# 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.

## 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 [1-3]. 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 [4] defined 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 [4] 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 [4]. 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 [4].

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 [5-9]. Some prolific scientists even adopt spurious affiliations with Saudi Arabian universities to secure financial benefits [10,11]. Concurrently, the paradigm of team science has become more common across an increasing number of scientific fields [12]. 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 [13] with a data freeze on May 2023. The full period 2000-2022 (23 calendar years) was considered. Similar to previous work [4], 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 [4], 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 [14] 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 [15] 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 [16]. 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 [15]; 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 [4]. 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 [5,6]. These policies have been heavily criticized and some of them have been reverted [17]. Regardless, China is currently publishing more scientific papers than any other country [18].

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 [10,11]. 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 [4], 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 [19,20] or citation cartels (citation farms) [21]. 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 [22], 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 [23.24]. 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 [13]. In previous work done 7 years ago [4], 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 [25], of artificial intelligence that may further facilitate writing papers [26,27] and with peer-review having major limitations [28], 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 [29]. Some authors have even argued that there should be a limit to the number of pages/papers a scientist can publish [30]. However, this may be a bad idea as it may further exaggerate publication bias and other selection biases [30]. Instead, it may be more realistic and appropriate to monitor extreme publication behaviors in centralized, standardized databases [31], 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.

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Figure 1

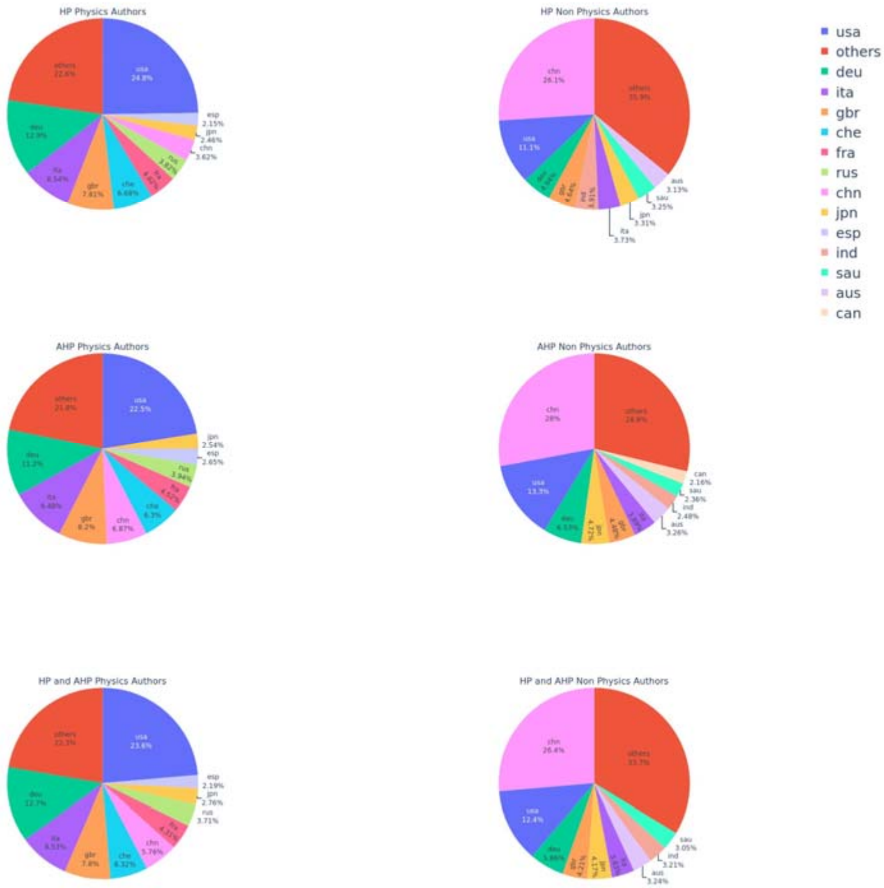
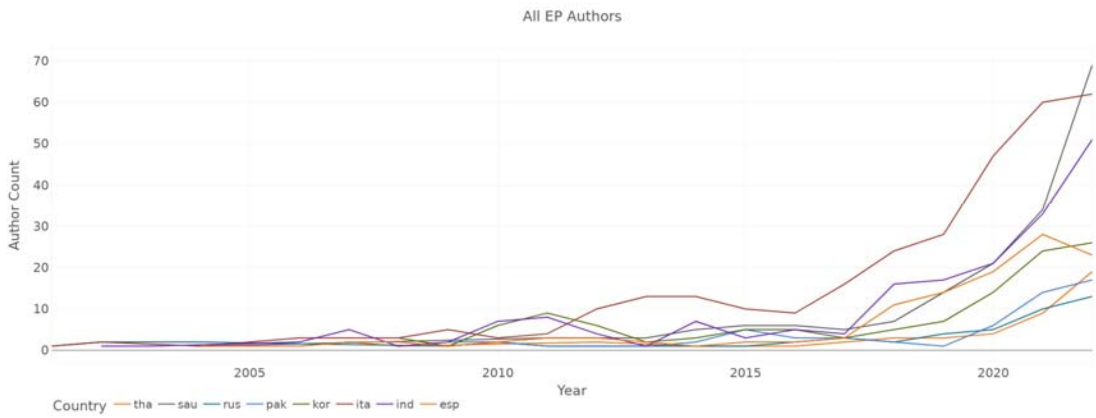


Figure 2


All EP Authors
Author Count
70
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50
40
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Figure 3

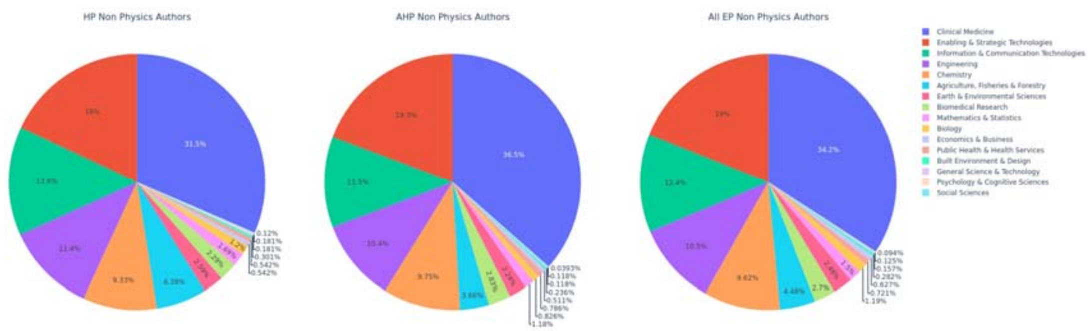
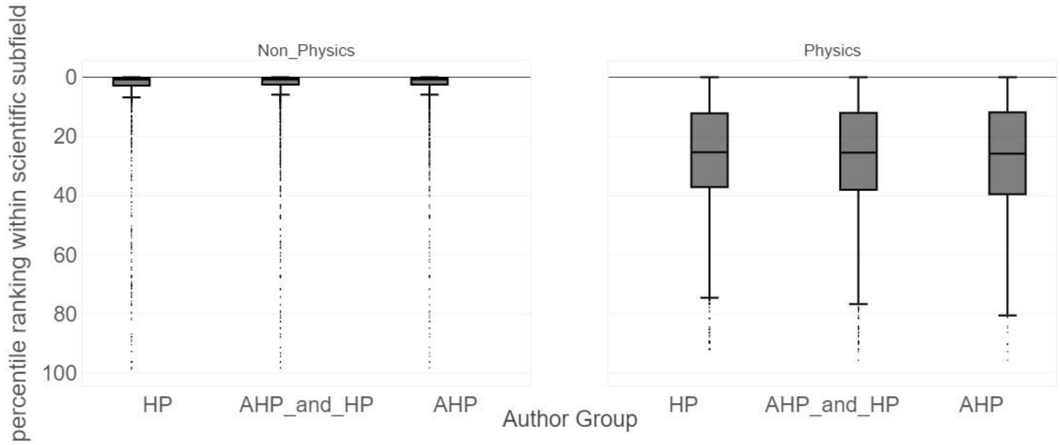
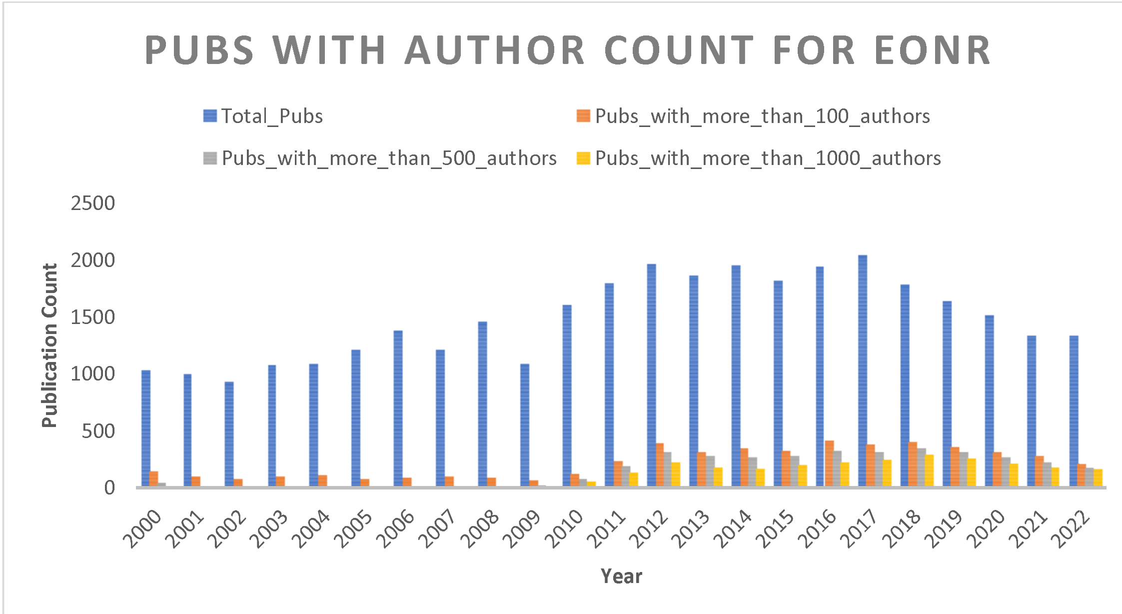

HP Non Physics Authors
AHP Non Physics Authors
All EP Non Physics Authors
Clinical Medicine
Enabling & Strategic Technologies
Information & Communication Technologies
Engineering
Chemistry
Agriculture, Fisheries & Forestry
Earth & Environmental Sciences
Biomedical Research
Mathematics & Statistics
Biology
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
HP
AHP_and_HP
AHP

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
2500
2000
1500
1000
500
0
2000
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2002
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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 |

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| 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 |
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| 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 |
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| gbr | 815 | HP_Physics_Authors | 4 |
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| fra | 482 | HP_Physics_Authors | 6 |

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| rus | 399 | HP_Physics_Authors | 7 |
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| ind | 123 | HP_Physics_Authors | 13 |
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| che | 541 | AHP_Physics_Authors | 6 |
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| ltu | 9 | AHP_Physics_Authors | 50 |
| 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 |
| idn | 6 | AHP_Physics_Authors | 57 |
| 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 |
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| kaz | 2 | AHP_Physics_Authors | 65 |
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| 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 |

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|---|---|---|---|
| | | 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 |

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|---|---|---|---|
| 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 |

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|---|---|---|---|
| | | 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 |