A 10-year (2010-2019) scientometrics assessment of Iranian and Turkish scholarly outputs based on Scopus database

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ABSTRACT
This study sought to compare scientific trends in research performance of Iranian and Turkish scholarly outputs based on 15 metrics in four categories This study is an analytical and applied study based on scientometrics indices and based on SciVal Tool. The findings showed that Iranian researchers' performance was better than Turkish researchers in metrics such as scholarly outputs, citation count, citations per publication, citedness rate, Field-Weighted Citation Impact, and views count, views per publication, Field-Weighted Views Impact, collaboration and top journal percentiles during the period. However, Turkish researchers had better performance than Iranian academics in collaboration and academic-corporate collaboration impact. Based on the research results, policymakers in Iran should take steps to remove obstacles to the international cooperation. Besides, this comparison shows that Iranian researchers should seek a greater perspective for competition. The most important issue is that despite the increase in the quantity of research, Iran should consider measures to increase their research quality and impact on industry and people's lives as well. Increasing the relationship between industry and academic institutes can contribute to this impact. In this study, while comparing all research outputs of Iran and Turkey based on 15 SciVal indicators, a comprehensive study has been conducted on the reasons for Iran's scientific growth, discussed in the discussion section, which can be the approach and plan of many research policy makers in other countries.

Keywords: Citation; Collaboration; Scientific Performance; Scientometrics assessment; Research evaluation.

INTRODUCTION

The concept of a knowledge-based economy has emerged as a new theoretical framework for assessing the progress of a nation. In this framework, economic development is about technology competition, which in turn is driven by science and scientific research (OECD

1996). Because scientific research produces new information and knowledge, which can promote technological innovation producing quality goods and services (Antonelli and Fassio 2016), this type of research can be a stimulus factor for positive progress in developing countries (Nguyen, Ho-Le and Le 2017). Studies show a strong and positive relationship between the outputs of scientific journals and the index of a knowledge-based economy (Nguyen and Pham 2011). But research must have some indicators that can contribute to this sustainable development. Quality is one of these indicators and of course, one of the most challenging ones too. Measuring the quality of scientific research is very important due to the increasing number of research and contractionary fiscal policies, particularly in developing countries. For this reason, bibliometrics and scientometrics analyses of published data have become more common to measure the quality of research conducted by organisations around the world. On the other hand, research shows that in recent years, the change in the orientation of science from individual work to a collective effort has led to the benefit of science itself. More than 90 percent of the world's leading innovations produced by collaborations in this century are almost four times as many as collaborations in the 1900s (Yang et al. 2017). All these issues urge the need to pay more attention to the quality of published knowledge.

Various methods and tools have been developed to evaluate the quality of research and scientific outputs like the SciVal tool. All metrics and information displayed in SciVal are based on Scopus (Erfanmanesh 2018). SciVal has been using Scopus data since 1996, with the number of citations displayed based on consecutive years of data (Erfanmanesh 2017). Of course, SciVal evaluation criteria are not limited to citations and monitor research outputs at various levels (journal, article, author, organisation). SciVal metrics make it possible to compare the obtained results with the global averages and standards. In fact, the research performance of a researcher, organisation, country, region, journal, research group, etc. can be evaluated through this user-friendly tool. These metrics include among others "Citations per Publication", "Views per Publication", "Citedness Rate", "Field-weighted Citation (FWCI) Impact", "Percentage of Highly-Cited Papers", Citation Threshold", "Percentage of Papers Published in High-Quality Journals", "SCImago Journal Rank (SJR)", "percentage of papers published through international, national, or institutional co-authorship and single authorship". In Iran, for instance, some studies have been conducted to study the quality of research outputs of the University of Isfahan (Pečlin et al. 2012) and Tehran University (Luo, Pelfrey, and Zhang 2014), but despite the importance of this tool, the researchers' search in various databases indicates that there is not a special study on the quality of all articles by researchers in Iran via SciVal tool.

Some SciVal studies are about introducing, and investigating different aspects, calculation methods, frameworks, and architectures or reactions to scientific metrics (Boyack and Klavans 2010; Torres-Salinas 2009; Jiajia and Wei 2014; Mousavizadeh, Chakoli, and Pournaghi 2020; Neilson 2010; Pagell 2016; Colledge and James 2015; Vardell, Feddern-Bekcan, and Moore 2011). In recent years, other studies examined SciVal in different samples of a scientific society at different levels (author, production, and institute levels). Osareh, Soheili and Keshvari compared the experts' overview to FWCI Index from SciVal to identify Top Authors. The findings showed that there is no difference in the ranking of authors based on quantitative and qualitative methods (Osareh, Soheili, and Keshvari 2020). Other researchers investigated psychology academics in 24 Australian universities in terms of quantity and citations. Lifetime metrics were predicted using a range of SciVal metrics (Craig, Cosh, and Luck 2021). In another attempt, Cardoso et al. investigated 572 Portuguese papers in three fields of Tourism, Leisure, and Hospitality Management (TLHM) based on the topic prominence approach in SciVal. According to the results, Portuguese

researchers did significant research in all studied fields. In addition, they achieved an acceptable rank in the topic prominence percentile. On the other hand, there was a significant increase in collaboration rate in the studies' years of publication (Cardoso et al. 2020).

Some studies rely on the relationship between SciVal metrics and performance research or indicators like economic indicators (R&D and Funding). For instance, the investigation on Russian universities research performance based on SciVal metrics and the economic impact of R&D (Avanesova and Shamliyan 2018). Researchers examined the impact of collaboration (a SciVal indicator) on the research performance of scientific institutions (some others SciVal indicators) (McManus et al. 2020; Aldieri, Kotsemir, and Vinci 2018; Khor and Yu 2016). Some studies compared academic institutes based on SciVal (Nourmohammadi 2020; Wijetunge, Silva, and Manatunga 2020; Cardoso et al. 2020). There are some studies that investigated some metrics on a very specialized subject such as epilepsy (Morán-Mariños et al. 2020), Hippophae rhamnoides (Pundir et al. 2021), medical radiation science (Ekpo, Hogg, and McEntee 2016) and diabetes (Boopathi and Gomathi 2020). In addition, some researchers used SciVal as a research society to investigate some new features or methods (Zanotto and Carvalho 2021; Madsen, Madsen and Gauffriau 2016).

The importance of the issue increases when a look at scientific policies in Iran shows that the scientific authority has received a lot of attention in recent years, especially in the field of medicine. Recently SciVal data has been used to determine the extent of movement in this direction towards scientific authority. On the other hand, comparing Iran with rival countries in the Middle East from a scientific point of view can provide a broader perspective for researchers and scientific policymakers to take action removing obstacles and achieving the desired point (Nazarzadeh Zare et al. 2014). If this comparison is made with a country like Turkey, which is geographically and regionally very similar to Iran, this comparison may become more spectacular (Nourmohammadi 2020). These two countries have many similarities, such as religious, cultural, and historical similarities, gross domestic product volume (GDP), population and growth rate, Muslim majority, and most importantly, drafting a "vision document" for political, economic, and social development and similar elements. In addition, both are considered strategic regions and territories in the Middle East and have been in competition or cooperation with each other for more than a few centuries.

According to the long-term plan, Iran and Turkey are seeking to become the undisputed regional power. According to the vision document of the Islamic Republic of Iran, by 2025, Iran should reach the first economic, scientific and technological rank in the region, and Turkey should be the top power in the Middle East region in 2023 (Movassagh 2018). Accordingly, this study seeks to compare the performance of Iranian and Turkish researchers based on articles indexed in Scopus in a ten-year period from 2010 to 2019 through the SciVal tool. Specifically, the objective of this study is to compare these two countries in terms of scientific achievements during a decade of competition from 2010 to 2019, based on bibliographic indicators including publication, citation, view, and collaboration metrics.

METHOD

This is an analytical and applied study based on scientometrics indices covering all scholarly outputs by researchers with Iranian and Turkish affiliations indexed in Scopus database (2010 to 2019). In fact, the articles could be included in the study provided that they had at least one author's affiliation in Iran and Turkey. To collect research data, firstly, "Iran" and "Turkey" keywords were searched in the field "AFFILCOUNTRY" in Scopus and the results were limited to articles published between 2010 and 2019.

Next, the SciVal research assessment tool, which is another solution of the Elsevier, was also used to analyse and visualise the data. SciVal allows analysis of the data from Scopus and provides researchers with more extensive analytical and visualisation capabilities. We compared research performance of Iranian and Turkish researchers based on SciVal Research Metrics (*SciVal Research Metrics Guidebook* 2020). Figure 1 presents the data collection process and Table 1 shows the definition of the studied research metrics. Descriptive statistics and Microsoft Excel spreadsheet application were used to analyse the findings.

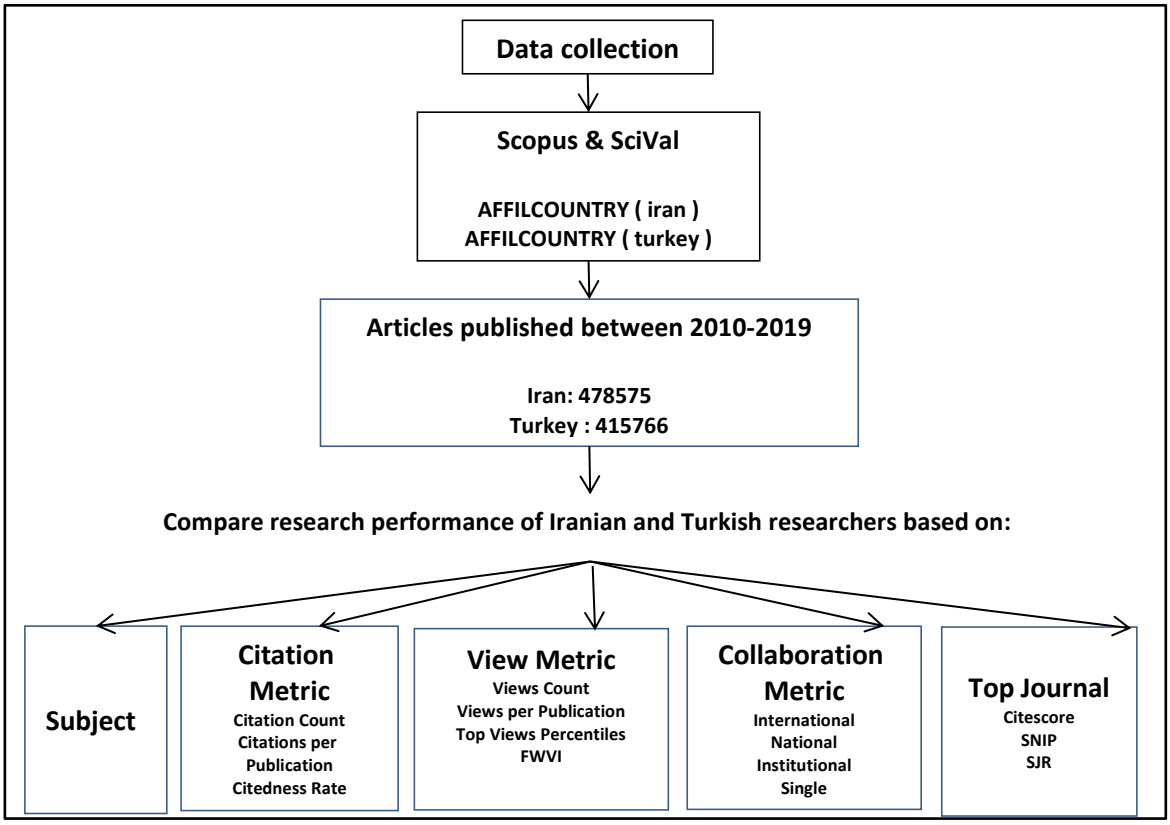

Figure 1: Data Collection Process

Table 1: The Studied Usage Metrics

Metric	Metric Type	Definition
Scholarly output	Snowball Power Productivity Published	The number of publications indexed in Scopus
Citation Count	Citation Impact Snowball Power	The number of citations received by a publication
Citations per publication	Citation Impact Snowball	The average citation impact of the publications as the number of an average received citations
Citedness Rate (Cited Publications)	Citation Impact Power*	The number of publications with at least 1 citation
Field-weighted citation Impact	Citation Impact Snowball	The number of citations received by an entity's publications compared with the average number of citations received by all other similar publications in the data universe
Outputs in top citation percentiles	Citation Impact Snowball Power*	The number of publications in the top 1, 5, 10 or 25% of the most-cited publications
Views Count	Power Views	The number of views received by publications
Views per Publication	Views	The number of views received by publications on average
Top Views Percentiles	Views	The number of publications in the top 1, 5, 10 or 25% of the most-viewed publications
Field-Weighted Views Impact(FWVI)	Views Citation Impact	The number of views received by an entity's publications compared with the average number of views received by all other similar publications in the same data universe
Collaboration **Single authorship**	Snowball Collaboration	The number of publications, which written by only a author
Institutional		The number of publications, which written by authors from only an institute in a country
National		The number of publications, which written by authors from different institutes in a country
International		The number of publications, which written by authors from different countries
Collaboration impact	Citation Impact Collaboration	The average Citations per Publication for publications with different types of geographical collaboration
Academic-Corporate Collaboration	Collaboration Snowball Power*	The degree of collaboration between academic and corporate affiliations
Academic-Corporate Collaboration Impact	Citation Impact Collaboration Snowball	The citation impact of an entity's publications with or without both academic and corporate affiliations
Outputs in Top Journal Percentiles	Citation Impact Snowball Power*	The extent to which an entity's publications are present in the most-cited journals in the data universe

***"when the "Total value" option is selected, but not when the "Percentage" option is selected"**
(SciVal Research Metrics Guidebook 2020)

RESULTS

Scholarly Outputs

The number of scholarly outputs of Iranian and Turkish researchers during the period of 2010 to 2019 in Scopus was 478,575 and 415,766, respectively. Figure 2 compares the number of scientific outputs of Iran and Turkey during a period of ten years.

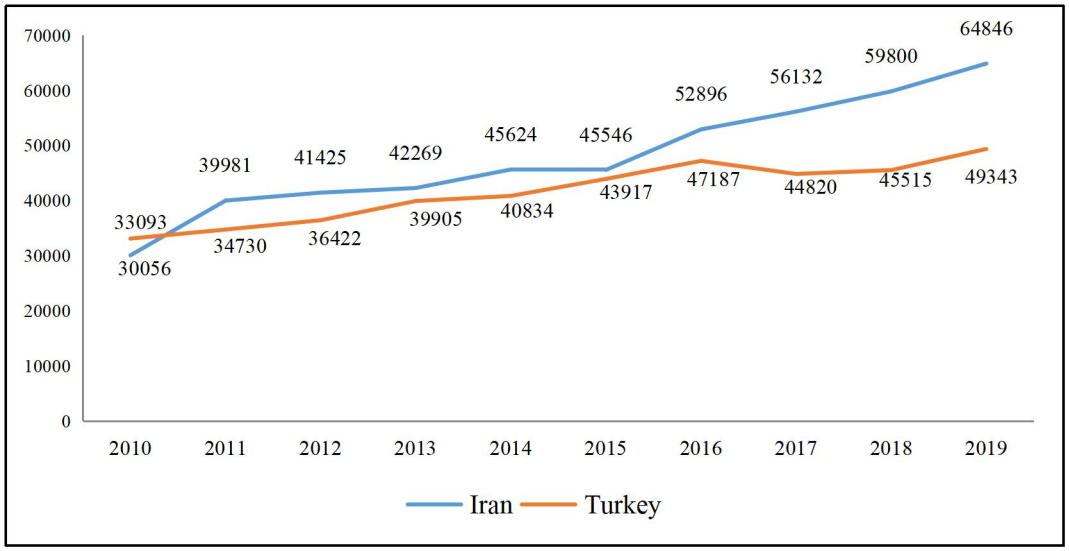

Figure 2: Comparison of the Growth of Scholarly Publications in Iran and Turkey

As shown in Figure 2, the growth of the number of scholarly publications of Iranian and Turkish researchers from 2010 to 2019 was 115.8 percent (from 30,056 in 2010 to 64,846 in 2019) and 49.1% (from 33,093 in 2010 to 49,343 in 2019), respectively. In all these years, except for 2010, Iran's scientific outputs were higher than Turkey's. The growth of the number of Iranian scientific productions from 2010 to 2011 was significant. However, the slope of this growth was slower between 2011 and 2015, and from 2015 onwards, which shows a significant growth trend. The trend was slightly increasing for Turkish publications. The subject distribution of Iranian and Turkish scientific products is presented in Figures 3 and 4.

According to Figure 3, scientific productions in the field of "engineering" and "medicine" were ranked first and second with 119,057 (14.3%) and 107,328 articles (12.9%), respectively. Based on the findings, 339,450 authors participated in the compilation of Iranian scientific productions.

In Turkey, among scientific products, the field of "medicine" is in the first rank with 152,396 (23.3%) articles, "Others" with 103,463 (15.8%) stand the second, and "Engineering" is in the third rank with 681,00 articles (10.4%) (Figure 4).

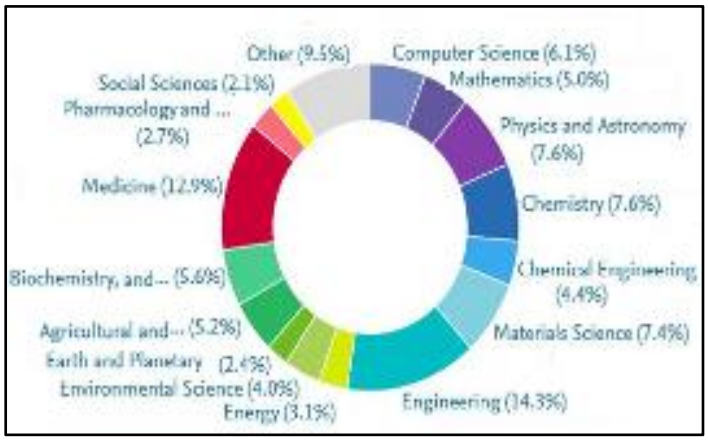

Figure 3: Distribution of Scientific Outputs of Iranian Researchers by Subject Area

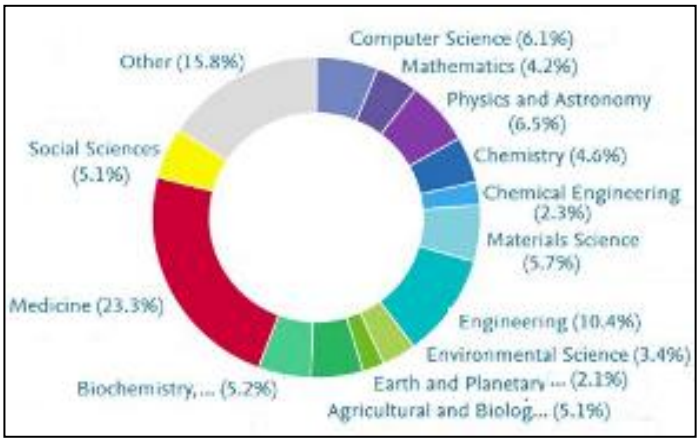

Figure 4: Distribution of Scientific Outputs of Turkish Researchers by Subject Area

Citation Count

The total scientific productions in Iran and Turkey received 4,692,904 and 3,562,981 citations, in turn. Figure 5 shows the number of citations received by the scientific outputs of Iranian and Turkish researchers between 2010 and 2019.

The number of citations to the scientific outputs of Iranian researchers from 2010 to 2014 experienced an increasing and then relatively declining trend, so the most and the least citations are related to 2014 and 2019, respectively. The number of citations to the scientific outputs of Turkish researchers also declined in this ten-year period. To sum up, except in 2014 (about 58 citations), the number of citations received by Iranian scientific products is higher than that of Turkish over the period. The decrease in the number of citations is due to the fact that the younger the article, the fewer citations it receives. Because there is a time delay in receiving citations by published articles, in general, in the total number of citations each year, newer articles receive fewer citations.

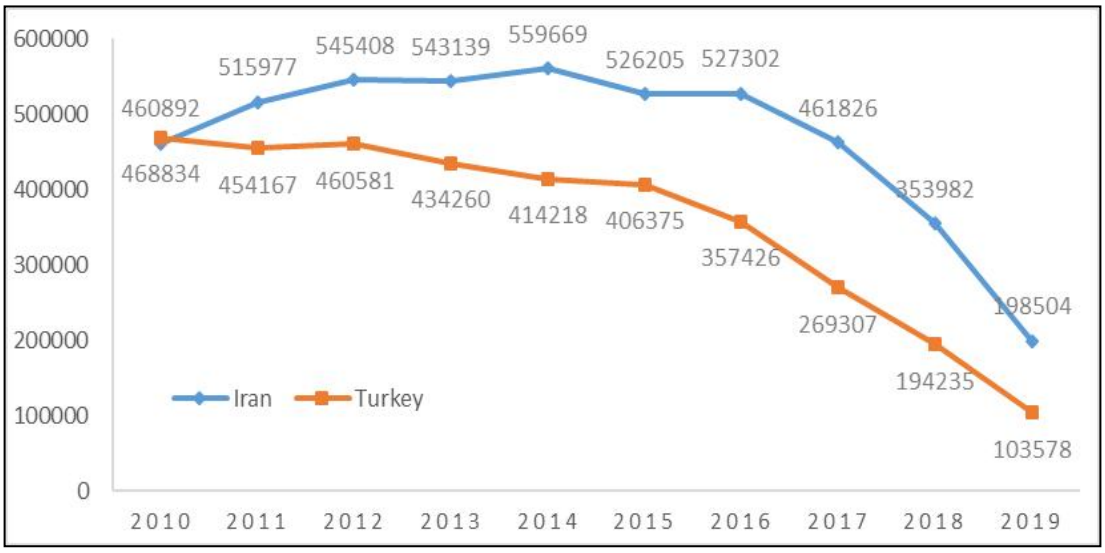

Figure 5: Comparison of the Number of Citations Received by Iranian and Turkish Scholarly Outputs

Citations per Publication

On average, each scientific output of Iranian and Turkish researchers received 9.8 and 8.6 citations, respectively. A comparison of the number of citations per publication is shown in Figure 6. The trends of the average number of citations for each scientific output of Iranian and Turkish researchers from 2010 to 2019 were decreasing. Except in 2011, the average number of citations for each Iranian researcher's scientific output is higher than that of Turkish researchers'.

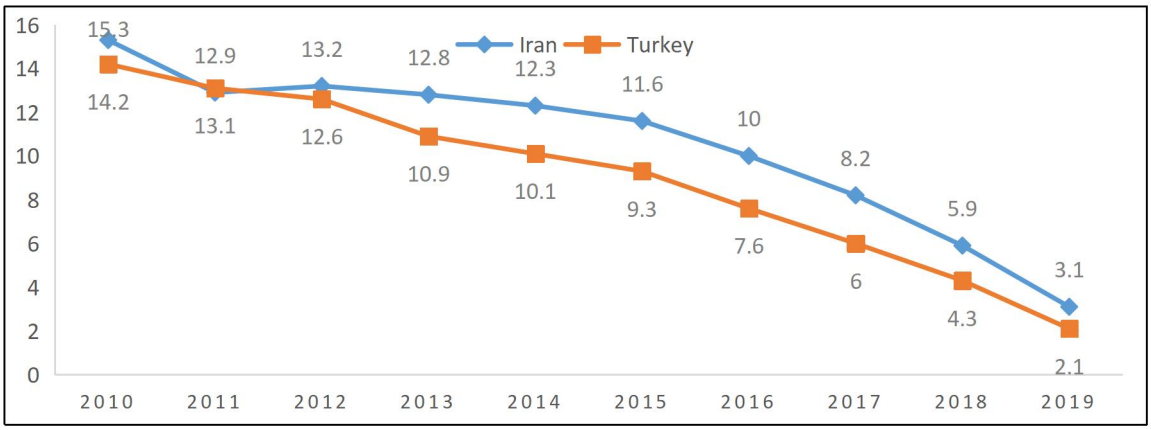

Figure 6: Comparison of the Average Number of Citations per Publication in Iran and Turkey

Citedness Rate

Figure 7 shows the citation rate during the period from 2010 to 2019. Citedness rate of Iranian inputs and Turkey are 79% and 73.4% respectively. As can be seen from Figure 7, the citedness rate of Iranian products decreased slightly from 2010 to 2017 (from 83.2 to 81.4) and experienced a significant decrease from 2018 to 2019. The citedness rate for Turkish publications was the same. In almost all the years, the citedness rate of Iranian products was higher than that of Turkish.

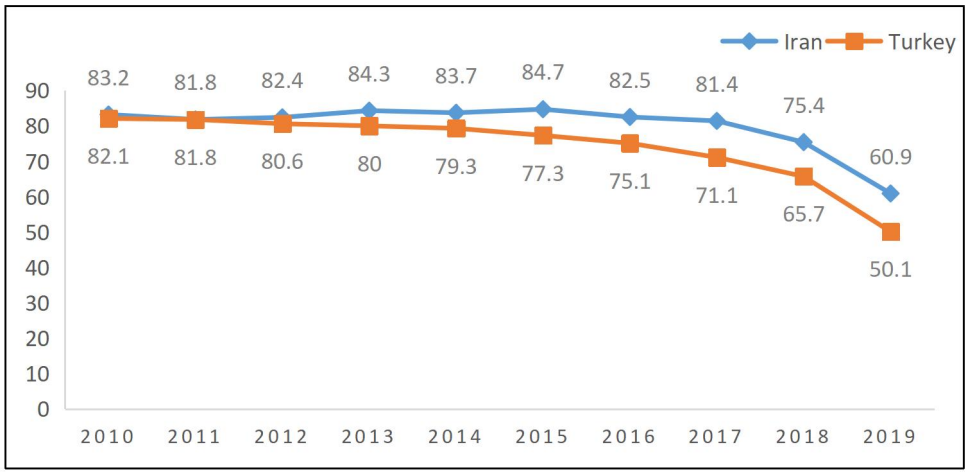

Figure 7: Comparison of Citedness Rate of Scholarly Outputs of Iranian and Turkish Researchers

Field-Weighted Citation Impact (FWCI)

The average of Field-Weighted Citation Impact (FWCI) for Iranian and Turkish researchers' scholarly outputs is 0.96 and 0.84, in turn. Figure 8 shows the FWCI metric of scientific outputs of Iranian and Turkish researchers over a ten-year period.

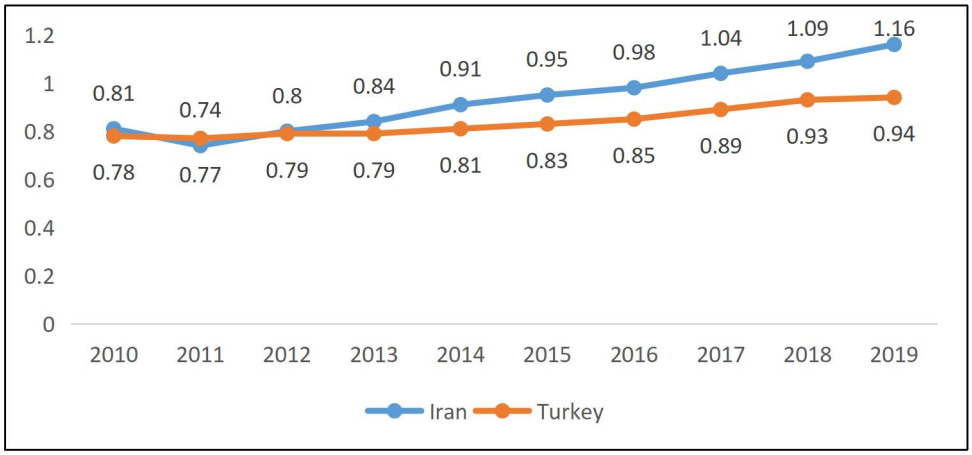

Figure 8: FWCI Metric of Scholarly Outputs of Iranian and Turkish Researchers (2010 - 2019)

As Figure 8 shows FWCI metric of Iranian scientific outputs increased in the period (0.81 in 2010 to 1.16 in 2019). This metric also shows a slight upward trend for Turkish scientific outputs (0.78 in 2010 to 0.94 in 2019). Except in 2011, the FWCI of Iranian researchers'

outputs was higher than that of Turkish researchers. A citation of 1.5 indicates that articles have received the expected global standard size of citations. When articles in a citation area receive more than 1, for example, 1.56, this means that 55% have received more citations than the expected global rate. So, it can be said that these articles probably had a higher quality. Now, in the comparison of Iran and Turkey, the difference in this number in the two countries shows the difference in the performance of their publications in receiving citations compared to the expected number of citations. Based on Figure 8, Iran has been able to exceed the global standard in receiving the expected citation from 2017 onwards.

Top Citation Percentiles

Figure 9 shows the number of Iranian's most-cited publications in four thresholds (1%, 5%, 10% or 25%) from 2010 to 2019. It is clear from Figure 9 that the number of Iranian's most-cited publications increased during a period of ten years. In general, 1% of Iran's articles are in 1%, 5.6% of articles in 5%, 11.4% of articles in 10%, and 30.3% in 25% of the most-cited publications.

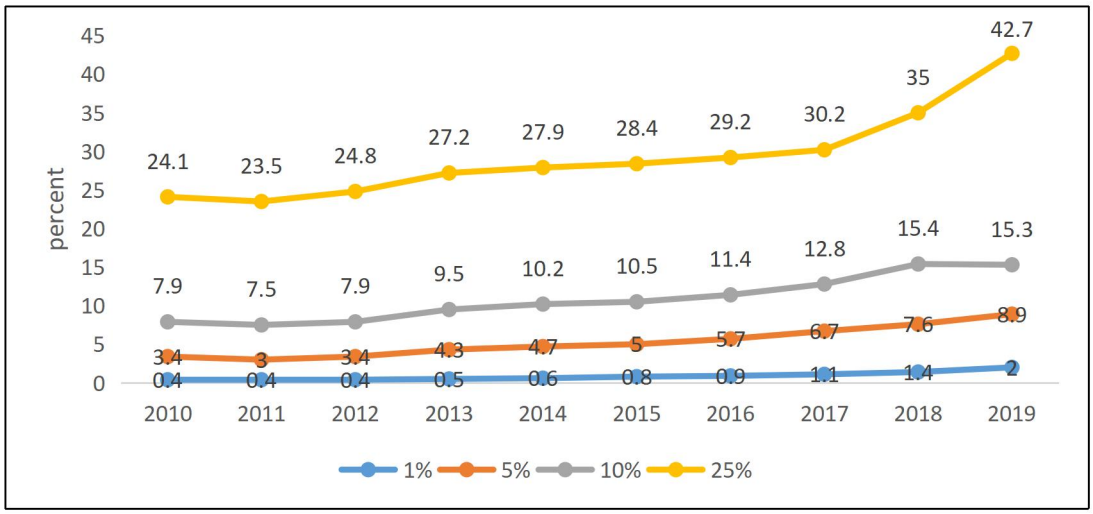

Figure 9: The Number of Iranian Scholarly Outputs in the Top 1, 5, 10 or 25% of the Most-Cited Publications

Figure 10 is a comparison of the most-cited publications of Iran and Turkey in the citation thresholds of 1%, 5%, 10% and 25%. It shows that the number of most-cited publications of Iran in all 4 thresholds is more than that of Turkey.

Views Count and Views per Publication

Views Count means the total number of views of the article abstract or clicking on article link in Scopus to view the full text on the publisher's website. Figure 11 shows the number of views of Iranian and Turkish publications (2010-2019). Iranian and Turkish researchers' publications were visited 15136570 and 8350037 times in this period, in turn. The number of views of Iranian scientific outputs in this ten-year period was strongly more than that of Turkish. The number of views of Turkish publications experienced a steady trend while this trend for Iranian publications is different with two peaks in 2011 and 2016 and a declining trend after 2016.

About Views per Publication, the findings showed that the average number of views per article for Iranian and Turkish publications is 31.6 and 20.1, in turn.

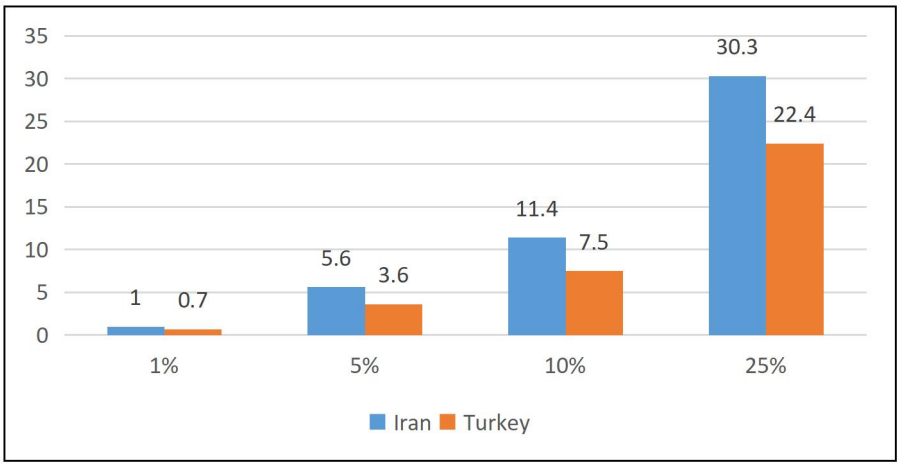

Figure 10: Percentage of Highly Cited Articles in Citation Thresholds of 1, 5, 10 and 25%

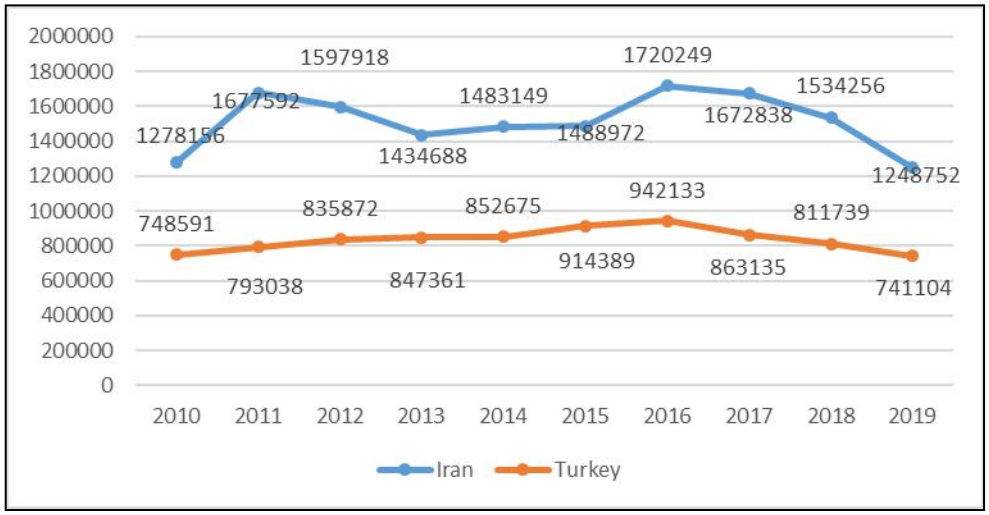

Figure 11: Views Count of Iranian and Turkish Publications

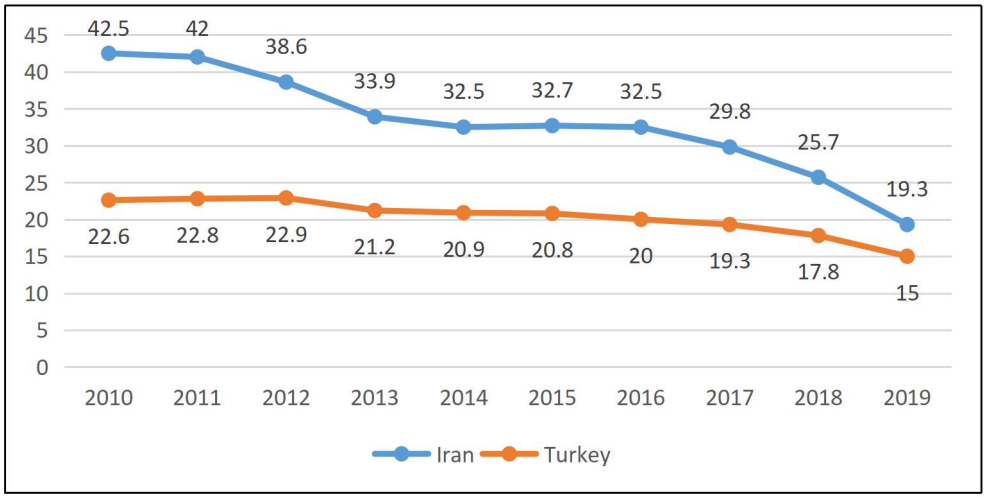

Figure 12: The Average number of Views per Publication

Figure 12 shows the average number of views per publication from 2010 to 2019**.** Although the average number of views per publication of Iranian and Turkish researchers' outputs decreased from 2010 to 2019 (from 42.5 to 19.3 and 22.6 to 15, respectively), the slope of the decline for Iranian articles was steeper than that of Turkish.

Top Views Percentiles

This metric indicates the publications which are in the top 1%, 5%, 10%, or 25% of the most-viewed publications. Figure 13 shows the percentage of publications of Iran and Turkey in 1, 5, 10, and 25% of the most viewed Scopus-indexed articles. From Figure 13, it is clear that the percentage of Iranian publications' in Top Views Percentiles is higher than that of Turkish.

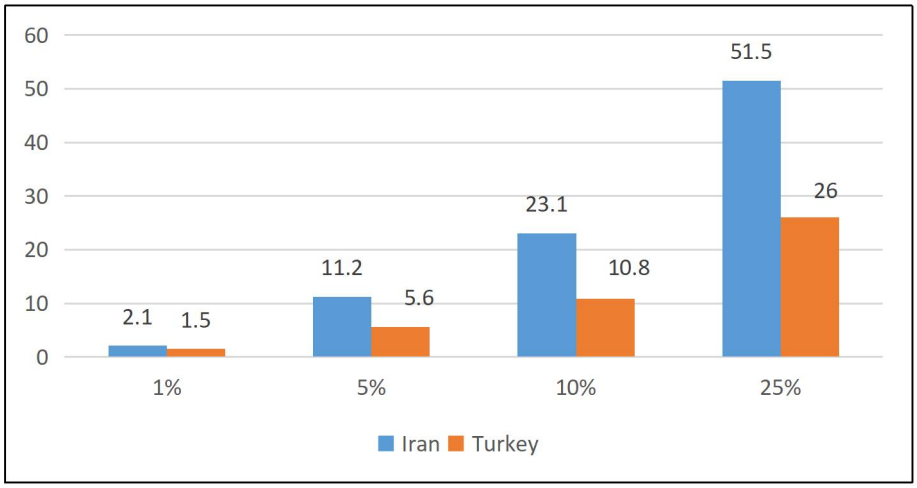

Figure 13: Percentage of publications in Top Views Percentiles (1, 5, 10 or 25%)

Figure 14 shows the publications of Iran and Turkey from 2010-2019 which are in the top views 25%. It shows that although the percentage of publications of the top 25% in Iran in all years is higher than that of Turkey, both of them experienced a steady trend during the period.

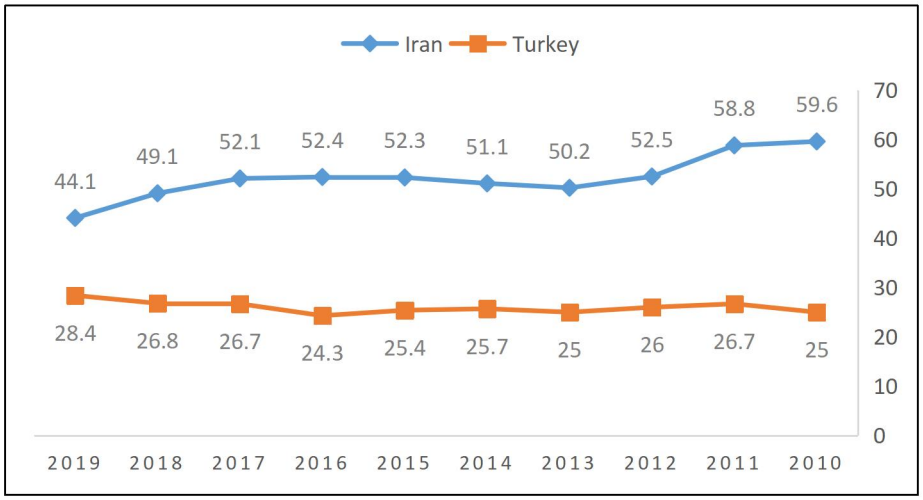

Figure 14: Percentage of publications in Iran and Turkey in Top Views Percentiles

Field-Weighted Views Impact (FWVI)

Figure 15 shows the FWVI metric of the publications from 2010 to 2019. FWVI at the field level for Iranian and Turkish publications in the ten-year period is 1.56 and 1.05, in turn. FWVI at the field level for Iranian publications declined from 2010 to 2013, then slightly increased until 2016 and decreased significantly in the following years while Turkish publications saw a steady increase during the period.

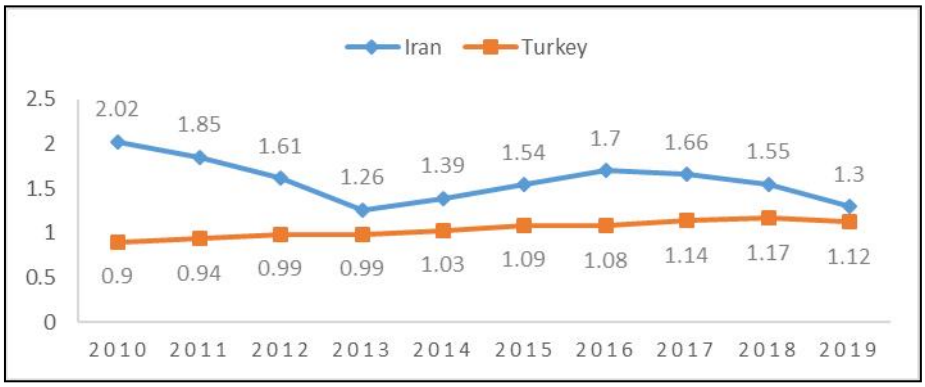

Figure 15: FWVI Metric of Iranian and Turkish Publications

Institutional Authorship and Collaboration

The rate of papers published through collaboration is also measured. There are four types of collaboration in science, namely international, national, institutional collaboration, and single authorship as well. Figure 16 highlights information about these types of collaborations. According to Figure 16, the percentage of institutional authorship in publications of Iran and Turkey was higher than other authorships, which, of course, decreased in the above-mentioned period. The percentage of international, national, and institutional authorships in Iranian publications was higher than that of Turkish while the percentage of single authorships in Turkey was higher than that of Iran (12.1 *vs.* 5.6)

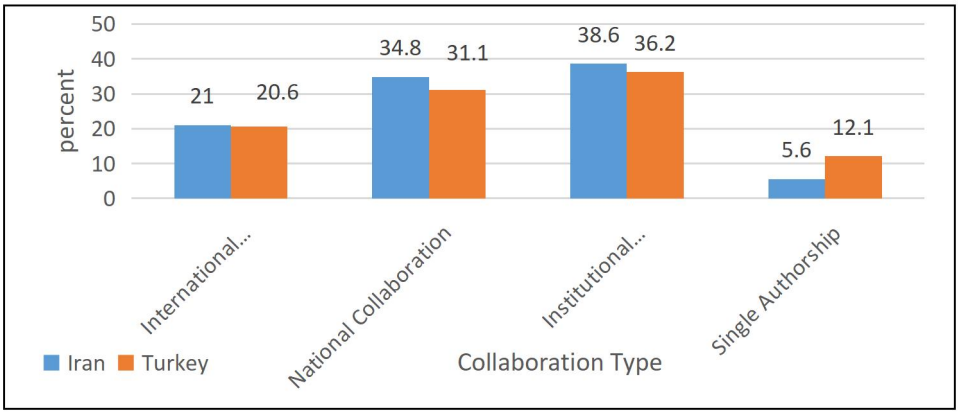

Figure 16. The Rate of Iranian and Turkish Scientific Outputs Published through Collaboration

Collaboration Impact

This metric computes the average Citations per Publication for publications with international, national, and institutional collaboration, and indicates how beneficial these collaborations are with respect to citation impact (SciVal Research Metrics Guidebook 2020). Figure 17 shows the average number of citations to publications resulting from international, national, institutional, and single authorships (collaborations).

According to the findings, the average number of citations per publication in international scholarly outputs is more than other types of authorship in both Iran and Turkey. The average citation per publication of Turkish international authorship is more than that of Iranians (17.3 vs. 15). In other types of authorship, Iranian Publications received more citations than that Turkish between 2010 and 2019.

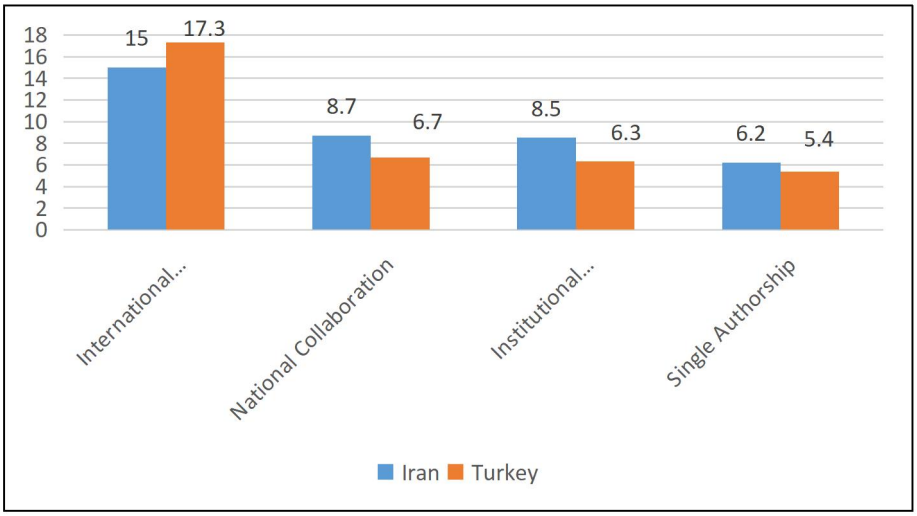

Figure 17: Comparison of Collaboration Impact of Co-authored Scholarly Outputs

Table 2 presents the top five countries that collaborate with Iran and Turkey in research. It shows that the United States is the most important partner of Iran and Turkey in publishing international scholarly outputs (23,725 and 23,725, in turn). According to SciVal, Iran's international collaboration with Turkey, and vice versa, ranks above ten.

Table 2: Comparison of Collaboration Between Iran and Turkey with Other Countries

Country	Country	Rank	publications
Iran	USA	1	23725
	Canada	2	11346
	UK	3	9962
	Malaysia	4	8769
	Germany	5	8447
	Turkey	**11**	**5334**
Turkey	USA	1	30934
	UK	2	13222
	Germany	3	12554
	Italy	4	10393
	France	5	8882
	Iran	**12**	**5334**

Academic-Corporate Collaboration and Academic-Corporate Collaboration Impact

Figure 18 shows the percentage of Academic-Corporate Collaboration in both countries between 2010 and 2019. Academic-Corporate Collaboration indicates the degree of collaboration between academic and corporate affiliations (a collaboration between university and industry) (*SciVal Research Metrics Guidebook* 2020). The findings show that the percentage of collaboration between the university and industry is 0.5% for the Iranian researchers' publications and 1.3% for the Turkish ones.

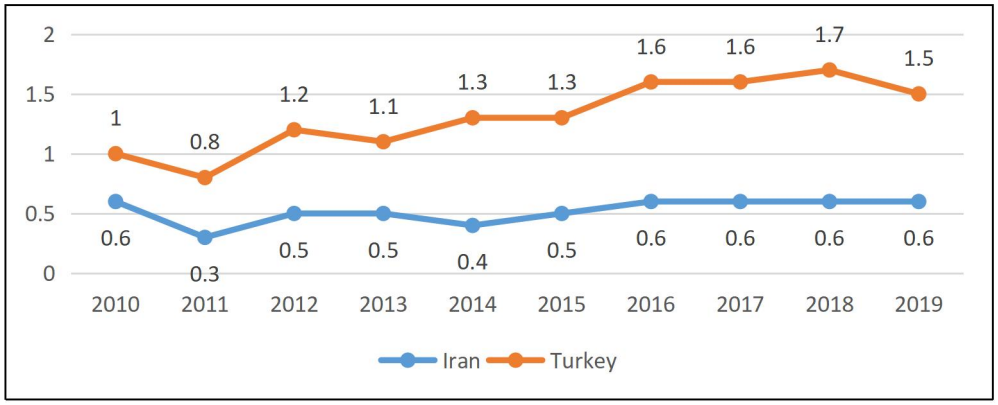

Figure 18: Comparison of Academic-Corporate Collaboration (%) between Iran and Turkey

According to Figure 18, Academic-Corporate Collaboration in Turkish publications was more than that of Iranians during a period of ten years. This indicates that although this type of collaboration witnessed a fluctuation over the period in Turkey, it generally had a growing trend. Regarding Iranian publications, the findings showed that except for a reduction in 2011 and 2014, the trend remained approximately unchanged.

Academic-Corporate Collaboration Impact calculates the Citations per Publication for publications with and without academic-corporate collaboration (a collaboration between university and industry) (SciVal Research Metrics Guidebook 2020).

Figures 19 and 20 show the number of citations per publication with and without academic-corporate collaboration from 2010-2019. It is clear from Figure 19 that the number of citations per publication with Academic-Corporate collaboration in Iran is more than that of Turkey apart from the years 2011 and 2013. Figure 20 indicates that although the trend of citations per publication without Academic-Corporate collaboration in Iran and Turkey is the same, the Iranian publications received more citations than those of Turkish. The average number of citations for each publication with university-industry collaboration in Iran and Turkey is 43.4 and 36.1 respectively. This citation rate is 9.6 for non-collaborative Iranian publications and 8.2 for the same kind of publications in Turkey.

Figure 19 shows this metric declined in both Iran and Turkey during a period of ten years. However, the declining trend for Iranians' fluctuated with two peaks in 2012 and 2015 (83 and 75.1 per publication, in turn). The academic-corporate collaboration impact metric for Turkish publications had an almost slight decline with a peak in 2015 (57.5 citations per publication). The number of citations per publication in Iranian and Turkish publications without Academic-Corporate collaboration also shows a sharp decline (15.2 to 3 for Iran and 13.9 to 2 from 2010 to 2019).

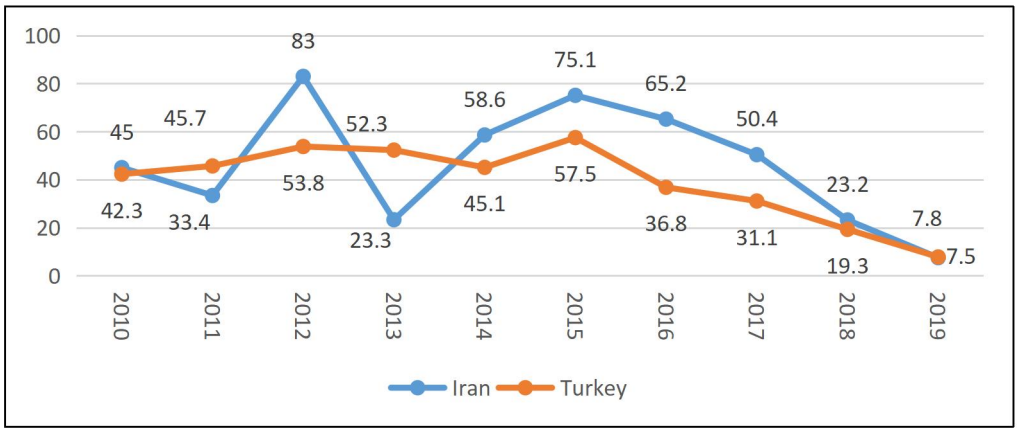

Figure 19: Comparison of Academic-Corporate Collaboration Impact with Academic-Corporate Collaboration

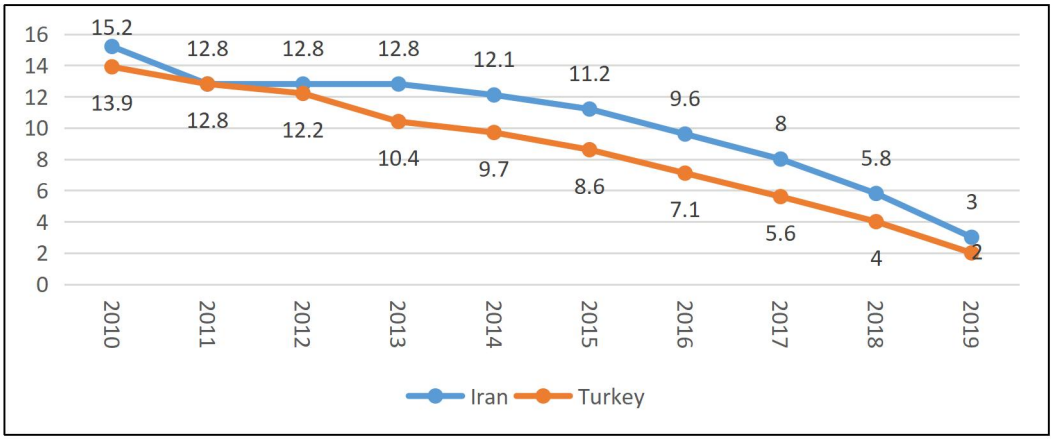

Figure 20: Comparison of Academic-Corporate Collaboration Impact without Academic-Corporate collaboration

Top Journal Percentiles

Figure 21 shows the percentage of scientific publications by Iranian and Turkish researchers published in the top 25% of Scopus journals based on three indicators: Citescore, SNIP, and SJR.

During a period from 2010 to 2019, the percentage of Iranian publications published in the top 25% of Scopus journals based on three indicators is higher than that of Turkish. Table 3 shows a comparison of the percentage of Iranian publications by Iranian and Turkish researchers published in the top 25% of Scopus journals based on three indicators: CiteScore, SNIP, and SJR between 2010 and 2019. According to the findings, the percentage of publications published in top journals in terms of three indicators did not differ much in both Iran and Turkey during this period.

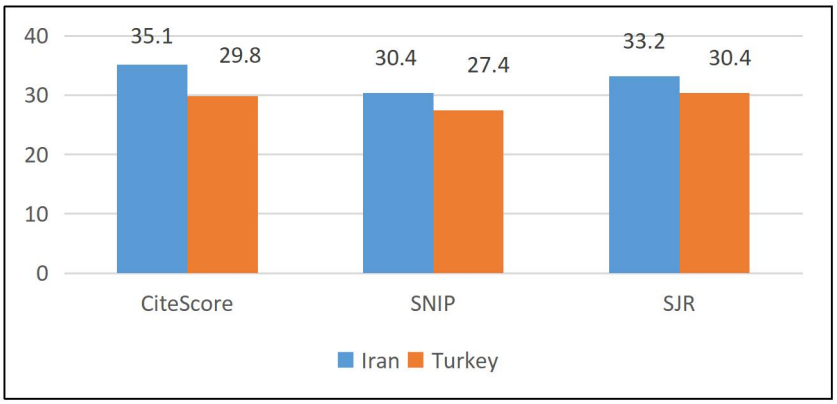

Figure 21: The Percentage of Scientific Publications in Both Countries Published in the Top 25% of Scopus Journals Based on Three Indicators

Table 3. Comparison of the Percentage of Scientific Outputs by Iranian and Turkish Researchers Published in the Top 25% of Scopus Journals Based on Three Indicators

Indicators	Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
CiteScore	Iran	33.5	30.3	31.3	31.3	32.1	34.3	37.1	36.7	37.9	39.2	35.1
	Turkey	30.7	29.6	30.0	28.0	28.3	28.8	29.9	29.6	30.4	32.1	29.8
SNIP	Iran	28.9	25.8	27.1	29.1	30.5	30.4	30.6	31.1	32.3	33.8	30.4
	Turkey	27.1	28.2	29.9	28.4	29	27.2	26.5	25.5	26.4	26.5	27.4
SJR	Iran	33.3	29.1	28.6	30.0	31.9	32.3	33.5	33.6	36.9	37.3	33.2
	Turkey	31.7	32.3	31.0	30.3	29.3	29.8	30.6	29.0	31.1	29.8	30.4

DISCUSSION

The study showed that even though Iran is struggling with economic problems and the brain drain due to the oppressive sanctions, Iranian outputs in various metrics have more potential than Turkish publications. According to scientific growth studies, making different policies by policymakers after the revolution has led to dramatic scientific growth in Iran. Policy makers' perspectives have changed, more attention has been paid to Iran science and technology quantitatively and qualitatively (Kharabaf and Abdollahi 2012; Naghizadeh and Naghizdeh 2016). Increasing the quality of journals and indexing them in Scopus and ISI databases has been one of the most important scientific policies of universities and scientific centres. To achieve this goal, Iranian scientific policymakers have paid special attention to scientific editing. Today, journals are managed by editors familiar with publishing procedures, so increasing the number of editors' membership in the World Association of Medical Journal Editors (WAME), Committee on Publication Ethics (COPE) and European Association of Science Editors (EASE) is the result of this policy (Habibzadeh 2006). What is more, raising the number of the top 1% of scholars in Essential Science Indicators (ESI) List (Kharabaf and Abdollahi 2012) has been another of Iran's scientific development in recent years. Furthermore, one of the key factors in the growth of science is equipping universities and research centres with cutting-edge equipment. (Abdollahi 2011) Consequently, Iran's Ministry of Health has taken fundamental steps to establish research authority. For instance, they have allocated grants to young assistant professors,

provided NIMAD grants, held Razi Festival, increased the number of research centres, and launched "Ph.D. by Research" academic programme. Another noticeable achievement of the Ministry of Health was developing and implementing the Iranian Scientometrics Information Database (ISID: www.isid.research.ac.ir) in 2015, with the aim of extracting and displaying up-to-date scientometric indicators of faculty members. Providing up-to-date feedback on members' research status, creating a tangible picture of colleagues' research status in various fields, and making a sense of competition among faculty members are some of the outcomes of this work.

This study compared the performance of Iranian and Turkish researchers based on SciVal metrics which are categorized into two groups and a metric can be a part of more than one group. The First Group includes Collaboration, Published, Viewed and Cited metrics and the second group consists of Productivity, Citation Impact, Snowball, Power, and Collaboration metrics. Overall, the research outputs were examined based on 15 metrics (Table 1) over the ten-year period between 2010 and 2019. The study of Iranian scientific products showed that most of the products were in the field of engineering (14.3%) and medicine (12.9%). This statistic was different for Turkish scientific outputs and medicine (23.3%) was in the first rank, then "other fields" (15.8%), and the engineering field (10.4%) received the third rank. At the end of 2020, Islamic World Science Citation Center (ISC 2020) reported that, according to Scopus data, Iran was ranked 11th in scientific production in the field of technology and engineering and 4th and 25th in terms of quality and quantity respectively. It can be said that the productivity of knowledge in Iran, despite sanctions and the brain drain, is due to the Iranians' deep potential in the world of science, which can be compared to that in Germany or Japan (Amin 2008). According to Forbes Magazine, Iran was ranked fifth in the world in terms of STEM (science, technology, engineering, and mathematics) graduates, with 335,000 graduated in 2016. Meanwhile, in 2019, the number of top universities in Iran and Turkey was almost equal according to the Shanghai rankings (13 and 12, respectively) (Academic Ranking of World Universities 2019, 2020). Analysis of the status of science in Turkey in 2016 showed that more than half of all scientific outputs in Turkey were in the field of medicine which could be due to the increase in medical schools in this country (i.e. 12,000 graduates per year) and fundamental changes in education over the past 25 years due to long negotiations with the European Union (EU), as well (Sengölge and Ar 2016).

Regarding citation counts, the number of citations received by Iranian and Turkish researchers' scientific outputs decreased during the period. Overall, the number of citations to Iranian scientific outputs is more than that of Turkish, which can be explained by the greater number of Iranian scientific outputs during 2010-2019. In addition, the number of views per publication for Iranian publications is more than of that Turkey. Since there is a positive correlation between the received citations by articles and usage metrics (downloads, views, and usages (McGillivray and Astell, 2019)), maybe one of the reasons for the higher number of citations for Iranian publications than Turkish articles is the higher number of views. However, increasing the number of citations depends on various factors such as paper quality, novelty, and paper age (ISC 2020), and a higher number of articles does not necessarily mean more citations. Based on the current study, Citations per Publication for Iranian publications were more than that of Turkish outputs (9.8 vs. 8.6 citations on average) over the ten-year period. In general, it can be said that the number of citations is a measure to show the influence of articles (Molléri, Petersen, and Mendes 2018), and Iran's superiority in citation-based criteria shows that the influence of Iranian articles during this decade has been greater than that of Turkish articles. Comparing this metric with American and Russian scientific outputs during a period of six years (2012-

2017) showed scores 3.1 and 7.9, in turn (Avanesova and Shamliyan 2018). The trend of Citations per Publication for both Iranian and Turkish articles was declining. The finding of a study about Iranian publications from 1998-2007 also revealed the same trend (Erfanmanesh 2013)., and the same was true for an analysis of Citations per Publication of Korean and foreign authors from 2012 to 2016. In addition, the study showed that the number of citations per publication in Korean publications was fewer than foreign studied publications (an average of 1.9. except in materials science) (Jang, Ki and Kim 2019). On average, each scientific output of Iranian and Turkish researchers received 9.8 and 8.6 citations, respectively during the ten-year period while a study about publications by faculty members in a university in Iran (the Allameh Tabataba'i University) indicated that the average of citations per publication was 4.2 (Galyani-Moghaddam, Jafari and Sattarzadeh 2017) that can be because of the difference in the number of studied samples.

This study has shown that the citedness rate of Iranian inputs is more than that of Turkish (79% vs. 73.4 %.). The result of a study on the top 20 countries in citedness rate was almost between 70-90 percent during 2005–2014 (Erfanmanesh, Tahira and Abrizah 2017). The results of another study in 2017 showed that although countries such as the United States and the United Kingdom are leaders in terms of scientific productivity and citation impact and have the highest number of articles indexed in Scopus journals, less developed countries are still on the top of the number of citations per publication and citedness rate (Erfanmanesh, Tahira and Abrizah 2017).

According to FWCI, approximately in all years, Iranian publications had a higher score than Turkish cases. Only in 2011, Turkish outputs experienced a better situation with scores 0.77 vs. 0.74. Given the relationship between the FWCI and the efficiency of researchers' work, it appears that both countries' scientific publications were not successful in terms of efficiency. What is more, the trend for Iranian scholarly outputs was upward compared to the steady trend of Turkish publications. Furthermore, findings of this study showed that FWCI in these two countries is near to countries such as Russia and India (Avanesova and Shamliyan 2018). A study on Russian publications that have 14th rank in the world in terms of the number of publications showed overall FWCI=0.75 between 2012 and 2017 (Avanesova and Shamliyan 2018). In addition, according to Avanesova and Shamliyan, comparing FWCI between 40 countries with the largest scientific publications between 2012 and 2018 highlighted the scores from 0.75 for Russia to 1.83 for Switzerland and Netherlands.

Another studied metric in this study was "top citation percentiles" which examined the top 1%, 5%, 10%, or 25% of the most-cited publications. This metric is the best method for citation count normalization in individual outputs based on subjects (Bornmann 2013). On the other hand, because the most-cited publications present a higher rate of interdisciplinary science, especially in the top 1% of scholarly outputs (Chen, Arsenault, and Larivière 2015), the number of publications in top percentile classes is very important.

According to the results, although the number of the most-cited scholarly articles increased in both countries from 2010-2019, comparing this metric in the two countries showed that the top citation percentiles of publications in Iran are more than that of Turkey. The results of a study in Korea showed an increasing trend in the top 10% of publications in Korean and foreign scientific outputs from 2012 to 2016 in three categories (engineering, material science, and medicine) and two types of publications (articles and reviews). On the whole, the average of the top 10% of Korean and foreign publications was 0.7 vs. 2.7 in engineering, 0.6 vs. 4.1 in material science, and 3.8 vs. 6.2 in medicine,

respectively (Jang, Ki and Kim 2019). Moreover, publications in the top 10% between Russian and American publications throughout the period from 2012 to 2017 were 7% and 18.3%, respectively while this metric for those of Iran and Turkey were 11.4% and 7.5%, in turn (Avanesova and Shamliyan 2018).

Count metrics are popular because they are easier for researchers to understand compared to the ones that use a weighting approach and complicated procedures. One study found that Views Count and Views per Publication were chosen by 16% and 35% of researchers as an assessment tool, respectively (Colledge and James 2015). On the other hand, some studies have shown that there is a strong correlation between the number of views and citations (Batooli and Batooli, 2020; Batooli 2017; Batooli, Janavi, and Ravandi 2016; Batooli, Mohammadloo, and Nadi-Ravandi, n.d.; Batooli, Nadi Ravandi, and Sabahi Bidgoli 2016; Bhoomaiah et al. 2020; Esmaeilpour Bandboni et al. 2016; Jang, Ki and Kim, 2019; Janavi, Batooli, and Nadi-Ravandi 2020). For these reasons, view metrics such as Views Count, Views per Publication, and top View Percentiles are important. The current study indicated that Iranian publications are in a better position than those Turkish in all three metrics. According to the average number of views, Iranian publications are seen 50% more than Turkish's, and except for scientific outputs that are in the top 1% of views, the number of Iranian outputs in the top 5, 10 and 25% is almost twice as many as Turkish publications. Comparing the top 10% of scholarly outputs in Russia and the USA showed scores of 10.4 vs. 10.8%, respectively (Avanesova and Shamliyan 2018). The average score of Top View Percentiles of Indian fisheries institutes was 5% (Bhoomaiah et al. 2020).

FWVI as another metric in the productivity of research was examined in this study and findings showed the superiority of Iranian publications over Turkish outputs in all years (1.56 vs. 1.05 on average). However, Iranian publications also experienced fluctuations during the period. Investigation of the research outputs of the RUDN University and 5-100 universities indicated that they were viewed much more often than foreign universities with higher citation rates (Kochetkov 2018). Moskaleva and Akoev's results showed that there is a strong correlation between Field-Weighted Citation Impact and Field-Weighted Views Impact. This means that the more an article is viewed, the more likely it is to be cited (Moskaleva and Akoev 2019). As mentioned above, the field-weighted citation impact of Iranian scientific outputs was higher than that of Turkish, which could be due to the higher field-weighted view impact of Iranian outputs compared to Turkish cases.

Collaboration plays a key role in the research impact. Some studies have examined the relationship between productivity, funding, and collaboration. According to the findings of a study, team projects published scientific outputs with more citations than single projects and concluded that productivity and collaboration are interrelated (Wuchty, Jones and Uzzi 2007). In another attempt, one study confirmed that co-authored articles received more citations than single-authored articles (Lee and Bozeman 2005) and at a higher level, articles by international authors receive twice the average citation as non-international ones. In addition, papers with foreign corresponding authors received a higher number of citations than articles with national corresponding authors (Nguyen, Ho-Le and Le, 2017). Another study in Argentina found a positive relationship between research funding and the number of international studies published in peer-reviewed journals (Ubfal and Maffioli 2011). Thus, it might be concluded that if collaboration affects the number of citations, and the amount of budget affects the rate of collaboration, then there is a positive relationship between funding and the number of citations. The current study showed that although the number of international research in Iran is slightly more than that of Turkey (21 vs. 20.6),

the number of citations to international publications in Turkey is significantly more than that of Iran (17.3 vs. 15) which can be because of the economic boom of Turkey in recent years (Çavuşoğlu and Türker 2013). On the other hand, Managers of the international department of public universities and experts in Iran believe that structural, political, cultural, linguistic, financial and equipment barriers are important obstacles to international scientific cooperation (Mehravar-Gilgo et al. 2021).

However, there are studies that deny the positive impact of research funding on the number of citations. Therefore, this issue should be more seriously investigated in further studies. For example, a report in "Nature" showed that there was a weak correlation between R&D funding and citation impact (name, year), and another study even showed that despite the positive impact of international publications, the budget had negative effects on the impact of research (Leydesdorff, Bornmann, and Wagner 2019). The International collaboration in the USA is 26.2% vs. 31.4% in Russia (Avanesova and Shamliyan 2018). Vazquez, Torress and Perez (2021) confirmed this finding in the field of artificial intelligence (AI) and showed that it has more authors and institutions collaborate than in China, India, and Australia. Of course, it is clear that perhaps if the issue is examined in other issues and with a different perspective, the issue will be different. For example, in the case of Covid-19, the findings showed that China's outputs were largely intra-national compared to the USA's outputs which had a multinational view (Mukherjee 2020). In another study on articles in Vietnam, the results indicated that the rate of international articles was 77% and most of their collaboration was with the USA and Japan. Furthermore, in line with this study's results, the rate of international collaborations experienced a slight decline during 2001-2005 (Nguyen, Ho-Le and Le 2017). The findings also revealed that the highest international collaboration of Iranian and Turkish researchers was with those in the US. The US has the biggest share in international co-authored publications with other countries.

A comparison of Iranian and Turkish publications showed that Academic–corporate collaboration in Turkey is 0.434 compared to 0.361 in Iran. This means that the rate of academic–corporate collaboration in Turkey is 83% more than that of Iran. While Academic–corporate collaboration in the US is 2.2%, it is 1.2% in Russia from 2012 to 2017. In other words, the rate of this type of corporation in the USA is 37.5% more than that of Russia (Avanesova and Shamliyan 2018). While some developing countries tend to create a stable base for economic growth, investigations show that some indicators strongly suggest that Turkey has a financial and technical advantage based on economic and social welfare settings that can help bridge the gap between government, industry, and universities (Göksidan, Erdil, and Çakmur 2018). On the other hand, according to research in Iran, the main burden of science in Iran is carried by universities and the interaction between universities and industry in Iran is very weak and unstable (Erfanmanesh, Moghiseh, and Shahraki 2018).

CONCLUSIONS

Despite all measures and policies, Iran is still far behind the world standards and scientific superpowers in some aspects. However, the results of this study can have important messages for policymakers in deciding on research funding as well as training experts in universities and scientific and research centres. Certainly, evaluating the scientific outputs provides a suitable tool for appropriate policy making and planning and recognising the past situation, leads to targeting scientific movements and determining research priorities,

as well as identifying weaknesses and shortcomings in the production of scientific knowledge. Maybe it is time for the country to dismiss power competition in the Middle East for now, but rather uses the competition for leverage to reach its full potential in scientific achievements and international reputation.

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AUTHOR DECLARATION

The authors declare no conflict of interest relating to data presented in this article. Its contents, including any opinions and/or conclusions expressed, are solely those of the authors.

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