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Application of Lotka's Law and i10-Index with the Number of Authors of Articles in Chemistry in Iran Published between 2000 and 2020

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ABSTRACT

Objective: The primary objective of the current research is to compare Lotka's law of author productivity and the Google Scholar *i10-Index* with the number of authors and their articles in the field of chemistry in Iran indexed in the Web of Science (WoS) from 2000 to 2020.

Materials and Methods: This study is a descriptive-qualitative type of research that was carried out using the scientometric approach. The statistical population of the present study consisted of all Iranian articles published in the field of chemistry indexed in the Science Citation Index Expanded. Some scientometric software packages were used to analyze the data with Lotka's law and i10-index.

Results: The most prolific Iranian authors in chemistry were Mohamadreza Ganjali from the University of Tehran, Majid Heravi from Alzahra University, and Mojtaba Shamsipur from the Razi University of Kermanshah, all being acclaimed scientists in Iran. The results suggest that the validity of Lotka's law was not confirmed in measuring Iranian authors' productivity in the field of chemistry. However, it is hard to draw a negative conclusion about the validity of Lotka's law from a single experiment. Moreover, investigating the *i10-index* revealed that 85% of the Iranian authors with more than one publication have an *i10-index*.

Conclusion: The results also indicated that the validity of Lotka's law cannot be confirmed, considering the Iranian chemistry papers indexed in the WoS. Furthermore, the results imply that the *i10-index* closely follows the authors with over one published paper and presents a high capability application in this field as a credible index.

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Introduction

The quantity and number of scientific outputs, especially research articles, is one of the most important indicators for evaluating scientific publications of any country, field, and researcher. One of the most important and common bibliometrics rules strongly used to study authors' scientific productivity and publication patterns is Lotka's Law. Lotka (1926) believed that there is an inverse relationship between the number of publications and the number of authors; that is, a large number of authors produce a small number of publications, and a disproportionately small number of authors produce a large fraction of the publications and receive the majority of the citations (Fortunato, S. et al., 2018; Huang et al., 2020). This small group comprises the most active and productive authors in any field of science. Narin explained Lotka's law by saying that "the number of authors who had n articles was about $1/n^2$ of authors who had only one article, and the share of all authors who had only one article was about 60 %". By implementing this law and identifying the most influential authors in any field of science, it is possible to provide a suitable collection for libraries and information centers by spending less time, energy, and money to collect the publications of the top authors. Lotka's law determines the extent of authors' scientific productivity based on the number of their scholarly publications and depicts the relationship between authors and articles, which represents quantity.

Another scientometric indicator for evaluating authors in any field of science is the *i10-index*, which was introduced in 2011 by Google Scholar. This indicator calculates the number of articles that have been cited at least 10 times (Noruzi, 2016; Dhamdhere, 2018). The *i10-index* and the *h-index*, which are presented by Google Scholar, show the information of the author's articles that have received more than 10 citations each, which is one of the advantages of this index. For example, the *i10-index* of an author is equal to 25 if 25 of the author's articles have received at least 25 citations.

Identifying productive and influential authors in any field of science helps to improve the productivity of science, research, and technology structures. Therefore, the present study intends to examine the gap between the quantity and quality of scientific publications in the field of chemistry. The reason for the selection of the field of chemistry is that the number of publications by Iranian researchers in this field is more than in other subject areas. As a result, it is a proper sample for analysis. Since the results obtained from implementing such rules could be used in scientific documents for scientific policy-making, they must first be verified. Moreover, in this study, Lotka's law was used as an indicator of quantity, and the *i10-index* was used as an indication of quality. Therefore, the present study was conducted to identify and evaluate the various aspects of the application of these two indicators (i.e., Lotka's low and *i-10 index*), and, if necessary, to reconstruct and complete the methodology of their implementation. It is worth noting that the *h-index* is currently used as an indicator to evaluate the quality of authors'

publications. Although the *h-index* is a complement to other scientometric indicators, it has its drawbacks. One of the disadvantages of the *h-index* is the ineffectiveness of an author's highly cited articles. Moreover, if the number of publications and citations of a specific author is high, fewer cited articles will also be ineffective based on the *h-index*.

In the present study, to demonstrate the quality of the authors' articles, the number of citations is considered and instead of the *h-index*, the *i10-index* is used. The *i10-index* distinguishes highly cited authors with a high number of articles from other authors. The present study assumes that the most productive authors have the most number of citations and if so, it can be concluded that the number of authors who follow Lotka's law has an *i10-index*, which together confirms the high quality and quantity of the few productive authors. The literature review shows that no research has been conducted on the *i10-index* and Lotka's law, not only in the field of chemistry in Iran but also in other areas around the world. However, several studies have been conducted on Lotka's law. Therefore, this study aims to answer the following questions:

1. What is the current status of Iranian scientific publications in chemistry based on the WoS published between 2000 to 2020?
2. Who are the top researchers in chemistry in the WoS based on the number of citations received between 2000 to 2020?
3. What is the level of matching between Lotka's law among chemistry researchers in Iran?
4. What is the level of matching of the *i10-index* among chemistry researchers in Iran?
5. What is the level of matching Lotka's law with the *i10-index* among chemistry researchers in Iran?

Literature Review

Previous studies have emphasized using Lotka's law in a variety of scientific fields and topics. Askew (2008) in his doctoral dissertation entitled "*An examination of Lotka's law in the field of library and information studies*" collected 7070 scientific articles from the WoS. These articles were selected from 25 journals that included studies on American academic libraries from 1998 to 2006. Finally, Askew concluded that the distribution of the authors in the area of library and information science is matching with the reliable results of Lotka's law.

Park (2008) in his bibliometrics research entitled "*Examined Asian and Pacific region authorship characteristics in leading library and information science journals,*" using articles indexed in the WoS from 1967 to 2005 concluded that the distribution of authors in this area did not match with Lotka's law. Ahmed and Rahman (2009) in their research studied Lotka's law based on the authorship distribution in nutrition research in Bangladesh. They examined the matching level of Lotka's law with the articles published between 1972 and 2006, and after analysis by the Kolmogorov-Smirnov test, they concluded that Lotka's law was not confirmed in

this area. However, by excluding the most productive researchers, the validity of Lotka's law was confirmed. Chang, Chou, and Yang (2010) in a scientometric study determined the core journals, using Bradford's and Lotka's laws in the field of technology acceptance models. Using the Bradford Law, they determined eight journals as the core journals. The results also suggest that the high distribution of authors in this field follows Lotka's law. Tsai and Chi (2012) in their research entitled "*An empirical study of research trends and forecasts: Customer relationship management,*" examined Lotka's law in the field of supply chain management using data from the Social Science Citation Index between 1989 and 2009. After collecting 2,739 articles produced by 2,267 authors, they found that 86.81% of these authors had produced only one article.

Materials and Methods

Our study is a descriptive-analytical study conducted with a scientometric approach. The Science Citation Index Expanded was used to search for publications and citations. In the advanced search section, the phrase "PY = 2000-2020" was searched, and all of the publications in the field of chemistry indexed in the Science Citation Index Expanded were extracted. Only research articles have been selected from among the publications.

This yields 33313559 records. Then, in the results analysis part, among the subject categories of the WoS, those related to the field of chemistry, which consists of 11 subject categories, were selected after consulting with a Subject-matter expert. The number of retrieved records related to the field of chemistry (not interdisciplinary) was 6096871 records, of which 3785459 were related to research articles and reviews. To collect data published by Iranian authors, we limited the results to only Iran, and 100719 articles finally were selected. The results were first saved for each separate topic in plain-text format. Then, each of the output files for analysis was separately imported to *the HistCite* and *Bibexcel* software, and the results exported from this software were saved in the Excel file. In the next step, the information needed for the final analysis was prepared in the Excel file. To perform the analysis without limiting the subject, all collected information was merged into a text file and then imported into the *HistCite* software. Finally, the final information required for the research was saved in the output Excel file. The purpose of using scientometric software packages was to analyze the data in the text file and convert it into an Excel file. Bibexcel was used to analyze the data to calculate Lotka's law and the *HistCite* was used to analyze the data to calculate the *i10-index*. After converting the data into an Excel file, the final data analysis was performed on the Excel file. Lotka's law was performed using the Lotka formula and the goodness of fit test, and the *i10-index* was calculated manually using Excel functions. To achieve the "Inverse-square law" using the above information sources, Lotka showed the percentage of authors with one, two, three, and n publications against the number of their publications, along with their variable logarithmic values. Lotka found that the line slope on

the line graph is approximately 2. Having analyzed the data, Lotka defined the general formula for the relationship between the frequency of (y) authors that have (x) articles as follows:

$X^n Y_x = c$

X = number of publications

Y = number of authors wrote x publication

n = constant number equals 2

C = constant value equals $6/\pi^2$ (Ahmad & Batcha, 2020).

Accordingly, the scientific productivity of each hundred authors who have produced only one article in a given period is equal to either 100/22 or 25 and the scientific productivity of authors who have produced 3 articles is 100/23 or 11 (Chaturbhuj & Sadik Batcha, 2020). The purpose of reviewing articles during 2000-2020 is that articles needed to be given enough time to be cited.

Results

Question 1: 1. What is the status of Iranian chemistry scientific publications published in the WoS from 2000 to 2020?

a) The position of Iran compared to other countries in the world

Table 1 depicts the global scientific publications in the field of chemistry in the WoS from 2000 to the end of 2020. The total number of retrieved records for all countries was 3785459. An immediate looking at the table identifies Iran obtained 16th rank in comparison with the whole countries with 100,719 articles in the field of chemistry.

Table 1. Global scientific publications in the field of chemistry from 2000 to 2020

Rank	Country name	Number of publications	Rank	Country name	Number of publications
1	United States	1,108,934	11	Russia	180,382
2	China	1,093,301	12	Canada	168,968
3	Germany	383,712	13	Australia	124,623
4	Japan	373,842	14	Brazil	107,409
5	India	277,034	15	Poland	107,086
6	France	263,293	16	Iran	100,719
7	United Kingdom	252,137	17	Switzerland	85,904
8	South Korea	197,557	18	Taiwan	82,454
9	Italia	195,223	19	Netherlands	81,815
10	Spain	191,804	20	Sweden	71,886

Table 1 only demonstrates the 20 countries that have produced the most scientific publications in the field of chemistry throughout the world. The United States placed in the first position due to having 1,108,934 articles. that the next places belong to China (109,3301 articles), Germany (373,842 articles), and Japan (383,712 articles), respectively.

b) The position of Iran compared to Asia and the Middle East countries

Table 2 illustrates the top 10 countries in Asia and the Middle East in concordance with the documents published in the field of chemistry from 2000 to the end of 2020. The findings release that the sixth rank is allocated to Iran among other Asian countries. As seen in Table 2, some countries such as China, Japan, India, South Korea, and Russia go head in the best position. Notice that Iran among Middle East countries

could achieve the first rank. The remarkable point is that Iran surprisingly has an outstanding difference from the first and second countries, that is, China with 1093301 articles (ranked second in the world) and Japan with 373842 articles (ranked third in the world). To illuminate it, the number of scientific publications in China is 10 times as many publications as in Iran, and the number of scientific publications in Japan is four times as many publications as in Iran. However, It should be noted that Iran has conducted two times more publications than Israel in the chemistry field.

Table 2. Top productive countries in Asia and the Middle East from 2000 to 2020

Rank	Country	No. of publications	Rank	Country name	No. of publications
1	China	109,3301	6	Iran	100,719
1	Japan	373,842	7	Taiwan	82,454
3	India	277,034	8	Turkey	61,611
4	South Korea	197,557	9	Singapore	44,494
5	Russia	180,382	10	Israel	40,468

C) The annual growth trend of Iranian scientific publications in the field of chemistry based on the Science Citation Index Expanded

According to Figure 1, we vividly can observe the ascending growth of Iranian scientific publications. Moreover, most of their publications in this field are related to recent years in particular in 2020.

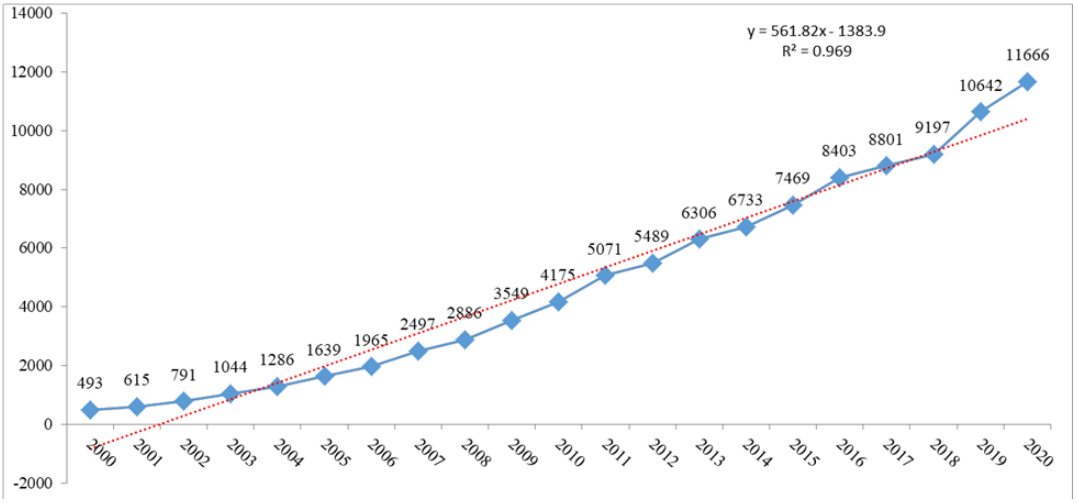

Figure 1. Annual growth trend of Iranian scientific publications in the field of chemistry

Question 2. Who are the productive researchers in chemistry in the WoS based on the number of publications and received citations?

Table 3 depicts a list of 20 Iranian authors along with their *h-index* and related affiliations. These authors published at least 350 articles in the field of chemistry. It should be noted that a single article may have been written by several authors. The findings show that Mohammad Reza Ganjali, Majid Mamhad Heravi, and Mojtaba Shamsipur with have at least 600 articles are in the highest positions given the number of publications among other scientists in the field of chemistry.

Table 3. Productive Iranian authors in chemistry based on the number of citations

Rank	Authors	Affiliations	N. of Publications	h-index
1	Mohammad Reza Ganjali	University of Tehran	828	80
2	Majid Mamhad Heravi	Alzahra university	766	68
3	Mojtaba Shamsipur	Razi University	660	64
4	Ali Morsali	Tarbiat Modares University	634	55
5	Masoud Salavati Niasari	University of Kashan	564	78
6	Mohammad Ali Zolfigol	Bu-Ali Sina University	525	60
7	Parviz Norouzi	University of Tehran	455	60
8	Issa Yavari	Tarbiat Modares University	433	37
9	Abolghasem Jouyban	Tehran University of Medical Sciences	426	40
10	Abbas Shafei	Tehran University of Medical Science	421	52
11	Mehring Ghaedi	Yasouj University	408	70
12	Ali Akbar Moosavi Movahhedi	University of Tehran	404	42
13	Ali Ramazani	University of Zanjan	395	50
14	Morteza Sadeghi	Isfahan University of Technology	392	36
15	Masoud Rezaei	Tarbiat Modares University	390	50
16	MojtabaMohammadi	University of Tehran	389	37
17	Ali Akbar Saboury	University of Tehran	389	41
18	Mona Hosseini-Sarvari	Shiraz University	368	42
19	Iraj Mohammadpour	University of Isfahan	365	43
20	Shahram tangestaninejad	University of Isfahan	359	43

Table 4 illustrates a list of the top 20 Iranian authors in chemistry, along with the *h-index*. These authors have received at least 7000 citations. Among these authors, Mohammad Reza Ganjali, Majid Mamhad Heravi, Mojtaba Shamsipur, Mohammad Ali Zolfigol, Masoud Salavati Niasari, and Parviz Norouzi have each received more than 10 thousand citations. Besides, they have the highest *h-index* among other Iranian authors in chemistry.

Table 4. Top Iranian authors in chemistry in terms of the number of citations

Rank	Authors	Number of citations	h-index
1	Mohammad Reza Ganjali	24,700	80
2	Majid Mamhad Heravi	17,537	68
3	Mjtaba Shamsipur	18,329	64
4	Ali Morsali	14,400	55
5	Masoud Salavati Niasari	19,911	78
6	Mohammad Ali Zolfigol	15,943	60
7	Parviz Norouzi	13,940	60
8	Issa Yavari	5,842	37
9	Abolghasem Jouyban	6,731	40
10	Abbas Shafei	10,505	52
11	Mehrorang Ghaedi	16,178	70
12	Ali Akbar Moosavi Movahhedi	7,367	42
13	Ali Ramazani	7,937	50
14	morteza sadeghi	5,200	36
15	Masoud Rezaei	10,793	50
16	MojtabaMohammadi	5,521	37
17	Ali Akbar Saboury	7,474	41
18	Mona Hosseini-Sarvari	7,177	42
19	Iraj Mohammadpour	7,550	43
20	Shahram tangestaninejad	7,735	43

Question 3: Lotka's law is confirmed among Iranian chemistry researchers?

The formula (X^n Y = c) was used to compare the scientific output of authors in chemistry with Lotka's law in which X represents the number of publications and Y represents the frequency of authors that have X works. Plus, n and c are parameters devoted to the field of their study. Lotka studied chemistry and physics in the late 19th and early 20th centuries. For the field of chemistry the parameter 0 = 5669 and c = 1.8888, and for physics the c = 0.6079 and n = 02.02 (Diodato & Gellatly, 1994).

First, using Lotka's formula, different values were calculated for each author with a specific number of publications, and then the results of different values were determined using the Kolmogorov-Smirnov statistical test. The Kolmogorov-Smirnov test is used to figure out whether observations are normal or not. To measure the normality of the data according to the formula, we have to calculate the critical value and frequency difference, and if the critical value is more than the frequency difference, the data is normal and Lotka's law will be confirmed. To calculate the difference between the frequencies, we calculate the cumulative frequency difference of the percentage of authors' names from the cumulative frequency of Lotka's law.

First, we calculate the critical value in the field of chemistry and the highest frequency difference:

$$critical\ value = \frac{1.63}{\sqrt{N}}$$

N is the total number of Iranian authors in chemistry. The total number of authors is 55834.

$$critical\ value = \frac{1.63}{\sqrt{55834}}$$

Critical value = 0.00689

Maximum frequency difference = 0.00718

By placing this number in the formula, the critical value at a 1% level of significance was obtained (0.00689). To confirm or reject Lotka's law, we compare the value obtained with the maximum difference in the frequencies. If the critical value would be greater than the difference in frequency, Lotka's law will be confirmed, and if the frequency difference would be greater than the critical value, it is more likely, with a probability of 99.9%, that the relationship between the number of authors and the number of articles is not matching. Considering that the highest difference in frequency (0.00718) is greater than the critical value (0.00689), the relationship between the number of authors and the number of articles, with a probability of 99.9%, does not obey Lotka's law.

Question 4: What is the level of matching of the i10-index among chemistry researchers in Iran?

The *i10-index* has only been used by Google Scholar since 2011; whence the number of citations in a document is at least ten with aiming to better evaluate the productivity of researchers and shows the number of documents of an author cited at least ten times by other authors (Dhamdhere, 2018). Table 5 demonstrates the total number of authors and also Iranian authors in chemistry having an *i10-index* in the Science Citation Index Expanded in the WoS. Table 5 depicts that the total number of Iranian authors in chemistry is 55,834, and the number of Iranian authors having an *i10-index* is 27,100. In other words, out of the total number of Iranian authors in chemistry, 48.54% have an *i10-index*.

Table 5. Total number of Iranian authors having i10-index in the field of chemistry between 2000 to 2020

field / data	Field of Chemistry in Iran
The number of authors having an *i10-index*	27,100
Total number of authors	55,834
Percentage of authors having an *i10-index*	48.54

The findings demonstrate that 15,679 authors had an *i-10 index* of one, meaning that 57% of authors have only one article that has received at least ten citations. Moreover, 43% of Iranian authors have an *i-10 index* of more than one, 16% have an *i10-index* of two, 6% have an *i10-index* of three, 4% have an *i10-index* of four, and the highest *i10-index* was 596, meaning that each of the 596 articles published by this author has at least 10 citations. They are the top Iranian authors in chemistry and the world.

Table 6. Iranian authors with the highest i10-index in the chemistry

Rank	Authors	Affiliations	i10-index
1	Mohammad Reza Ganjali	University of Tehran	596
2	Mojtaba Shamsipur	Razi University	443
3	Majid Mamhad Heravi	Alzahra university	439
4	Masoud Salavati Niasari	University of Kashan	425
5	Ali Morsali	Tarbiat Modares University	394
6	Mohammad Ali Zolfigol	Bu-Ali Sina University	384
7	Parviz Norouzi	University of Tehran	341
8	Abbas Shafei	Tehran University of Medical Science	287
9	Ali A. Ensafi	Isfahan University of Technology	259
10	Iraj Mohammadpour	University of Isfahan	243

Table 6 shows ten Iranian authors in chemistry who had an *i10-index* above 100. As can be seen in Table 6, Mohammad Reza Ganjali from the University of Tehran with an *i10-index* of 506 has the highest *i10-index* among the Iranian authors in chemistry. Furthermore, Mojtaba Shamsipur from the Razi University with an *i10-index* of 412 was in second place and after that Masoud Salavati Niasari from Kashan University, Parviz Norouzi from the University of Tehran,

and Majid Mamhad Heravi from Alzahra University could obtain the highest *i-10 index* among Iranian authors in chemistry based on the WoS.

Question 5*: *What is the level of matching Lotka's law with the i10-index among chemistry researchers in Iran?

The comparative study of scientometric laws has been done in most scientific fields, such as the study of Lotka's law with Pao's law and Bradford's laws. In Lotka's law and other scientometric laws, we are dealing with the number of published documents (i.e., the number of scientific publications), but in the *i10-index*, as in the *h-index* and *g-index*, we are dealing with the number of citations (i,e., quality of scientific publications). Therefore, the purpose of this study was to show the relationship between quantity and quality in a new way of measuring researchers based on their scientific publications.

Findings suggest that Lotka's law in the field of chemistry, as regards the Iranian publications, is not confirmed in the Science Citation Index Expanded of the WoS. Based on our research hypothesis, if Lotka's law had been confirmed, we would have compared the authors confirmed by the law with the authors with the highest *i-10 index*, indicating what percentage of authors confirmed by this law, who are also prolific ones, had an *i10-index*. Furthermore, the number of authors with the *i10-index* and also the authors who have the *i10-index* was calculated for Iranian authors in chemistry. Because the validity of Lotka's law was not confirmed and the research hypothesis was rejected, the comparative study of the *i10-index* and Lotka's law was not performed because it does not lead to definite results. However, according to the findings, prolific authors and the authors who have the highest *i10-index* were compared.

Findings also showed that, out of 100719 articles published, 26677 articles received at least ten citations. This means that 40% of papers have received at least ten citations and were considered in the calculation of the authors' *i10-index*. The findings also demonstrated that out of 55,834 Iranian authors in chemistry, 27,100 authors have an *i10-index*. This means that about 49% of authors have an *i10-index*, of which 15,679 authors (57,856%) have an *i10-index* of one, meaning that 15,679 authors have only one article with 10 citations.

Discussion

The present study compared Lotka's law and the *i10-index* with the number of authors of chemistry papers in the Science Citation Index Expanded of the WoS from 2000 to 2020. Also, the scientific publications of Iran in the field of chemistry and the number of their citations were studied. The findings showed that during the 18 years, Iran with 100719 scientific publications in the field of chemistry, which is 1.76% of the total publications in the field of chemistry throughout the world, ranks 16th in the Science Citation Index Expanded of the WoS. Iran also ranks 6th among Asian countries and first among Middle Eastern countries. The results also

showed that the growth of scientific publications in Iran has significantly increased so most of its publications are related to 2020. Previous studies described the field of chemistry as the most productive scientific field in Iran for its international publications and collaborations (Binesh & Maghsoudi Daryeh, 2008; Mehrad & Gazni, 2007; Osareh & McCain, 2008).

The results also showed that Mohammad Reza Ganjali from the University of Tehran, Majid Mamhad Heravi from Alzahra University, and Mojtaba Shamsipur from Razi University were three prolific and well-cited Iranian authors in chemistry in the Science Citation Index Expanded of the WoS, respectively. Moreover, the results of the study suggested that the validity of Lotka's law was not confirmed in the study of scientific publications of Iranian authors in chemistry. This result is consistent with Mujumdar's (2006) findings in his analysis of co-authors in which Lotka's law was also rejected. But in the three groups of authors, that is, the first, non-contributors, and all authors, the law was confirmed. The results of a study by (Chang, Chou, & Yang, 2010) suggested that the distribution of the authors in the field of technology acceptance models follows Lotka’s law. Ahmed and Rahman (2009) in the field of food research and Cocosila, Serenko, and Turel (2011) in the field of management information systems suggest that the high distribution of authors did not follow Lotka's law. However, this law was confirmed by Keshvari (2009) on the scientific publications of Iranian authors in the Science Citation Index, Social Sciences Citation Index, and Art and Humanities Citation Index. Nevertheless, this law was not confirmed based on the data extracted from the Social Sciences Citation Index and Art and Humanities Citation Index. Fattahi, Danesh, and Soheili (2011) in their research suggested that the frequency distribution of authors at Ferdowsi University of Mashhad follows Lotka's law, but the validity of this law was not confirmed in Osareh and Mostafavi's (2011) research in the field of computer science and artificial intelligence. The difference between the observed reality in the number of authors with 1, 2, 3,...,n article in the field of chemistry with the numbers obtained from Lotka's formula indicates that Lotka's law in this field was not confirmed. The reason may be that this law did not consider co-authorship. This finding is in line with Mujumdar's (2006) findings in the analysis of co-authors. It appears that given the current situation (the effects of information technology and electronic resources), this law needs further investigation so that it can be used as a general principle, at all times. Based on the results of all research carried out on Lotka's law, it can be concluded that finding a unified method at the national and international levels can make the results of these types of studies more reliable and comparable.

Conclusion

The results also showed that 27,100 authors had an *i10-index*. In other words, about 50 percent of Iranian authors in chemistry had an *i10-index*. This comparative study of authors with an *i10-index* was performed with 46% of authors with more than one article. The results showed that out

of 25,176 authors with more than one article, 21,368 authors had an *i10-index*. In other words, 85% of authors who have more than one indexed article in the WoS had an *i10-index*, which indicates the Iranian authors' high quality of research in the field of chemistry. Since no research has been done so far, in this case, it is not possible to compare findings with previous results. In addition, it should be noted that the *i10-index* was not used in citation international databases such as the WoS and Scopus databases. Given that there is a high correlation between being a prolific author and having the *i10-index*, this research can be done at the international level and in other highly productive scientific fields, and the *i10-index* could be used as a practical indicator for evaluating researchers.

Author Contributions

Conceptualization, M.F., S.F. and A.N.; methodology, M.F., S.F. and A.N.; software, M.F.; validation, M.F., S.F. and A.G.; formal analysis, M.F. and A.G.; investigation, M.F.; resources, M.F.; data curation, M.F. and A.G.; writing—original draft preparation, M.F., S.F. and A.N.; writing—review and editing, M.F., S.F. and A.N.; visualization, M.F. and A.G.; supervision, S.F. and A.N..; project administration, S.F.; funding acquisition, S.F. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

Data is available on request from the authors.

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Ethical considerations

The authors avoided from data fabrication and falsification.

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Conflict of interest

The authors declare no conflict of interest.

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