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Scientific Excellence and Publication Patterns: The Winning Applicants of the Bolyai János Research Scholarship in Hungary in 2021

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Abstract: The following paper examines some of the publishing habits observed among the winning applicants of the Bolyai János Research Scholarship. As an academic support programme, the Bolyai Research Scholarship forms a bridge between scholars with the title of doctor of the Hungarian Academy of Sciences (HAS) and the young generation of researchers with an academic degree. The winning applicants in 2021 were researchers under the age of 45, cooperating with international co-authors, having highly cited publications and showing a continuous publication history of 15 years on average. The scholarship holders come primarily from research centres and universities. The paper argues that the achievements of scholarship holders follow the international patterns of academic excellence and publication as well as the requirements for international cooperation and publishing mainly in open access journals. In doing so, they prefer journals under the umbrella of Elsevier for performing their publication activities; however, there has been a significant increase in those publishing in MDPI journals, recently. The results show that one-third of the applicants had published before and a fifth of them had published in one of the journals of MDPI two months after announcing the list of the winning applicants. At the same time, differences in publication traditions and award systems reveal marked differences in publication strategies and evaluation criteria across fields of science. Based on this, the descriptive statistics presented in this paper contribute to our understanding of the conscious career planning of young scholars in line with international standards.

Keywords: Bolyai János Research Scholarship; MDPI; scientific excellence; open access publications; scientific career paths; scientometrics

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1. Introduction

To ensure competitive and sustainable growth, it is essential that economies guarantee that their education systems work as effectively as possible. It is therefore in the interest of all responsible governments to collect facts and receive regular feedback on their education systems as well as their effectiveness and to formulate development strategies to improve in the areas concerned [1]. In alignment with this aim, numerous governments have established specialised institutions over the past few decades with the purpose of fostering the research and innovation activities of early-career researchers in the form of grants or scholarships. One of the most common characteristics of these institutions is that they encourage international research collaboration and, in most cases, do not even require applicants to have citizenship status in the country where the given institution operates. Another common feature of these institutions is that, whether it is openly declared or not, the foundation of their existence is to stimulate and promote scientific excellence through excellence funding [2].

However, while many studies examine the overall operation as well as the positive and negative effects of scientific excellence funding and grant schemes, including [2–5], less attention has been paid to the country- and discipline-specific characteristics of different support programmers so far [6,7]. Similarly, the requirements of the "publishing industry" and the internationalisation of various research domains are widely accepted all over the world [8–10], but we have limited empirical knowledge of the different publication habits, types and achievements between disciplines based on international standards and trends.

The detailed analysis of the scientific performance of the Bolyai János Research Scholarship in Hungary in 2021 aims to shed light on some aspects of the above-mentioned gaps "from below", with special regard to the pivotal role of proliferating open access publications. For the above reasons, the following hypotheses were formulated at the beginning of our study:

Hypothesis 1 (H1). *One of the hallmarks of scientific excellence is the communication of high-quality research carried out via cooperation between international co-authors. It is probable that among the winners of the Bolyai János Research Scholarship, there is a significant proportion of publications written in the form of international co-authorship.*

Hypothesis 2 (H2). *Since one of the conditions for receiving the research scholarship is the commitment to publish an open access publication, it is likely that this requirement will result in an increasing proportion of open access journal articles in the publication activities of the winning applicants of the Bolyai János Research Scholarship.*

Hypothesis 3 (H3). *Since the publication of open access journal articles is more widespread in the publication practice of researchers in the natural and life sciences, it is likely that similar rates are seen among the winning applicants of the Bolyai János Research Scholarship.*

2. The Definition of Scientific Excellence

The term excellence was first used in the context of science in the United States in the 1960s, as a reaction to the necessity of overcoming mediocre performance in the field of science and technology [3]. It found sudden momentum in the early 1990s when the concept of scientific excellence became a constant point of reference in scientific policies in several European countries through the foundation of Networks of Excellence, which was supported by funds provided by the European Union and Centres of Excellence financed by their establishing nations [3]. Later, an even broader influence was exerted by the European Research Council (ERC) and the creation of dedicated research funding opportunities in many OECD countries. In Hungary, there are three major research funding opportunities encouraging and recognising scientific excellence: the Bolyai János Research Scholarship, established by the Hungarian government in 1997, the Lendület (Momentum) Programme established by the Hungarian Academy of Sciences in 2009 and the Hungarian Scientific Research Fund. It must be mentioned that the concept of scientific excellence has not been exempt from criticism over the years. As Stilgoe puts it, the term excellence says nothing about the importance of science as such, but it says everything about who decides what excellence is: "Excellence is judged by peers and backed up by numbers such as h-indexes and journal impact factors, all of which reinforces disciplinary boundaries and focuses scientists' attention inwards rather than on the problems of the outside world" [11]. It has also been revealed how, in the pursuit of excellence, journal rankings might lead to discouraging interdisciplinarity by systematically giving more value to disciplinary research [12]. Others argue that the goal of reaching scientific excellence results in a form of hyper-competition, posing a threat to the norms of good research and ultimately leading to a lower quality of research output [4]. In close connection to the concept of excellence, excellence funding can be defined as a form of financial support based on outstanding quality and performance to facilitate ground-breaking research and improve international competitiveness. Although the literature on the effects of excellence funding is limited,

there have been some studies on its effects on national research systems. This form of funding is based on the idea that differentiating resource allocations will lead to a better performance of the science system. Governments hope that increasing the concentration of researchers who will perform "best" will increase the effectiveness of research, decrease low-quality research and yield more and better outcomes for the entire system, such as breakthrough innovations and the attraction of scientific talent [7]. However, excellence funding can create imbalances in the system of science by providing additional support for a selected group of researchers and researcher teams, thereby unequally distributing the available funds among the applicants. Thus, it tends to strengthen the presence of the Matthew effect; that is, those researchers who are initially in a more advantageous position will enjoy the benefits of cumulative advantage over time and eventually be granted an even higher concentration of funding. More general studies on the effects of science funding have also found evidence for it: early funding itself is an asset for acquiring later funding [13]. As has been found in a recent meta-study, this concentration of funding does not necessarily translate into improved scientific performance or higher productivity when it comes to publication numbers or citations [5]. Earlier research suggests that excellence policies are more prone to reveal existing but tacit diversity in the system than to generate new relational patterns. In four Nordic countries, the introduction of Centres of Excellence has increased the concentration of resources allocated to a limited number of researchers, although excessive accumulation of resources is avoided [14]. It is, however, doubtful whether this concentration will generate the desired increase in scientific performance.

2.1. The Significance of Open Access Publications

It is not an exaggeration to say that in the past few decades, the emergence of the practice of open access publications has revolutionised the way research results and scientific knowledge are disseminated. Its significance can be best described by Richard Poynder's: "What is remarkable about the open access (OA) movement is that despite having no formal structure, no official organization and no appointed leader, it has (in the teeth of opposition from incumbent publishers) triggered a radical transformation in a publishing system that had changed little in 350 years. Most notably, it has demonstrated that it is no longer rational, or even necessary, for subscription paywalls to be built between researchers and research" [15]. The advocates of the open access movement promote the idea that making scientific content broadly available and free of charge for the readers will improve scholarly communication and provide some protection to libraries, universities and the members of the scientific community from the arbitrary price increases in subscription journals. Open access offers two major advantages: the author's work is made available to the widest possible audience as it is freely and easily available to virtually anyone with access to the Internet and, therefore, more citations are expected to be received. In fact, several studies have shown that open access articles tend to receive more citations than their subscription-based equivalents [16–18], although this impact is mainly observed in the case of open access articles published in so-called hybrid journals [19] and green open access articles [20]. Based on the perceived advantages and knowing that more and more research funders are making it mandatory for researchers to publish their papers in open access journals, it has long been expected that, especially in the form of gold open access [15], the practice of open access publications will replace subscriptions as the dominant model for the distribution of journal articles. Recent studies suggest that although the debate over the chance of lower standards in peer-review processes, the lack of quality control and the possible appearance of predatory journals is ongoing, the rate of open access publications has been steadily increasing over the past decade. For instance, while only 19% of research papers funded by the European Research Council were available as green open access articles in 2009, this rate increased up to 29% in 2016. The increase was even more spectacular in the case of green and gold open access articles, reaching 37% in 2016 from 19% measured in 2009 [21,22]. This tendency is observed even though the article processing charges (APCs) of open access

publishing have been dramatically increasing as of late [6]. It also has to be noted that the penetration of open access publications is different among various disciplines. The highest open access rates can be observed in the Natural and Technical Sciences among all disciplines. Researchers and scholars in the fields of Mathematics, Physics, Information Technology and Astronomy were among the first ones to publish open access articles. Although the rate of open access publications in the Social Sciences is higher than in most disciplines of the Humanities, it remains low in the Natural and Medical Sciences. The lowest rate of open access articles is found in the field of Law [6].

2.2. Research Funds and Programmes in Hungary

In Hungary, there are three major research funding opportunities encouraging and recognising scientific excellence: the Bolyai János Research Scholarship established by the Hungarian government in 1997, the Lendület (Momentum) Programme established by the Hungarian Academy of Sciences in 2009 and the Hungarian Scientific Research Fund.

The HSRF's budget may be used to support, by means of a public bid system, scientific research, or the establishment of the conditions necessary for carrying out such research and for making the results publicly available, which are expected to lead to the discovery of new scientific laws and the development of knowledge, methods and procedures. The HSRF's budget may also be used for the development of infrastructure to facilitate the production of such scientific results (Hungarian Scientific Research Fund, 1997). Established in 1986 and operating as an independent fund since 1991, the HSRF was the only dedicated basic research resource in Hungary from 1993 to the end of 2014 [23]. The HSRF has supported a significant number of early-career researchers. Its funding strategy provided opportunities for deserving research at all stages of a researcher's career. To encourage and recognise excellence in research and development, the government established the Bolyai János Research Scholarship. This scholarship is awarded by an independent, professionally and scientifically autonomous Board of Trustees established by the President of the Hungarian Academy of Sciences (hereinafter referred to as the HAS) within the framework of the HAS's public body, through a public application system [24].

The aim of the Momentum Programme, established by the HAS in 2009, is to strengthen the Hungarian young researcher base by attracting and retaining outstanding researchers and young talents from abroad. The Momentum Programme aims to support both excellence and mobility by providing funding for research teams conducting ground-breaking research in host research centres [25].

The most important research funding opportunity according to our case study, which was established by the Hungarian government to encourage and recognise excellence in research and development, is the Bolyai János Research Scholarship. The following chapter gives a concise description of the scholarship, listing all the requirements that successful applicants are required to meet.

3. The Bolyai János Research Scholarship

The Bolyai János Research Scholarship is awarded by a Board of Trustees appointed by the President of the HAS and operates within the framework of the HAS's public body through a public application system to encourage and recognise outstanding research and development achievements. The scholarship is open to HAS applicants under 45 years of age who hold a scientific degree but have not yet obtained the title of doctor of the HAS. The aim of the scholarship is to facilitate the writing of a scientific work or the preparation of a work on an equivalent research topic as well as the preparation for the award of the title of doctor of the HAS. Applications may be submitted in any field of science or discipline. The scholarship is open to any applicant with a higher education degree who meets the following criteria:

- Is a Hungarian citizen or a Hungarian researcher living abroad;

- Holds a PhD or equivalent degree at the time of application, or, if not yet held at the time of application but the university's doctoral council has already decided to award the degree, provide evidence of this fact;
- Has not yet obtained the title doctor of the HAS at the time of submitting the application;
- Is under 45 years of age on the closing date for applications;
- Wishes to carry out his or her research in a Hungarian scientific institution (higher education institution, research institute or other scientific research centre) and has a declaration of acceptance from the institution.

Section 64 (3) of Act XC of 2020 on the Central Budget of Hungary for 2021 (Kvtv.) establishes the monthly amount of the scholarship, which was HUF 124 500 on the day of the announcement of the application. The number of new scholarships to be awarded in 2021 was expected to be 160, from the estimate of expenditure for 2021 set out in Chapter XXXIII. Successful researchers received the scholarship from the 1st of September in 2021, based on a favourable decision of the Board of Trustees of the HAS Bolyai János Research Scholarship. The submission and evaluation of proposals are carried out with the assistance of eleven peer-review panels corresponding to the HAS classes; this facilitates the disciplinary analysis of the data, as defined in Table 1.

Table 1. Definition of disciplines by HAS class. Source: HAS.

Number	Field of Science	According to the HAS Classes
1	Humanities, Arts and Social Sciences (HASS)	I. Linguistics and Literary Studies
		II. Philosophy and Historical Science
		IX. Economics and Law
2	Life Sciences (LS)	IV. Agricultural Sciences
		V. Medical Sciences
		VIII. Biological Sciences
3	Science, Technology, Engineering and Mathematics (STEM)	III. Mathematical Sciences
		VI. Engineering Sciences
		VII. Chemical Sciences
		X. Earth Sciences
		XI. Physical Sciences

4. Methodology

Using standard descriptive statistical tools, the present study includes a detailed analysis of the publication habits of the winning applicants, based on data derived from both Scopus and the Hungarian Scientific Bibliography Database (MTMT). In order to tackle the possibly arising issues of incompatibility, we used the publication-type approach as a common denominator, which means that a defined set of scientific publication types was chosen and examined for both databases. It proved to be helpful that articles appearing in the Scopus database are automatically shown in the Hungarian Scientific Database, so the two databases are partially synchronised. This group of scientific publications was established and introduced by a Doctoral Decision of the Presidency of the Hungarian Academy of Sciences in 2012. According to the referred decision, the list of all scientific publication types is as follows [26]:

1. Published in a journal: academic article/study, summary article, short publication, multi- or group-author publication, source publication, review/critique, art criticism, essay.
2. Books: textbook, monograph, handbook, source publication, critical edition, workshop study, atlas.

3. Published in a book: professional study, book chapter, essay, source publication, review/critique, art criticism, work of art description, map, workshop study.
4. Conference publication: in a journal, book, or other conference proceedings (usually at least four pages).
5. Protection forms: patents.
6. Creation: for technical applications (the composition type was introduced in the HSB in 2013).

Our analysis was carried out using the SPSS 26.0 statistical software package.

5. Results of the Empirical Study

The number of winning applicants of the Bolyai János Research Scholarship was 169 in 2021. Of these, 168 winners possessed an ID in the Hungarian Scientific Bibliography Database. If we take a look at the number of winners over the last 11 years, it can be seen that from 2010 onwards, there were 173 winners on average (Figure 1).

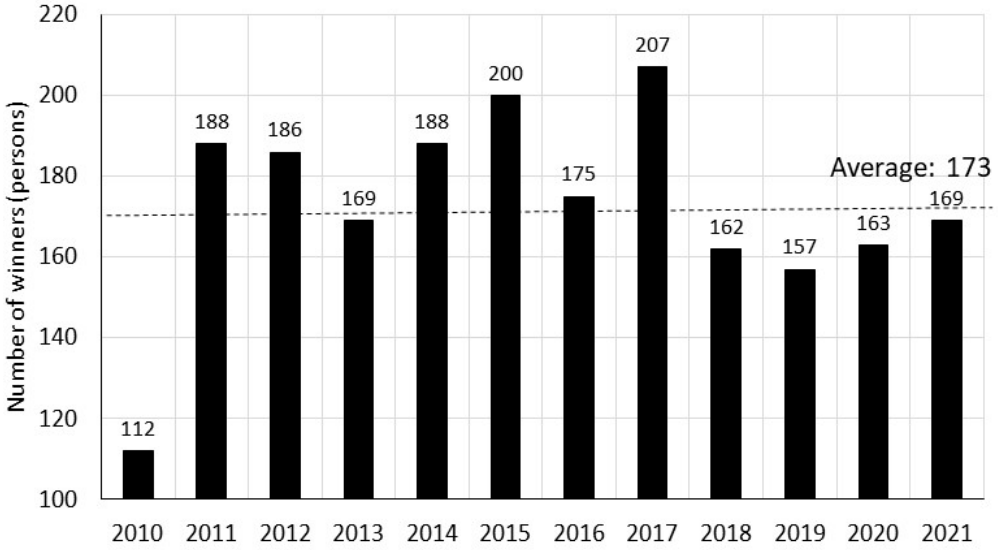

Figure 1. The number of Bolyai János Research Scholarship holders awarded between 2010 and 2021 (previous awardees, 2021).

In 2021, applicants for the Bolyai János Research Scholarship were awarded after an average of 15 years of publication recorded in the Hungarian Scientific Bibliography Database and 8 years after obtaining their PhD degree. The corresponding figures were 17 years (HSB) and 10 years for HASS (49 persons); 14 years and 9 years for LS (61 persons); and 13 years and 8 years for STEM (58 persons) (Table 2).

The average age of the scholarship holders was 38.7 years, with the youngest being 31 and the oldest 45 years old.

Regarding the institutions and universities of origin, most of the winners came from the ELKH (50 persons, 30%), SZTE (21 persons, 12%), ELTE (19 persons, 11%) and BME (18 persons, 11%) (Figure 2). A significant number of researchers arrived from the DE (14 persons), PTE (11 persons) and SE (10 persons). Almost three-quarters (73%) of the winning applicants were male. The proportion of men was 61% for HASS, 75% for LS and 81% for STEM among the scholarship holders surveyed. On average, those with Scopus identifiers had 30 complete scientific publications, 420 references and an h-index of 9 according to the Scopus database (Table 3). A total of 93% of the winning applicants (156 persons) had a Scopus identifier, i.e., have published at least one Scopus-indexed journal article, book or conference publication. In STEM and LS (one person had an incorrect identifier in LS), all the scholarship holders, and in HASS 78% (38 out of 49 persons) of the scholarship holders, can be found in the Scopus database. The number of scholarship holders having HASS research publications indexed by Scopus was nearly a third of the number of references

and nearly a quarter and a sixth of the number of references of STEM and LS scholars, respectively. The specific excess of publications by STEM and LS scholarship holders may be partly explained by the higher number of co-authors. The average number of co-authored publications was 4 pieces for HASS, 6 for STEM and 15 for LS.

Table 2. Distribution of winners by field of study, average age and number of years in publishing. Source: HSB, Scopus.

Field of Science	Number of People (Persons)	Average Number of Years Since First Publication According to the Hungarian Scientific Bibliography Database (Years)	Average Number of Years Since First Publication According to Scopus (Years)	Minimum Age (Years)	Average Age (Years)	Maximum Age (Years)
HASS	**49**	**17.2**	**10.0**	**33**	**41.0**	**45**
Linguistics and Literary Studies (HAS I.)	11	18.0	10.4	34	41.5	45
Philosophy and Historical Sciences (HAS II.)	20	17.7	10.6	33	40.8	45
Economics and Law (HAS IX.)	18	16.3	9.3	36	41.1	44
LS	**61**	**14.2**	**12.6**	**32**	**38.6**	**45**
Agricultural Sciences (HAS IV.)	10	14.3	11.8	32	38.6	44
Medical Sciences (HAS V.)	27	12.9	12.1	32	37.5	44
Biological Sciences (HAS VIII.)	24	15.5	13.4	34	39.8	45
STEM	**58**	**12.7**	**11.0**	**31**	**36.8**	**45**
Mathematical Sciences (HAS III.)	9	10.7	10.1	31	35.4	44
Technical Sciences (HAS VI.)	16	12.9	10.3	32	37.6	43
Chemical Sciences (HAS VII.)	16	12.7	11.3	31	36.2	45
Earth Sciences (HAS X.)	5	14.2	8.6	34	37.4	44
Physical Sciences (HAS XI.)	12	13.3	13.0	33	37.3	45
Total	**168**	**14.5**	**11.4**	**31**	**38.7**	**45**

As of 2000—the year of the first publication—to the publication of this article, the awarded applicants have published 4698 publications according to Scopus, of which 10% are related to HASS and 45–45% to LS and STEM. On average, they have won after 11 years of active publication, but some scholarship holders have been writing Scopus publications for 22 years. The average number of years of active publication for awarded applicants is 10 for HASS, 13 for LS and 13 for STEM. The SCImago Journal & Country Ranking (SJR) is a free portal that provides scientific indicators for journals and countries based on Elsevier's Scopus database. The SJR is primarily used to show in which quartile a journal falls in each field of research ranking: in the first quartile (0–25%, Q1, the first quarter from the top, where Q indicates the quartile), or in the second (Q2), third (Q3) or last quartile (Q4). Of the articles published by successful applicants in Scopus-ranked journals, 62% in the 10 years prior to the application fell in Q1, 23% in Q2, 10% in Q3 and 5% in Q4 (Table 3). Higher Q ratings—Q1—were observed for LS and STEM, and lower ratings—Q4—were seen for HASS sciences. On average, the scholarship holders have written 15 journal articles,

according to Scopus. The average is nearly 20 articles for STEM researchers, 19 for LS and 6 for HASS (Table 4). These findings are partly in line with our third hypothesis as the number of articles was the highest in the case of STEM sciences, closely followed by Life Sciences, while the Humanities and Social Sciences lagged behind.

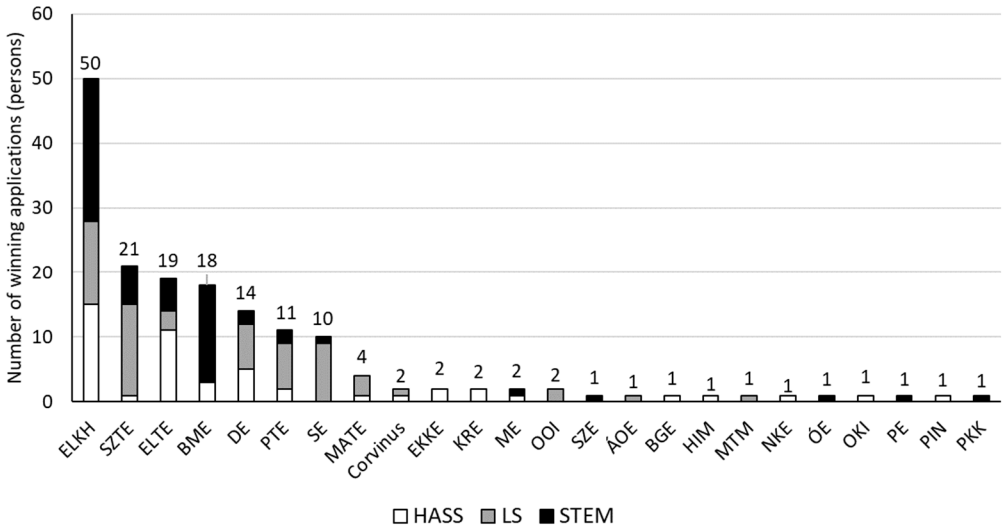

Figure 2. The distribution of 2021 scholarship holders by institutions. (Source: HAS). Abbreviations: University of Veterinary Medicine Budapest = UVMB (ÁOE); Corvinus University of Budapest = CORVINUS; Budapest Business School = BBS (BGE); Budapest University of Technology and Economics = BUTE (BME); University of Debrecen = UD (DE); Eötvös Loránd Research Network = ELRN (ELKH); Eötvös Loránd University = ELU (ELTE); Eszterházy Károly Catholic University = EKCU (EKKE); Military History Institute and Museum = MHIM (HIM); Károli Gáspár University of the Reformed Church in Hungary = KGURCHH (KRE); Hungarian University of Agriculture and Life Sciences = HUALS (MATE); Hungarian Museum of Natural Science = HMNS (MTM); University of Miskolc = UM (ME); University of Public Service = UPS (NKE); Óbuda University = OU (ÓE); National Institute of Criminology = NIC (OKI); National Institute of Oncology = NIO (OOI); University of Pannonia = UP (PE); University of Pécs = UP (PTE); Periféria Policy and Research Centre Kft. = PPRC (PKK); Institute of Political History Nonprofit Kft. = IPH (PIN); Semmelweis University = SU (SE); Széchenyi István University = SZIU (SZE); University of Szeged = USZ (SZTE).

The primary purpose of scientific publishing is to communicate new scientific findings to the scientific community [8]. Co-authored publications are collaborative, and thus, as a secondary goal, they facilitate information flow, productivity, informal professional discourses and scientific socialisation [9,27–29]. They can also be important for awareness, recognition and resource acquisition [30,31]. Examining the composition of co-authorship is a widely used method for investigating scientific collaborations [32], although it allows only a formal part of the collaborations to be revealed [10]. In our analysis, the following types of co-authorships are determined:

- Publications prepared in international collaboration—at least one author from another country;
- Only national collaboration—at least one author from another Hungarian institution;
- Only institutional collaboration—all authors from a given institution;
- Single-author communications.

A total of 5% of Scopus publications by scholarship holders were single-authored, more than a fifth (22%) were written in an institutional collaboration, 30% in a national collaboration and 42% in an international collaboration (Table 5). In the field of HASS, the single authorship rate reached 26%, while in the case of LS, 2% was measured. The highest percentage of international collaboration was 46% in STEM, including 62% in Physical Sciences, while the lowest rate was measured in HASS (30%). These figures show that our

hypothesis regarding the high proportion of international co-authored publications proved to be true.

Table 3. Average number of complete scientific publications and h-index by discipline according to the Scopus database. Source: Scopus.

Field of Science HAS Class	Average Number of Complete Scientific Publications (pcs/Person)	Average Number of References (pcs/Person)	Hirsch Index Average	Average Number of Authors of Publications (Person/ Publication)
HASS	**11**	**115**	**4**	**4**
Linguistics and Literary Studies (HAS I.)	10	53	3	2
Philosophy an Historical Science (HAS II.)	13	210	5	6
Economics and Law (HAS IX.)	10	54	4	2
LS	**36**	**621**	**12**	**15**
Agricultural Sciences (HAS IV.)	34	363	10	11
Medical Sciences (HAS V.)	35	559	12	10
Biological Sciences (HAS VIII.)	37	796	14	22
STEM	**36**	**412**	**10**	**6**
Mathematical Sciences (HAS III.)	26	120	5	3
Technical Sciences (HAS VI.)	42	345	9	4
Chemical Sciences (HAS VII.)	37	583	13	7
Earth Sciences (HAS X.)	11	123	4	7
Physical Sciences (HAS XI.)	46	611	12	8
Average	**30**	**420**	**9**	**9**

In the case of international collaboration, a high number of specific references can be measured in all disciplines. Between 2016 and 2020, the number of references per publication was 19 for international collaboration, 9 for national collaboration, 7.5 for institutional collaboration and 3 for single-author publications. (Table 5). The functioning of the scientific publishing sector has been the subject of much debate both within and outside the scientific community, regarding the high profit margins of large subscription-based journal publishers. In one of the largest scientometric databases, the Clarivate Analytics Web of Science (WoS), 45 million documents were indexed between 1973 and 2013. The analysis of publications shows that in the Natural Sciences, Medical Sciences, Social Sciences and Humanities, the following publishers have all increased their share of published publications to the greatest extent, especially since the advent of digitisation in 1990 [33].

- Elsevier;
- Wiley-Blackwell;
- Springer;
- Taylor & Francis;
- SAGE.

Table 4. Specific number and proportion of quartiles in journal articles by discipline. Source: SciVal.

Field of Science, 2011–2020	Q1		Q2		Q3		Q4	
HAS Class	**pcs/Person**	**%**	**pcs/Person**	**%**	**pcs/Person**	**%**	**pcs/Person**	**%**
HASS	**2.9**	**50.0%**	**1.5**	**26.8%**	**0.8**	**14.3%**	**0.5**	**8.9%**
Linguistics and Literary Studies (HAS I.)	0.8	32.1%	0.8	32.1%	0.4	14.3%	0.5	21.4%
Philosophy an Historical Science (HAS II.)	4.6	61.9%	1.4	18.4%	0.9	12.2%	0.6	7.5%
Economics and Law (HAS IX.)	2.2	38.1%	2.2	37.1%	1.0	17.1%	0.4	7.6%
LS	**12.5**	**67.0%**	**3.8**	**20.2%**	**1.5**	**8.0%**	**0.9**	**4.8%**
Agricultural Sciences (HAS IV.)	12.1	49.8%	5.3	21.8%	3.3	13.6%	3.6	14.8%
Medical Sciences (HAS V.)	12.9	72.0%	3.9	21.7%	0.7	4.1%	0.4	2.1%
Biological Sciences (HAS VIII.)	12.8	71.8%	3.0	17.0%	1.7	9.3%	0.3	1.9%
STEM	**11.9**	**59.9%**	**4.8**	**23.9%**	**2.3**	**11.8%**	**0.9**	**4.5%**
Mathematical Sciences (HAS III.)	5.9	43.8%	5.6	41.3%	1.3	9.9%	0.7	5.0%
Technical Sciences (HAS VI.)	6.7	41.8%	5.6	35.2%	2.7	16.8%	1.0	6.3%
Chemical Sciences (HAS VII.)	17.6	70.7%	4.7	18.8%	2.0	8.0%	0.6	2.5%
Earth Sciences (HAS X.)	2.6	38.2%	2.6	38.2%	1.6	23.5%	0.0	0.0%
Physical Sciences (HAS XI.)	19.9	68.7%	4.0	13.8%	3.4	11.8%	1.7	5.7%
Average	**9.5**	**61.9%**	**3.5**	**22.6%**	**1.6**	**10.4%**	**0.8**	**5.1%**

These five publishers accounted for more than 50% of all journal publications published in 2013. They are most concentrated in the Social Sciences (top five publishers with 70% of publications), while Humanities publications show a relatively independent, more fragmented picture (20% of all journal publications belonging to the top five). The analysis of Scopus publications among the winning applicants showed that the publishers boasting the highest number of published articles (Figure 3) are as follows:

- Elsevier;
- MDPI;
- Springer;
- Wiley-Blackwell;
- The IEEE (Institute of Electrical and Electronics Engineers).

Over the last 5 years, MDPI has ranked first among these publishers in terms of the number of publications.

We also examined what percentage of the awarded applicants wrote an MDPI publication before and after winning the scholarship and how many successful applicants did not publish with MDPI. Altogether, 31% of the successful applicants wrote an MDPI publication before applying for the scholarship (Figure 4). The total number of MDPI articles published among the researchers was 322. The results of the Bolyai János Research Scholarship were announced in September 2021. After barely two months, 32 people had already written an MDPI publication. The average time between the submission and actual publication of these articles was 40 days.

Table 5. Number of publications and references by type of co-authorship for awarded applicants in Scopus between 2016 and 2020. Source: Scopus.

Field of Science	International Collaboration			Only National Collaboration			Only Institutional Collaboration			Single-Authored		
HAS Section	**Ratio (%)**	**Publication (pcs)**	**Reference/ Publication**	**Ratio (%)**	**Publication (pcs)**	**Reference/ Publication**	**Ratio (%)**	**Publication (pcs)**	**Reference/ Publication**	**Ratio (%)**	**Publication (pcs)**	**Reference/ Publication**
HASS	**29.9**	**69**	**11.5**	**28.6**	**66**	**5.8**	**15.1**	**35**	**6.6**	**26.4**	**61**	**2.9**
Linguistics and Literary Studies (HAS I.)	12.5	4	3.2	9.4	3	2.0	34.4	11	9.7	43.8	14	1.6
Philosophy an Historical Science (HAS II.)	46.3	44	12.7	40.0	38	6.3	3.2	3	20.3	10.5	10	1.1
Economics and Law (HAS IX.)	20.2	21	10.5	24.0	25	5.4	20.2	21	3.0	35.6	37	3.8
LS	**40.8**	**324**	**28.7**	**36.0**	**286**	**9.7**	**21.6**	**172**	**8.5**	**1.6**	**13**	**1.7**
Agricultural Sciences (HAS IV.)	36.7	66	19.7	41.1	74	6.6	21.7	39	6.5	0.6	1	0.0
Medical Sciences (HAS V.)	37.5	136	15.0	38.8	141	11.3	22.6	82	11.0	1.1	4	0.5
Biological Sciences (HAS VIII.)	47.3	125	48.2	27.3	72	10.2	22.4	59	6.8	3.0	8	2.5
STEM	**46.3**	**464**	**12.8**	**26.6**	**267**	**9.2**	**23.5**	**235**	**7.0**	**3.6**	**36**	**2.9**
Mathematical Sciences (HAS III.)	48.8	39	2.0	18.8	15	3.0	8.8	7	1.4	23.8	19	3.2
Technical Sciences (HAS VI.)	35.8	126	11.6	28.4	100	8.0	32.7	115	5.4	3.1	11	1.7
Chemical Sciences (HAS VII.)	45.8	131	16.9	26.2	75	11.0	28.0	80	11.4	0.0	0	0.0
Earth Sciences (HAS X.)	33.3	9	13.1	48.2	13	8.3	11.1	3	5.3	7.4	2	1.5
Physical Sciences (HAS XI.)	62.0	160	12.9	24.8	64	10.6	11.6	30	2.4	1.5	4	5.2
Average	**42.3**	**857**	**18.7**	**30.5**	**618**	**9.1**	**21.7**	**440**	**7.5**	**5.4**	**110**	**2.7**

Half of the successful applicants (84) have not written any MDPI publications as of the date of publication. These authors work predominantly in the field of HASS. When examining their entire career, the most popular publishers among researchers were Elsevier, Springer and MDPI (Table 6). The rapid increase in the number of MDPI publications somewhat supports the validity of our second hypothesis regarding the high proportion of open access journal articles among the winning applicants of the Bolyai János Research Scholarship.

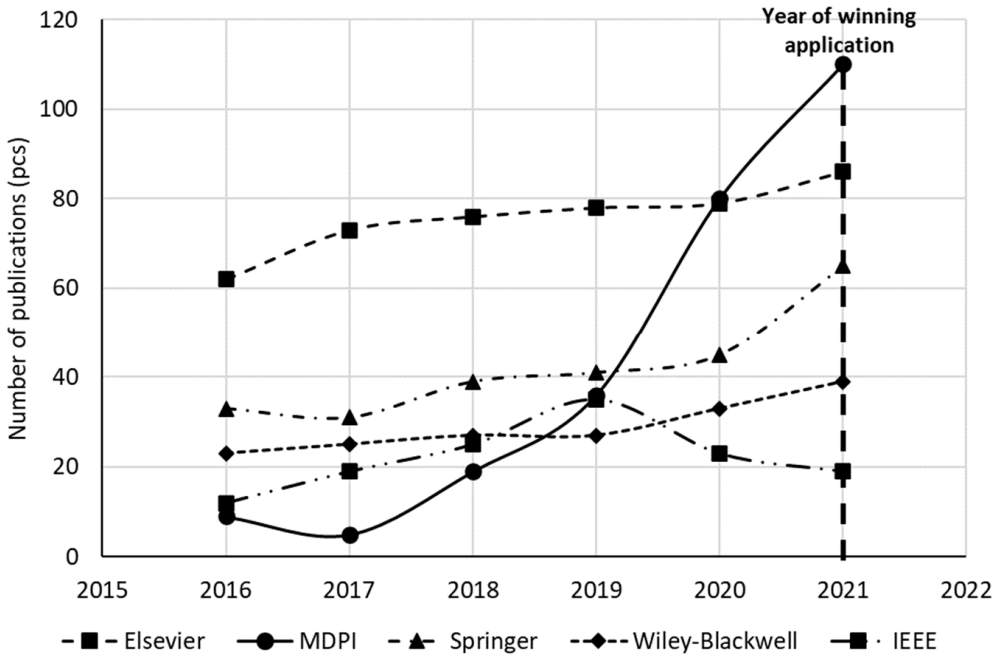

Figure 3. Number and distribution over time of publications for the top publishers between 2016 and 2021. Source: Scopus.

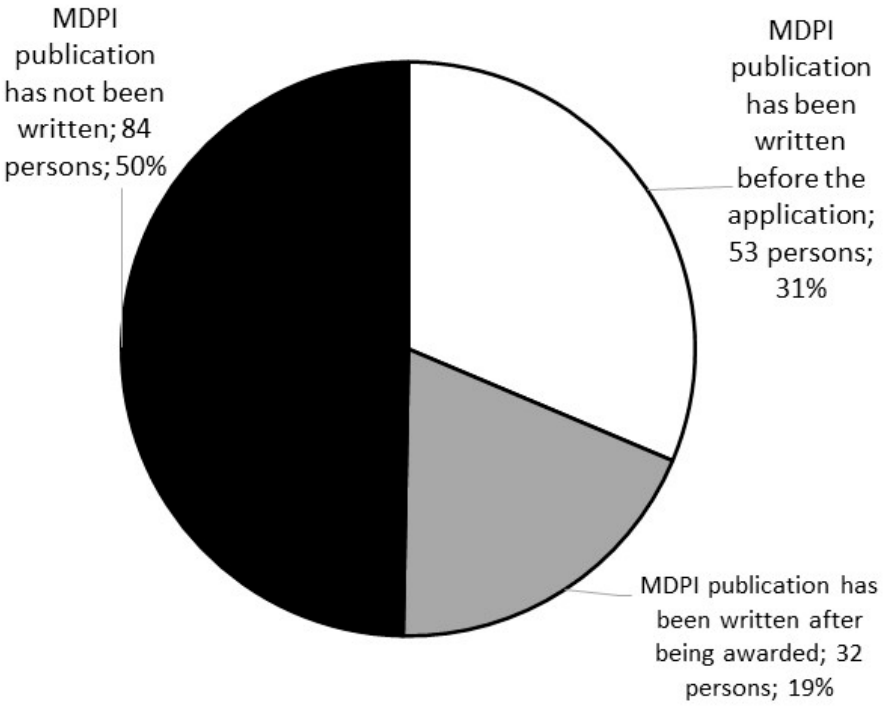

Figure 4. Relationship between awarded applicants and MDPI. Source: MDPI.

Table 6. Top publishers in different fields of science, based on the total scientific output of the scholarship holders. Source: Scopus.

Field of Science, Class	Ranking	Publisher Name	Number of Publications (pcs)	Proportion of All Journal Articles (%)
HASS	**1**	**Elsevier**	**42**	**13%**
	2	**Wiley-Blackwell**	**24**	**7%**
	3	**Springer**	**21**	**6%**
	6	**MDPI**	**13**	**4%**
Linguistics and Literary Studies (HAS I.)	1	Hungarian Ethnographic Society	4	13%
	2	Budapest Tech Polytechnical Institution	3	10%
	3	Springer	2	7%
Philosophy and Historical Sciences (HAS II.)	1	Elsevier	27	17%
	2	Wiley-Blackwell	20	12%
	3	Frontiers Media S.A.	11	7%
	9	MDPI	5	3%
Economics and Law (HAS IX.)	1	Elsevier	15	11%
	2	Hungarian Central Statistical Office	10	7%
	3	Springer	10	7%
	7	MDPI	7	5%
LS	**1**	**Elsevier**	**160**	**11%**
	2	**Springer**	**133**	**10%**
	3	**MDPI**	**131**	**9%**
Agricultural Sciences (HAS IV.)	1	Elsevier	30	10%
	2	MDPI	30	10%
	3	Springer	27	9%
Medical Sciences (HAS V.)	1	Elsevier	83	15%
	2	MDPI	72	13%
	3	Springer	54	10%
Biological Sciences (HAS VIII.)	1	Springer	52	10%
	2	Elsevier	47	9%
	3	Wiley-Blackwell	47	9%
	4	MDPI	29	5%

Table 6. *Cont.*

Field of Science, Class	Ranking	Publisher Name	Number of Publications (pcs)	Proportion of All Journal Articles (%)
STEM	**1**	**Elsevier**	**271**	**19%**
	2	**Springer**	**98**	**7%**
	3	**MDPI**	**98**	**7%**
Mathematical Sciences (HAS III.)	1	Springer	27	19%
	2	Elsevier	26	18%
	3	Academic Press	10	7%
Technical Sciences (HAS VI.)	1	Elsevier	56	18%
	2	MDPI	37	12%
	3	Springer	26	8%
Chemical Sciences (HAS VII.)	1	Elsevier	126	24%
	2	American Chemical Society	72	13%
	3	MDPI	40	7%
Earth Sciences (HAS X.)	1	Elsevier	8	16%
	2	Copernicus GmbH	4	8%
	3	Hungarian Central Statistical Office	4	8%
	4	MDPI	4	8%
Physical Sciences (HAS XI.)	1	Elsevier	55	14%
	2	Institute of Physics Publishing	33	8%
	3	Springer	26	6%
	7	MDPI	17	4%
Total	**1**	**Elsevier**	**473**	**15%**
	2	**Springer**	**252**	**8%**
	3	**MDPI**	**242**	**8%**

According to the Hungarian Scientific Bibliography Database, winning applicants in the field of HASS (with an average of 59 publications) had the highest number of complete scientific publications (Table 7). Here, the average proportion of publications was as follows:

- Thirty percent (18 per person) published in a journal were either published in Hungary or in a Hungarian language journal;
- Ten percent (6 per person) were books written or edited;
- Thirty percent (18 per person) were in the form of conference publications published in a journal or book.

In STEM, the share of conference publications reached 27%, exceeding 50% of total scientific publications in technical sciences.

Table 7. Average number of complete scientific publications and h-index by discipline. Source: HSB.

Field of Science HAS Class	Average Number of Total Scientific Publications (pcs)	I. Average Number of Journal Articles (pcs)	II. Average Number of Books (pcs)	III. Average Number of Book Excerpts (pcs)	IV. Average Number of Conference Publications (pcs)	Hirsch Index Average
HASS	**59**	**30**	**6**	**18**	**5**	**7**
Linguistics and Literary Studies (HAS I.)	66	32	8	22	5	7
Philosophy an Historical Science (HAS II.)	47	26	3	16	3	7
Economics and Law (HAS IX.)	69	33	8	19	9	8
LS	**46**	**39**	**1**	**2**	**4**	**13**
Agricultural Sciences (HAS IV.)	72	47	1	4	19	11
Medical Sciences (HAS V.)	36	35	0	1	0	13
Biological Sciences (HAS VIII.)	45	40	1	2	2	14
STEM	**48**	**32**	**1**	**2**	**13**	**10**
Mathematical Sciences (HAS III.)	29	22	2	1	5	6
Technical Sciences (HAS VI.)	63	29	1	1	32	9
Chemical Sciences (HAS VII.)	41	38	0	1	2	13
Earth Sciences (HAS X.)	54	27	2	14	11	8
Physical Sciences (HAS XI.)	50	39	0	1	10	12
Average	**50**	**34**	**2**	**7**	**8**	**10**

6. Conclusions

Several governments have founded specialised institutions over the past few decades with the aim of promoting the research and innovation activities of early-career researchers in the form of grants or scholarships. One of the most important features of these institutions is that they stimulate scientific excellence through excellence funding. In Hungary, the most significant research funding opportunity encouraging and recognising scientific excellence is the Bolyai János Research Scholarship established by the Hungarian government in 1997 to provide financial support for young talented researchers. It was first awarded in 1998 by the Board of Trustees of the scholarship. Since then, around 3400 researchers and scholars have been awarded the grant for 1, 2 or 3 years. The goal of the scholarship is to help researchers to write a large-scale scientific study, to prepare them to apply for the title of doctor of the HAS, and to encourage them to succeed in the research community in their home country [34]. As an increasing number of research funding institutions and agencies are making it mandatory for researchers to publish their papers in open-access-type journals, the Bolyai János Research Scholarship also requires the winning applicants to publish their findings in the form of open access journal articles. This requirement has contributed to the steady increase in the rate of open access publications in the last

decade. One of the cornerstones of scientific excellence is the publication of high-quality, international, co-authored research. The publication of open access journal articles is more common in the Natural and Life Sciences and less widespread in the field of Social Sciences and Humanities.

These international publication trends and patterns can be observed among the winning applicants of the Bolyai János Research Scholarship as well. In 2021, 169 people were awarded the scholarship after an average of 15 years of publications recorded in the Hungarian Scientific Bibliography Database and an average of 11 years in Scopus. The winners had 30 publications in a journal indexed by Scopus and 50 scientific publications recorded in the Hungarian Scientific Bibliography Database. Our first hypothesis was proven, as it turned out that there was a significant proportion of publications written in the form of international co-authorship among the winners of the Bolyai János Research Scholarship. Three-quarters of them were male in 2021. The most popular publisher was Elsevier, but MDPI has grown rapidly in popularity among the scholarship holders. This is mostly attributed to MDPI's considerably faster article processing time compared to other established publishers as well as the fact that an increasing number of research funders require researchers to publish their findings in the form of an open access paper. In line with the perceived international publication trends, a high proportion of international co-authorship (over 40%) and co-authorship (nine persons per journal) was observed in the Life Sciences and STEM disciplines. This finding supports the validity of our second hypothesis as the proportion of open access journal articles in the publication activities of the winning applicants of the Bolyai János Research Scholarship showed an increasing tendency. It also resonates with our third hypothesis, according to which the publication of open access journal articles is more widespread in the publication practice of researchers in the Natural and Life Sciences, and similar rates have been observed among the winning applicants of the Bolyai János Research Scholarship. Compared to the publication habits of researchers in the Life Sciences and STEM disciplines, scholarship holders in the fields of Humanities and Social Sciences published a fairly large number of books (6 papers) and book chapters (18 papers). This also confirms that these fields of science are characterised by different scientific attitudes, which are reflected in different publication patterns and strategies [35].

The results of our study might give some guidance for those young scholars and researchers who seek to plan their academic careers more consciously and follow the steps needed to reach scientific excellence. In line with our findings, they are encouraged to publish more open access articles and a considerable part of their overall publications is advised to be written in the form of a preferably international co-authorship. Although, now, this tendency seems to be more apparent in the Natural and Life Sciences, we have every reason to believe that it will increasingly gain importance in the fields of Humanities and Social Sciences in the future.

Our case study has its own limitations, and its findings can only be interpreted within the realm of its examined subject. However, in the future, it will be possible to extend the scope of our investigation to analysing other government-funded research programmes in other European countries with the aim of comparing the publication performance of the winning applicants to one another. As of now, there are two obstacles to carrying out such an analysis. The requirements and the assessment criteria are slightly different in the case of each scholarship, making it extremely difficult to perform a valid comparison. The other hindrance is the availability of reliable data on the publication performance of scholarship winners, coupled with a lack of primary sources and a lengthy process of data collection and data purification. Despite these obstacles, it would be worth examining whether those young scholars who proved their excellence share similar publication patterns regardless of their country or university.

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vision, T.K.; project administration, C.F.; funding acquisition, T.K. All authors have read and agreed to the published version of the manuscript.

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