TGE TÉR - GAZDASÁG - EMBER
Journal of Region, Economy and Society

SZÉCHENYI EGYETEM
UNIVERSITY OF GYŐR
Kautz Gyula Faculty of Business and Economics

Submitted: 16/07/2025 Revised: 29/07/2025 Accepted: 30/07/2025 Published online: 14/09/2025

A kutatási kiválóság regionális változása: magasan idézett kutatók elemzése (2020-2024)

The Shifting Landscape of Research Excellence: A Regional Analysis of Highly Cited Researchers (2020-2024)

Kohus Zsolt[1]

[1]Széchenyi István University, University Library and Archives, Győr, Magyarország, 9026 Győr, Egyetem tér 1., https://orcid.org/0000-0002-2153-615X, Email: kohus.zsolt@sze.hu

Paper type: Research Article

Absztrakt

Cél – A tanulmány célja a Magasan Idézett Kutatók regionális megoszlásának vizsgálata a 2020-2024 közötti időszakban, valamint a kutatási kiválóság megoszlásának dinamikájának feltárása a régiók tekintetében. Az elemzés nemcsak globálisan, hanem 21 kutatási klaszter szintjén is tanulmányozza a Magasan Idézett Kutatók regionális megoszlását.

Tervezés/módszertan/megközelítés – Az elemzés a Clarivate által évenként publikált Highly Cited Researcher listán alapszik. Az első vizsgálat során 34.225 Magasan Idézett Kutató regionális megoszlása került meghatározásra 2020-2024 között. Az ezt követő szakaszban a Magasan Idézett Kutatók 21 kutatási klaszter szerinti megoszlása állt a vizsgálatok központjában, évenkénti bontásban.

Eredmények – Bár Észak-Amerika áll az első helyen a Magasan Idézett Kutatók számában a vizsgált időszakban, Ázsia, Kína pozíciója jelentős erősödést mutat nemcsak számosságban, hanem a Magasan Idézett Kutatók arányában is. Ázsia 2023-ban és 2024-ben is megelőzte Európát. A klaszter-specifikus régiós megoszlás jelentős heterogenitást mutat. A kutatási Klaszterek kapcsán Észak-Amerika uralja a klaszterek többségét, de több esetben észlelhető Ázsia erőteljes előretörése. Az eredmények arra is rámutatnak, hogy a Magasan Idézett Közlemények és Magasan Idézett Kutatók között szignifikáns lineáris kapcsolat található.

Eredetiség – A tanulmány elsőként vizsgálja a Magasan Idézett Kutatók regionális megoszlásának változását 5 éves időablakban. Bár Ázsia globális reprezentációja a globális tudományos kimenetek területén régóta ismert, az eredményeink kutatási klaszterek szintjén is hangsúlyozzák a globális tendenciákat, és felhívja a figyelmet a kutatási és együttműködési stratégiák újraértékelésére.

Kulcsszavak: magasan idézett kutató, kutatási klaszter, régió.

Abstract

Purpose – The aim of this study is to examine the regional distribution of Highly Cited Researchers from 2020 to 2024 and to explore the dynamics of research excellence across different regions. The analysis is conducted both globally and within 21 specific research clusters.

Design/methodology/approach – The analysis is based on the annually published Highly Cited Researchers list by Clarivate. The first phase of the study determined the regional distribution of 34,225 Highly Cited Researchers between 2020 and 2024. Subsequently, the focus shifted to the distribution of HCRs across 21 research clusters, analysed on an annual basis.

Findings – Although North America holds the leading position in the global number of Highly Cited Researchers during the examined period, Asia – particularly China – shows significant growth in both absolute and relative terms. Asia surpassed Europe in the number of Highly Cited Researchers in 2023 and 2024. The cluster-specific regional distribution reveals substantial heterogeneity. While North America dominates most research clusters, notable instances of Asia's strong advancement are evident. The results also show a significant linear relationship between Highly Cited Papers and Highly Cited Researchers.

Originality – This is the first study to analyse the changes in the regional distribution of Highly Cited Researchers in a five-year period. While Asia's increasing global representation in scientific output has long been recognized, our findings highlight global trends at the level of research clusters and emphasise the need to reconsider research and cooperation strategies.

Keywords: highly cited researcher, research cluster, region

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)
https://doi.org/10.14513/tge-jres.00424

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

1. Introduction

The increase in competition among researchers and their institutions shifted the motivation for scientific production from normative goals toward self-interest. This, along with the still persistent "publish or perish" culture, has manifested in higher publication and citation counts for scholars, factors that likely to contribute to the scientific reputation of both individuals and their affiliated organisations (Fanelli, 2010; Johann et al. 2024). However, publication strategies may differ among researchers. Some may choose to publish fewer but high-impact papers, while others become mass or prolific producers (Costas and Bordons, 2008; Demeter et al., 2022; Larivière and Costas, 2016).

One of the key questions is what distinguishes top-researchers from others. This is partly due to the differing perception of success and research excellence among scholars. A potential tool to address this question is the use of bibliometric indicators (Abramo et al., 2013; Kwiek, 2018; Piro et al., 2016). In 1955, Garfield introduced the citation index and the absolute number of citations to identify scientific success (Garfield, 1955). This gave rise to citation-based metrics. Later, due to criticism from research community – including concerns about disciplinary differences, research cluster variations, and the temporal evolution of citations (Garfield, 2006; Seglen, 1997) – the normalized citation impact measures were introduced (Bornmann and Marx 2015; Seglen, 1997). Waltman (2016) distinguished five basic citation impact indicators: the total number of citations, the average number of citations per paper, the number of highly cited publications, the proportion of highly cited publications, and the Hirsch index (h-index). For each of these indicators, normalized variants can be developed (Waltman, 2016). However, no quality indicator is without drawbacks. Thus, the identification of researcher excellence depends on the approach employed (Frietsch et al., 2025).

Publication databases can be used to identify top-performing researchers. A prominent example is Clarivate, which has published its Highly Cited Researchers (HCRs) list since 2001, and annually since 2014. This list is based on data derived from the Web of Science and considers the number of publications and citation counts. To identify HCRs, Clarivate uses Highly Cited Papers (HCPs) – articles and reviews that rank among the top 1% in citations for their field or research cluster. Each author of each HCP is selected and ranked for each research category. The more HCPs a researcher has, the higher the number of points they receive. The approximate number of researchers considered for the HCR list corresponds to the square root of the total number of scholars in each category. In the most recent 2024 edition of the HCR list, 21 categories were used. However, Clarivate decided to exclude Mathematics and reassign papers from this cluster to the Cross-Field category.

The HCR list has been studied by several scholars and research groups, although the focus of these studies varies. Basu (2006) and Bauwens et al. (2012) highlighted the dominance of HCRs from the United States. They found that the top 25 institutions on the HCR lists from 2001 to 2014 accounted for more than 30% of all listed HCRs. Bornmann and Bauer (2015) also confirmed the leading role of the United States. They noted that HCRs are a factor considered by the Shanghai Ranking – one of the oldest and best-known global university rankings. Manipulations of the HCR list can therefore affect a higher education institution's position in the global rankings. Li (2016) identified a shift in the contribution of the United States compared to other countries, observing an increase in the number of HCRs from the United Kingdom, Germany, China, and specifically the Chinese Academy of Sciences. The growing presence of HCRs from Asia – particularly from China – was further confirmed by Li (2018), who found significant increases in the fields of Chemistry, Materials Science, and Engineering.

Some other scholars focused specifically on the collaboration patterns of HCRs. For example, Egret et al. (2024) found that HCRs exhibit a higher level of collaboration with other HCRs, particularly in disciplinary categories other than Cross-field. Aksnes and Aagaard (2021) showed that HCRs tend to have larger teams and engage in more multilateral collaborations compared to other researchers. Martinez and Sá (2020) revealed that Brazilian HCRs typically collaborate with at least two non-Brazilian scholars and identified partnerships with English-speaking researchers in indexed journals as a major factor contributing to higher

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

citation rates. In France, Chaignon et al. (2023) found that more than 85% of HCPs are internationally co-authored, primarily with collaborators from the United States and other European countries. These studies underscore the role of collaboration networks in the recognition and impact of HCRs.

Despite the growing literature on HCRs, two major gaps remain. First, most studies analyse data from one or two years. As a result, they do not capture the longitudinal trends necessary to understand changes in the number of HCRs over time. Second, there is a lack of regional comparison. While many previous studies focus on individual countries, broader regional patterns are often overlooked. To address these gaps, I collected Clarivate's Highly Cited Researchers data for the 5-year period between 2020 and 2024. The study aims to answer the following research questions:

Q1: How has the number of HCRs changed across different regions between 2020-2024?

Q2: What is the region-specific distribution of HCRs across the 21 research clusters during this period?

Q3: How does the number of HCPs correlate with the number of HCRs?

2. Materials and Methods

Clarivate's HCR lists for the years 2020 to 2024 were downloaded on May 10, 2025 (Clarivate, 2024c). Each list included the following information for each HCR: first name, last name, category, and both primary and secondary affiliations. For the purposes of this study, only the primary affiliation was considered.

Data from the 2020-2024 lists were compiled for further analysis. First, the country corresponding to each primary affiliation was extracted in a new column. Then, based on the country, one of the following world regions were assigned in a subsequent column: North America, South America, Asia, Europe, Africa, and Australia and Oceania.

The final dataset included six key variables: the year of the HCR list, the first name of the HCR, the last name of the HCR, category (one of the 21 research categories), primary affiliation name, primary affiliation country, and primary affiliation region. The complete dataset initially contained 34.225 rows corresponding to individual HCR entries. However, 23 entries were removed during data cleaning, as 16 researchers were listed as "Independent" and had no affiliation included, as well as seven entries did not include identifiable country information in the affiliation field. As a result, the final sample consisted of 34.202 HCRs across the five-year period.

The data were analysed using Microsoft Excel. Both tables and figures were created using Excel's built-in PivotTable and chart functions.

The analysis was conducted in three parts. The first part was performed at the regional level without distinguishing between research clusters. The second part focused specifically on the research clusters. It is important to note that in 2023 and 2024, Mathematics was no longer included as a separate category in the HCR list. Instead, HCPs in Mathematics were reassigned to the Cross-Field category. As a result, the Mathematics category was excluded from this analysis to ensure consistency across the study period.

The third part of the analysis examined the relationship between HCRs and HCPs. HCPs are used by Clarivate as a basis for constructing the HCR list. These papers include articles and reviews that rank among the top 1% globally in terms of citation count. Each HCP is assigned to a research category and each contributing author is considered for selection. The approximate number of HCRs is determined by the square root of the total number of scholars in that category. Therefore, a higher number of HCPs increases the likelihood of a researcher being selected as an HCR.

HCP data were extracted from the Web of Science InCites database using the "Analyse Organisations" feature. The unit of analysis was set to countries, and a new table was constructed showing the number of HCPs attributed to each country. As the number of HCPs is continuously changing due to ongoing citation updates, it is not possible to determine the exact number of HCPs used for the final HCR list. Klein and Kranke (2023) also emphasised, that the methodology behind the construction of the HCR list lacks full transparency, and the exact number of HCPs considered in the final selection is not entirely traceable.

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

 Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

Given this limitation, I decided not to restrict the HCP data to the specific timeframe used by Clarivate for their annual HCR list. Instead, all available HCPs were included in the analysis, regardless of publication year.
The relationship between HCRs and HCPs was tested by linear regression in Microsoft Excel. In this model, the number of HCPs served as the independent variable, while the number of HCRs represented the dependent variable.

3. Results

3.1 The total number of HCRs by region

This study analyses the regional and national distribution of 34.203 Highly Cited Researchers (HCRs) over the period 2020–2024. The annual number of HCRs ranged from 6,880 to 7,219 (see Table 1). It is noteworthy that the classification scheme was revised in 2023, reducing the total number of categories from 22 to 21 due to the removal of the Mathematics category. According to Clarivate's updated methodology, research outputs previously classified under Mathematics have been incorporated in the Cross-Field category as of 2023.

Table 1: The number and regional distribution of HCRs, 2020-2024

Number of HCRs							
Year	North America	Asia	Europe	Australia and Oceania	South America	Africa	**Total**
2020	2845	1273	1900	324	28	19	**6389**
2021	2819	1513	1852	350	35	28	**6597**
2022	2974	1808	2020	356	35	26	**7219**
2023	2877	1896	1951	340	30	24	**7118**
2024	2700	1939	1869	334	25	13	**6880**
Total	**14215**	**8429**	**9592**	**1704**	**153**	**110**	34203
Regional Distribution of HCRs (%)							
Year	North America	Asia	Europe	Australia and Oceania	South America	Africa	**Total**
2020	44.53%	19.92%	29.74%	5.07%	0.44%	44.53%	**100%**
2021	42.73%	22.93%	28.07%	5.31%	0.53%	42.73%	**100%**
2022	41.20%	25.05%	27.98%	4.93%	0.48%	41.20%	**100%**
2023	40.42%	26.64%	27.41%	4.78%	0.42%	40.42%	**100%**
2024	39.24%	28.18%	27.17%	4.85%	0.36%	39.24%	**100%**
Total	**41.56%**	**24.64%**	**28.04%**	**4.98%**	**0.45%**	**0.32%**	100%

Source: Compiled by the author based on Clarivate data of HCRs, 2020-2024

As shown in Figure 1, North America – comprising the United States and Canada – dominates in terms of HCRs representation. Between 2020 and 2022, Europe was the second largest region by HCR count. However, beginning in 2023, Asia surpassed Europe in absolute numbers. Collectively, these three regions – North America, Europe, and Asia – have accounted for over 93% of all listed HCRs throughout the study period.
The rise of Asia is particularly noteworthy: its share of global HCRs increased steadily from 19.92% in 2020 to 22.93% in 2021, 25.05% in 2022, 26.64% in 2023, and 28.18% in 2024. While Asia's influence has grown, North America has maintained its leading position, albeit with a gradual decline in its share – from 44.53% in 2020 to 39.24% in 2024. Europe has experienced a slower decline, with its share decreasing from 29.97%

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

 Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

in 2020 to 27.17% in 2024. These figures reflect shifting regional dynamics in global research influence, with Asia's steady rise contrasting with more gradual but noticeable declines in North America and Europe.

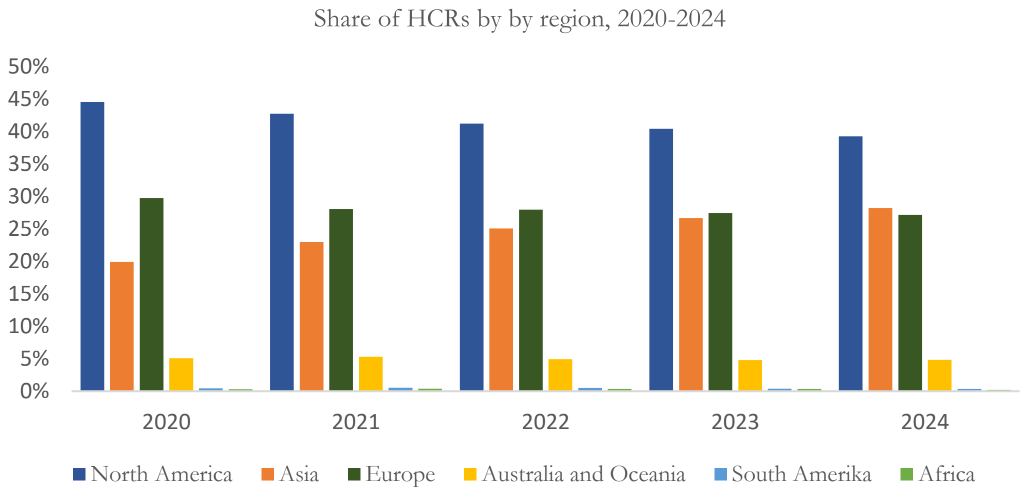

Figure 1: Share of HCRs by region, 2020-2024

In North America, the United States leads with the highest number of Highly Cited Researchers (HCRs), totalling 13,176, followed by Canada. In Asia, the top 10 countries by HCR count are led by Mainland China with 5,601 HCRs, followed – at a significantly lower scale – by Hong Kong, Singapore, Saudi Arabia, Japan, South Korea, Israel, Taiwan, India, and Malaysia. In Europe, the top 10 countries include the United Kingdom with 2,716 HCRs, followed by Germany, the Netherlands, France, Switzerland, Spain, Italy, Belgium, Sweden, and Denmark (see Table 2).

Table 2: The Top10 countries with the highest number of HCRs for North America, Asia and Europe

Region	Country	Number of HCRs
North America	United States	13176
	Canada	1039
Asia	China Mainland	5601
	Hong Kong	493
	Singapore	489
	Saudi Arabia	443
	Japan	432
	South Korea	312
	Israel	194
	Taiwan	118
	India	85
	Malaysia	57
Europe	United Kingdom	2716
	Germany	1720
	Netherlands	976
	France	708
	Switzerland	577
	Spain	516
	Italy	511
	Belgium	391
	Sweden	292
	Denmark	284

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

Source: Compiled by the author based on Clarivate data of HCRs, 2020-2024

At the institutional level, the top 10 institutions contributing the highest number of HCRs are Harvard University (United States, 1,083), Chinese Academy of Sciences (China, 807), Stanford University (United States, 611), Tsinghua University (China, 355), Massachusetts Institute of Technology (United States, 334), Max Planck Society (Germany, 310), National Institutes of Health (United States, 307), University of Oxford (United Kingdom, 287), University of Pennsylvania (United States, 271) and University of California, San Diego (United States, 259). Among these top 10 institutions, six are based in North America, while two each represent Asia and Europe.

These institutions reflect a blend of research excellence and regional influence. Of the top 10, seven are higher education institutions, all of which are recognized in the 2024 Shanghai Academic Ranking of World Universities with prominent positions: Harvard University (1st), Stanford University (2nd), Tsinghua University (22nd), Massachusetts Institutes of Technology (3rd), University of Oxford (6th), University of Pennsylvania (14th), and University of California San Diego (18th). According to the Scimago Institutional Ranking, the Chinese Academy of Sciences holds the top global position (1st worldwide and in China), the Max Planck Society ranks 9th in Western Europe and 51st globally, and the National Institutes of Health is ranked 13th in North America and 33rd worldwide. These rankings underscore the global prominence and outstanding research performance of these leading institutions across different regions.

3.2 Regional distribution of HCRs across 21 Clusters

Between 2020 and 2024, the global distribution of Highly Cited Researchers (HCRs) reveals a clear trend: the contribution of Asia, particularly China, has been steadily increasing year by year. In contrast, the share of North American HCRs has shown a gradual decline. To explore this trend in greater detail – especially the growing influence of Asia and China – a region-specific analysis was conducted across 21 research clusters (excluding Mathematics, which was removed from the most recent HCR list). This analysis aimed to identify which regions contributed the most HCRs in each cluster, with special emphasis on Asia's performance.

The findings show that North America was the leading contributor in 13 out of 21 clusters, Asia and Europe each led in 4 clusters. Australia and Oceania, South America, and Africa did not emerge as the top contributors in any cluster (see Table 3).

Table 3: The number of Highly Cited Researchers (HCRs) in 21 clusters by region (North America, Asia and Europe), 2020-2024. The highest regional HCR count in each cluster is indicated in bold.

Cluster	Number of HCRs		
	North America	Asia	Europe
Agricultural Sciences	101	195	**214**
Biology and Biochemistry	**797**	102	350
Chemistry	324	**694**	164
Clinical Medicine	**1203**	127	894
Computer Science	67	**292**	120
Cross-Field	**6070**	4358	3932
Economics and Business	**242**	34	114
Engineering	111	**422**	131
Environment and Ecology	285	167	**339**
Geosciences	**287**	204	262
Immunology	**508**	112	286
Materials Science	322	**656**	83
Microbiology	**407**	107	236

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

Molecular Biology and Genetics	**704**	96	161
Neuroscience and Behaviour	**620**	27	390
Pharmacology and Toxicology	294	56	**338**
Physics	**443**	235	180
Plant and Animal Sciences	231	326	**327**
Psychiatry and Psychology	**398**	19	396
Social Sciences	**504**	87	474
Space Science	**263**	7	167

Source: Compiled by the author based on Clarivate data of HCRs, 2020-2024

I also conducted an annual analysis of HCR trends across each of the 21 clusters, comparing the performance of North America, Asia, and Europe. This analysis revealed a notable shift in regional dominance within nine clusters during the observed period: Agricultural Sciences, Biology and Biochemistry, Clinical Medicine, Cross-Field, Engineering, Geosciences, Molecular Biology and Genetics, Plant and Animal Sciences, and Social Sciences. The changes in HCRs for North America, Asia, and Europe between 2020-2024 are summarised in Table 4. These results are further discussed in the following section and visualized in Figures 2-7.

Table 4: The number of HCRs in 9 clusters characterised by notable regional changes

Category	Year	Number of HCRs		
		North America	Asia	Europe
Agricultural Sciences	2020	22	22	53
	2021	23	38	49
	2022	20	44	38
	2023	19	48	37
	2024	17	43	37
Biology and Biochemistry	2020	116	15	107
	2021	139	16	43
	2022	199	29	67
	2023	182	25	69
	2024	161	17	64
Clinical Medicine	2020	274	12	180
	2021	239	18	175
	2022	252	26	170
	2023	228	34	193
	2024	210	37	176
Cross-Field	2020	1094	559	695
	2021	1183	730	736
	2022	1268	943	855
	2023	1303	1023	824
	2024	1222	1103	822
Engineering	2020	23	102	31
	2021	23	99	31
	2022	23	89	27
	2023	20	78	21
	2024	22	54	21
Geosciences	2020	67	23	55
	2021	55	30	52
	2022	57	35	48
	2023	52	56	57
	2024	56	60	50
Molecular Biology and Genetics	2020	149	13	39
	2021	133	14	27
	2022	148	22	34

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

	2023	135	21	29
	2024	139	26	32
Plant and Animal Sciences	2020	60	58	81
	2021	51	59	70
	2022	43	58	62
	2023	40	69	61
	2024	37	82	53
Social Sciences	2020	88	13	82
	2021	121	15	102
	2022	118	16	112
	2023	94	20	93
	2024	83	23	85

Source: Compiled by the author based on Clarivate data of HCRs, 2020-2024

In Agricultural Sciences, Europe's dominance in 2020 was overtaken by Asia starting in 2022. Both North America and Europe experienced a decline in the number of HCRs during this period. In Plant and Animal Sciences, Europe lost its leading role in 2023 and 2024. North America also showed a consistent downward trend in contributions from 2020 to 2024 (Figure 2).

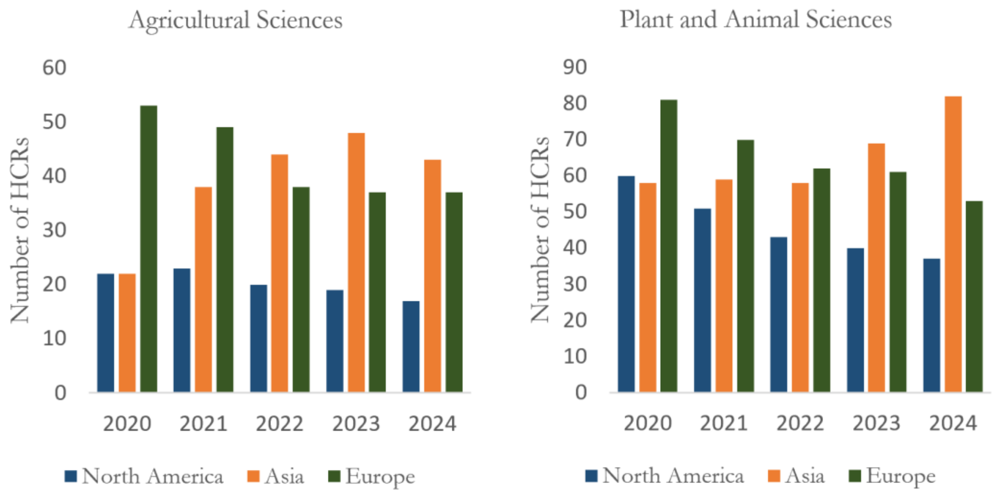

Figure 2: The number of HCRs in Agricultural Sciences and Plant and Animal Sciences in North America, Asia, and Europe, 2020-2024

In Biology and Biochemistry, the gap between North America and Europe widened from 2020 to 2021, followed by a significant decline in the number of European HCRs from 2021 to 2024, compared to 2020. In Molecular Biology and Genetics, North America maintained the top position throughout the period. However, the gap between Europe and Asia narrowed significantly: while Europe still leads over Asia, the difference in the number of HCRs decreased from 26 in 2020 to 6 in 2024 (Figure 3).

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

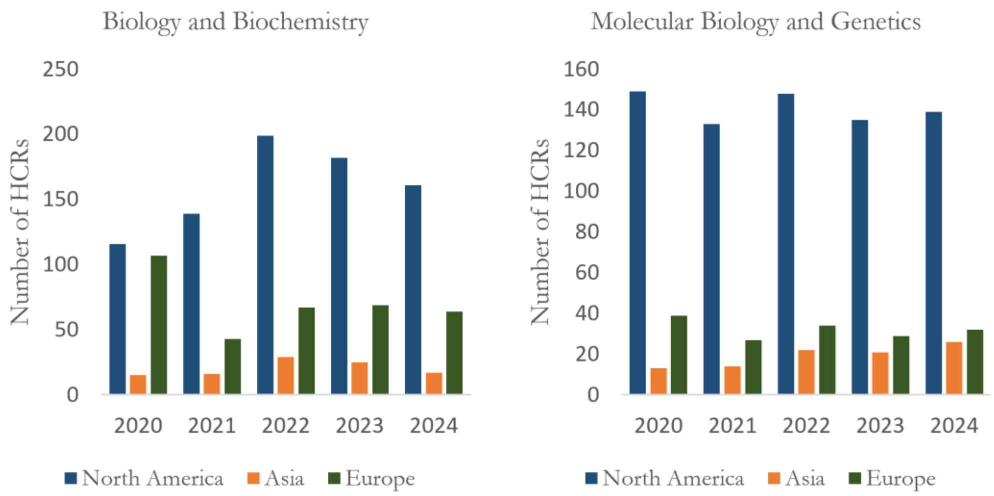

Figure 3: The number of HCRs in Biology and Biochemistry and Molecular Biology and Genetics in North America, Asia, 2020-2024

In Clinical Medicine, although North America holds the leading position, the number of HCRs has been decreasing. In contrast, Asia shows an upward trend (Figure 4).

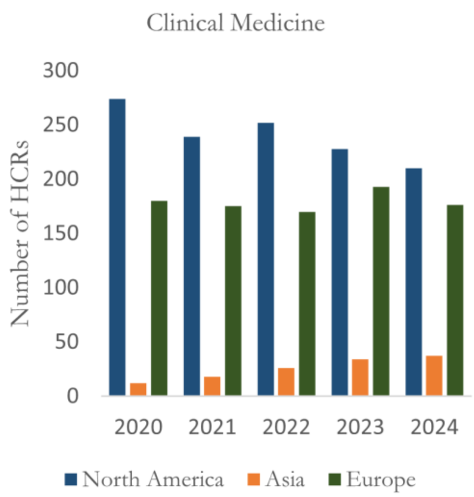

Figure 4: The number of HCRs in Clinical Medicine in North America, Asia, and Europe, 2020-2024

In Engineering, Asia ranks first but shows a consistent decline in HCRs between 2020-2024. Simultaneously, the higher position of Europe compared to North America decreased between 2020 and 2023, and in 2024, North America overtook Europe. In Geosciences, Asia has shown a steady growth, surpassing North America in 2023 and both North America and Europe in 2024 (Figure 5).

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

 Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

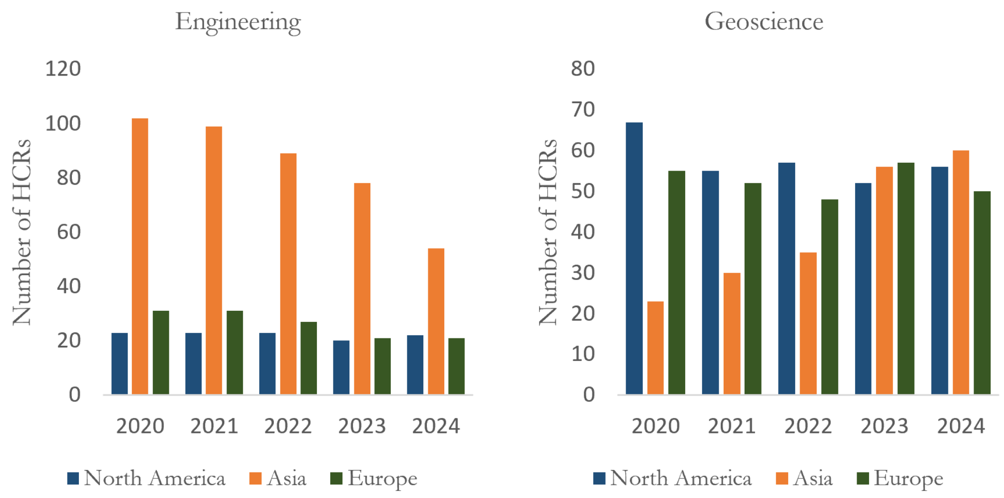

Figure 5: The number of HCRs in Engineering and Geosciences in North America, Asia, and Europe, 2020-2024

In Social Sciences, the gap between the leading North America and Europe narrowed over time, and in 2024, Europe preceded North America (Figure 6).

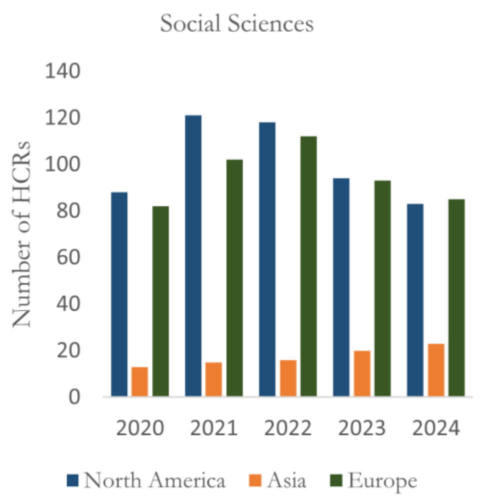

Figure 6: The number of HCRs in Social Sciences in North America, Asia, and Europe, 2020-2024

In the Cross-Field category, North America remains in the leading position, but Asia has preceded Europe in the number of HCRs since 2022 (Figure 7).

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

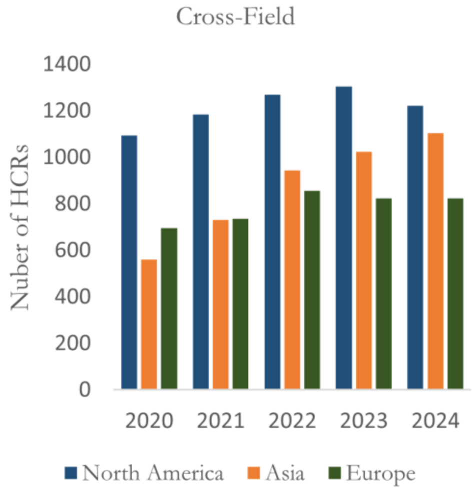

Figure 7: The number of HCRs in Cross-Field category in North America, Asia, and Europe, 2020-2024

From the perspective of cardinality, the Cross-Field category has consistently had the highest number of HCRs in each year from 2020 to 2024. The strengthening of the Asian Region in terms of HCRs is predominantly driven by the significant increase in this category. However, Asia's growth is also evident in other categories, such as Social Sciences, Geosciences and Clinical Medicine.

These findings highlight the importance of analysing the regional representation of HCRs at the level of individual clusters. Among the nine clusters with notable reorganisation, Asia demonstrates either a leading role or significant strengthening in Agricultural Sciences, Plant and Animal Sciences, Engineering, Geosciences, and Cross-Field. North America maintains a leading position in Biology and Biochemistry, Molecular Biology and Genetics, and Clinical Medicine. Europe has the highest number of HCRs in Social Sciences, and is also strongly represented in Cross-Field, Geosciences, and Clinical Medicine.

3.3 Correlation between the number of Highly Cited Researchers (HCRs) and the number of Highly Cited Papers (HCPs)

In the final part of this study, I plotted the number of HCRs against the number of HCPs for each country. The results reveal a significant linear relationship between the number of HCPs and the number of HCRs ($R^2 = 0.832$, $p < 0.0001$, ***) (Figure 8).

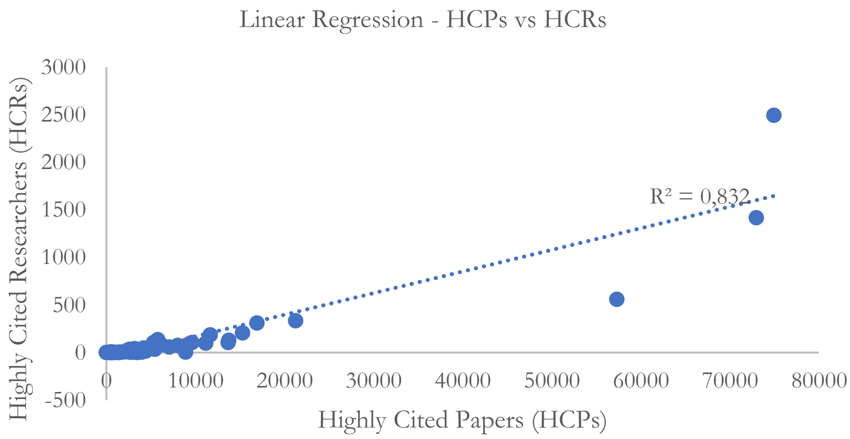

Figure 8: Linear Regression between the number of HCPs and HCRs.

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

 Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

The HCR-to-HCP ratio is the lowest for the United States, followed by Hong Kong, Singapore, China Mainland, Australia, Netherlands, Germany, Canada, Ireland, and Israel. Among the top 10 countries, North America is represented by two countries, Asia by four, Australia and Oceania by one, and Europe by three. The number of HCRs, HCPs and the proportion of HCR-to-HCP ratio are shown in Table 5.

Table 5: The number of HCPs and HCRs, and the HCR-to-HCP ratio by country

Country	Region	HCPs	HCRs	HCPs/HCRs
United States	North America	74946	2493	30.06
Hong Kong	Asia	5756	135	42.64
Singapore	Asia	5299	106	49.99
China Mainland	Asia	72953	1418	51.45
Australia	Australia and Oceania	16886	310	54.47
Netherlands	Europe	11669	185	63.08
Germany	Europe	21260	334	63.65
Canada	North America	15282	207	73.83
Ireland	Europe	2613	35	74.66
Israel	Asia	3186	42	75.86
Belgium	Europe	6158	81	76.02
Macau SAR	Asia	536	7	76.57
Austria	Europe	4183	49	85.37
Switzerland	Europe	9591	104	92.22
Luxembourg	Europe	391	4	97.75
New Zealand	Australia and Oceania	2295	23	99.78
United Kingdom	Europe	57297	561	102.13
Denmark	Europe	5563	53	104.96
South Korea	Asia	7988	76	105.11
France	Europe	13745	129	106.55
Spain	Europe	11166	98	113.94
Japan	Asia	8964	76	117.95
Sweden	Europe	7058	58	121.69
Italy	Europe	13676	107	127.81
Saudi Arabia	Asia	5430	35	155.14
Portugal	Europe	2931	18	162.83
Country	**Region**	**HCPs**	**HCRs**	**HCPs/HCRs**
Norway	Europe	3601	18	200.06
Finland	Europe	3090	15	206.00
Kenya	Africa	475	2	237.50
Qatar	Asia	763	3	254.33
Kuwait	Asia	260	1	260.00
Taiwan	Asia	3363	12	280.25
United Arab Emirates	Asia	1418	5	283.60
South Africa	Africa	2867	10	286.70
Brazil	South America	4414	14	315.29
Czech Republic	Europe	2261	7	323.00
Estonia	Europe	663	2	331.50
Iceland	Europe	366	1	366.00
Lithuania	Europe	377	1	377.00
Mexico	South America	1776	4	444.00
Cyprus	Europe	462	1	462.00
Morocco	Africa	471	1	471.00
Ukraine	Europe	487	1	487.00

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

Colombia	South America	979	2	489.50
Chile	South America	1574	3	524.67
Thailand	Asia	1254	2	627.00
Argentina	South America	1327	2	663.50
Malaysia	Asia	2700	4	675.00
Croatia	Europe	678	1	678.00
Hungary	Europe	1470	2	735.00
Lebanon	Asia	745	1	745.00
Russia	Asia	2991	4	747.75
Serbia	Europe	767	1	767.00
Greece	Europe	2608	3	869.33
Iran	Asia	3958	3	1319.33
Pakistan	Asia	3383	2	1691.50
Turkiye	Asia	3505	2	1752.50
India	Asia	8906	5	1781.20

Source: Compiled by the author based on the number of HCRs and HCPs provided by Clarivate (HCR List 2024) and Web of Science InCites (HCPs)

4. Summary

This study provides a comprehensive analysis of Highly Cited Researchers (HCRs) across various regions and research clusters from 2020 to 2024. The analysis covers both the overall number of HCRs and their distribution across geographic regions (North America, Asia, Europe, Australia/Oceania, South America, and Africa) – as well as across 21 specific research clusters. The study also investigates the number of Highly Cited Papers (HCPs) and proportion of HCRs to HCPs.

Regarding Q1, North America (United States and Canada) maintains its position as the leading region in terms of HCR share throughout the study period. However, its percentage share shows a steady decline from 44.53% in 2020 to 39.24% in 2024. The United States accounts for the highest number of HCRs with 13.176 in 2024. Asia demonstrates a significant growth over the period, with its share of global HCRs increasing from 19.92% in 2020 to 28.18% in 2024, surpassing Europe in 2023. Within Asia, China has the highest number of HCRs with 5.601 in 2024. Europe, which initially held the second largest share, experiences a gradual decline, falling from 29.74% in 2020 to 27.17% in 2024. Collectively, North America, Europe, and Asia account for over 93% of all listed HCRs.

Q2 explores the regional distribution of HCRs across different clusters. The study further analyses HCR representation across 21 research clusters, identifying the leading region in each. North America is the top contributor in 13 clusters, while Asia and Europe each lead in four.

A more detailed annual analysis basis across nine selected clusters reveals significant shifts in regional leadership. Notable observations include the Cross-Field category, where North America holds the leading position and Asia overtakes Europe in 2022; Agricultural Sciences, where Asia has shown predominance since 2020; and Plant and Animal Sciences, where Europe lost its leading position to Asia in both 2023 and 2024.

Q3 investigates the relationship between the number of HCPs and HCRs across countries. The findings reveal a significant linear correlation, indicating that countries with a higher number of HCPs also tend to have more HCRs.

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

5. Discussion

The observed trends in the distribution of Highly Cited Researchers (HCRs) from 2020 to 2024 reveal a dynamic shift in the global research landscape. While North America has maintained its leading position, the rise of Asia, surpassing Europe in HCR representation by 2023, is a noteworthy development. This transition aligns with the well-documented rise of Asian science in recent decades, driven by increased research funding, strategic policy initiatives, and expanding international collaborations (Lee and Haupt 2020; Shu et al. 2022; Tollefson 2018; Zhou and Leydesdorff 2006). China's proactive approach to regional integration, including the Belt and Road Initiative (BRI), has further facilitated knowledge exchange and research cooperation (Lukács and Völgyi 2021), contributing to the region's expanding research output.

Europe's gradual decline in HCR share warrants closer examination. Factors such as shifting research priorities, changes in resource allocation, and a slower increase in research productivity relative to Asia may contribute to this trend (Aghion et al. 2021). As noted by Jonkers and Tijssen (2008), European countries may need to reassess and adapt their research strategies to maintain competitiveness in an evolving global research environment. Initiatives promoting cooperation with Asia – such as "Keleti Nyitás – Opening to the East Policy," which aims to internationalise higher education in Hungary – (Lukács et al. 2020, 2021; Lukács and Völgyi 2018), could potentially foster stronger academic ties and enhance knowledge transfer (Lukács et al. 2020, 2021; Lukács and Völgyi 2018).

The cluster-specific analysis highlights the heterogeneity of regional strengths. North America's dominance in the Cross-Field category and Asia's prominence in Agricultural Sciences, underscore the importance of considering disciplinary differences when evaluating research performance. Additionally, factors such as self-citation practices, collaboration networks, and citation concentration may also vary across disciplines and publication types, influencing HCR outcomes (Chi 2016; Wang et al. 2017; Zanotto et al. 2016; Zeng et al. 2022).

The strong linear relationship between Highly Cited Papers (HCPs) and Highly Cited Researchers (HCRs) reinforces the idea that impactful research, as measured by citation counts, is closely associated with the presence of highly influential researchers. However, it is important to recognise the limitations of citation-based metrics (Bornmann and Marx 2015; Mingers and Leydesdorff 2015; Szomszor et al. 2020). Furthermore, the success of Southeast Asian integration, particularly through the ASEAN Economic Community (AEC), has created a more unified production base (Völgyi and Lukács 2014), which may contribute to increased research productivity and citation impact in the region.

The Shanghai Ranking (Academic Ranking of World Universities), a prominent global university ranking, places significant emphasis on the number of HCRs affiliated with an institution. While this indicator highlights the presence of high-impact researchers, it has also been subject to criticism. Proponents argue that it encourages institutions to attract and support high-impact researchers, thereby enhancing research excellence. Critics, however, warn that it may lead to an overreliance on citation metrics, potentially distorting institutional research priorities (Abduh 2023; D. Docampo et al. 2015; Domingo Docampo and Cram 2019). The increasing prominence of Asian universities in the Shanghai Ranking is partly due to the growing number of HCRs affiliated with these institutions.

From the perspective of the Shanghai Ranking, the number of HCRs plays a crucial role in determining an institution's standing (Bornmann and Bauer, 2015). However, it is important to recognise that other factors, such as international collaboration (Zanotto et al. 2016), and the overall research environment (Nemeth et al. 2023) also significantly influence the position of higher education institutions in global ranking systems. Therefore, it is a key responsibility for university management not only to attract top scholars, but also to nurture the future generation of HCRs. In this context, it becomes essential to critically assess the reliance on HCRs and other citation-based indicators in evaluating research excellence.

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

The ongoing shift in the global distribution of HCRs carries important implications for international research collaborations. As Asian countries gain prominence, collaborative networks may increasingly shift towards East-West partnerships. While this shift could lead to new knowledge creation and innovation, it also raises questions about equitable collaboration and the fair distribution of research benefits (Frenken et al. 2009; Jonkers and Tijssen 2008; Zanotto et al. 2016). Furthermore, the emergence of mega free trade agreements (mega-FTAs) in the Asia-Pacific region, particularly from a Japanese perspective (Lukács and Völgyi 2018), may reshape trade and investment patterns, potentially influencing research collaborations and knowledge flows.

5.1 Limitations and further research

This study, while providing a comprehensive overview of the distribution of Highly Cited Researchers (HCR), has several limitations. First, the analysis is based on a specific dataset complied by Clarivate Analytics, which may not fully represent all impactful researchers worldwide. Second, the study does not examine the specific research topics or methodologies employed by HCRs across different regions and clusters. Future research could explore the publication and citation portfolio of HCRs, as well as their contribution to the ranking positions of higher education institutions in different regions. Additionally, it would be valuable to analyse the collaboration patterns of HCRs at the level of individual researchers, including their institutional affiliations and co-authorship networks.

6. Conclusions

The global research landscape is undergoing a significant transformation, with Asia emerging as a major force in scientific production and impact. This study provides empirical evidence of this shift, highlighting the increasing presence of Asian researchers among the world's most highly cited. While North America and Europe continue to remain key players, the rise of Asia underscores the need to re-evaluate research strategies and to place a greater emphasis on fostering equitable and mutually beneficial international collaborations.

Conflict of interest:
There is no conflict of interest.

References:
Abduh, A. J. (2023, January 22). A critical analysis of the world's top 2% most influential scientists: Examining the limitations and biases of highly cited researchers lists. *Authorea Preprints.* https://doi.org/10.22541/au.167435298.80209125/v1

Abramo, G., Cicero, T., & D'Angelo, C. A. (2013). The impact of unproductive and top researchers on overall university research performance. *Journal of Informetrics, 7*(1), 166–175. https://doi.org/10.1016/j.joi.2012.10.006

Aghion, P., Antonin, C., & Bunel, S. (2021). *The power of creative destruction: Economic upheaval and the wealth of nations.* Harvard University Press. https://doi.org/10.4159/9780674258686

Aksnes, D. W., & Aagaard, K. (2021). Lone geniuses or one among many? An explorative study of contemporary highly cited researchers. *Journal of Data and Information Science, 6*(2), 41–66. https://doi.org/10.2478/jdis-2021-0019

Basu, A. (2006). Using ISI's "Highly Cited Researchers" to obtain a country level indicator of citation excellence. *Scientometrics, 68*(3), 361–375. https://doi.org/10.1007/s11192-006-0117-x

Bauwens, L., Mion, G., & Thisse, J.-F. (2012). The resistible decline of European science. *Recherches Économiques de Louvain, 77*(4), 5–31. https://doi.org/10.3917/rel.774.0005

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Bornmann, L., & Bauer, J. (2015). Which of the world's institutions employ the most highly cited researchers? An analysis of the data from highlycited.com. *Journal of the Association for Information Science and Technology, 66*(10), 2146–2148. https://doi.org/10.1002/asi.23396

Bornmann, L., & Marx, W. (2015). Methods for the generation of normalized citation impact scores in bibliometrics: Which method best reflects the judgements of experts? *Journal of Informetrics, 9*(2), 408–418. https://doi.org/10.1016/j.joi.2015.01.006

Chaignon, L., Docampo, D., & Egret, D. (2023). In search of a scientific elite: Highly cited researchers (HCR) in France. *Scientometrics.* https://doi.org/10.1007/s11192-023-04805-3

Chi, P.-S. (2016). Differing disciplinary citation concentration patterns of book and journal literature? *Journal of Informetrics, 10*(3), 814–829. https://doi.org/10.1016/j.joi.2016.05.005

Clarivate. (2024). *Highly cited researchers – Past list.* https://clarivate.com/highly-cited-researchers/past-lists/

Costas, R., & Bordons, M. (2008). Is g-index better than h-index? An exploratory study at the individual level. *Scientometrics, 77*(2), 267–288. https://doi.org/10.1007/s11192-007-1997-0

Demeter, M., Pelle, V., Mikulás, G., & Goyanes, M. (2022). Higher quantity, higher quality? Current publication trends of the most productive journal authors in the field of communication studies. *Publishing Research Quarterly, 38*(3), 445–464. https://doi.org/10.1007/s12109-022-09893-2

Docampo, D., Egret, D., & Cram, L. (2015). The effect of university mergers on the Shanghai ranking. *Scientometrics, 104*(1), 175–191. https://doi.org/10.1007/s11192-015-1587-5

Docampo, D., & Cram, L. (2019). Highly cited researchers: A moving target. *Scientometrics, 118*(3), 1011–1025. https://doi.org/10.1007/s11192-018-2993-2

Egret, D., Chaignon, L., & Docampo, D. (2024). Mapping the paths of highly cited researchers: A comprehensive look at the 2023 cross-field distribution. *Scientometrics, 129*(11), 7107–7129. https://doi.org/10.1007/s11192-024-05151-8

Fanelli, D. (2010). Do pressures to publish increase scientists' bias? An empirical support from US states data. *PLOS ONE, 5*(4), e10271. https://doi.org/10.1371/journal.pone.0010271

Frenken, K., Hoekman, J., Kok, S., Ponds, R., van Oort, F., & van Vliet, J. (2009). Death of distance in science? A gravity approach to research collaboration. In A. Pyka & A. Scharnhorst (Eds.), *Innovation networks* (pp. 43–57). Springer. https://doi.org/10.1007/978-3-540-92267-4_3

Frietsch, R., Gruber, S., & Bornmann, L. (2025). The definition of highly cited researchers: The effect of different approaches on the empirical outcome. *Scientometrics.* https://doi.org/10.1007/s11192-024-05158-1

Garfield, E. (1955). Citation indexes for science: A new dimension in documentation through association of ideas. *Science, 122*(3159), 108–111. https://doi.org/10.1126/science.122.3159.108

Garfield, E. (2006). The history and meaning of the journal impact factor. *JAMA, 295*(1), 90. https://doi.org/10.1001/jama.295.1.90

Johann, D., Neufeld, J., Thomas, K., Rathmann, J., & Rauhut, H. (2024). The impact of researchers' perceived pressure on their publication strategies. *Research Evaluation.* Advance online publication. https://doi.org/10.1093/reseval/rvae011

Jonkers, K., & Tijssen, R. (2008). Chinese researchers returning home: Impacts of international mobility on research collaboration and scientific productivity. *Scientometrics, 77*(2), 309–333. https://doi.org/10.1007/s11192-007-1971-x

Klein, A.-M., & Kranke, N. (2023). Some thoughts on transparency of the data and analysis behind the Highly Cited Researchers list. *Scientometrics, 128*(12), 6773–6780. https://doi.org/10.1007/s11192-023-04852-w

Kwiek, M. (2018). High research productivity in vertically undifferentiated higher education systems: Who are the top performers? *Scientometrics, 115*(1), 415–462. https://doi.org/10.1007/s11192-018-2644-7

Larivière, V., & Costas, R. (2016). How many is too many? On the relationship between research productivity and impact. *PLOS ONE, 11*(9), e0162709. https://doi.org/10.1371/journal.pone.0162709

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

Lee, J. J., & Haupt, J. P. (2020). Winners and losers in US-China scientific research collaborations. *Higher Education, 80*(1), 57–74. https://doi.org/10.1007/s10734-019-00464-7

Li, J. T. (2016). What we learn from the shifts in highly cited data from 2001 to 2014? *Scientometrics, 108*(1), 57–82. https://doi.org/10.1007/s11192-016-1958-6

Li, J. T. (2018). On the advancement of highly cited research in China: An analysis of the Highly Cited database. *PLOS ONE, 13*(4), e0196341. https://doi.org/10.1371/journal.pone.0196341

Lukács, E., Kovács, Z., Völgyi, K., & Filep, B. (2020). A „keleti nyitás" politika szerepe a magyar felsőoktatás és a Széchenyi István Egyetem nemzetköziesítésében [The role of the economic policy "Opening to the East" in the internationalization of Széchenyi István University and the Hungarian higher education system]. *Külügyi Szemle, 19*(1), 80–104.

Lukács, E., & Völgyi, K. (2018). Mega-FTAs in the Asia-Pacific Region: A Japanese perspective. *European Journal of East Asian Studies, 17*(1), 158–175. https://doi.org/10.1163/15700615-01701008

Lukács, E., & Völgyi, K. (2021). Chinese foreign direct investments in Hungary from the perspective of BRI, international capacity cooperation, and Made in China 2025. *Contemporary Chinese Political Economy and Strategic Relations, 7*(1), 413–446.

Lukács, E., Völgyi, K., Filep, B., & Kovács, Z. (2021). The role of the economic policy "Opening to the East" in the internationalization of Széchenyi István University and the Hungarian higher education system. In *China-Hungary relations: Economic policy and higher education* (pp. 83–109).

Martinez, M., & Sá, C. (2020). Highly cited in the South: International collaboration and research recognition among Brazil's highly cited researchers. *Journal of Studies in International Education, 24*(1), 39–58. https://doi.org/10.1177/1028315319888890

Mingers, J., & Leydesdorff, L. (2015). A review of theory and practice in scientometrics. *European Journal of Operational Research, 246*(1), 1–19. https://doi.org/10.1016/j.ejor.2015.04.002

Nemeth, P., Torma, A., Lukacs, E., & Filep, B. (2023). Sustainability opportunities and barriers at universities: Development of a sustainable university environment. *Chemical Engineering Transactions, 107,* 505–510. https://doi.org/10.3303/CET23107085

Piro, F. N., Rørstad, K., & Aksnes, D. W. (2016). How does prolific professors influence on the citation impact of their university departments? *Scientometrics, 107*(3), 941–961. https://doi.org/10.1007/s11192-016-1900-y

Seglen, P. O. (1997). Why the impact factor of journals should not be used for evaluating research. *BMJ, 314*(7079), 497. https://doi.org/10.1136/bmj.314.7079.497

Shu, F., Liu, S., & Larivière, V. (2022). China's research evaluation reform: What are the consequences for global science? *Minerva, 60*(3), 329–347. https://doi.org/10.1007/s11024-022-09468-7

Szomszor, M., Pendlebury, D. A., & Adams, J. (2020). How much is too much? The difference between research influence and self-citation excess. *Scientometrics, 123*(2), 1119–1147. https://doi.org/10.1007/s11192-020-03417-5

Tollefson, J. (2018). China declared world's largest producer of scientific articles. *Nature, 553*(7689), 390. https://doi.org/10.1038/d41586-018-00927-4

Völgyi, K., & Lukács, E. (2014). A délkelet-ázsiai régió integrációs sikere: az ASEAN egységes termelési bázis [Integration success of Southeast Asia – the ASEAN single production base]. *Tér és Társadalom, 28*(4), 97–116. https://doi.org/10.17649/tet.28.4.2601

Waltman, L. (2016). A review of the literature on citation impact indicators. *Journal of Informetrics, 10*(2), 365–391. https://doi.org/10.1016/j.joi.2016.02.007

Wang, X., Wang, Z., Huang, Y., Chen, Y., Zhang, Y., Ren, H., et al. (2017). Measuring interdisciplinarity of a research system: Detecting distinction between publication categories and citation categories. *Scientometrics, 111*(3), 2023–2039. https://doi.org/10.1007/s11192-017-2348-4

Zanotto, S. R., Haeffner, C., & Guimarães, J. A. (2016). Unbalanced international collaboration affects adversely the usefulness of countries' scientific output as well as their technological and social impact. *Scientometrics, 109*(3), 1789–1814. https://doi.org/10.1007/s11192-016-2126-8

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)

Vol. XX, No. Y, pp. ZZ-ZZ, 20XX
https://doi.org/10.14513/tge-jres.00424

Zeng, A., Fan, Y., Di, Z., Wang, Y., & Havlin, S. (2022). Impactful scientists have higher tendency to involve collaborators in new topics. *Proceedings of the National Academy of Sciences, 119*(33), e2207436119. https://doi.org/10.1073/pnas.2207436119

Zhou, P., & Leydesdorff, L. (2006). The emergence of China as a leading nation in science. *Research Policy, 35*(1), 83–104. https://doi.org/10.1016/j.respol.2005.08.006

Publisher name: Széchenyi István University
ISSN: 3058-1079 (Online)