STRUCTURAL CHARACTERISTICS OF THE MTA RESEARCH NETWORK'S SCIENTIFIC PERFORMANCE 2016

BASED ON WEB OF SCIENCE AND MTMT DATA

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2017

Introduction

The aim of the present report is to provide an overview of the internationally measurable scientific performance and performance structure of the MTA research network (henceforth MTA). The analysis focuses on the publications of the 3-year period concluded in 2016, thus it is constructed of the internationally available output from 2014 to 2016 (in case of citation impact the analysis takes the 2013-2015 period due to the minimum time window limit). In accordance with international standards, the scope of samples was constricted to the most prominent journal publications (reviews and articles). The analysis is based on MTA publications sorted by Web of Science (WoS) and Scopus (a data set thoroughly cleansed to enable a deeper structural analysis). The report applies several other international databases (with regard to reference value, discipline classifications, etc.). The key points of the annual overview are the following:

- The performance of the main disciplines is represented through a comparison of WoS and Scopus data. To achieve this, the so called "Fields of Science" discipline classification is applied, which enables the taxonomic comparison of the two databases.

- The European scientific cooperation network is represented through co-authorship patterns and project collaborations (based on comparison), the latter indicator relies on the data of H2020 programs with MTA participation.

- With regard to partner country co-operation a two-fold method is used. The conventional "full counting" method is combined with "fractional counting," an ever spreading method in contemporary bibliometric studies, in order to provide a better picture of each country's impact.

- Academy & industry collaboration is analysed by discipline based on co-authorship patterns.

Applied databases and sources:

Web of Science citation database (SCI, SSCI, A&HCI): bibliographic data

Scopus: bibliographic data

InCites: indicators and limit values for each discipline based on WoS data

SciVal: indicators and limit values for each discipline based on Scopus data

Essential Science Indicators (TR): ESI discipline classification and disciplinary reference values

CORDIS: the European Commission's primary public repository and portal to disseminate information on all EU-funded research projects (H2020)

Output and Impact Indicators of the Main Disciplines

The research network's performance in the main disciplines will be analysed using data from the two most significant citation indexes, Web of Science and Scopus. These databases use a different discipline classification, thus commensurability is provided by the "Fields of Science" system that is applicable for both indexes (the taxonomy of the OECD and the Frascati Manual). Accordingly, six main areas are observed: 1. natural science (NAT) 2. medical science (MED) 3. engineering (ENGI) 4. agricultural science (AGRI) 5. social science (SOC) 6. humanities (HUM).

The output of the main disciplines is shown in the total number of publications (these results are by no means a ranking among disciplines, yet they provide comparative data about their output). The indicators used to show citation impact are independent of size and area. In accordance with international practice, impact is shown through (1) mean normalized citation score, MNCS and (2) the 10% excellence index, meaning the percentage of publications that belong to the most cited 10 % within the discipline. Apart from enabling the commensurability of disciplines and the age of referenced works, (2) it reveals data about the discipline's relation to international standards. For impact measurement purposes a 2-3 years' citation window is chosen (this is the shortest period during which the citation rate of most disciplines becomes visible).

The below figures show the research network's performance through the comparison of data calculated by WoS and Scopus. With regard to the total output in 2013-2016 (Figure 1), it is shown that MTA appears with equal volume in natural sciences, engineering and – contrary to expectations – social science (their data points appear along the diagonal). The first two shows only 5-7 % difference in favour of WoS. In medical science, in the humanities and especially in agricultural science the MTA has a higher number of publications in Scopus (the difference is ~40, ~60, ~160% respectively). The figure about the citation score (MNCS) (Figure 2) gives a seemingly similar picture about the relative position of disciplines. Natural science and social science (!) and this time medical science show a similar impact according to WoS and Scopus, and their citation rate is above world average in both indexes (MNCS>1). The impact of agricultural science and this engineering is higher in Scopus (above world average) and near world average in WoS. Yet again, humanities rank higher in Scopus, but the difference is insignificant (0.8 vs. 0.7), and both indexes place the discipline slightly below world average.

The figure showing the percentage in the most cited works (pp 10%, Figure 3) provides an interesting picture. Natural science and engi-

Fields of Science: the hierarchic disciplinary nomenclature introduced in the Frascati Manual, the scheme applied in the OECD

MNCS: It correlates the annual number of MTA publications to the disciplinary average (the average citation number within the discipline in the given year). Reference value (it refers to the international average) = 1.

Pp10: The proportion of MTA output belonging to the most cited 10% within a discipline in each year. Reference value = 10%

neering has the largest portion in the discipliner "elite," and these are the fields that rank above world average (pp10>10%). WoS favours humanities and social science (contrary to relevant premises): along with natural and medical science, social science is above world average, humanities are just below (agricultural studies show similar results in both databases, slightly below world average). The most likely explanation is the sorting system of WoS: especially in social science and humanities the database works with a narrower, highly acknowledged scope of journals, thus it shows a lower number of high quality publications with considerable impact, a larger percentage of which is potentially highly cited than the Scopus collection. As this result reveals, despite the wider range of publications, Scopus is not the most appropriate choice for humanities due to WoS advantage in other impact dimensions.

Figure 1

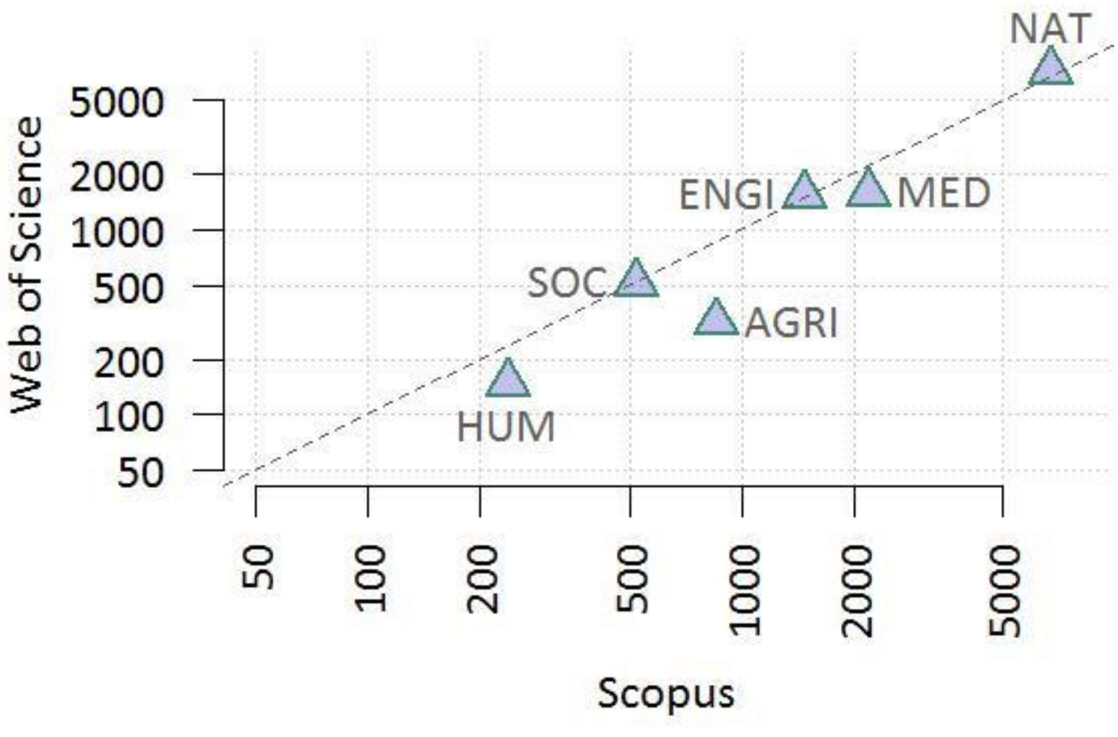


Figure 2

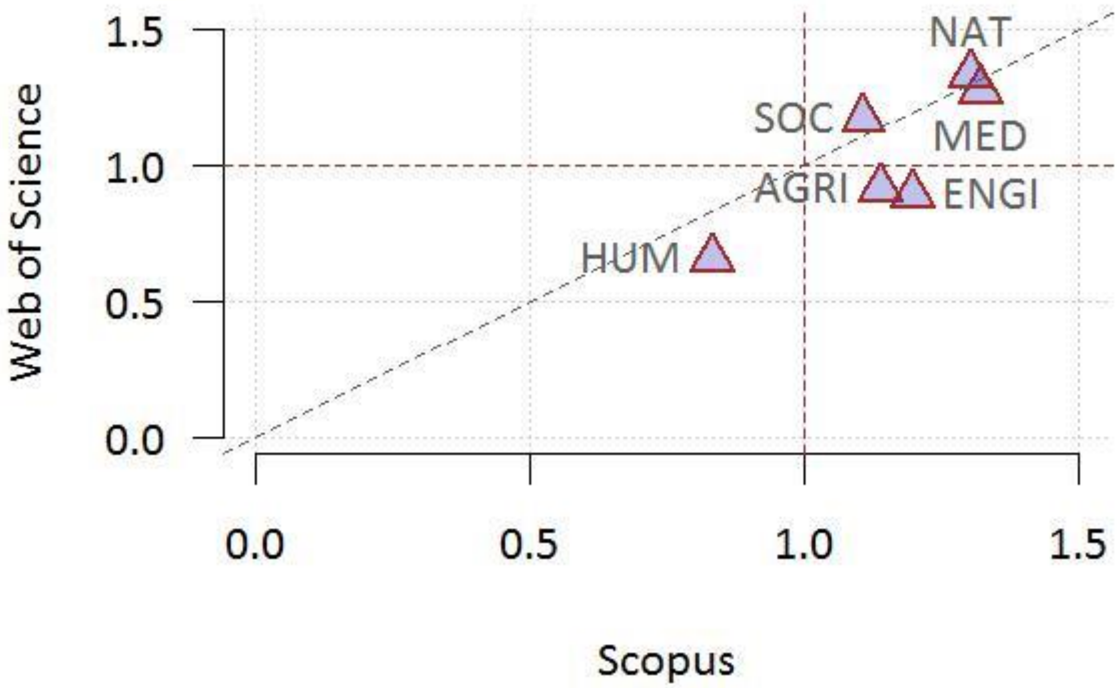
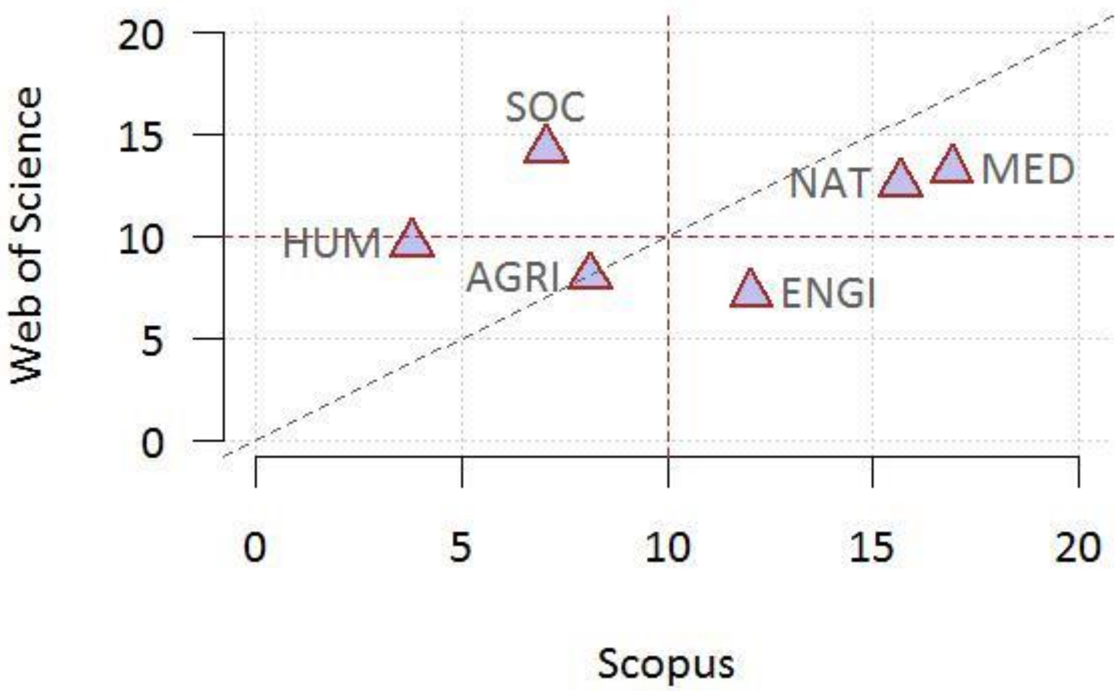


Figure 3



Output and Impact Indicators in Other Disciplines

Scientific performance in the given time period is shown through size independent and classified data, in order to aid the comparison of different fields. To this end, this study relies on WoS data and applies the WoS related ESI (Essential Science Indicators) classification, as the above mentioned selectivity of WoS provides a sort of quality control (especially regarding size independent indicators), and the 22 categories of ESI are easily comprehensible (yet undoubtedly over-aggregated).

Figure 4 shows the disciplinary structure of MTA output and its percentage in the national output through a relative indicator. Compared to previous periods the structure remained the same: output is dominated by physics, space research and mathematics (50-70%). The next group (30-50%) has the most participants: materials science ranks first, but chemistry, most fields of supra-individual life science and environmental science (ecology, geoscience) also belong here. 20-30% of the national output is produced by social science, psychology and behavioural science, as well as fields closely related to application and practise such as agricultural science, animal and plant science (their publication output frequently overlaps), computer science, pharmacology and engineering. Immunology also belongs to this group, yet clinical medicine constitutes only 9% (this is a quantitative indicator, for other dimensions please check the next section). On the whole, the figure represents the research network's role in basic research well.

Since scientific impact is represented by size independent indicators, this dimension enables us to compare MTA performance with different regions and country groups as benchmarks. The below figures show the comparison of international reference values, national performance (HU) and EU-13 performance (aggregated).

Compared to the output, the disciplinary distribution of citation rate and impact shows a different structure. The percentage of internationally cited publications ranges 60-100% (Figure 5), and it goes over 80% in most disciplines. The mean normalized citation score (MNCS, Figure 6) is also over or near world average, and over EU13 and national average with a few exceptions (these minor differences are less noticeable if stability intervals are shown, as they compensate the uncertainty of sampling). The latter is not surprising in those fields where national output is dominated by the MTA network (e.g. physics), yet there are some areas where the impact is over the national average despite the relatively low output. Immunology is a remarkable example, but psychology and neurology also belongs to this category. Social science is worth highlighting (separately from economics), as it ranks over both national and world average. Medical science (which has the lowest

ESI: the discipline classification system of Essential Science Indicators with regard to WoS

MNCS: It correlates the annual number of MTA publications to the disciplinary average (the average citation number within the discipline in the given year). Reference value (it refers to the international average) = 1.

Pp10: The proportion of MTA output belonging to the most cited 10% within a discipline in each year. Reference value = 10%

share) performs over world average, but stays slightly below national average (the second most important after physics). Despite the high share in national impact, the same is true for space research.

With regard to excellence – the portion of publications belonging to the most cited “elite” – (Figure 7), the quantitative and impact based approach shows an even greater difference. Most disciplines rank over or near world average and perform better than EU13 levels. Among low share disciplines immunology, psychology and medicine yet again give a remarkable performance. Social science and “application-related” fields are not prominent in this respect. However, it is essential to note that in case of the top-ranking physics, this category is greatly affected by the MTA participation in international particle physics research.

Figure 4

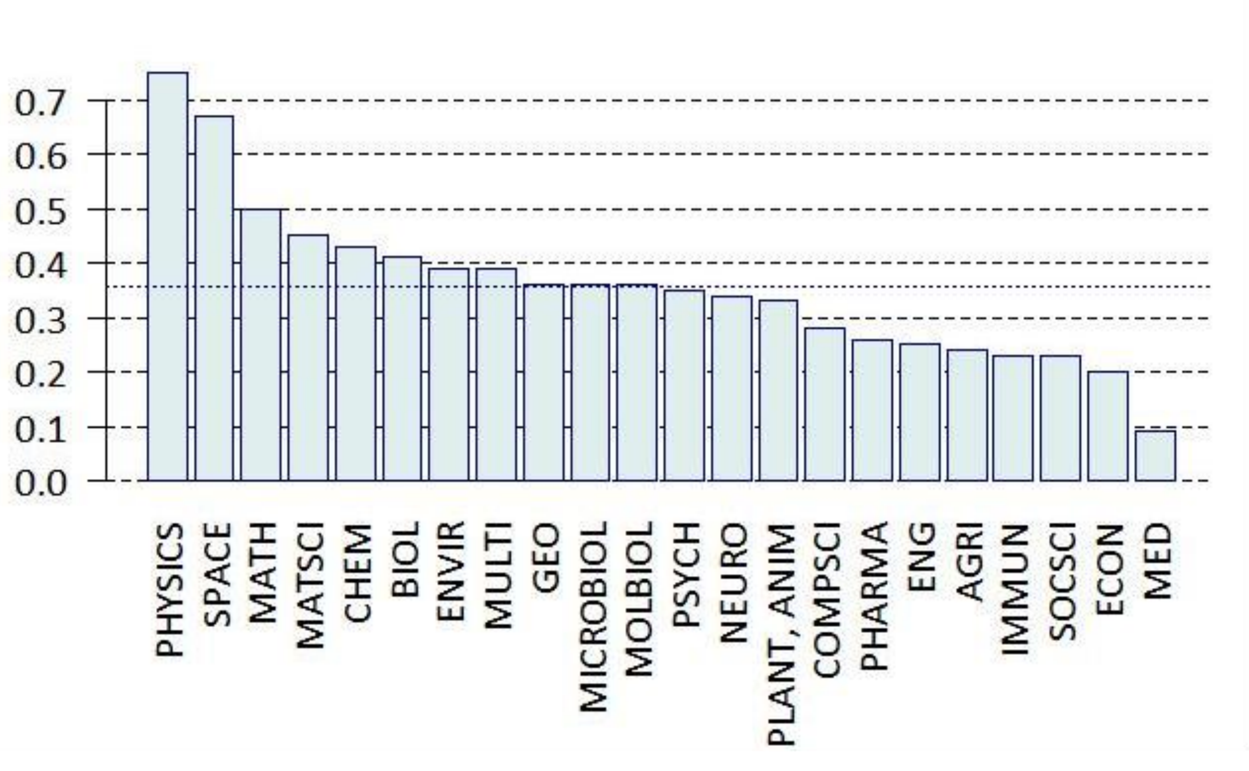


Figure 5

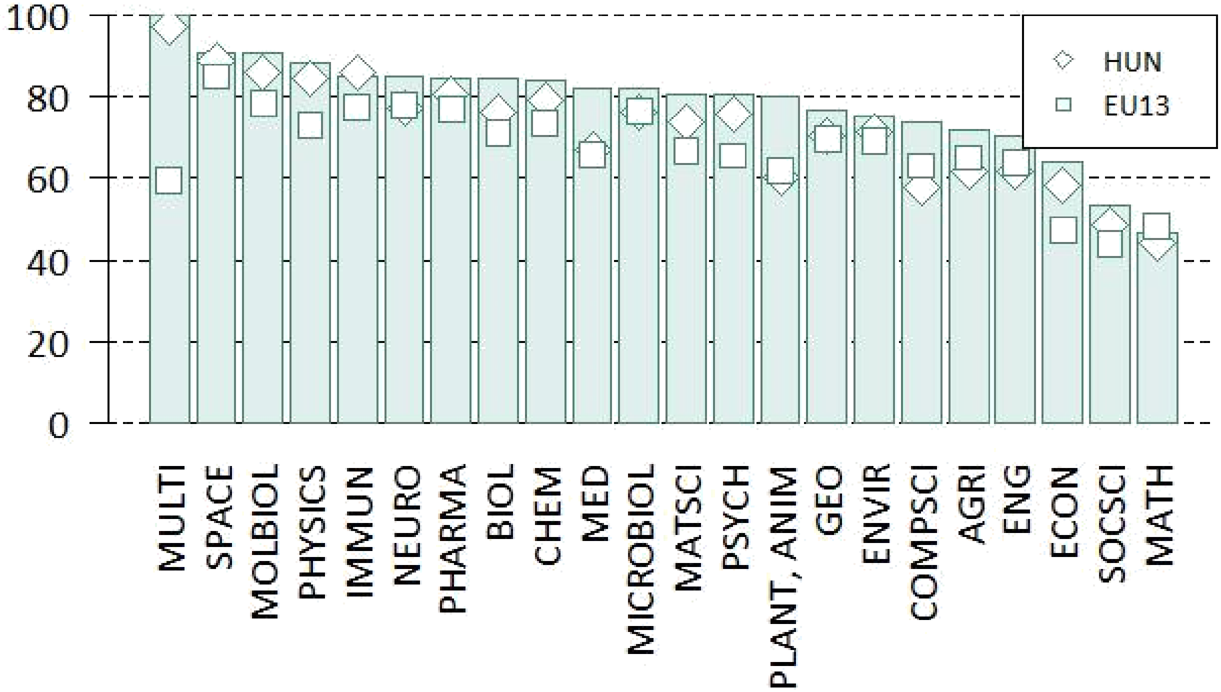


Figure 6

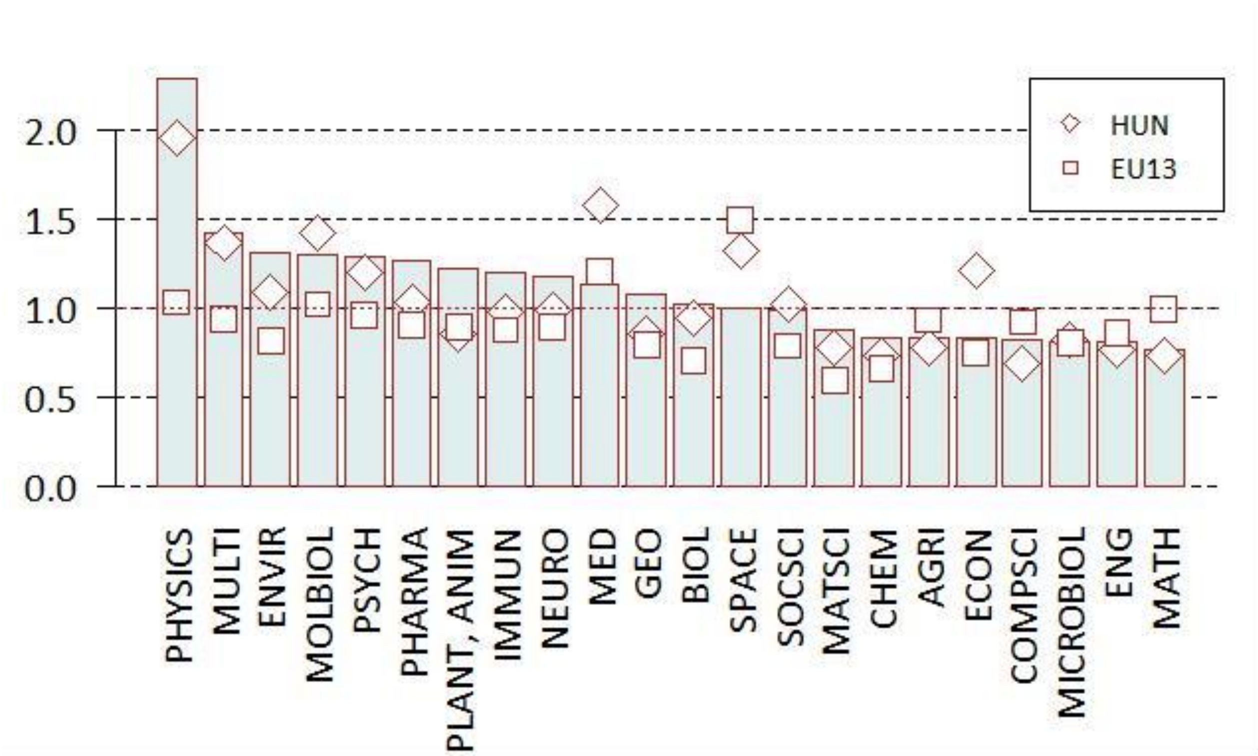
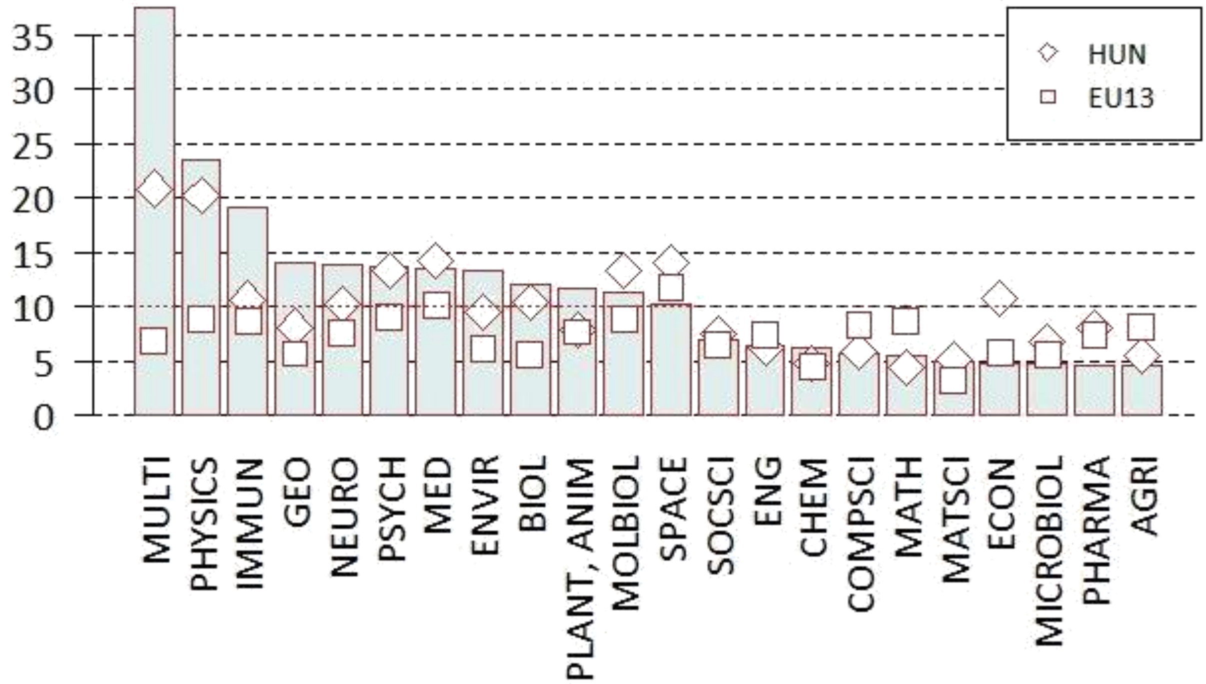


Figure 7



The Internationally Visible Research Network of the MTA

The significance and success of the research network within the national and international R&D system can easily be illustrated through the MTA scientific co-operation network. The basic indicators of scientific co-operation are co-authorship and its indexes. The research network's international relations can be characterized by the portion of co-operation-based publications in the total output. This is shown on Figure 8 for each discipline. According to the figure, international co-operation takes up a large percentage of the total output (50-80% with a few exceptions), and it is over the EU13 average in almost all cases. It comes as no surprise that physics and space research score over 80% (considering the consortiums around large international research infrastructures), but even economics and agricultural science have around 60%, significantly exceeding the EU13 level (approx. 30%).

Another important characteristics of the network are the names, impact and role of collaborating countries. The number of co-operation-based publications among partner countries and the percentage of such publications in the total output is a wide-spread indicator of col-

The proportion of publications produced by international collaborations is the basic indicator of international scientific co-operation.

Full counting: the traditional way of measuring co-operation intensity, it allocates the co-authored work to each contributor (thus it multiplies the number of international publications)

Fractional counting: a recently suggested way laboration. To this end, two methods are applied: (1) the conventional approach marks the impact of each country with the number of collaborations they take part in. This is called "full counting." According to contemporary bibliometrics, however, (2) "fractional counting" provides a more realistic picture regarding the intensity of co-operation, as it considers the share of each country in the publication, and assigns publications accordingly. This method enables us to somewhat counteract distortion due to hyperauthorship, which strongly over-represents countries with large author consortiums in high output disciplines (see high-energy physics).

of measuring co-operation intensity, that divides co-authored publications in relation to the authors' participation (this method does not multiply the number of international publications)

Participation in collaborative research and international projects is another fundamental indicator of international co-operation. In order to represent these two dimensions in a single figure, the European network of the MTA is analysed comparatively through co-authorship and the comparison of partner patterns in collaborative projects. For the latter, we used MTA-related H2020 projects from the Cordis database since 2014. Figure 9 shows the impact of the most important European partner countries in these two dimensions based on fractional counting (project percentages considered for each consortium partner). Despite the similar impact ranking, it is clearly visible that collaborative projects have a larger share than co-authorships in almost all partner countries. Germany unalterably takes the lead in both dimensions followed by the United Kingdom. France precedes Spain and the Netherlands in co-authorships, yet in collaborative projects they are on the same level. The next group has similar co-authorship numbers, but less projects with MTA (Sweden, Belgium, Austria, Poland, Czech Republic, Switzerland). The figure confirms that with regard to projects there is a stronger collaboration with central countries than co-authorship (the full counting method also confirms this pattern; in that case the exclusion of non-EU countries does not distort the impact of project participation that much).

Application of the two methods to the analysis of beyond Europe co-authorship provides quite similar results. The USA is the number one collaborative partner (preceding Germany). The "full counting" method assigns a much larger percentage to great eastern countries (Russia and China has more than 50 % of the cumulative values ranking just behind Spain and Switzerland, whilst Japan takes the middle ground with 40%), whereas "fractional counting" positions these countries at 20%. Each country's percentage is represented in maps both with the full counting and the fractional counting method (Figure 11: Europe, full; Figure 12: Europe, fractional; Figure 13: world, full; Figure 14: world, fractional).

Finally, another dimension of co-operation is worth observing: that which exceeds scientific impact and tends towards "social impact."

Academy & industry relations are important indicators in this respect, in this case this means the percentage of publications produced in co-operation with the private sector. Figure 10 shows this for each discipline including its relations to different benchmarks. Pharmacology leads the list quite obviously, and engineering is also top-ranking, even though the latter ranked much lower in other dimensions. Chemistry, neurology, material science and molecular biology are also on top gaining 2-4% which is above the EU13 average (and close to the national percentage). In some fields there is a possibility for more collaboration with the private sector if they already have a share in it, yet the intensity of such collaborations fall below the national and EU13 average (immunology, computer science).

Figure 8

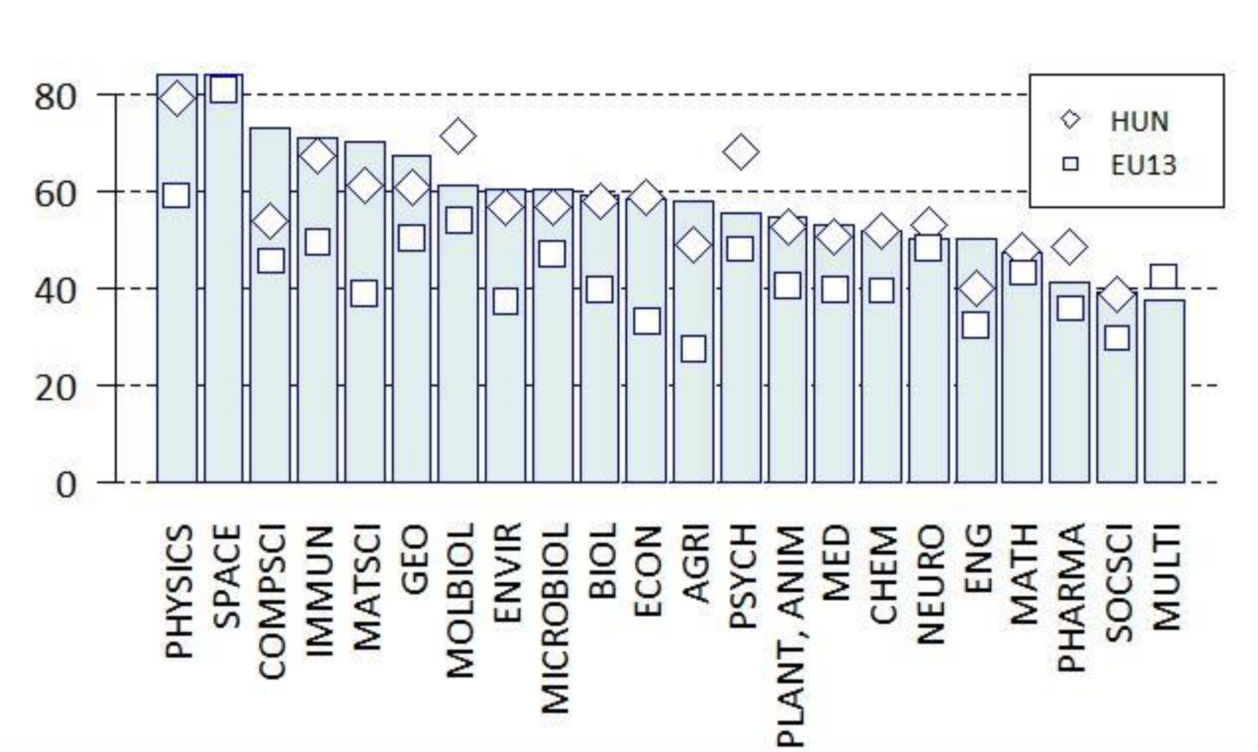


Figure 9

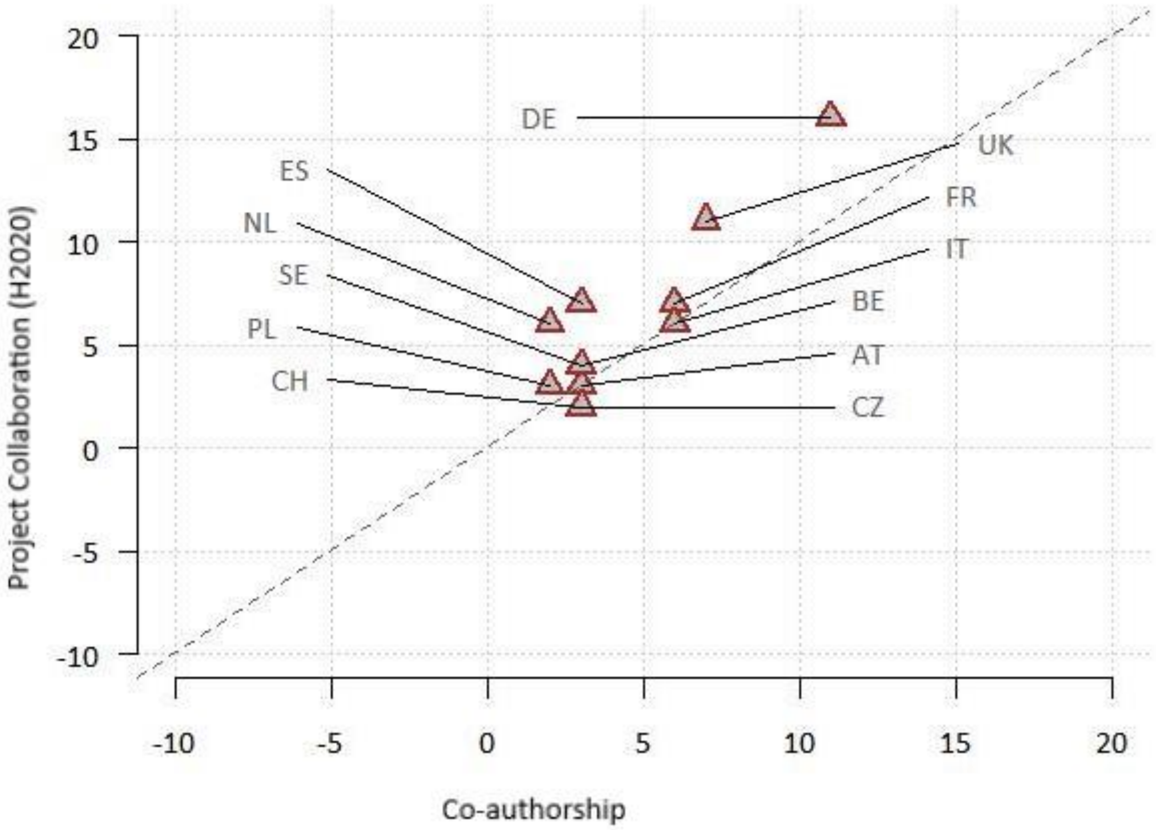


Figure 10

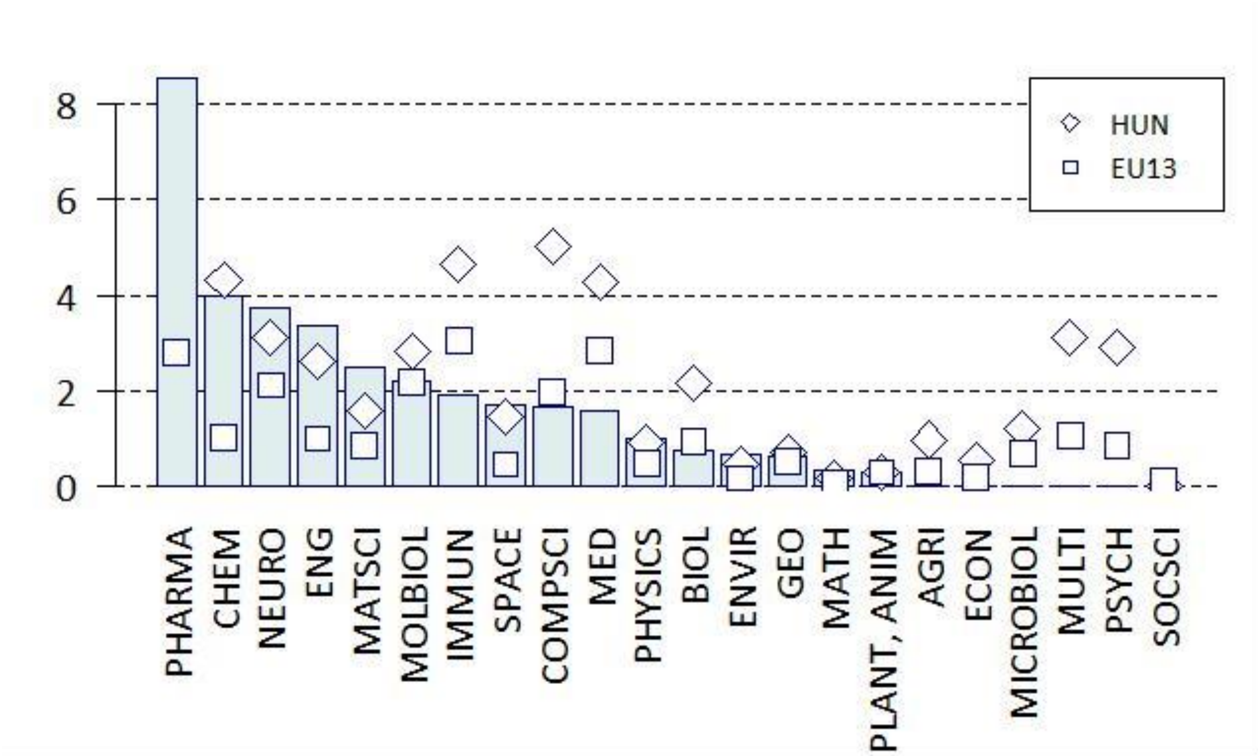
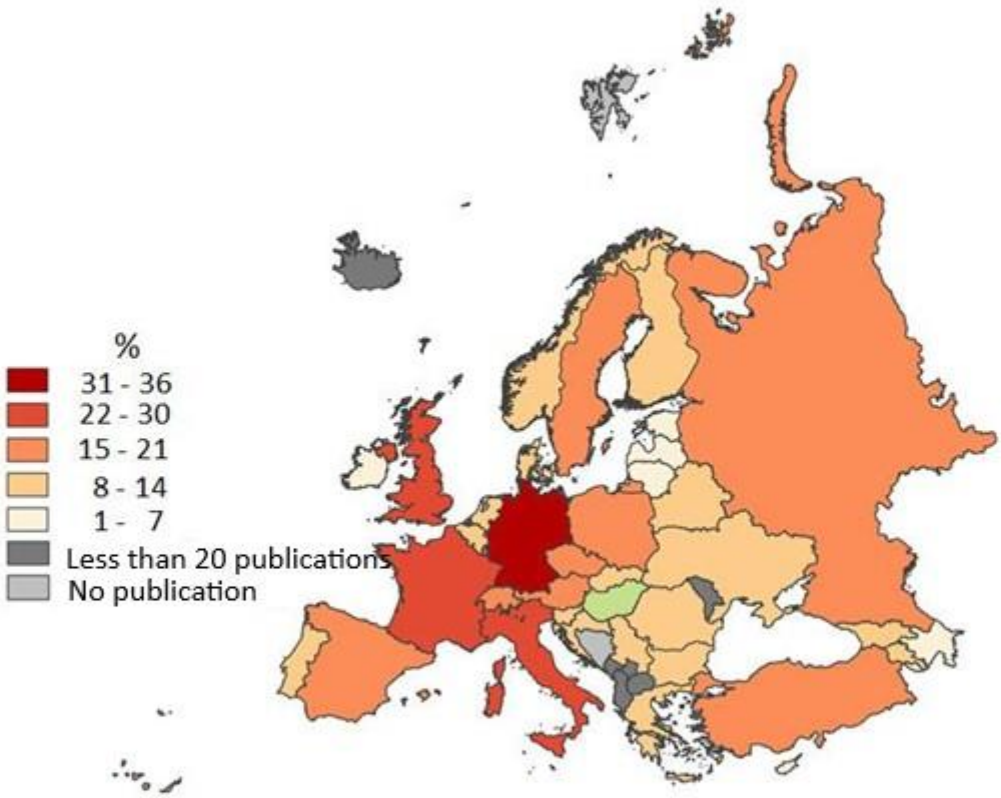


Figure 11



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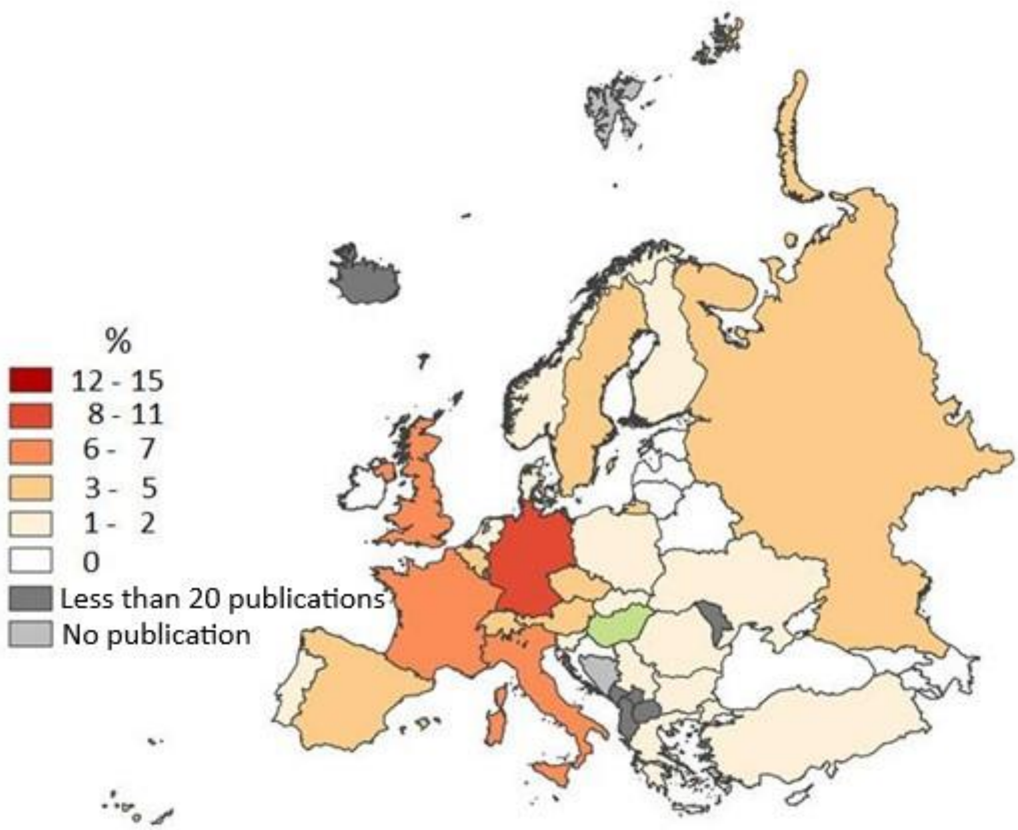


Figure 13

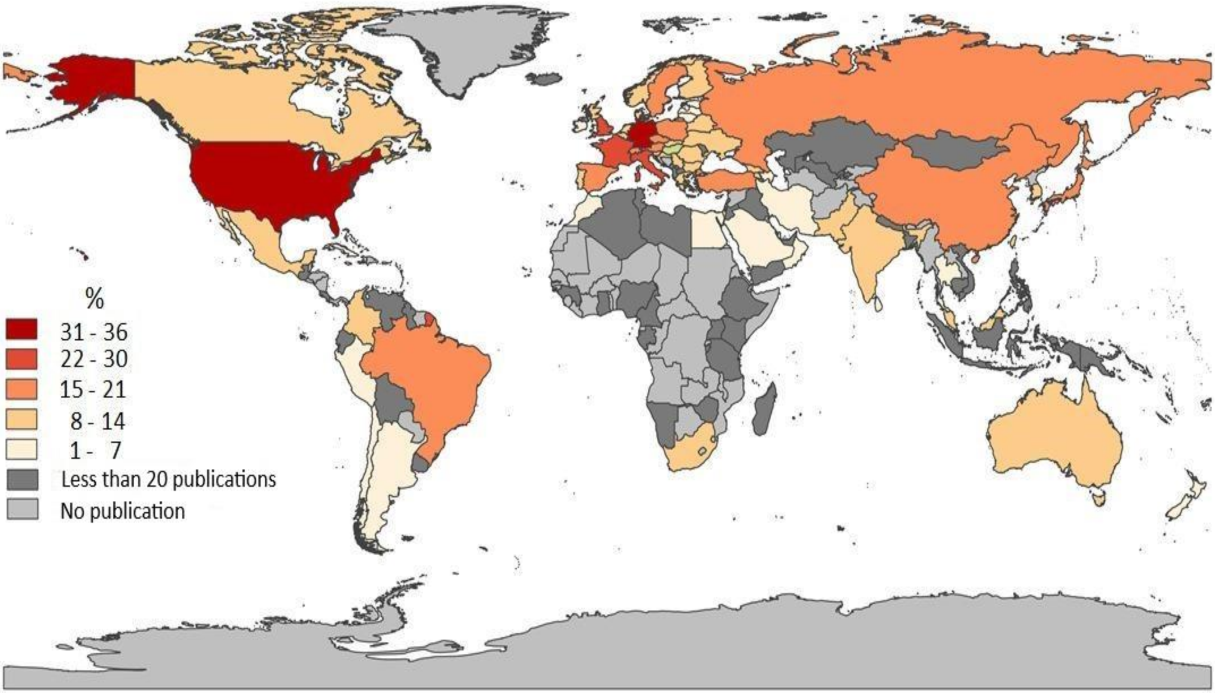
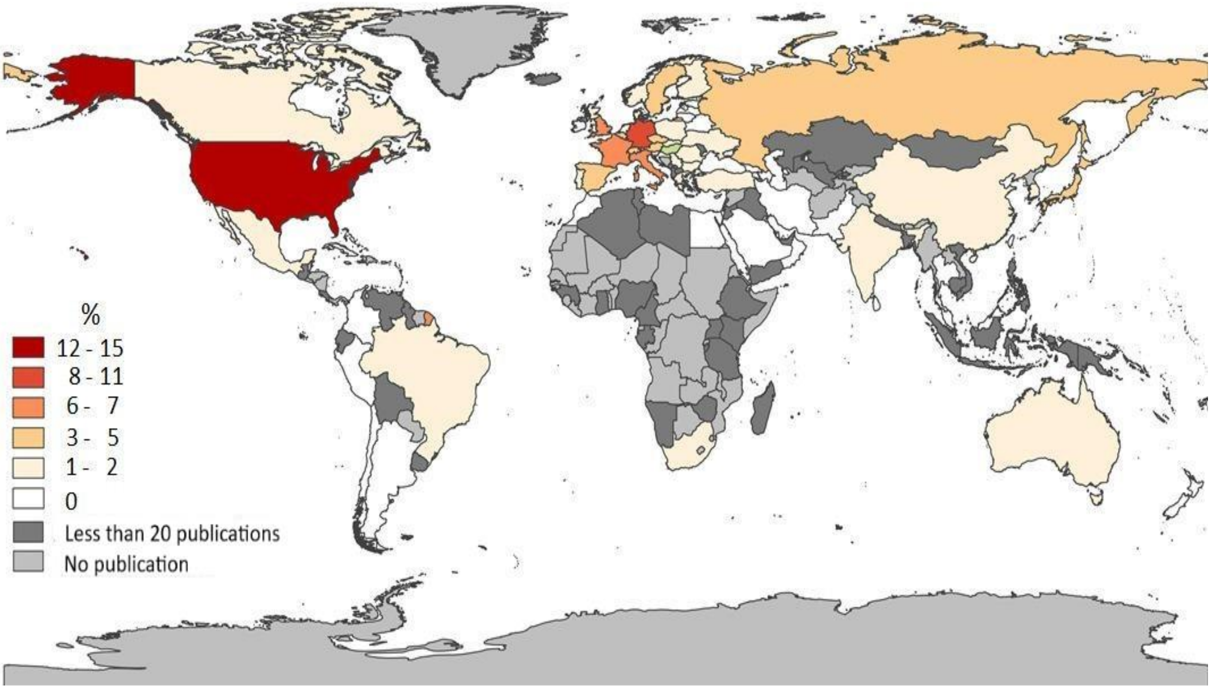


Figure 14



Appendix

Abbreviation	Discipline
Agri	Agricultural Sciences
Biol	Biology and Biochemistry
Chem	Chemistry
Med	Clinical Medicine
Compsci	Computer Science
Econ	Economics and Business
Eng	Engineering
Envir	Environment/Ecology
Geo	Geosciences
Immun	Immunology
MatSci	Materials Science
Math	Mathematics
Micro-biol	Microbiology
Molbiol	Molecular Biology & Genetics
Multi	Multidisciplinary
Neuro	Neuroscience & Behavior
Pharma	Pharmacology
Physics	Physics
Plant, Anim	Plant & Animal Science
Psych	Psychiatry/Psychology
SocSci	Social Sciences
Space	Space Science