being assessed. People often recognise that, in fact, it is easier to count items than to assess their quality. In other words, it is easier to count how many apples one has than to try and assess how juicy they each are.

At the institutional level, BBU, as part of its attempt to reach international status, started to support and encourage research and publication, taking this encouragement to a possible "extreme". In 2006, the university's leadership decided to start the implementation of a programme called UBB500 (BBU500), which had as its final aim reaching a visible position in the most famous world rankings (starting with ARWU, as a reference point, but not limiting their aim to only this).

Thus, a decision made in March 2006 (Breckner, 2007: 78-79) stipulated, in a 10-point list, that the university should set specific aims where scientific research is concerned (which in practice translated into publications output). Point 1 on the list included the aims to be reached in order to become competitive internationally with other well-ranked universities, aims that were meant to be synchronising BBU's performance with the well-performing universities in the fields of teaching, learning, scientific research, graduates, services towards the community, etc., while Point 7 made reference to the encouraging of international-performant researchers through an award system and a new funding system. A more detailed description of the programme by the university's Academic Council¹⁰ reveals that an increase in the number of ISI publications is the most important factor for increasing BBU's visibility in the rankings.

 $^{^{10}\,}http://centre.ubbcluj.ro/cdu/sinteze/studiu_4_2008.pdf$

Research results visible at an international level were recognised through awards at institutional level and through other support measures. Unfortunately, the financial crisis of 2009 *de facto* ended the programme before it could achieve any noticeable results. However, BBU's requirements regarding publications have not decreased – on the contrary; now, according to a decision of the Board of Administration (consisting of the Rector, Vice-Rectors and Deans of the faculties), each academic has the obligation to publish at least one academic paper per year, with some faculties of the university using additional criteria (such as one ISI article, not just any article). Those that do not meet this criterion have the obligation to publish more in the following year and they also have to teach additional hours.

Nevertheless, one notices that the emphasis is still on quantity rather than the quality of publications, and quality what makes the difference when it comes to international rankings.

The Academics' Perspective

In order to assess the academics' perspective, we organised a focus group with nine participants affiliated with six different faculties of the university. We prepared a list of ten open questions and we did not limit the answers given in any way. The participants were two assistant lecturers, six lecturers and one assistant professor, and were coming mainly from the field of social sciences and humanities, with one participant from the field hard sciences.

The first aspect we noticed was that the academics' perspective focused mainly on their own institution, and they were not too aware of requirements applicable at national or international levels. The answers we received when we asked about other Romanian higher education institutions were rather short and sometimes consisted of just one word. This can be perhaps explained by the fact that they are focused on

complying with their employer's requirements and they are not considering changing employers in the near future.

The next topic that came up several times during the discussion was the fact that everyone perceived clear cleavages in the field: between hard sciences and soft sciences and between being a teacher and being a researcher. Hard sciences were perceived to be more performant, and publishing in journals with higher impact factors was perceived to be an easier process. We are aware that this is the case in many other countries as well.

The cleavage between being a researcher and being a teacher was discussed, with some participants (from the field of humanities) expressing the view that there could be a clearer separation between the roles of teacher and researcher, with the number of teaching hours varying depending on their preference. For example, if a person is a great teacher, they should have the option to teach more and research less, and vice versa. Naturally, being a teacher or a researcher would have parity of esteem, with neither role being seen as "lower than" or "superior to" the other.

The participants holding the lower academic positions complained about the high institutional standards, arguing that they did not match the funding available. It was pointed out that there is a risk of demotivating staff and sending them into a catatonic state if an institution raises publishing standards without supporting research with adequate funding. As a matter of fact, participants agreed that at national level there is no predictability in funding calls, and thus it is very hard to establish a stable connection between publishing requirements and research funding. One participant made the comparison with the building of a house which starts with the roof (the results, i.e. papers published) and not with the foundation (the policy regarding research funding). Funding predictability both at national and institutional level was found to be a concern for all participants.

The consequences of the mismatches mentioned above are more severe for the newer academics – those that have richer experience in

the field (the Assistant/Associate professor) advocated for effort and perseverance as a solution to the lack of support.

Some of the participants also stated that they could have used more support from their institution concerning specific aspects of publishing, starting from academic writing courses to specific funds being allocated for conference participation, training on working with journal-related resources and networking in their respective fields.

Finally we asked them how they see publications, on a spectrum ranging from a purely formal requirement to a natural consequence of their research or the need to communicate with their peers and their students. Opinions ranged across the spectrum, with the majority seeing it as a mix of several factors. Two opinions are probably worth mentioning here. The first one refers to the institutional level and comes from a lecturer in the field of social sciences: "They ask for everything, but they offer nothing" (referring to the perceived lack of institutional support concerning publishing). The second one comes from another lecturer in the field of social sciences, commenting on the link between the predictability of research funding and their own attitude to publishing: "Passion dies with the lack of funding".

Conclusion

At national level, it is obvious that the global ISI trend has taken hold, with publication output being considered as an increasingly important element. However, publication metrics could be put to better use when it comes to funding allocation or to building a national ranking of universities. At institutional level, research output in the form of publications varies greatly across institutions, but it is of utmost importance to a university aiming for WCU status, even if the academics working for the institution perceive such requirements as being too high and not adequately supported.

Formal requirements both at national and institutional level lack adequate funding support. If publications are the natural consequence of a research process, not supporting such process and nevertheless requiring publications has impacts both on the quality of publications and on the staff motivation for writing them.

Academic staff who are less experienced perceive acutely the lack of predictability of funding as well as the lack of support offered by the institution; however, the more experienced ones seem to fare better and have less anxiety regarding funding predictability.

There are a number of global trends that are not yet reflected at national or institutional level. For instance, the debate is still open regarding what is considered to be a "publication". Should monographs be included here? How about medals in sport competitions or performances in theatre plays? When calculating the impact of individual researchers, easier-to-quantify indicators are used (the Hirsch index or the *i10*), and harder-to-quantify items (such as interviews in the media, blog posts, tweets, etc.) are not yet considered.

One can see clearly the difference between the policies applied at national and institutional level, especially when the institution concerned is aiming to achieve international visibility. However, at the same time, it becomes clear that the system's inclination is rather for form and not content, quality or efficiency (i.e. the system values the quantity and not the quality of the scientific output). The many changes brought to the legislation do not make the system any more agile; rather they make it more cumbersome and increasingly less predictable and less coherent. The same is valid for publication policies at national level. Thus the system has responded to the ISI trend by adapting to it only superficially and without changing essentially: as a manner of preservation against exterior influences that might lead to more openness and transparency. An individual institution's efforts shed further light on the system's inertia when it comes to responding in a timely manner to an international trend. The rush of the Romanian national system to adopt (or rather adapt) an international trend has led to the risk of institutions being confronted with their staff's catatonia as far as publication requirements are concerned.

Perspectives for the Future

In an ideal world, publications should serve primarily a communication role. An academic may communicate through their papers at the same time with students, with their peers and with the wider community (be it outside one's own university or outside the academic field altogether), showcasing their mastery and proficiency in the field, and doing this all out of passion, not because of a formal, externally-imposed requirement. Unfortunately, such an ideal world is possible only in philosophical discussions or in utopic societies (such as those suggested by Italo Calvino in *Invisible Cities*).

References

- Agachi, P. Ş., Nica, P., & Moraru, C. (2007). "University Ranking as Stimulus for Quality Enhacement: A Case Study of Romania", In J. Sadlak & N. C. Liu (Eds.), The World-Class University and Ranking: Aiming Beyond Status (223-241). Bucharest Shanghai Cluj-Napoca, RO: Cluj University Press.
- Altbach, P. (2003). "The Costs and Benefits of World-Class Universities". *International Higher Education, 33*, 5-8. https://doi.org/10.6017/ihe.2003.33.7381.
- Altbach, P. (2011). The Past, Present, and Future of the Research University. *Economic and Political Weekly, 46*(16), 65-73. https://www.jstor.org/journal/econpoliweek.
- Blommaert, J., Collins, J., & Slembrouck, S. (2005). Space of Multilingualism. *Language and Communication*, 25(3), 197-216. DOI: 10.1016/j.langcom.2005.05.002.
- Breckner, W., & Trif, E. (Eds.). (2007). *Strategic și Operațional. Consiliul Academic: Proiect, Realizări, Perspective 2004-2008.* Cluj-Napoca, RO: Cluj University Press.
- Corlan, A. D. (2015). "Romania in Science & Engineering Indicators 2014". I. Descriptive Statistics of Indicators and Rates. *Revista de Politica Științei și Scientometrie, 4*(2), 110-123. https://rpss.inoe.ro/articles/romania-in-science-engineering-indicators-2014-i-statistica-descriptiva-a-indicatorilor-si-ratelor.
- Frangopol, P. T. (2006). "Învățământul superior românesc între mediocritate și competitivitate". Revista de Politica Științei și Scientometrie, 4(4), 195-204[Electronic version]. Retrieved [2018, June], from Unitatea Executivă pentru Finanțarea Învățământului Superior, a Cercetării, Dezvoltării și Inovării (UEFISCDI), București, RO site: http://old.uefiscdi.ro/UserFiles/File/CENAPOSS/nr. %204.%202006.pdf.
- Frangopol, P. T. (2007). "Cercetarea românească la răscruce, pericolul mediocrității. Soluții, riposte, întrebări", in *Revista de Politica Științei și Scientometrie*, *5*(2), 65-71[Electronic version]. Retrieved [2018, June], from Unitatea Executivă pentru Finanțarea Învățământului Superior, a Cercetării, Dezvoltării și Inovării (UEFISCDI), București, RO site: http://old.uefiscdi.ro/UserFiles/File/CENAPOSS/nr. %202.%202007.pdf.
- Marga, A. (2005). *University Reform Today, 4th edition*. Cluj-Napoca, RO: Cluj University Press.

- Nica, P. (2000). "Romanian perspectives on the Design and Use of System-Level Indicators in Higher Education Systems". In A. Yonezawa & F. Kaiser (Eds.), System-Level and Strategic Indicators for Monitoring Higher Education in the Twenty-First Century (121-136). Bucharest, RO: UNESCO CEPES.
- Sadlak, J. (1990). Higher education in Romania, 1860-1990: between academic mission, economic demands and political control. Buffalo, NY: Comparative Education Center, Graduate School of Education, State University of New York.
- Sadlak, J., & Liu, N. C. (Eds.). (2007). *The World-Class University and Ranking: Aiming Beyond Status*. Bucharest Shanghai Cluj-Napoca, RO: Cluj University Press.
- Sandu, S. (2013). "The Visibility and Performance of Romanian Scientific Research". *Annals of the "Constantin Brâncuşi" University of Târgu Jiu, Economy Series*(6), 6-12. http://www.utgjiu.ro/revista/ec/pdf/2013-06/1_Sandu%20Steliana.pdf.
- Science and Engineering Indicators 2014 [Electronic version]. Retrieved [2018, June], from National Science Foundation National Center for Science and Engineering Statistics (NCSES), Arlington, VA site: https://www.nsf.gov/statistics/seind14/
- Tai, H.-H. (2007). "The Features of a World-Class University: Lessons from International Ranking". In J. Sadlak & N. C. Liu (Eds.), *The World-Class University and Ranking: Aiming Beyond Status* (39-54). Bucharest Shanghai Cluj-Napoca, RO: Cluj University Press.