A Citation Analysis of the Scientific Publication of Universities: A Study of Tarbiat Modares University during 1988-2019

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ABSTRACT: *The performance of university plays an important role in the scientific development of a society. One of the methods of university evaluation is the use of citation analysis technique. The purpose of this research is to analyze the scientific productions of Tarbiat Modares University in the period of 1988 -2019. This research is of scientometric type and its statistical population was all scientific productions of Tarbiat Modares University indexed in Web of Science that its number is 24004 records and it is drawn by its analysis HistCite software and scientific map. Findings show that the trend of scientific productions of the university is increasing and most production in 2019 was with 2636 documents. The citation trend increased until 2011 but has declined since then. Most national cooperations were Islamic Azad University and University of Tehran and international cooperation with the United States. The drawn cluster showed the most important papers in the field of Chemistry. This study helps university officials for better planning of scientific development.*

1. Introduction

Today, scientific growth and development is one of the important factors in the power of societies and leads to development and sustainable development infrastructure (Osareh&Marefat, 2005). Science is the product of curiosity, thinking, reasoning as well as individual and group experience. Scientific development and achievement of major research achievements require the collaboration of all scholars and scientists; therefore, cooperation is one of the mechanisms of scientific development and play a key role in all scholarly fields and provide prosperity (Su et al., 2017). Scientometrics analysis, which involves the use of statistical methods, is increasingly being used for research assessment (Wallin 2005; Zhang and Chen 2020). Generally in scientometrics, it uses quantitative methods to evaluate and measure scientific products, but by using these methods, qualitative results can be achieved and the performance of scientific organization and centers can be examined (Wallin 2005). One of these quantitative methods in scientometrics is citation analysis. Garfield believes citation analysis is a tool used to examine citations of scientific articles. In this way, all citations are a scale of the impact of influence on science. That is, the more citations of articles have, the greater their impact and importance (ChavoshiNajafAbadi and Shabani, 2009). One of the best tools for citation analysis is the HsitCite software, which analyzes citation links between documents. This software, using tables and graphs obtained from Web of Science citation data, as well as drawing scientific maps using data clustering, helps the researcher to gain a deeper understanding of the relationships in different parts of science and process (Sedghi et al., 2017). Science mapping aims to discover the latent relationships and phenomena in the structure of science via visual imagery that, unless otherwise, cannot be easily revealed. In other words, some communications and phenomena in the structure of science are abstractly comprehensible to the mind, while the same physical relations are not tangible to the eye. For this reason, science mapping generally uses some symbols of size and color to show their concepts and importance (Senel and Demir, 2018; Doulani, 2020).

Tarbiat Modares University (TMU) is one of the important Iranian universities because it is the first graduate school in Iran. The university was established in 1981. At present, TMU has 169 fields of Master's programs and 129 fields of Doctoral programs,

offered by 17 faculties and 14 research centers. This university has more than 9800 students, 32000 graduates, and 720 faculty members. The university's first scientific publication, which was indexed by the Web of Science database, dates back to 1988. Since then, more than 24000 documents have been indexed with the affiliation university in Web of Science. Also, Tarbiat Modares University is ranked 342 in the world in 2020 based on Leiden Ranking. Therefore, it is necessary to scrutiny the scientific output of Tarbiat Modares University. In this study, scientific publications of Tarbiat Modares University were analyzed with HistCite software to understand the research trends, and this study was tried to clarify this issue by answering the following questions:

- How are the number and historical trend of scientific products of Tarbiat Modares University researchers in Web of Science?

- How is the trend of citations of scientific productions of Tarbiat Modares University researchers by year in Web of Science?

- How is the status of national and international cooperation between Tarbiat Modares University researchers in Web of Science?

- Which clusters are more important in mapping?

2. Literature Review

There have been many international studies in the field of scientometrics and mostly have been dealt with a specific subject area. These studies analyze the status of scientific products in a specific field and show positive or negative points. Various studies have been conducted on the scientific output of universities around the world.

Mansourzadeh et al (2020) research over the last 15 years has examined EMRI and found that scientific productions have grown significantly since 2014. However, the number of articles fluctuated, indicating changes in the human resources research infrastructure and research projects in EMRI. One of the points in this importance of scientific collaboration needs to be strengthened.

In a study, Mokhtari et al. (2019) studied the scientific products of Hamadan University of Medical Sciences in Iran. Researchers used software Excel and VOS viewer to analyze scientific products extracted from the Scopus database. Findings show that the trend of scientific productions is increasing and most of them have been published in Q1 journals. The most international cooperation with the United States, the United Kingdom and, Switzerland. Also, cooperation with Middle-eastern countries needs more emphasis. Finally, by drawing a map, important clusters, including epidemiological studies, laboratory studies, pharmacological studies, and microbiological studies were identified.

Ahmed and Al-Reyaee (2019) studied the scientific products of Al-Jouf University, Saudi Arabia, in the Scopus database. This university has a total of 80 scientific productions, of which 209 papers were published in 2017, while in 2006, only 3 papers were published. Also, the university has received a total of 3631 citations, the most citations to an article in 2007 with 229 citations. Al-Jouf University has the most cooperation with Egypt with 62 articles.

In a study titled "Research productivity and international collaboration of top Indonesian universities", Dormadji et al. (2018) analyzed scientific productions of Indonesia's top universities. Findings show that scientific productions had increased dramatically since 2010. Also, these universities had a collaboration with the United States, the Netherlands, Australia, and their neighboring countries. One of the recommendations of this study is in the field of international cooperation, which shows that in order to improve the quality of the university, there should be an increase in cooperation at the international level.

In another study, Dwivedi (2017) worked on 16556 records retrieved in Web of Science. The results show that the publications have grown since 2005 and most of the scientific productions are in the field of Chemistry and then Physic.

Siwach and Kumar (2015) studied the behavior of scholars of Maharshi Dayanand University with bibliometric techniques. In the period 2000-2013, 1247 records were extracted, the most papers for 2013 with 219 and the least in 2001 with 30 papers. Most of the articles indexed on chemistry were with 455 articles. Researchers attribute the growing trend of papers to the increase in research projects.

In another study, Sweileh et al. (2014) analyzed the scientific productions of An-Najah University for 35 years. A total of 791 published were indexed in Scopus. 601 documents were published in high-quality journals. The total number of citations for scientific productions was 4553 with an average of 5.8 citations per document. The university had international collaborations with 59 countries. In this study, it emphasizes the increase of international cooperation and publication of articles in journals with high Impact Factor.

In summarization, it can be said that the increasing trend of scientific productions and the importance of scientific publications in the development of societies, the need for product analysis and evaluation of the performance of universities and scientific institutes are increasing day by day.

3. Methodology

This research is a kind of scientometric research and the citation analysis technique has been used to explain the status of scientific productions of Tarbiat Modares University researchers. The statistical population of the Tarbiat Modares University from 1990 to 2019. Because the scientific productions of this university are indexed with different spellings, the advanced Organization- Enhanced search was used in the database. Data were retrieved from the Web of Science database and 24004 records were obtained. Then data saved as full records (500 records) in plain text and preprocessing for HistCite software. HistCite developed by Garfield and suitable for data analysis from Web of Science and can identify the high cited records among all of the documents and depicts their relationships by clustering (Garfield et al. 2002). Therefore, using this software, desired indicators were analyzed. There are two methods for calculating citations in HistCite: LCS (Local Citation Score) and GCS (Global Citation Score). LCS shows the citation frequency within the collection and GSC shows the citation frequency based on the total count in the Web of Science. Finally, using clustering techniques, important and main areas of scientific publications were identified.

4. Finding

1- How is the number and historical trend of scientific productions of Tarbiat Modares University researchers in Web of Science?

Figure 1 shows the frequency distribution of scientific publications of Tarbiat Modares University during the years 1900–2019. The first scientific production indexed in Web of Science was in 1988 with 2 documents and the highest scientific production for 2019 was with 2636 productions. In total, 24004 documents have been published by the authors of Tarbiat Modares University. Scientific publications trend increased and scientific productions have grown significantly in the last 5 years. Although science publications increased in the year 2011 but decreased until the year 2014.
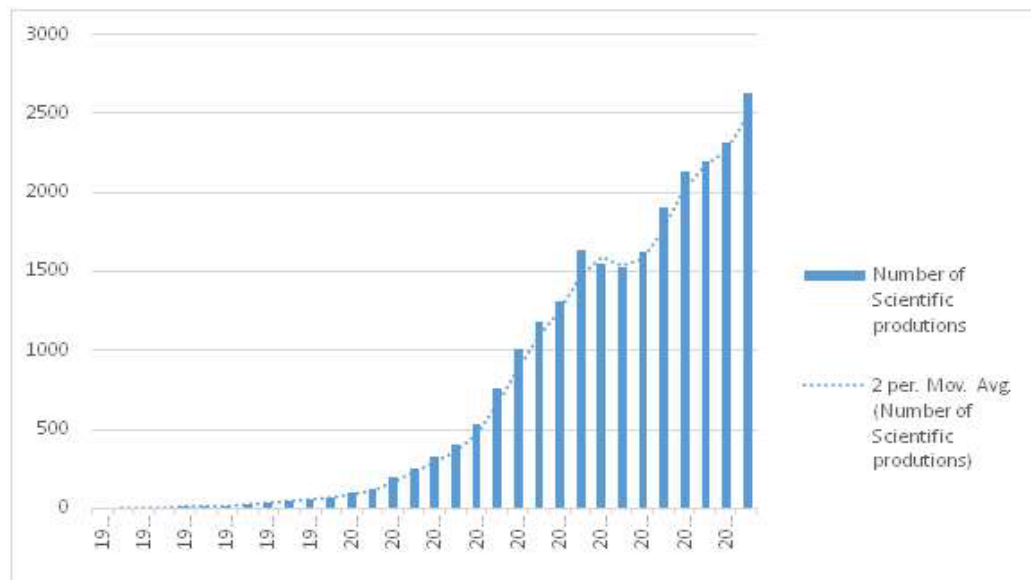

Figure 1. Trend of scientific productions

2. How is the trend of citations of scientific productions of Tarbiat Modares University researchers by year in Web of Science?

Figure 2 shows the completely upward trend of citation to scientific productions of Tarbiat Modares University until 2011 and increased again in 2015 and then declined. However, the declining trend of citations in recent years is normal and publications may receive more citations in the coming years. According to Figure1, the trend of citation seems to be similar to the trend of scientific production. Actually the more publications in a year, the more citations.
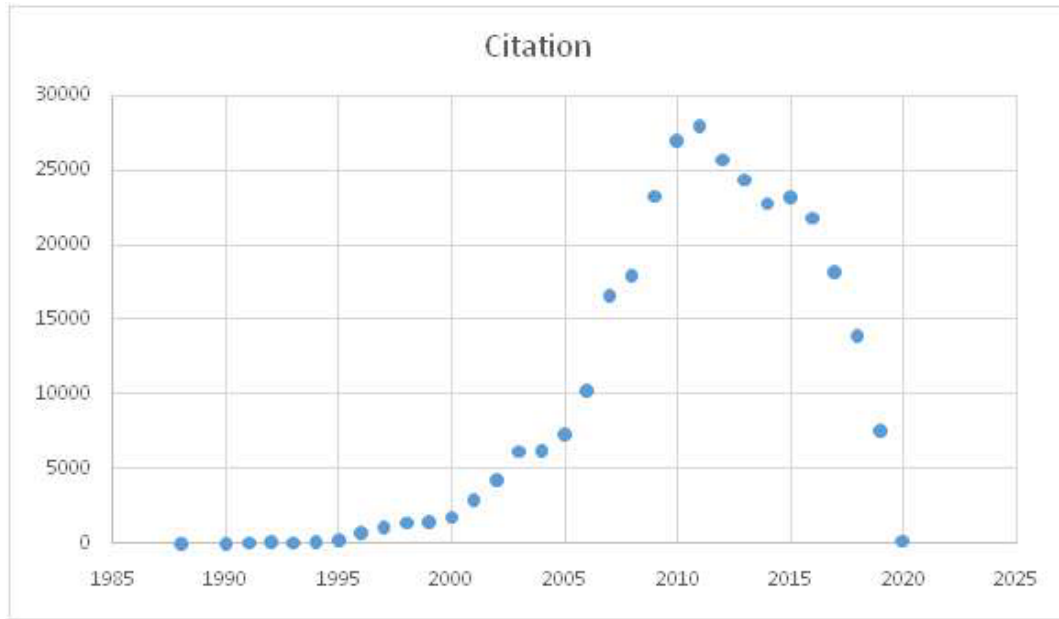
Figure 2. Trend of citation

3. How is the status of national and international cooperation between Tarbiat Modares University researchers in Web of Science?

According to a search conducted on Web of Science, 6354 Iranian organizations and institutes have had a scientific collaboration with Tarbiat Modares University. Table 1 shows the 10 national institutions that have had the most cooperation between TMU. The most collaboration between the university and Islamic Azad University With 2079 cases 8.7 percent, also the University of Tehran and University of Tehran Medical Science are ranked next with 1980 and 1557, respectively. Most universities and institutes (Table1) have a good ranking in global ranking systems. Also, TMU with 30218 citations has had the most collaboration with the University of Tehran.

Table 1. National cooperations

#	Institution	Recs	Percent	TLCS	TGCS
1	Tarbiat Modares Univ	22314	93.2	30102	288523
2	Islamic Azad Univ	2079	8.7	1630	22370
3	Univ Tehran	1980	8.3	2646	30218
4	Univ Tehran Med Sci	1557	6.5	1340	19604
5	ShahidBeheshtiUniv Med Sci	851	3.6	697	9518
6	Tarbiat ModarresUniv	738	3.1	1885	14410
7	ShahidBeheshtiUniv	468	2.0	415	4851
8	Sharif UnivTechnol	447	1.9	403	6237
9	AmirkabirUnivTechnol	436	1.8	465	6457
10	Pasteur Inst Iran	412	1.7	457	5227

Based on the results obtained TMU has collaborated with 140 countries around the world. Accordingly, the highest international collaborations were with the United States (4.3%), Canada (1.9%) and Australia (1.7%) with 1018, 460 and 415 scientific publications, respectively (Tablev2).

Table 2. International cooperation

#	Country	Recs	Percent	TLCS	TGCS
1	Iran	23773	99.3	33329	314099
2	USA	1018	4.3	1262	18658
3	Canada	460	1.9	616	7781
4	Australia	415	1.7	600	7973
5	UK	404	1.7	414	6697
6	Germany	369	1.5	483	7810
7	Italy	314	1.3	324	4726
8	Peoples R China	309	1.3	779	6650
9	Malaysia	280	1.2	563	7223
10	Netherlands	222	0.9	227	4205

United States, Australia, Germany, Canada and Malaysia have had the most highly citation collaboration with TMU, respectively.

4. Which clusters are more important in mapping?

HistCite software can visualize the citation relationship between documents. The top 10 paper with LCS citations were selected in figure 3. It shows the highest cited papers between 2003 and 2014. In Figure, there are 10 nodes and 7 links. Further, the minimum LCS is 38 and the maximum is 103. The ID assigned to each node indicates the number of that document in the software.
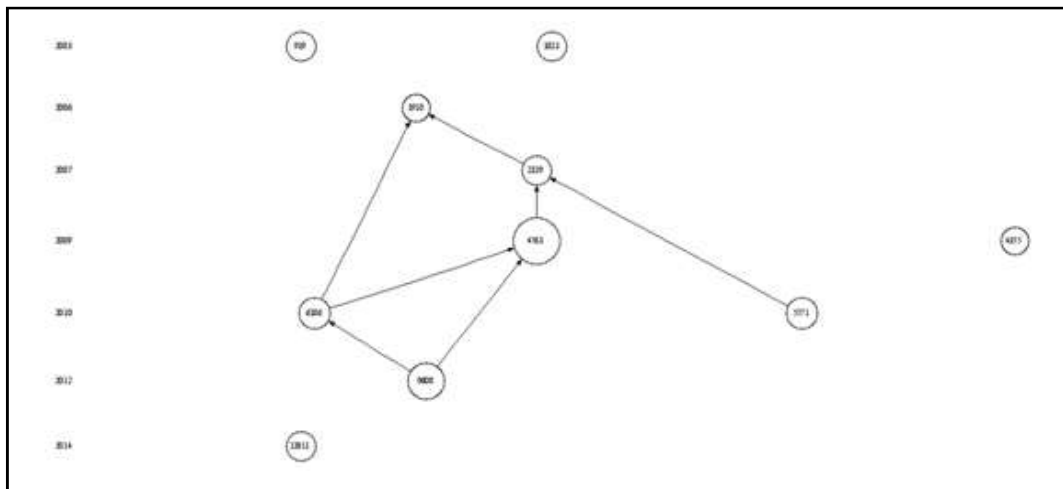

Figure 3. Mapping of important cluster

According to Figure 3 and Table3, the paper ID 4763 is the highest cited among all of the documents with 103 citations. This paper was written by Ali Morsali and Mohammad Yaser Masoomi. It was published in COORDINATION CHEMISTRY RE-VIEWS with an Impact Factor of 15.36 in 2009 and the type of this paper is Review. The second high citation scientific product is paper ID 9600 with 62 citations in 2012 that same collaboration author. The citation of other documents in Figure 3 is close to each other. The latter high cited document is in 2014. Paper ID 12011with LCS 41 published in CRYSTAL GROWTH & DESIGN with Impact Factor of 4.082. According to Table 3, except for paper ID 4355, other articles are in the field of chemistry.

Table 3. Detail node

ID	Authors/Title/ Journal/ Year	LCS	GCS
919	Mahjoub A; Morsali A Hg(II), Tl(III), Cu(I), and Pd(II) complexes with 2,2 '-diphenyl-4,4 '-bithiazole (DPBTZ), syntheses and X-ray crystal structure of [Hg(DPBTZ)(SNC)(2)]JOURNAL OF COORDINATION CHEMISTRY 56 (9): 779-7852003 JUN 15	41	53
1023.	(Morsali, A; Mahjoub, AR; Darzi, SJ; Soltanian, MJ Syntheses and characterization of mixed-anions lead(II) complexes, [Pb(phen)(2)(CH3COO)]X (X=NCS-, NO3-and ClO4-), crystal structure of [Pb(phen)(2)(CH3COO)][(ClO4)ZEITSCHRIFT FUR ANORGANISCHE UND ALLGEMEINE CHEMIE 629 (14): 2596-25992003 DEC	42	63
1910	Askarinejad, A; Morsali, ATl-1 three-dimensional coordination polymer involving tetra nuclear cubic cage nodes, [Tl-4(mu(8)-SB)(2)](n){H2SB=4-[(4-hydroxyphenyl) sulfonyl]-1-benzenolINORGANIC CHEMISTRY COMMUNICATIONS 9 (2): 143-1462006 FEB		
2329	Mahmoudi, G; Morsali, A; Hunter, AD; Zeller, MMercury(II) coordination polymers generated from 1,4-bis(2 or 3 or 4-pyridyl)-2, 3-diaza-1, 3-butadiene ligandsCRYSTENGCOMM 9 (8): 704-7142007	42	90
4355	Ghazanfari, T; et al.Sardasht-Iran Cohort Study of Chemical Warfare Victims: Design and Methods ARCHIVES OF IRANIAN MEDICINE 12 (1): 5-142009 JAN	38	65
4763	Morsali, A; Masoomi, MYStructures and properties of mercury(II) coordination polymers COORDINATION CHEMISTRY REVIEWS 253 (13-14): 1882-19052009 JUL	103	331
5571	Soltanzadeh, N; Morsali, A Sonochemical synthesis of a new nano-structures bismuth(III) supramolecular compound: New precursor for the preparation of bismuth(III) oxide nano-rods and bismuth(III) iodide nano-wiresULTRASONICS SONOCHEMISTRY 17 (1): 139-1442010 JAN	48	76
6186	Akhbari, K; Morsali, AThallium(I) supramolecular compounds: Structural and properties considerationCOORDINATION CHEMISTRY REVIEWS 254 (17-18): 1977-20062010 SEP	48	115
9600	Masoomi, MY; Morsali A Applications of metal-organic coordination polymers as precursors for preparation of nano-materials COORDINATION CHEMISTRY REVIEWS 256 (23-24): 2921-29432012 DEC	62	300
12011	Masoomi, MY; Stylianou, KC; Morsali, A; Retailleau, P; Maspoch D.Selective CO2 Capture in Metal-Organic Frameworks with Azine-Functionalized Pores Generated by Mechano synthesis CRYSTAL GROWTH & DESIGN 14 (5): 2092-20962014 MAY	41	92

5. Conclusions

Scientific development plays an important role in the development of a country and since university is one of the important scientific organizations in any country, the study and analysis of its scientific productions are of great importance. In this study, the citation analysis of scientific products of Tarbiat Modares University has been done from the beginning to the present (1981 – 2019). Tarbiat Modares is one of the top universities in Iran according to CWTS Leiden ranking. Therefore, studying the scientific products of the university can be useful. Web of Science indexed first TMU scientific production in 1988 and a total of 24004 scientific productions have indexed included in this database until 2019. The share of each faculty member in the

scientific output of the university is 33.33. This shows that faculty members have good participation in scientific productions and it is important for them to get output and publication from their scientific activities. Overall, the findings show that the university's scientific products have grown especially for the last 5 years also an upward trend of citation to scientific productions of Tarbiat Modares University until 2011 and its subsequent changes are significant. According to the findings of Mansourzadeh et al. (2020), Ahmed and Reyaee (2019) the increase in production is a general trend. 6354 internal organization collaboration with TMU shows the willingness of Iranian researchers to cooperate with this insanitation and expresses the importance of this university in Iran. Tarbiat Modares University has the most international cooperation with the United States, followed by Canada and Australia. Although the university has international cooperation with many countries, the percentage of international cooperation is low compared to the total productions. The results agree with the findings of Mansourzadeh (2020), Mokhtari et al. (2019), Dormadji et al. (2018), and Sweileh et al. (2014). From the analysis of the cluster formed in the historiographical map, it can be concluded that TMU is strong in the field of chemistry and articles have been published in prestigious journals also all articles have been co-authored, so that one of them has more than 10 authors. In general, the number of scientific productions and citations show that Tarbiat Modares University is trying to increase the quantity and quality of its scientific products. This university has been successful in attracting national cooperation, but like other Iranian institutions, it has not been able to have much international cooperation and university policies need to change in the direction of international cooperation. Given that the most important cluster in the subject is Chemistry, attention to other departments should be a priority in the university programs, and progress in their subject areas, and university officials should remove obstacles and problems to achieve the main goals of the university. TMU researchers may work with their fellow Iranian scientists across the work. They also can expand their activities with other countries' researchers especially with China, Russia, and Japan for more scientific productions.

Finally, Tarbiat Modares University needs to find out important factors for citation decreasing since 2011. Obviously does not mean this decrease includes all disciplines especially Chemistry.

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