Evolving patterns of extremely productive publishing behavior across science

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ABSTRACT

We aimed to evaluate how many authors are extremely productive and how their presence across countries and scientific fields has changed during 2000-2022. Extremely productive (EP) authors were defined as those with >60 full papers (articles, reviews, conference papers) published in a single calendar year and indexed in Scopus. We identified 3,191 EP authors across science excluding Physics and 12,624 EP authors in Physics. While Physics had much higher numbers of EP authors in the past, in 2022 the number of EP authors was almost similar in non-Physics and Physics disciplines (1,226 vs. 1,480). Excluding Physics, China had the largest number of EP authors, followed by the USA. However, the largest fold-wise increases between 2016 and 2022 were seen in Thailand (19-fold), Saudi Arabia (11.5-fold), Spain (11.5-fold), India (10.2-fold), Italy (6.9-fold), Russia (6.5-fold), Pakistan (5.7-fold), and South Korea (5.2-fold). Excluding Physics, most EP authors were in Clinical Medicine, but from 2016 to 2022 the largest relative increases were seen in Agriculture, Fisheries & Forestry (14.6-fold), Biology (13-fold), and Mathematics and Statistics (6.1-fold). EP authors accounted for 4,360 of the 10,000 most-cited authors (based on raw citation count) across science. While most EP Physics authors had modest citation impact in a composite citation indicator that adjusts for co-authorship and author positions, 67% of EP authors in non-Physics fields remained within the top-2% according to that indicator among all authors with >=5 full papers. Extreme productivity has become worryingly common across scientific fields with rapidly increasing rates in some countries and settings.

Keywords: productivity, authorship, publish or perish

INTRODUCTION

Authorship of scientific papers is highly coveted in the "publish or perish" mentality. Many scientists are very active, publishing large numbers of papers each year. Productivity is facilitated further by the advent of team science, especially in fields where extremely large numbers of authors are listed in each paper, and by an inflation of authors due to changes in norms of credit allocation (Hosseini et al., 2022; Wager et al., 2015; Papatheodorou et al., 2008). For very productive authors, it is often difficult to separate to what extent their records may reflect true productivity, lenient criteria for authorship credit or even outright gift authorship practices. Studying the most extreme cases may help understand the evolving dynamics of research productivity and authorship.

It is arbitrary to set a threshold of what is "most extreme". However, previous work (Ioannidis et al., 2018) idefined hyperprolific authors (HP) as those who, in any single calendar year, had published more than 72 full papers (including original articles, reviews, and conference papers and excluding editorials/commentaries, notes, and letters). Such productivity amounts to publishing more than 1 full paper every 5 days, even counting weekends. Analysis of the Scopus data for the period 2000-2016 (Ioannidis et al, 2018) found that the vast majority of these authors were in physics disciplines, nuclear and particle physics specifically, reflecting the well-known practice in that field of equating authorship with participation in some experimental group without necessarily writing or editing the resulting papers. Excluding physics, during 2000-2016 the few HP authors (n=154, excluding Chinese names) were mostly concentrated in a few scientific subfields such as epidemiology, cardiology, and crystallography (Ioannidis et al, 2018). Their numbers had clearly increased between 2000 and 2014, but seemed to level off between 2014 and 2016. An interview survey of these authors revealed that frequently there was a lax approach towards traditional Vancouver authorship criteria (Ioannidis et al, 2018).

Since 2016, the pressure to publish or perish may have grown stronger across several scientific fields. Extreme productivity has also been further incentivized in some countries and settings, including monetary benefits which are sometimes out of proportion to typical salaries of researchers (Xu et al., 2021; Quan et al., 2017; 7. Kim & Bak, 2016; Andersen & Pallesen, 2008; Chapman et al., 2019). Some prolific scientists even adopt spurious affiliations with Saudi Arabian universities to secure financial benefits (Bhattacharjee, 2011; Catanzaro, 2023). Concurrently, the paradigm of team science has become more common across an increasing number of scientific fields (Fontanarosa et al., 2017). The effect these evolving circumstances have had on the phenomenon of extreme productivity is unknown. It would be also be interesting to examine which countries and scientific fields are particularly affected. Therefore, in this work we examined the evolving presence of extremely productive authors across science in the extended period 2000-2022.

METHODS

Databases and definitions

We used the Scopus database (Baas, et l. 2020) with a data freeze on May 2023. The full period 2000-2022 (23 calendar years) was considered. Similar to previous work (Ioannidis et al, 2018), we considered the number of full papers published by each author. Full papers included the Scopus categories “article”, “review”, and “conference paper”. All other items were not counted (including the categories “editorial”, “note”, “letter”, “correction”, and others). Of note, the number of HP authors identified in the previous work for the years 2000-2016 is expected to be different in the current analysis, because more journals have been added to Scopus retrospectively for these years, some published items may have changed characterization, and author IDs are continuously corrected for errors (e.g. some authors who had their papers split in two or more separate Scopus ID files may have had their files combined and thus now they would emerge as extremely productive, while this was not previously apparent). Eligible authors were selected based on the number of full papers that they had published in a single calendar year exceeding a set threshold.

As previously defined (Ioannidis et al., 2018), an author was called “hyperprolific” (HP) for a given calendar year if he/she published more than 1 full paper every 5 days, i.e. 73 or more full papers. Moreover, we extended the capture of highly productive authors to also take into account authors who are “almost hyperprolific” (AHP). These are authors who have published 61-72 full papers in any given year, i.e. more than 1 paper every 6 days (>60) but not more than 1 paper every 5 days (<73). The sum of HP and AHP authors are called “extremely productive” (EP) authors.

For each Scopus author ID that met the criteria for extreme productivity in a calendar year, we captured the number of full papers in that calendar year, the Scopus listed affiliation and country of affiliation (at the time of the Scopus data freeze), the total number of full papers published in his/her career and during 2000-2022, and the main scientific subfield of his/her work. Scientific fields were classified according to the Science-Metrix classification (Archambault et al., 2011) into 20 fields and 174 subfields. The classification is principally journal-based, with each journal allocated to one field/subfield, except for the minority of multidisciplinary journals where published items may be allocated to more than one field/subfield. For each author, the main field is the one where he/she has published more items during 2000-2022. In the case where the author contributed equal output to two or more fields, the subfield in which the author had the highest amount of publications relative to the total number of publications in that field is chosen as the author’s field.

We cross-linked these data with the data from another project (Ioannidis et al., 2019) where we have generated for all authors with at least 5 full papers information on 6 citation indicators (total citations, h-index, co-authorship-adjusted hm index, citations to papers as single author, citations to papers as first author, citations to papers as single/fist/last author) and a composite citation indicator combining these 6 indicators (Ioannidis et al., 2016). Authors are then ranked based on the composite citation indicator across all authors and also specifically across all the authors allocated to the same main scientific subfield. Percentile ranking is then provided for each author across science and within his/her main subfield. The composite indicator adjusts for co-authorship and author positions and is thus expected to attenuate the relative impact and ranking of many EP authors who are massively co-authoring papers, especially in middle-author positions. Composite indicator values and rankings are typically updated by our team every year (Ioannidis et al., 2019); however, for this project we also separately updated them specifically using the May 2023 Scopus data freeze that was used also for the collection of HP, AHP, and EP data, so that the linked data would be consistent.

Analyses

We began by separating upfront authors whose main subfield is one of the subfields of the Physics & Astronomy field in the Science-Metrix classification (henceforward called "Physics" group for parsimony), from those whose main subfield is within one of the other 19 fields of science ("non-Physics" group). This was essential, since it is well documented that the large majority of EP authors have traditionally been in physics-related disciplines (Ioannidis et al., 2018). The main analyses focused on the non-Physics group, but we also examined the evolution of extreme productivity in the Physics group for contrast.

The main analyses examined the number of HP, AHP and EP authors in each calendar year between 2000-2022 to discern and describe time patterns. We also evaluated the distribution of these authors in different countries and assessed whether the rate of increase in such authors is particularly high in recent years (2016-2022) in specific countries. Furthermore, we evaluated the distribution of these authors each year in the main fields of science. This allowed us to discern and describe whether the rate of increase in such authors is particularly high in recent years (2016-2022) in specific fields. We then explored whether any specific subfield(s) within the fields with most rapidly increasing presence of such authors is responsible for the massive increase. Rates of prolific authors were also expressed in conjunction with the total number of authors with >=5 full papers during 2000-2022 in each country and in each field.

In order to describe the citation impact of HP, AHP, and overall EP authors, we evaluated how many of them were ranked among the top-10,000 most-cited scientists across non-Physics and Physics based on raw citation counts including self-citations; and in the top-2% percentile according to the composite citation indicator within their main subfield (with or without citations). We also generated boxplots of the percentile rankings within their subfield for such authors, so as to visualize the features of the full distribution of composite citation indicator-based rankings.

For the Physics group, we also examined whether changes over time in the total number of HP, AHP, and EP authors are related to the number of full papers published every year that include an affiliation from the European Organization for Nuclear Research (EONR) (AFID(60019778)) and even more specifically to those papers among them that have a large number of listed authors (>100, >500, and >1000).

RESULTS

Extremely productive authors

During 2000-2022, in the non-Physics group (all scientific fields, excluding the "Physics & Astronomy" field in the Science-Metrix classification), there were 1,661 authors who had reached HP status (>72 full papers published) in at least one calendar year, 2,543 authors who had reached AHP status (61-72 full papers published) in at least one calendar year, and overall 3,191 authors who had reached EP status (>60 full papers published) in at least one calendar year. The respective numbers for the Physics group were 10,441, 8,588, and 12,624. Table 1 shows for each calendar year in each of these two groups, the number of HP, AHP and EP authors.

The Physics group witnessed a very sharp increase in the number of HP authors between 2010 (n=125) and 2012 (n=5,170) and the number of HP authors remained relatively constant at 5,000 until 2019. In 2020 there was a small decrease and in 2021 and 2022 there was a very sharp decrease; in 2021, the sharp decrease in HP authors was compensated by an equally sharp increase in the number of AHP authors, but this compensation did not seem to occur in 2022. This pattern is largely explained by examination of the full papers published each year with the affiliation of European Organization of Nuclear Research. The number of such papers has declined sharply in the last few years, with the greatest decline in 2022 and with even greater proportional declines for the number of papers with this affiliation who have a large number of authors (>100, >500, >1000) (supplementary table 1 and supplementary figure 1)

Excluding Physics, the number of both HP and AHP authors showed a 5-fold increase between 2000 and 2006, it increased 2-3-fold in the next decade and has seen another acceleration of growth with 3-4-fold increase in the last 6 years (2016-2022). In 2022, the number of HP and AHP authors across science excluding Physics was almost similar to the respective numbers in Physics. Excluding Physics, there were 1,266 extremely productive authors in 2022 (versus 1,480 for Physics) (Table 1).

Countries of extremely productive authors across science

Some countries accounted for the lion's share of EP authors. Figure 1 shows the share of each country in HP, AHP, and overall EP authors during the cumulative period 2000-2022 in the non-Physics and Physics groups (detailed numerical data appear in Supplementary Table 2). Patterns are similar for HP, AHP, and EP authors, but they differ in the non-Physics versus Physics fields. In Physics the main countries reflected to a large extent participation in EONR projects and thus the order was USA, Germany, Italy, UK, Switzerland, China, and France. Excluding Physics, China has had the highest number of EP authors every year since 2003 and in the cumulative 2000-2022 period it was followed by the USA, Germany, Japan, UK, Italy, and Australia. However, in recent years some countries had risen much faster towards the top ranks in the non-Physics fields.

In non-Physics fields during 2022 specifically, the countries with the highest number of EP authors were China (n=303), USA (n=124), Saudi Arabia (n=69), Italy (n=62), Germany (n=58), India (n=51), UK (n=47), Australia (n=47), Japan (n=35), Canada (n=28), Iran (n=26), South Korea (n=26), Spain (n=23), Netherlands (n=20), Taiwan (n=19), Thailand (n=19), Pakistan (n=17), Denmark (n=15), Malaysia (n=14), France (n-14), Russia (n=13), Singapore (n=12), Hong Kong (n=11), and Switzerland (n=7). Compared to 2016, most countries had 1.5-4-fold increases in the numbers of EP authors, but several countries had much higher increases: Thailand 19-fold (19 vs. 1), Saudi Arabia 11.5-fold (69 vs. 6), Spain 11.5-fold (23 vs. 2), India 10.2-fold (51 vs. 5), Italy 6.9-fold (62 vs. 9), Russia 6.5-fold (13 vs. 2), Pakistan 5.7-fold (17 vs. 3), South Korea 5.2-fold (26 vs. 5). The number of EP authors in these 8 countries with rapidly rising numbers in each year during 2000-2022 is shown in Figure 2 (detailed numerical data are in Supplementary Table 3).

Across countries with more than 50,000 authors with >=5 full papers when all scientific fields were considered, the highest proportions of EP authors among all authors were seen in Switzerland (823 of 81,045, 1.0%), Germany (1,791 of 370,960, 0.5%), and

Italy (1,200 of 249,100, 0.5%). However, this was driven by the very strong participation of these countries in Physics multi-authored work. In the non-Physics group, among countries with more than 5,000 authors with >=5 full papers, the highest proportion of EP authors among all authors were seen in Saudi Arabia (98 of 27,588 authors, 0.36%) followed by Iraq (13 of 10,485, 0.12%), Malaysia (52 of 43,918, 0.12%), United Arab Emirates (9 of 8,059, 0.11%), Philippines (6 of 5,531, 0.11%), and Pakistan (33 of 32,529, 0.10%).

Scientific fields of extremely productive authors across science

Figure 3 shows the share of each scientific field (excluding the field of Physics & Astronomy) in the total number of prolific authors during 2000-2022. The patterns are similar for HP, AHP, and EP authors (detailed numerical data appear in Supplementary Table 4).

Among non-Physics fields, the scientific fields with the highest concentration of EP authors in 2022 were Clinical Medicine (n=678), Enabling & Strategic Technologies (n=327), Information & Communication Technologies (n=283), Engineering (n=168), Agriculture, Fisheries & Forestry (n=146), and Chemistry (n=140). There were modest numbers of EP authors that year in Earth & Environmental Sciences (n=57), Mathematics & Statistics (n=43), Biomedical Research (n=37), Biology (n=26), Economics & Business (n=17), and Public Health & Health Services (n=10), few EP authors in Built Environment & Design (n=6) and Psychology & Cognitive Sciences (n=2), and no EP authors in 5 fields (Social Sciences, Communication & Textual Studies, Historical Studies, Philosophy & Theology, Visual & Performing Arts). Compared with 2016, most fields saw a 2- to 4-fold increase in the number of EP authors in 2022, but there was a more dramatic increase in Agriculture, Fisheries & Forestry 14.6-fold (146 versus 10), Biology 13-fold (26 vs. 2), and Mathematics and Statistics 6.1-fold (43 vs. 7), while Economics & Business, Built Environment & Design and Psychology & Cognitive Sciences had no EP authors in 2016.

Given that the majority of EP authors in 2022 excluding Physics were in Clinical Medicine, we also examined whether specific subfields within this field had more major increases between 2016 and 2022. The highest fold-increases were seen in Complementary & Alternative Medicine (10.3-fold), Tropical Medicine (5.5-fold), Dentistry (4.5-fold), Immunology (4.2-fold), and Pharmacology & Pharmacy (3.8-fold). We also examined the subfields of Agriculture and Biology that had the most dramatic fold-increases between 2016 and 2022. The highest-fold increases were seen in Plant Biology & Botany (16 versus 1, 16-fold), Food science (78 versus 5, 15.6-fold), Fisheries (14 versus 1, 14-fold), Agronomy & Agriculture (13 versus 1, 13-fold) and Dairy & Animal Science (24 versus 2, 12-fold).

In terms of representation of EP authors among all authors with >=5 full papers in the field during 2000-2022, the highest proportions outside of Physics were seen in in Enabling and Strategic Technologies (605 of 685703 authors, 0.12%), Information and Communication Technologies (396 of 627,550, 0.08%), Chemistry (307 of 546,679, 0.08%), Engineering (334 of 456,772, 0.07%), and Agriculture, Fisheries and Forestry (143 of 211,946, 0.07%).

Ranking for citation impact

Based on raw citation counts, EP authors accounted for 4,360 of the top-10,000 most-cited authors across science. In the Physics group, EP authors accounted for 3,336 /17,768 (18.8%) of the top-2% (with and/or without self-citations counted) according to raw citation counts but only 576/17,578 (3.28%) of the top-2% according to the composite citation indicator. In non-Physics fields, EP authors accounted for 2,402/184,391(1.30%) of the top-2% by raw citation counts and 2,139.184,113 (1.16%) of the top-2% according to the composite citation indicator. As shown in Figure 4, the large majority of EP authors across science excluding Physics have very prominent ranking even with the composite citation indicator (67.0% were in the top-2%), while most EP authors in Physics have very modest ranks with the composite citation indicator (4.56% are in the top-2%).

DISCUSSION

The current analysis of the Scopus database has documented a massive increase in the number of authors who exhibit extreme productivity in recent years in fields outside the discipline of nuclear and particle physics that has been well-known to operate with large-scale collaborations resulting in massive co-authorships of published papers. In fact, as the productivity of EONR overall and in terms of massively co-authored papers has recently declined, by 2022 the number of authors with extreme productivity in fields outside of Physics has almost matched the number of such authors in Physics. Overall, during 2000-2022, more than 3,000 authors outside of Physics (and more than 12,000 in Physics) have had at least one calendar year where they published more than 1 full paper every 6 days. Most of them had at least one calendar year where they published more than 1 full paper every 5 days. Outside of Physics, the increase in the number of EP authors seems to have accelerated during 2016-2022 with a >3-fold increase in this period. However, some countries and some fields have witnessed a far more marked increase in EP behavior.

China has remained the country with the highest number of AP, AHP, and EP authors for many consecutive years now. Overall, the ascendancy of China among EP authors may reflect the use of policies in China that placed emphasis in promoting productivity, with major financial records (Xu et al., 2021; Quan et al., 2017). These policies have been heavily criticized and some of them have been reverted (Wang et al., 2021)]. Regardless, China is currently publishing more scientific papers than any other country (Xie & Freeman, 2019).

Eight countries had very impressive relative increases in the number of EP authors, amounting to 5-19-fold increases between 2016 and 2022. The advent of Saudi Arabia among the affiliation of EP authors may be due to the strong financial incentives offered by Saudi institutions. In Scopus, this reflects almost entirely local Saudi authors who reach extreme productivity, not the listing of Saudi institutions by authors working mostly in other countries in the Clarivate Highly Cited Researchers database (Bhatacharjee, 2011; Catanzaro, 2023). Spain, Italy, and South Korea have also seen a spectacular increase in the number of HP authors. It is unclear to which extent this may be related to specific national and/or university/institutional policies that favor raw productivity and English-language international publications over local language publications. Thailand, India, Russia and Pakistan have also witnessed sharp increases in EP author counts, even if the numbers are still modest in absolute terms when seen against their large populations. Excluding Physics, the highest presence of EP authors after adjusting for the total number of authors in each country is seen in Arab countries (Saudi Arabia, Iraq, United Arab Emirates, Pakistan) and in Malaysia and Philippines. It is possible that cultural reasons promote concentration of massive authorship practices is some scientists in these countries.

The majority of EP authors outside of Physics operate within the broad field of Clinical Medicine. This is not surprising, given that about one in three authors across science belong to this field. Nevertheless, some particular subfields seem to have a more major acceleration of the EP phenomenon. Agriculture, Fisheries & Forestry, Biology, and Mathematics and Statistics have also witnessed extreme relative increases in the number of EP authors in recent years. It is possible that these impressive increases reflect specific niches where EP behavior has become established and is adopted by several scientists working in these niches. Authorship practices may have become more lax in these niches, new norms of co-authorship may have evolved or unethical practices such as paper mills may have infiltrated these fields.

In our analysis, we made no effort to identify whether EP authors fulfill the typically required authorship criteria (e.g. Vancouver). However, based on previous survey results (Ioannidis et al., 2018), it is likely that many, if not most, of these authors do not routinely follow Vancouver criteria. Moreover, we made no effort to identify if some of the EP authors are associated with overtly unethical practices such as paper mills (Else & van Noorden, 2021; Christopher, 2021) or citation cartels (citation farms) (Fister et al. 2016). These characterizations would require in-depth evaluations of the CVs of single authors and meticulous investigative work. The Scopus data that we have made available may facilitate such efforts in the future.

Regardless of the exact of mix of genuine productivity, spurious authorship standards, and outright unethical research practices (Ioannidis & Maniadis, 2024), EP authors appear to enjoy high success in terms in citation impact, especially when raw citation counts are considered. 44% of the most-cited authors across science in terms of raw citations are EP authors. This suggests that counting citations without adjusting for co-authorship patterns may be highly problematic. Using a composite citation indicator that tries to correct for co-authorship and author position patterns, most of the Physics EP authors no longer rank very highly. Among non-Physics EP authors, the vast majority still reach the very top ranks of citation impact, even with these adjustments. This means that besides the sheer volume of published items, they often have influential position placements such as last author. This is a typical situation in some fields such as Clinical Medicine, where department leaders acquire the senior author spot, often with questionable research contributions or even overt gift authorship (Al-Herz et al., 2014; Kovac, 2013). While EP authors are a very small percentage of the scientific workforce, they have a substantial share among the ranks of the most-cited scientists. Given this high visibility and perceived impact, it is likely that many of them may also exert high influence in their environments and shape the course of science in their institutions and in their fields. This may make EP behavior not only legitimized but also highly coveted by other scientists in the same environment, propagating the further growth of the EP authors' cohort.

Our work has some limitations. First, the identification of EP authors may be affected by errors in Scopus. Scopus author profile quality on precision (collecting the right publications for an author) and recall (collecting all publications for the author in the database in the profile) is continuously monitored using a gold set. In previous work done 7 years ago (Ioannidis et al., 2018), we had excluded authors with Chinese names, because at that time there was uncertainty about precision and recall for authors from Eastern Asia. Currently, the average overall precision reported by Elsevier by October 2023, is 96.6% with a recall of 92.1%. Specifically for authors in the gold set publishing in Eastern Asia, the precision is 97.1% and the recall 91.2% versus precision of 97.9% and a recall of 89.8% for authors publishing in North America.

Second, there is no absolute cut-off for the number of annual papers that may be too much. Nevertheless, the use of two different thresholds gives qualitatively similar patterns for the features of extreme productivity behavior. Third, some journals are not covered by Scopus. Hence, the number of publications for some authors may be undercounted and the number of EP authors may be even larger than estimated here. Fourth, we did not account for other aspects of author productivity besides full papers. While journal-published items that are not full papers typically require far less effort than full papers, books may require major effort. It would be interesting to evaluate in the future also the presence of prolific book authors in databases that index published books.

Allowing for these caveats, our analyses show a major increase in authors with extreme productivity across almost all scientific fields with multiple countries and fields and subfields leading this phenomenon. While some very talented, outstanding scientists may be included in the EP group, spurious and unethical behaviors may also abound. With the advent of mega-journals publishing many thousands of papers every year (Ioannidis et al., 2023), of artificial intelligence that may further facilitate writing papers (Flanagin, et al., 2023) and with peer-review having major limitations, the increase in EP authorship patterns is likely to continue in the future. Productivity and citation metrics have acquired major influence in most scientific environments and they are often misused despite the availability of guidance for their more proper use (Hicks et al, 2015). Some authors have even argued that there should be a limit to the number of pages/papers a scientist can publish (Martinson, 2017). However, this may be a bad idea as it may further exaggerate publication bias and other selection biases. Instead, it may be more realistic and appropriate to monitor extreme publication behaviors in centralized, standardized databases (Ioannidis & Maniadis, 2023), as we have done here. This monitoring should allow careful in-depth assessments of extreme patterns for single authors, teams, institutions, and countries.

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Table 1. Number of hyperprolific (HP), almost hyperprolific (AHP) and overall extremely productive (EP) authors in 2000-2022 in Physics (Ph) and non-Physics (nonPh) groups

Year	HP-Ph	HP-nonPh	AHP-Ph	AHP-nonPh	EP-Ph	EP-nonPh
2000	7	19	9	16	16	35
2001	5	10	8	29	13	39
2002	12	13	22	25	34	38
2003	15	24	17	34	32	58
2004	25	49	84	53	109	102
2005	36	64	117	74	153	138
2006	114	93	500	78	614	171
2007	501	108	124	79	625	187
2008	50	105	473	110	523	215
2009	44	132	217	106	261	238
2010	125	126	187	130	312	256
2011	958	143	1513	161	2471	304
2012	5170	141	215	149	5385	290
2013	4985	137	340	162	5325	299
2014	4580	169	826	204	5406	373
2015	4669	177	771	200	5440	377
2016	4938	185	252	202	5190	387
2017	4863	206	770	235	5633	441
2018	5039	294	213	313	5252	607
2019	4935	360	361	355	5296	715
2020	4155	431	686	414	4841	845
2021	972	568	3944	572	4916	1140
2022	761	674	719	592	1480	1266

FIGURE LEGENDS

Figure 1. Pie charts of the number of HP, AHP and EP (sum of HP and AHP) authors in Physics and non-Physics scientific fields according to country of affiliation for the entire period 2000-2022.

Figure 2. Number of EP authors in non-Physics scientific fields in each calendar year between 2000 and 2022 for the eight countries that have more than 5-fold increases between 2016 and 2022.

Figure 3. Pie charts of the number of HP, AHP and overall EP (sum of HP and AHP) authors in non-Physics disciplines according to main scientific field for the entire period 2000-2022.

Figure 4. Boxplots of rankings based on composite citation indicator (all career-long, including self-citations) for HP, AHP, and overall EP (sum of HP and AHP) authors, separately for Physics and for all other scientific fields excluding Physics.

Figure 1

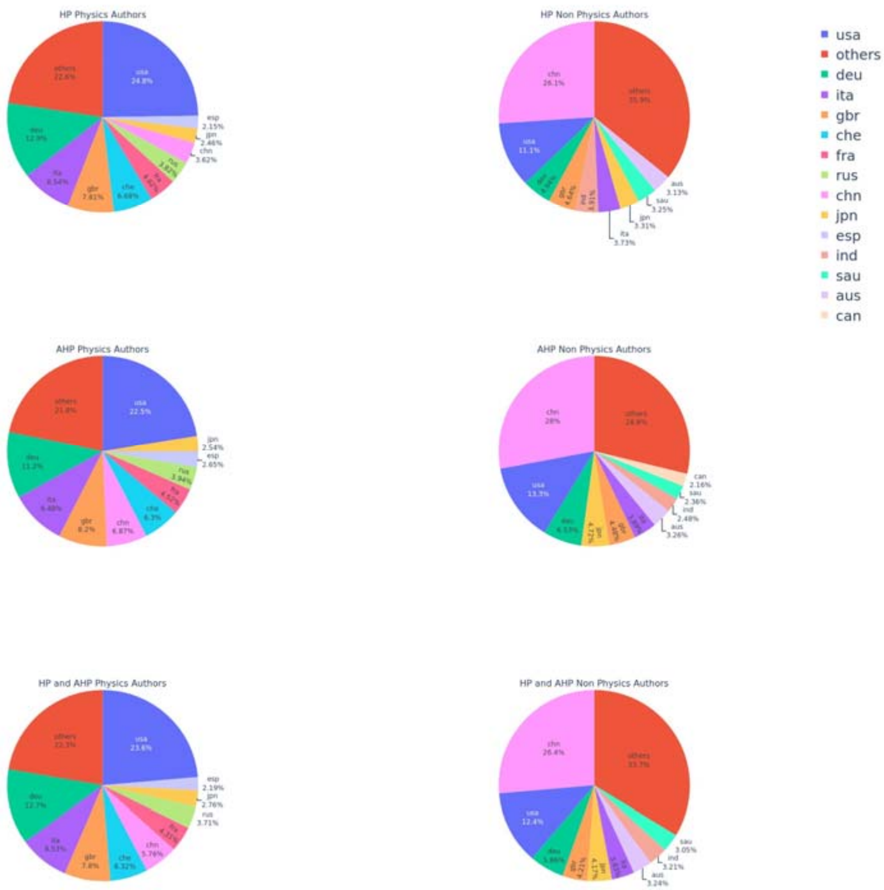

HP Physics Authors
HP Non Physics Authors
AHP Physics Authors
AHP Non Physics Authors
HP and AHP Physics Authors
HP and AHP Non Physics Authors
usa
others
deu
ita
gbr
che
fra
rus
chn
jpn
esp
ind
sau
aus
can

Figure 2

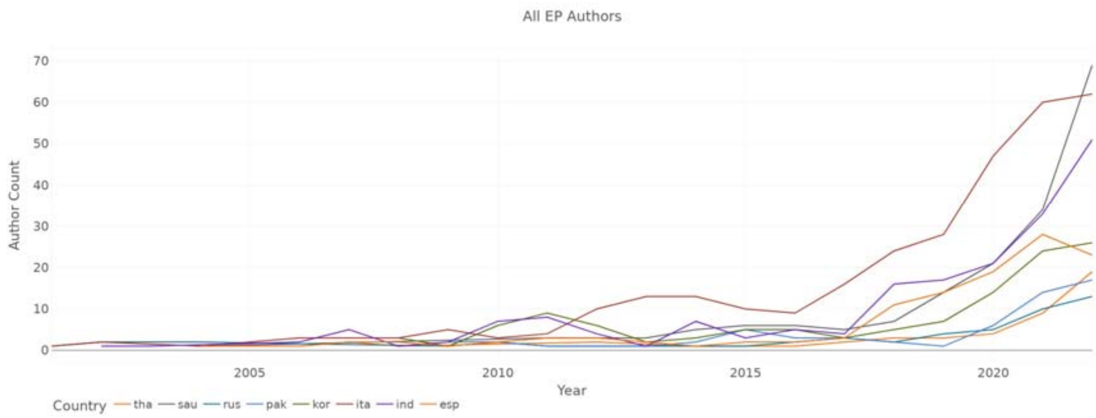

All EP Authors
Author Count
0
10
20
30
40
50
60
70
2005
2010
2015
2020
Year
Country
tha
sau
rus
pak
kor
ita
ind
esp

Figure 3

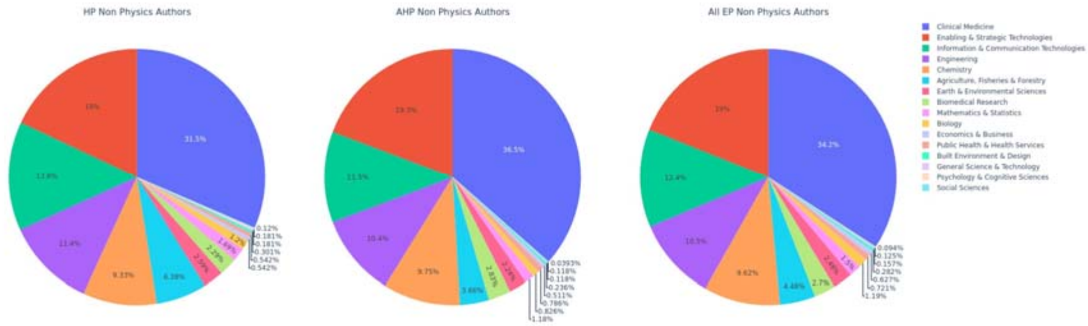
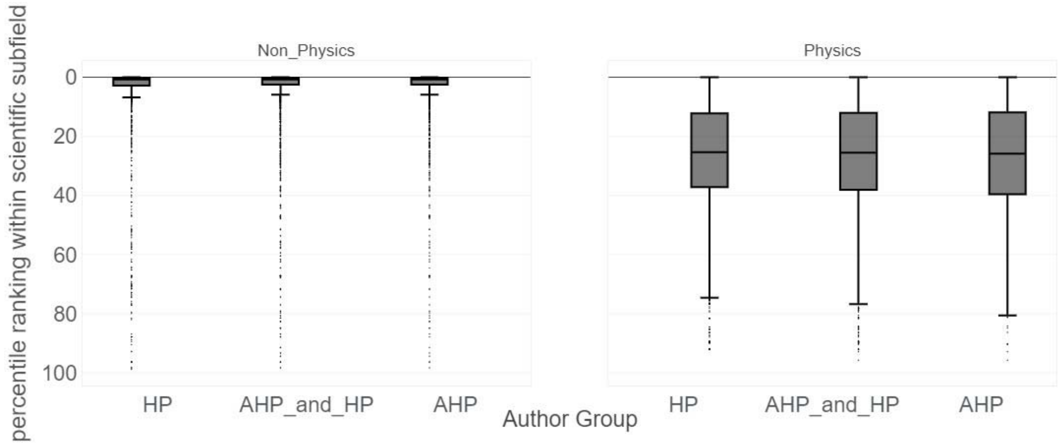
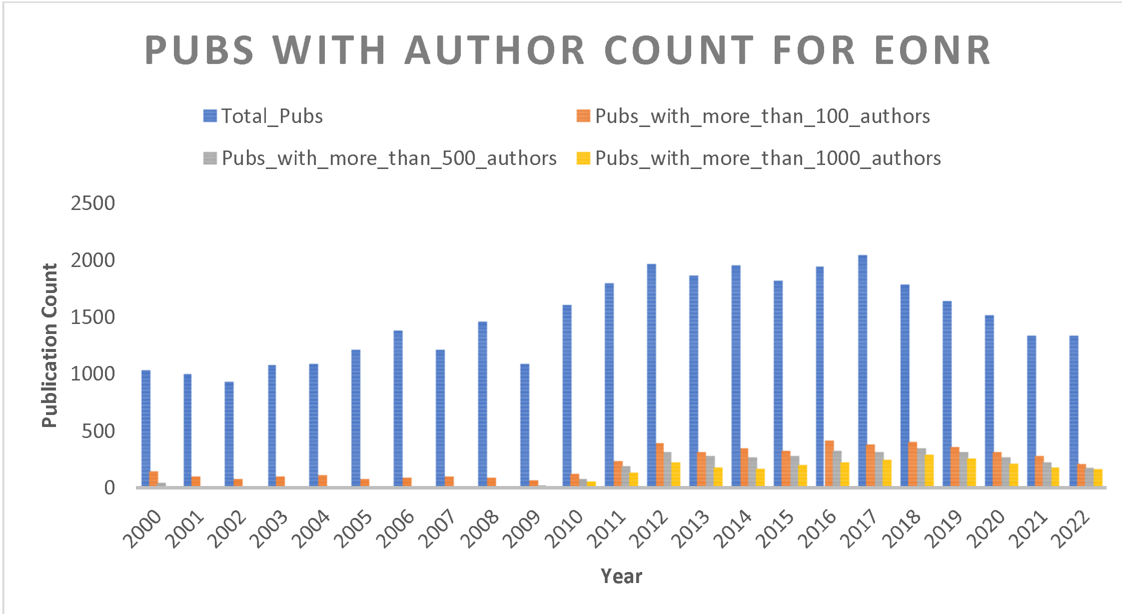

HP Non Physics Authors
AHP Non Physics Authors
All EP Non Physics Authors
Clinical Medicine
Enabling & Strategic Technologies
Information & Communication Technologies
Engineering
Chemistry
Agriculture, Fisheries & Forestry
Earth & Environmental Sciences
Biomedical Research
Mathematics & Statistics
Biology
Economics & Business
Public Health & Health Services
Built Environment & Design
General Science & Technology
Psychology & Cognitive Sciences
Social Sciences

Figure 4


Non_Physics
Physics
percentile ranking within scientific subfield
0
20
40
60
80
100
HP
AHP_and_HP
AHP
Author Group

Supplementary Table 1 and Supplementary Figure 1. Number of full papers overall and with >100, >500, and >1000 authors published with an affiliation from the European Organization for Nuclear Research

	Total_Pubs	Pubs_with	Pubs_with	Pubs_wit
2000	1026	139	32	0
2001	986	91	5	0
2002	927	67	0	0
2003	1064	91	1	1
2004	1076	96	1	0
2005	1202	69	1	1
2006	1369	78	3	2
2007	1207	94	2	2
2008	1445	75	6	3
2009	1079	56	9	2
2010	1600	109	64	50
2011	1795	225	182	123
2012	1950	377	306	215
2013	1862	308	273	163
2014	1943	345	254	159
2015	1808	315	274	187
2016	1933	409	310	221
2017	2039	369	307	234
2018	1778	396	339	284
2019	1631	349	300	253
2020	1505	307	260	200
2021	1324	270	222	171
2022	1330	203	168	155


PUBS WITH AUTHOR COUNT FOR EONR
Total_Pubs
Pubs_with_more_than_100_authors
Pubs_with_more_than_500_authors
Pubs_with_more_than_1000_authors
Publication Count
0
500
1000
1500
2000
2500
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year

Supplementary Table 2. Number of HP, AHP, and overall EP (sum of HP and AHP) authors in each country during 2000-2022 for Physics and for non-Physics scientific fields

cntry	Number of authors	Group	Rank
chn	433	HP_Non_Physics_Authors	1
usa	185	HP_Non_Physics_Authors	2
deu	82	HP_Non_Physics_Authors	3
others	80	HP_Non_Physics_Authors	4
gbr	77	HP_Non_Physics_Authors	5
ind	65	HP_Non_Physics_Authors	6
ita	62	HP_Non_Physics_Authors	7
jpn	55	HP_Non_Physics_Authors	8
sau	54	HP_Non_Physics_Authors	9
aus	52	HP_Non_Physics_Authors	10
kor	31	HP_Non_Physics_Authors	11
twn	29	HP_Non_Physics_Authors	12
mys	27	HP_Non_Physics_Authors	13
irn	27	HP_Non_Physics_Authors	13
fra	26	HP_Non_Physics_Authors	15
nld	25	HP_Non_Physics_Authors	16
can	25	HP_Non_Physics_Authors	16
esp	24	HP_Non_Physics_Authors	18
pak	19	HP_Non_Physics_Authors	19
dnk	18	HP_Non_Physics_Authors	20
prt	14	HP_Non_Physics_Authors	21
tha	14	HP_Non_Physics_Authors	21
sgp	13	HP_Non_Physics_Authors	23
egy	13	HP_Non_Physics_Authors	23
zaf	13	HP_Non_Physics_Authors	23
che	11	HP_Non_Physics_Authors	26
grc	11	HP_Non_Physics_Authors	26
rus	10	HP_Non_Physics_Authors	28
bra	9	HP_Non_Physics_Authors	29
tur	9	HP_Non_Physics_Authors	29
irq	8	HP_Non_Physics_Authors	31
hkg	8	HP_Non_Physics_Authors	31
isr	8	HP_Non_Physics_Authors	31
nor	7	HP_Non_Physics_Authors	34
idn	7	HP_Non_Physics_Authors	34
bel	7	HP_Non_Physics_Authors	34
pol	6	HP_Non_Physics_Authors	37
bgd	6	HP_Non_Physics_Authors	37
are	6	HP_Non_Physics_Authors	37

rou	5	HP_Non_Physics_Authors	40
fin	5	HP_Non_Physics_Authors	40
swe	5	HP_Non_Physics_Authors	40
cze	5	HP_Non_Physics_Authors	40
vnm	4	HP_Non_Physics_Authors	44
aut	4	HP_Non_Physics_Authors	44
chl	3	HP_Non_Physics_Authors	46
irl	3	HP_Non_Physics_Authors	46
bgr	3	HP_Non_Physics_Authors	46
jor	3	HP_Non_Physics_Authors	46
phl	3	HP_Non_Physics_Authors	46
lux	2	HP_Non_Physics_Authors	51
srb	2	HP_Non_Physics_Authors	51
qat	2	HP_Non_Physics_Authors	51
svk	2	HP_Non_Physics_Authors	51
cyp	2	HP_Non_Physics_Authors	51
nga	2	HP_Non_Physics_Authors	51
mar	2	HP_Non_Physics_Authors	51
nzl	2	HP_Non_Physics_Authors	51
lbn	2	HP_Non_Physics_Authors	51
mac	2	HP_Non_Physics_Authors	51
mex	2	HP_Non_Physics_Authors	51
kwt	1	HP_Non_Physics_Authors	62
geo	1	HP_Non_Physics_Authors	62
per	1	HP_Non_Physics_Authors	62
omn	1	HP_Non_Physics_Authors	62
dji	1	HP_Non_Physics_Authors	62
ukr	1	HP_Non_Physics_Authors	62
brn	1	HP_Non_Physics_Authors	62
isl	1	HP_Non_Physics_Authors	62
grd	1	HP_Non_Physics_Authors	62
gha	1	HP_Non_Physics_Authors	62
hun	1	HP_Non_Physics_Authors	62
mus	1	HP_Non_Physics_Authors	62
syr	1	HP_Non_Physics_Authors	62
pse	1	HP_Non_Physics_Authors	62
eth	1	HP_Non_Physics_Authors	62
ecu	1	HP_Non_Physics_Authors	62
uzb	1	HP_Non_Physics_Authors	62
ltu	1	HP_Non_Physics_Authors	62
tun	1	HP_Non_Physics_Authors	62
kaz	1	HP_Non_Physics_Authors	62
usa	2587	HP_Physics_Authors	1
deu	1346	HP_Physics_Authors	2
ita	892	HP_Physics_Authors	3
gbr	815	HP_Physics_Authors	4
che	697	HP_Physics_Authors	5
fra	482	HP_Physics_Authors	6

rus	399	HP_Physics_Authors	7
chn	378	HP_Physics_Authors	8
jpn	257	HP_Physics_Authors	9
esp	224	HP_Physics_Authors	10
can	218	HP_Physics_Authors	11
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nld	118	HP_Physics_Authors	15
swe	115	HP_Physics_Authors	16
pol	110	HP_Physics_Authors	17
kor	109	HP_Physics_Authors	18
tur	97	HP_Physics_Authors	19
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aut	57	HP_Physics_Authors	26
hun	48	HP_Physics_Authors	27
nor	46	HP_Physics_Authors	28
rou	44	HP_Physics_Authors	29
dnk	38	HP_Physics_Authors	30
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mys	17	HP_Physics_Authors	45
cyp	16	HP_Physics_Authors	47
svn	16	HP_Physics_Authors	47
geo	14	HP_Physics_Authors	49
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est	13	HP_Physics_Authors	51
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ltu	9	HP_Physics_Authors	52
ukr	8	HP_Physics_Authors	54

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qat	2	HP_Physics_Authors	64
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ind	63	AHP_Non_Physics_Authors	8
sau	60	AHP_Non_Physics_Authors	9
can	55	AHP_Non_Physics_Authors	10
irn	50	AHP_Non_Physics_Authors	11
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cze	11	AHP_Non_Physics_Authors	32
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irl	4	AHP_Non_Physics_Authors	45
aut	4	AHP_Non_Physics_Authors	45
nor	3	AHP_Non_Physics_Authors	49
isl	3	AHP_Non_Physics_Authors	49
nzl	3	AHP_Non_Physics_Authors	49
lbn	3	AHP_Non_Physics_Authors	49
phl	3	AHP_Non_Physics_Authors	49
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brn	1	AHP_Non_Physics_Authors	63
cyp	1	AHP_Non_Physics_Authors	63
grd	1	AHP_Non_Physics_Authors	63
gha	1	AHP_Non_Physics_Authors	63
hun	1	AHP_Non_Physics_Authors	63
mus	1	AHP_Non_Physics_Authors	63

syr	1	AHP_Non_Physics_Authors	63
ken	1	AHP_Non_Physics_Authors	63
bgr	1	AHP_Non_Physics_Authors	63
mex	1	AHP_Non_Physics_Authors	63
usa	1930	AHP_Physics_Authors	1
deu	964	AHP_Physics_Authors	2
ita	814	AHP_Physics_Authors	3
gbr	704	AHP_Physics_Authors	4
chn	590	AHP_Physics_Authors	5
che	541	AHP_Physics_Authors	6
fra	388	AHP_Physics_Authors	7
rus	338	AHP_Physics_Authors	8
esp	228	AHP_Physics_Authors	9
jpn	218	AHP_Physics_Authors	10
can	169	AHP_Physics_Authors	11
ind	103	AHP_Physics_Authors	12
pol	102	AHP_Physics_Authors	13
bel	94	AHP_Physics_Authors	14
tur	93	AHP_Physics_Authors	15
kor	93	AHP_Physics_Authors	15
nld	92	AHP_Physics_Authors	17
bra	87	AHP_Physics_Authors	18
cze	77	AHP_Physics_Authors	19
swe	76	AHP_Physics_Authors	20
grc	67	AHP_Physics_Authors	21
isr	56	AHP_Physics_Authors	22
twn	54	AHP_Physics_Authors	23
aus	46	AHP_Physics_Authors	24
hun	44	AHP_Physics_Authors	25
prt	39	AHP_Physics_Authors	26
rou	36	AHP_Physics_Authors	27
aut	36	AHP_Physics_Authors	27
nor	31	AHP_Physics_Authors	29
fin	30	AHP_Physics_Authors	30
mex	28	AHP_Physics_Authors	31
pak	25	AHP_Physics_Authors	32
hrv	24	AHP_Physics_Authors	33
col	23	AHP_Physics_Authors	34
zaf	23	AHP_Physics_Authors	34
sau	20	AHP_Physics_Authors	36
mar	20	AHP_Physics_Authors	36
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hkg	18	AHP_Physics_Authors	39
svn	18	AHP_Physics_Authors	39
dnk	16	AHP_Physics_Authors	41
srb	15	AHP_Physics_Authors	42
svk	15	AHP_Physics_Authors	42
arg	14	AHP_Physics_Authors	44

blr	14	AHP_Physics_Authors	44
irn	14	AHP_Physics_Authors	44
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mys	13	AHP_Physics_Authors	47
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est	9	AHP_Physics_Authors	50
egy	8	AHP_Physics_Authors	52
lka	8	AHP_Physics_Authors	52
chl	7	AHP_Physics_Authors	54
ukr	7	AHP_Physics_Authors	54
tha	7	AHP_Physics_Authors	54
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sgp	5	AHP_Physics_Authors	58
others	5	AHP_Physics_Authors	58
irl	4	AHP_Physics_Authors	60
dza	3	AHP_Physics_Authors	61
vnm	3	AHP_Physics_Authors	61
arm	3	AHP_Physics_Authors	61
nzl	3	AHP_Physics_Authors	61
mng	2	AHP_Physics_Authors	65
lva	2	AHP_Physics_Authors	65
mne	2	AHP_Physics_Authors	65
ecu	2	AHP_Physics_Authors	65
kaz	2	AHP_Physics_Authors	65
pri	1	AHP_Physics_Authors	70
irq	1	AHP_Physics_Authors	70
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qat	1	AHP_Physics_Authors	70
aze	1	AHP_Physics_Authors	70
pse	1	AHP_Physics_Authors	70
are	1	AHP_Physics_Authors	70
usa	2984	HP_and_AHP_Physics_Authors	1
deu	1603	HP_and_AHP_Physics_Authors	2
ita	1077	HP_and_AHP_Physics_Authors	3
gbr	985	HP_and_AHP_Physics_Authors	4
che	798	HP_and_AHP_Physics_Authors	5
chn	728	HP_and_AHP_Physics_Authors	6
fra	544	HP_and_AHP_Physics_Authors	7
rus	468	HP_and_AHP_Physics_Authors	8
jpn	349	HP_and_AHP_Physics_Authors	9
esp	277	HP_and_AHP_Physics_Authors	10
can	257	HP_and_AHP_Physics_Authors	11
bel	172	HP_and_AHP_Physics_Authors	12
ind	155	HP_and_AHP_Physics_Authors	13
nld	142	HP_and_AHP_Physics_Authors	14
pol	136	HP_and_AHP_Physics_Authors	15
kor	136	HP_and_AHP_Physics_Authors	15

cze	134	HP_and_AHP_Physics_Authors	17
swe	128	HP_and_AHP_Physics_Authors	18
tur	114	HP_and_AHP_Physics_Authors	19
bra	110	HP_and_AHP_Physics_Authors	20
grc	98	HP_and_AHP_Physics_Authors	21
isr	79	HP_and_AHP_Physics_Authors	22
aus	79	HP_and_AHP_Physics_Authors	22
twn	74	HP_and_AHP_Physics_Authors	24
prt	72	HP_and_AHP_Physics_Authors	25
aut	64	HP_and_AHP_Physics_Authors	26
hun	54	HP_and_AHP_Physics_Authors	27
nor	52	HP_and_AHP_Physics_Authors	28
rou	51	HP_and_AHP_Physics_Authors	29
mex	48	HP_and_AHP_Physics_Authors	30
dnk	39	HP_and_AHP_Physics_Authors	31
fin	36	HP_and_AHP_Physics_Authors	32
pak	34	HP_and_AHP_Physics_Authors	33
sau	33	HP_and_AHP_Physics_Authors	34
hrv	32	HP_and_AHP_Physics_Authors	35
zaf	32	HP_and_AHP_Physics_Authors	35
bgr	31	HP_and_AHP_Physics_Authors	37
col	30	HP_and_AHP_Physics_Authors	38
mar	28	HP_and_AHP_Physics_Authors	39
hkg	25	HP_and_AHP_Physics_Authors	40
srb	24	HP_and_AHP_Physics_Authors	41
svk	24	HP_and_AHP_Physics_Authors	41
svn	24	HP_and_AHP_Physics_Authors	41
arg	21	HP_and_AHP_Physics_Authors	44
mys	21	HP_and_AHP_Physics_Authors	44
blr	20	HP_and_AHP_Physics_Authors	46
chl	19	HP_and_AHP_Physics_Authors	47
irn	19	HP_and_AHP_Physics_Authors	47
cyp	16	HP_and_AHP_Physics_Authors	49
geo	14	HP_and_AHP_Physics_Authors	50
est	13	HP_and_AHP_Physics_Authors	51
ltu	11	HP_and_AHP_Physics_Authors	52
egy	10	HP_and_AHP_Physics_Authors	53
tha	10	HP_and_AHP_Physics_Authors	53
ukr	9	HP_and_AHP_Physics_Authors	55
nzl	9	HP_and_AHP_Physics_Authors	55
idn	8	HP_and_AHP_Physics_Authors	57
lka	8	HP_and_AHP_Physics_Authors	57
sgp	7	HP_and_AHP_Physics_Authors	59
others	6	HP_and_AHP_Physics_Authors	60
arm	6	HP_and_AHP_Physics_Authors	60
irl	6	HP_and_AHP_Physics_Authors	60
pri	4	HP_and_AHP_Physics_Authors	63
dza	4	HP_and_AHP_Physics_Authors	63

vnm	4	HP_and_AHP_Physics_Authors	63
aze	4	HP_and_AHP_Physics_Authors	63
mng	2	HP_and_AHP_Physics_Authors	67
irq	2	HP_and_AHP_Physics_Authors	67
lva	2	HP_and_AHP_Physics_Authors	67
mne	2	HP_and_AHP_Physics_Authors	67
qat	2	HP_and_AHP_Physics_Authors	67
are	2	HP_and_AHP_Physics_Authors	67
ecu	2	HP_and_AHP_Physics_Authors	67
kaz	2	HP_and_AHP_Physics_Authors	67
per	1	HP_and_AHP_Physics_Authors	75
omn	1	HP_and_AHP_Physics_Authors	75
bgd	1	HP_and_AHP_Physics_Authors	75
pse	1	HP_and_AHP_Physics_Authors	75
jor	1	HP_and_AHP_Physics_Authors	75
chn	846	HP_and_AHP_Non_Physics_Authors	1
usa	398	HP_and_AHP_Non_Physics_Authors	2
deu	188	HP_and_AHP_Non_Physics_Authors	3
gbr	135	HP_and_AHP_Non_Physics_Authors	4
jpn	134	HP_and_AHP_Non_Physics_Authors	5
ita	123	HP_and_AHP_Non_Physics_Authors	6
others	109	HP_and_AHP_Non_Physics_Authors	7
aus	104	HP_and_AHP_Non_Physics_Authors	8
ind	103	HP_and_AHP_Non_Physics_Authors	9
sau	98	HP_and_AHP_Non_Physics_Authors	10
can	59	HP_and_AHP_Non_Physics_Authors	11
irn	58	HP_and_AHP_Non_Physics_Authors	12
kor	56	HP_and_AHP_Non_Physics_Authors	13
mys	52	HP_and_AHP_Non_Physics_Authors	14
nld	48	HP_and_AHP_Non_Physics_Authors	15
esp	46	HP_and_AHP_Non_Physics_Authors	16
fra	41	HP_and_AHP_Non_Physics_Authors	17
twn	39	HP_and_AHP_Non_Physics_Author	18

		s	
pak	33	HP_and_AHP_Non_Physics_Authors	19
rus	32	HP_and_AHP_Non_Physics_Authors	20
dnk	30	HP_and_AHP_Non_Physics_Authors	21
sgp	29	HP_and_AHP_Non_Physics_Authors	22
che	25	HP_and_AHP_Non_Physics_Authors	23
tha	25	HP_and_AHP_Non_Physics_Authors	23
hkg	24	HP_and_AHP_Non_Physics_Authors	25
grc	22	HP_and_AHP_Non_Physics_Authors	26
idn	21	HP_and_AHP_Non_Physics_Authors	27
bra	20	HP_and_AHP_Non_Physics_Authors	28
tur	20	HP_and_AHP_Non_Physics_Authors	28
zaf	20	HP_and_AHP_Non_Physics_Authors	28
egy	19	HP_and_AHP_Non_Physics_Authors	31
bel	19	HP_and_AHP_Non_Physics_Authors	31
prt	18	HP_and_AHP_Non_Physics_Authors	33
swe	14	HP_and_AHP_Non_Physics_Authors	34
irq	13	HP_and_AHP_Non_Physics_Authors	35
cze	12	HP_and_AHP_Non_Physics_Authors	36
fin	11	HP_and_AHP_Non_Physics_Authors	37
isr	11	HP_and_AHP_Non_Physics_Authors	37
pol	10	HP_and_AHP_Non_Physics_Authors	39
vnm	10	HP_and_AHP_Non_Physics_Authors	39
nor	9	HP_and_AHP_Non_Physics_Authors	41
bgd	9	HP_and_AHP_Non_Physics_Authors	41
are	9	HP_and_AHP_Non_Physics_Authors	41

rou	8	HP_and_AHP_Non_Physics_Authors	44
mac	6	HP_and_AHP_Non_Physics_Authors	45
aut	6	HP_and_AHP_Non_Physics_Authors	45
phl	6	HP_and_AHP_Non_Physics_Authors	45
col	5	HP_and_AHP_Non_Physics_Authors	48
chl	5	HP_and_AHP_Non_Physics_Authors	48
qat	5	HP_and_AHP_Non_Physics_Authors	48
irl	5	HP_and_AHP_Non_Physics_Authors	48
nga	4	HP_and_AHP_Non_Physics_Authors	52
nzl	4	HP_and_AHP_Non_Physics_Authors	52
lbn	4	HP_and_AHP_Non_Physics_Authors	52
srb	3	HP_and_AHP_Non_Physics_Authors	55
isl	3	HP_and_AHP_Non_Physics_Authors	55
cyp	3	HP_and_AHP_Non_Physics_Authors	55
mar	3	HP_and_AHP_Non_Physics_Authors	55
bgr	3	HP_and_AHP_Non_Physics_Authors	55
jor	3	HP_and_AHP_Non_Physics_Authors	55
lux	2	HP_and_AHP_Non_Physics_Authors	61
omn	2	HP_and_AHP_Non_Physics_Authors	61
brn	2	HP_and_AHP_Non_Physics_Authors	61
svk	2	HP_and_AHP_Non_Physics_Authors	61
gha	2	HP_and_AHP_Non_Physics_Authors	61
ltu	2	HP_and_AHP_Non_Physics_Authors	61
tun	2	HP_and_AHP_Non_Physics_Authors	61
mex	2	HP_and_AHP_Non_Physics_Authors	61
kwt	1	HP_and_AHP_Non_Physics_Author	69

		s	
geo	1	HP_and_AHP_Non_Physics_Authors	69
per	1	HP_and_AHP_Non_Physics_Authors	69
lva	1	HP_and_AHP_Non_Physics_Authors	69
dji	1	HP_and_AHP_Non_Physics_Authors	69
ukr	1	HP_and_AHP_Non_Physics_Authors	69
grd	1	HP_and_AHP_Non_Physics_Authors	69
hun	1	HP_and_AHP_Non_Physics_Authors	69
mus	1	HP_and_AHP_Non_Physics_Authors	69
syr	1	HP_and_AHP_Non_Physics_Authors	69
pse	1	HP_and_AHP_Non_Physics_Authors	69
ken	1	HP_and_AHP_Non_Physics_Authors	69
eth	1	HP_and_AHP_Non_Physics_Authors	69
ecu	1	HP_and_AHP_Non_Physics_Authors	69
uzb	1	HP_and_AHP_Non_Physics_Authors	69
kaz	1	HP_and_AHP_Non_Physics_Authors	69

Supplementary Table 3. Number of non-Physics EP authors in each calendar year for the 8 countries with the highest fold-increases between 2016 and 2022.

Country	Year	EP authors (non-Physics)
tha	2022	19
sau	2022	69
rus	2022	13
pak	2022	17
kor	2022	26
ita	2022	62
ind	2022	51
esp	2022	23
tha	2021	9
sau	2021	34
rus	2021	10
pak	2021	14
kor	2021	24
ita	2021	60
ind	2021	33
esp	2021	28
tha	2020	4
sau	2020	21
rus	2020	5
pak	2020	6
kor	2020	14
ita	2020	47
ind	2020	21
esp	2020	19
tha	2019	3
sau	2019	14
rus	2019	4
pak	2019	1
kor	2019	7
ita	2019	28
ind	2019	17
esp	2019	14
tha	2018	3
sau	2018	7
rus	2018	2
pak	2018	2
kor	2018	5
ita	2018	24
ind	2018	16
esp	2018	11

tha	2017	2
sau	2017	5
rus	2017	3
pak	2017	3
kor	2017	3
ita	2017	16
ind	2017	4
esp	2017	3
tha	2016	1
sau	2016	6
rus	2016	2
pak	2016	3
kor	2016	5
ita	2016	9
ind	2016	5
esp	2016	2
tha	2015	1
sau	2015	6
rus	2015	1
pak	2015	5
kor	2015	5
ita	2015	10
ind	2015	3
esp	2015	2
tha	2014	1
sau	2014	5
rus	2014	1
pak	2014	2
kor	2014	3
ita	2014	13
ind	2014	7
esp	2014	1
sau	2013	3
pak	2013	1
kor	2013	2
ita	2013	13
ind	2013	1
esp	2013	2
tha	2012	2
sau	2012	3
pak	2012	1
kor	2012	6
ita	2012	10
ind	2012	4
esp	2012	3
sau	2011	3
rus	2011	1
pak	2011	1

kor	2011	9
ita	2011	4
ind	2011	8
esp	2011	3
rus	2010	2
pak	2010	2
kor	2010	6
ita	2010	3
ind	2010	7
rus	2009	1
pak	2009	2
kor	2009	1
ita	2009	5
ind	2009	2
esp	2009	1
tha	2008	1
kor	2008	3
ita	2008	3
ind	2008	1
esp	2008	2
tha	2007	2
ind	2007	5
esp	2007	2
tha	2006	1
ita	2006	3
ind	2006	2
esp	2006	1
esp	2005	1
sau	2004	1
rus	2004	2
ita	2004	1
esp	2004	1
ind	2003	1
rus	2002	2
ita	2002	2
ind	2002	1
rus	2001	1
ita	2001	1

Supplementary Table 4. Number of HP, AHP, and EP authors in each scientific field

Scientific Field	HP authors	AHP authors	EP authors
Physics & Astronomy	10441	8588	12624
Enabling & Strategic Technologies	299	490	605
Information & Communication Technologies	229	292	396
Chemistry	155	248	307
Engineering	189	265	334
Agriculture, Fisheries & Forestry	106	93	143
Mathematics & Statistics	28	30	48
Clinical Medicine	523	929	1091
Earth & Environmental Sciences	43	57	79
Built Environment & Design	5	6	9
General Science & Technology	3	3	5
Public Health & Health Services	9	20	23
Biomedical Research	38	72	86
Economics & Business	9	13	20
Biology	20	21	38
Psychology & Cognitive Sciences	3	1	3
Social Sciences	2	3	4
Philosophy & Theology	0	0	0
Historical Studies	0	0	0
Communication & Textual Studies	0	0	0
General Arts, Humanities & Social Sciences	0	0	0
Undetermined	0	0	0
Visual & Performing Arts	0	0	0