From global performance rankings towards national productivity ratings: Productivity of scientific action in technology and management/social sciences

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ABSTRACT

The dilemma of rising costs and weakening study achievements in higher education (HE) are threatening OECD countries in the era of massification of higher education [cf. 11]. Governments and the public have both their own interests (public and private) in HE as human capital. Most countries are striving to have "world-class" research universities and a variety of stakeholders are looking for reliable methods and indicators to identify universities, which have proved to be (non)productive in scientific action. It is not surprising that there is a growing interest in global university ranking systems. Simultaneously, OECD propagates for evidence-based higher education and science policy.

The famous QS- World University Rankings rely heavily on the expert assessments on best universities, a method launched in the 1980's by the national rankings of the US World and News report. The rankings based on expert opinions is intended to provide comparative knowledge about the quality of teaching students to become. Another ranking (HEEACT), in turn, focuses on indicators drawn from available data of scientific publications and citations. This method was launched world-wide by the Shanghai-ranking (ARWU). In our view, rankings describe first and foremost universities' pecking order in the international reputation markets. Nowadays rankers are also providing on-line interactive services for wide audience. But, the lack of proper input data makes it almost impossible to utilize rankings in reasonable evidence-based policy. Mere performance rankings are not enough. Therefore the paper suggests rating-system based on productivity of scientific action. According to the IAU there are altogether 9,500 universities in some 200 countries. In the three renowned 2010 field-specific global rankings, QS, HEEACT and ARWU, 710 universities from 50 countries are 'good' enough to be notified.

The paper demonstrates two rating-cases for evaluating scientific action. The first rating-case ('global framework') utilizes QS-, HEEACT and IAU-data in the fields of technology/engineering and management/ social sciences to calculate representation coefficients. Rating A^{++} indicates maximal international reputation, A^{+} and A are intermediate level classifications and A_0 indicates no international visibility. American universities are then compared with European universities.

The second rating-case provides a national example (case Finland) of a productivity evaluation of research and teaching. The productivity-ratings lean on input-output analysis by disciplines in five-year-terms. The developed national rating-system serves as means to sieve out the productivity (A^{++}, A^{+}, A, A_0) of Finnish university units in the fields of engineering and business.

Even under ongoing globalization, HE- and science policy in state-driven HE-systems is still inevitably national, because most resources (input) come from public sources. The paper concludes that the global performance rankings may be paving the way for new

kind of national productivity-ratings in a vast number of countries.

Keywords: global rankings, productivity ratings, evidence-based policy

1. INTRODUCTION

Since their launch in the start of the current millennium, global university rankings has been said to strengthen the view of a geopolitical pecking order of higher education systems, where United States comes first, Europe second, and the rest of the world third [cf. 10, 5, 3]. However, the critics [e.g.. 1, 2] keep arguing that global rankings tend to emphasize solely the norms of the top research universities and that rankings do not even try normalize size differences between universities. Rankings do not either take into account, whether a university is multidisciplinary or specialized in a certain field [see 6].

One crucial difference is that in Europe higher education systems are supply-driven whereas in the U.S. demand-driven. A demand-driven argument in defence of rankings typically leans on the 'informed consumer's standpoint' [see 5]. Clarke's [3] supply-driven argument promotes rankings instead as bases for assessing the quality of (national) higher education, for which we have certain doubts.

We have all the reason to believe that global rankings are here to stay. Especially by-fields rankings of ARWU, HEEACT and QS leave no doubt that higher education is and will be a global endeavor. However, mere international reputation and the related indicators is a too narrow evidence base for policy-making. Everywhere higher education leans on its national input based much on continuous financing of the tax-payers. Hence, it is important to ask how to make more reliable comparisons in different fields, but even more up-to-date it is to ask how to proceed further from international reputation indicators to analyzing scientific productivity.

2. AN ANALYSIS ON INTERNATIONAL REPUTATION INDICATORS

According to the International Association of Universities (IAU) there are altogether 9,500 criterion met universities in some 200 countries. In the three renowned 2010 field-specific global rankings, QS, HEEACT and ARWU, only 710 universities from 50 countries are 'good' enough to be notified. First we will ask how universities of the United States (USA), European Union (EU) and rest of the world (RoW) are represented in global rankings as compared to 'the global supply' read out from IAU's list of world universities.

All in all QS, ARWU and HEEACT offer 58 different series of evaluations by fields for years 2007, 2008, 2009 and 2010. Each year 3 800 ranking notifications are assigned to specific university units worldwide. Although the selection of fields is wide in this paper we focus only on following six: ARWU's Engineering/Technology & Computer Sciences (TEC) and Social Sciences (SOC), QS's Technology (TEC) and Social Sciences & Management (SOC) and HEEACT's Engineering, Computing & Technology (TEC) and Social Sciences (SOC).

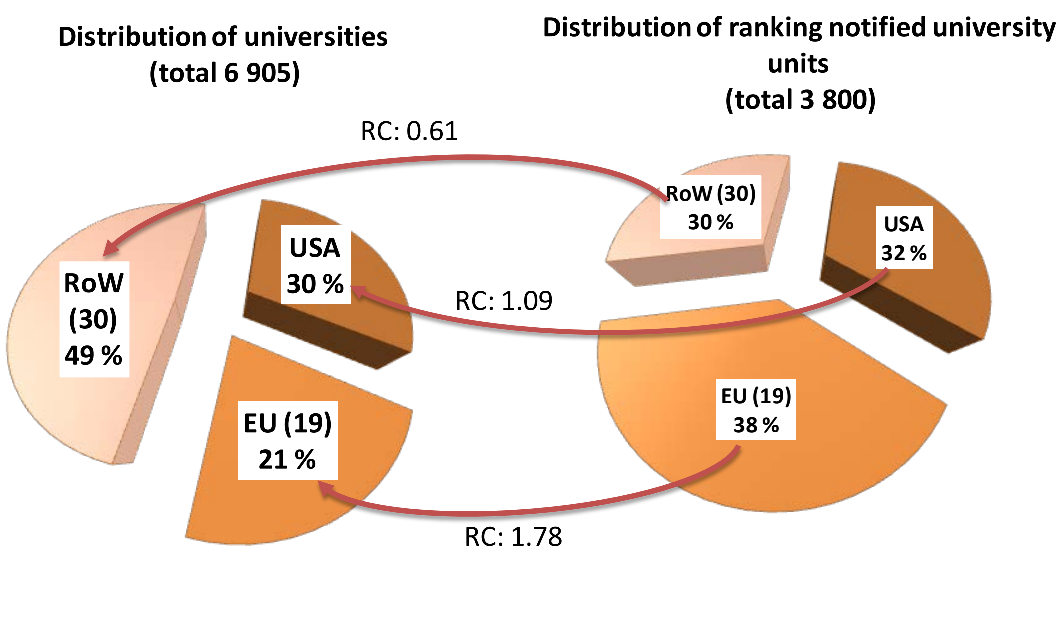
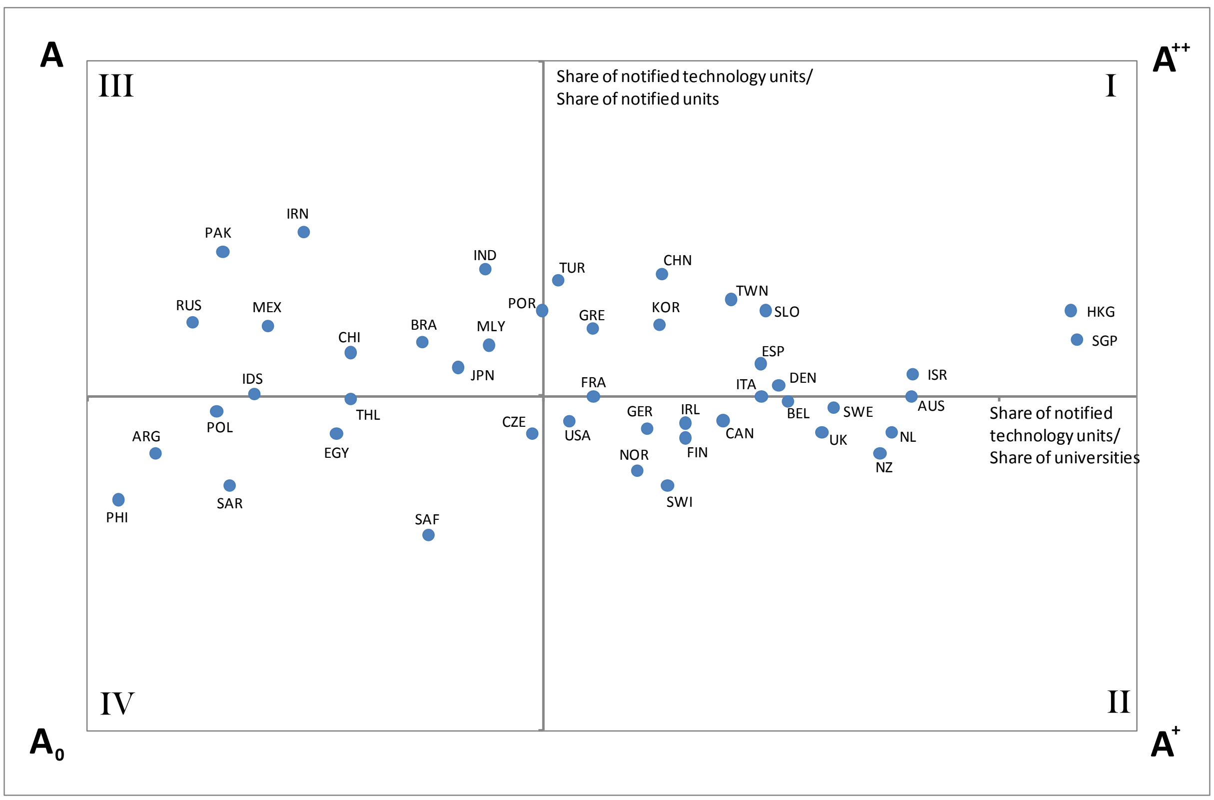


Figure 1. Global distributions of universities and ranking notified university units in 2010. Representation coefficients (RC) the United States (USA), 19 European Union countries (EU) and 30 other countries (RoW)

Figure 1 demonstrates the global distribution of universities vis-à-vis global distribution of ranking notified university units in 2010. From the 50 countries under analyses there are 6 905 universities listed in the IAU data. United States (USA) reaches a share of 30 % from the total number. The 19 countries from the European Union (EU) make up a 21 % share leaving a 49 % share for the 30 countries from the rest of the world (RoW). Out of the 3 800 ranking notified university units in 2010 USA's share is 32 %, EU's share is 38 % and RoW's share is 30 %.

When we calculate the representation coefficients (RC) by relating shares from notified university units to shares of universities (see Fig. 1) we find that the highest coefficient goes to EU (1.78) USA coming second (1.09) while RoW (0.61) is left third and being heavily under-represented among the notified university units. Even this preliminary analysis reveals that when moving from university level evaluations towards field specific analyses, the "well-known pecking order" can be re-evaluated. Should the field rankings reflect 'quality' as the compilers of rankings gladly argue then it must be said that the supply-driven EU-system is surprisingly strong in relation to the demand-driven US-system. As Americans themselves say one triking feature of the US-system is that it contains the world's very finest universities as well as a bundle of not so good higher education institutes.

Next we take a closer look into the field of technology. We will calculate two representation coefficients for each country. The first coefficient (see the X-axis in Fig. 2) relates country's share of ranking notified technology units to country's share of universities. Values above the X-axis (see Fig. 2) indicate good ranking visibility in the field of technology. Values below the X-axis (see Fig. 2) indicate poor ranking visibility in the field of technology. The second coefficient (see the Y-axis in Fig. 2) relates country's share of ranking notified technology units to country's share of all ranking notified university units. Values right to Y-axis (see Fig. 2) indicate technology focus in country's ranking visibility. Values left to Y-axis (see Fig. 2) indicate other focus. Rating A^{++} is received when both coefficients yield values greater than origo (1, 1) which indicates maximal international reputation. Ratings A^{+} and A are received when only one of the two coefficients yield a value greater or equal to origo (1, 1) and they indicate intermediate level classification. Rating A_0 is received when both coefficient yield values less than origo (1, 1) and it indicates no international visibility.



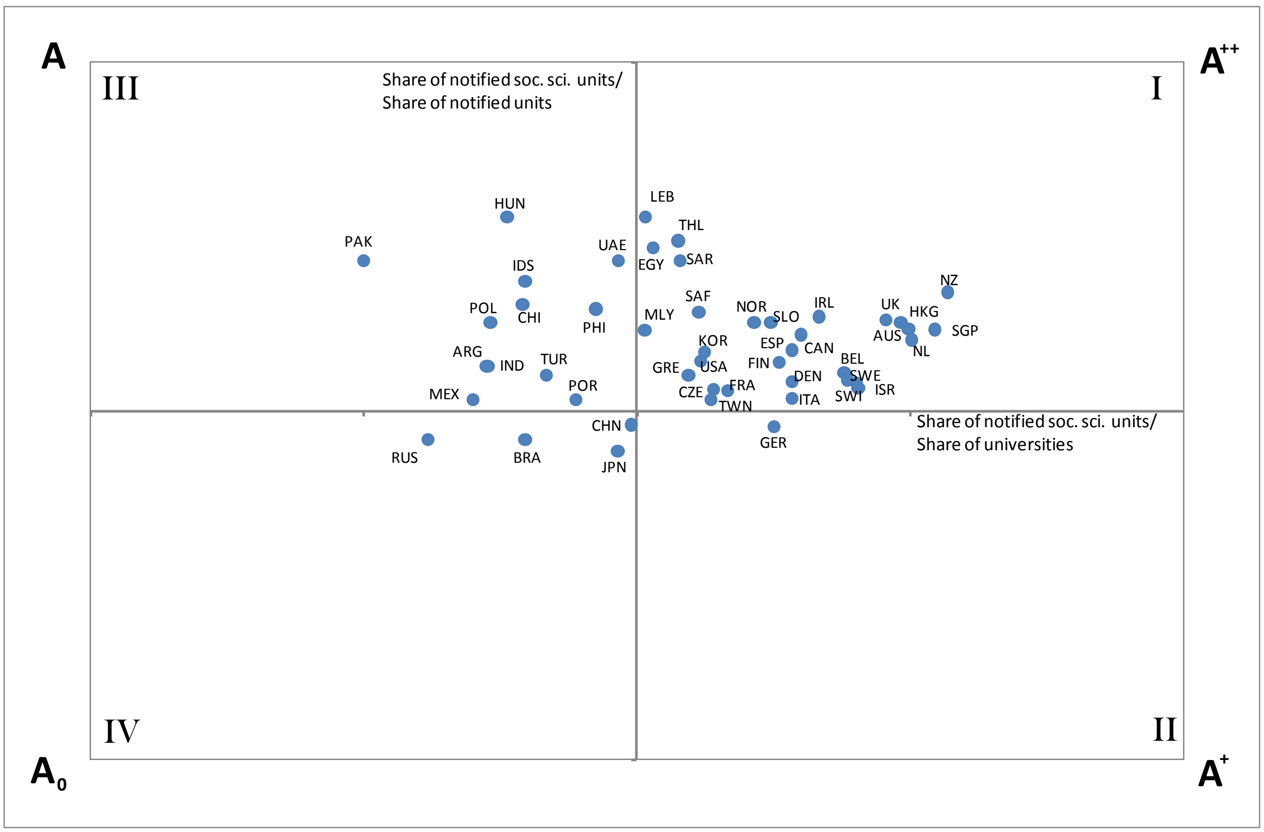
*The origo (1, 1) indicates ranking neutral visibility. Distance from the origo is logarithmic.

Figure 2. Rating framework of ranking visibility in technology in 45 countries in 2010. A^{++} indicates maximal ranking visibility, A^{+} and A indicate intermediate ranking visibility and A_0 indicates poor visibility.

Figure 2 shows that 7 out of the 13 countries reaching maximal ranking visibility rating A^{++} in the field of technology are EU countries. Countries reaching the highest rating A^{++} in technology are also likely to facilitate lively business life and opportunities. Let us notice that the 'demand-driven' USA reaches 'only' rating A^{+} in the field of technology. Out of the total of 24 countries reaching intermediate level ratings A^{+} or A in the field of technology 7 are EU countries. From the 8 countries receiving rating A_0 in the field of technology 2 are EU countries. Thus in the field of technology EU countries are well represented in the highest rating of A^{++}.

Next we take a look into the field of management/social sciences. The global rankings do not draw a clear line between management and social sciences so we combine the two in our analyses.

Figure 3 shows that 13 out of the 30 countries reaching maximal ranking visibility rating A^{++} in the field of social sciences are EU countries. USA also reaches the rating A^{++} in the field of social sciences. Germany is the only country reaching intermediate level rating A^{+}, but rating A in the field of social sciences is reached by 12 countries from which 4 are EU countries. Altogether 4 countries receive rating A_0 in the field of social sciences and none of them are EU countries. Thus in the field of social sciences EU countries are also well represented in the highest rating of A^{++}.



*The origo (1, 1) indicates ranking neutral visibility. Distance from the origo is logarithmic.

Figure 3. Rating framework of ranking visibility of social science units in 47 countries in 2010. A^{++} indicates maximal ranking visibility, A^{+} and A indicate intermediate ranking visibility and A_0 indicates poor visibility.

What comes to evidence based policy let us remind that the main concern with ranking data is that the whole input side is neglected. Therefore we briefly demonstrate, with Finnish data how field specific analysis can be applied even further into productivity analysis of research and teaching.

3. A NATIONAL PRODUCTIVITY RATING SYSTEMS –CASE FINLAND

In Finland, the Ministry of education maintains a specific HE-data-base (KOTA) providing an access to input and output data of Finnish universities also by disciplines. In our productivity analyses of research and teaching in 16 Finnish universities by 9 disciplines (Medicine, Natural Sciences, Education, Business and Management, Nursing and Health Sciences, Engineering, Humanities, Psychology and Social Sciences) the indicators for output of research are i) refereed articles published in international scientific journals, ii) doctoral degrees and iii) merit-based funding. The indicators for input of research are i) professorial man-years and ii) external funding of research. The indicators for output of teaching, in turn, are i) master's degrees and ii) doctoral degrees. The indicators for input of teaching are i) professorial man-years and ii) other teaching man-years.

Each of the nine disciplines is analyzed. In phase one units (66 altogether) are assigned with productivity coefficients for research by relating unit's share of discipline's total output to unit's share of discipline's total input As a result each unit scores on productivity of research and teaching on a scale from 1 to 100. [8, 9]

The rating system based on the results of productivity analyses sieves out the most productive units in their own disciplines. Figure 4 illustrates, with an example of the Finnish university units in the field of Technology, that the units scoring 50 or more (in the scale of 1 to 100) in productivity of both research and teaching (Research + and Teaching +) position themselves in quadrant I and hence receive rating of A^{++}. In our example Helsinki University of Technology is the only Finnish technology unit to reach this quadrant getting rating A^{++} with scores 66 for research and 68 for teaching. [7]

Units scoring 50 or more on productivity of research (Research +), but scoring less than 50 for teaching (Teaching -) position themselves in quadrant II with a rating of A^{+}. Only the technology unit of the Swedish language university Åbo Akademi is positioned in this quadrant with scores 70 on research and 41 on teaching.

Units which score less than 50 in productivity of research (Research -), but score 50 or more for teaching (Teaching +) place themselves in quadrant III with a rating of A. In the example Lappeenranta University of Technology (score 32 on research/score 62 on teaching) and Tampere University of Technology (39/52) fall into this A-rate quadrant. These units meet the 'standards' of the discipline in teaching, but have all the reason to strengthen their research basis.

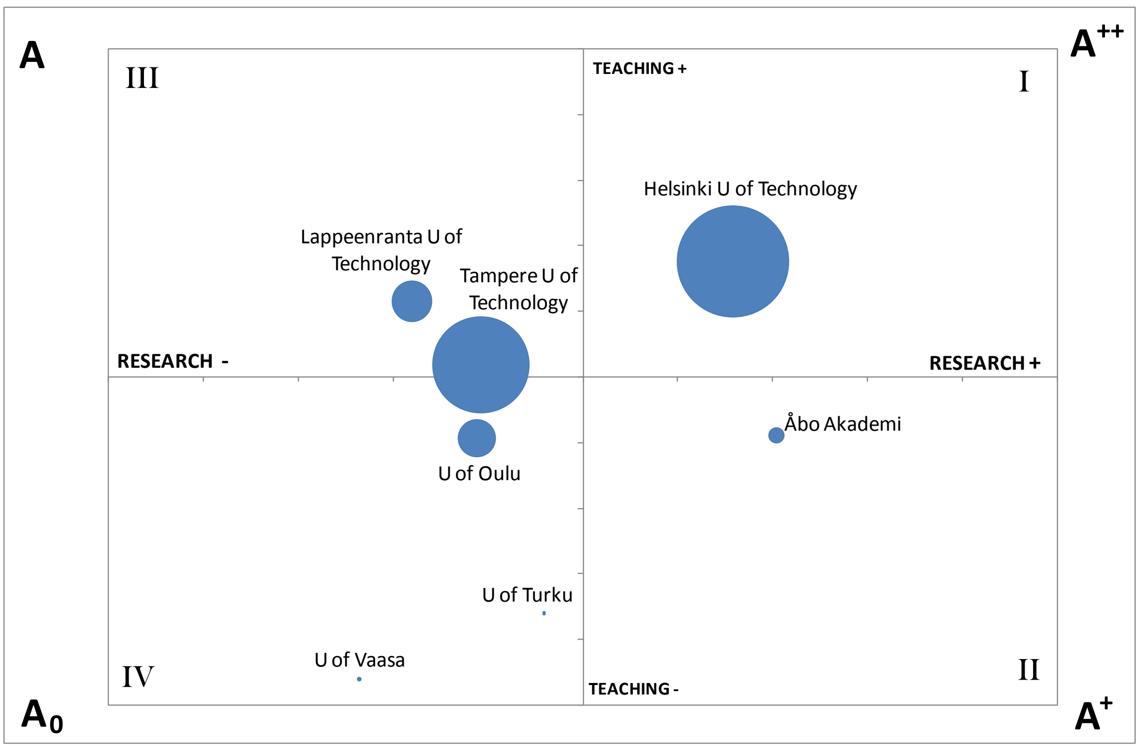


Figure 4. A rating system for productivity of research and teaching: example of the university units in technology in Finland.

Those units, scoring less than 50 in productivity of both research and teaching (Research -, Teaching -) are placed in quadrant IV with a rating of A_0. In the example such units are found in Oulu (38/39), Turku (46/14) and Vaasa (26/4). These units show lesser evidence of productive research and teaching than other units. It is important to note, however, that even those units which have received an A_0 rating have still managed to gain results noted by the science community, albeit on a smaller scale than the units within the other three quadrants. Note, that the size of the marker (circle) is in relation to the size of inputs. The tiny circles indicate universities with very small inputs in the field in question and hence those universities naturally have very little importance for the education policy. While the universities with big inputs, indicated by big circle markers, like Helsinki University of Technology, in our example, have a lot of importance when government decisions are made.

4. CONCLUSIONS

Even under ongoing globalization, HE- and science policy in state-driven HE-systems is still inevitably national. Our analysis show how global university rankings have moved towards field-specific evaluations of research and teaching, thus also paving the way for a new kind of national productivity-ratings in service of evidence-based policy, as various countries wish to capitalize on the emerging opportunities arising from the new global division of labour in higher education. In this paper it was demonstrated with two case examples (technology and social sciences) that those countries which are strong in technology are not necessarily the same countries which are strong in social sciences. Utilizing fully the available data of all fields will only give apt tools for tracing more accurately the new global division of labour in higher education

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