JISTaP http://www.jistap.org
Journal of Information Science Theory and Practice
eISSN : 2287-4577 pISSN : 2287-9099

Research Paper
J Inf Sci Theory Pract 6(2): 24-35, 2018
https://doi.org/10.1633/JISTaP.2018.6.2.2

Bibliometrics in Practice in Developing Nations: A Study on the Development of Scientometrics and Bibliometrics Careers in Iran

Saeid Asadi*
Department of Information Science, Shahed University, Tehran, Iran
E-mail: s.asadi@shahed.ac.ir

Fatemeh Atash Deligani
Freelance Researcher, Isfahan, Iran
E-mail: atash.f1470@gmail.com

Behrooz Rasuli
Iranian Research Institute for Information Science and Technology, Tehran, Iran
E-mail: rasouli@students.irandoc.ac.ir

Majid Shaian Majd
AQR Library, Mashhad, Iran
E-mail: majid_shaianmajd@yahoo.com

ABSTRACT
Developing countries may pay attention to bibliometric indicators in accordance with their scientific development plans. Bibliometrics research topics and bibliometric indicators have grown dramatically in Iran since 2000 as a part of the post-war reconstruction programs. This paper aims to highlight how scientometrics may attract attention in developing countries such as Iran in response to national movements in education and science. An in-depth review on available guidelines for promotion of innovation, science, and technology in Iran was done followed by a review on previous research in this topic. Further data were gathered from Scopus and other sources. The findings show a considerable growth in research output of Iran in recent years and expansion of bibliometrics studies and jobs accordingly. Combined with research output measures, more attention was found in academia about cross-section development of science and technology in Iran. The demand in society has led to the foundation of scientometrics programs in Iranian universities as well as scientometrics departments in central libraries and research deputies in major academic institutions. The changing image of science and research in Iran has a relation with the growth of scientometrics academic and professional departments. The lessons taught from this mutual collaboration can be used in other developing nations.

Keywords: scientometrics, bibliometrics, academic programs, Iran, research and practice

Open Access

Accepted date: March 11, 2018
Received date: December 13, 2017

***Corresponding Author:** Saeid Asadi
Assistant Professor
Department of Information Science, Shahed University, Persian Gulf Freeway, Postcode 3319118651, Tehran, Iran
E-mail: s.asadi@shahed.ac.ir

1. INTRODUCTION

According to Robert Merton, the key aim of science is producing and communicating scientific knowledge. Therefore, knowledge is scientific when it is socially shared and validated (Small, 2015). This idea has resulted in the development and spread of various (new) information channels including academic journals, books, etc. Very soon, with the increase in the number of scientific publications, researchers, research administrators, and governments look for certain tools and techniques to evaluate these publications. According to Gingras (2016), this demand has its roots in the ideology of the "new public management" of the 1980s that resulted in the development of several quantitative indicators for assessing scientific knowledge.

Extensive use of advanced quantitative indicators by different sectors (i.e., researchers, research administrators, governments, etc.) at different levels (i.e., individual, institutional, national, and global) resulted in the emergence of *Bibliometrics* in the 1990s (Gingras, 2016). Pritchard (1969) defines *bibliometrics* as the "application of mathematical and statistical methods to books and other media of communication." In 1969, the term *scientometrics* was coined by Nalimov and Mulchenko (1969) as "the application of quantitative methods which are dealing with the analysis of science viewed as an information process." Today, the term scientometrics is broadly accepted and widely used to describe all activities aiming to evaluate research and research performance. However, sometimes bibliometrics and scientometrics are used interchangeably in the literature.

As the interest in scientometrics began to rise in theory and practice, specific publications and applications started to appear. Academic books, journals, and conferences were founded to address different issues in this field. In addition, major applications of scientometrics were initiated in different domains. As Andrés (2009) believes, the main areas of applications of scientometrics are methodology research, scientific disciplines, and science policy. The importance of scientometrics and its indicators had led to developing new related academic courses (or even programs) in several countries.

Whether scientometrics is only a research methodology, or a course in the library and information science (LIS) field, or a dedicated program, it is strongly connected to LIS theory and practice (Zhao, 2011). However, Zhao (2011) believes that LIS curriculums have not properly covered scientometrics courses, especially in the US and Canada. However, in recent decades, scientometrics has found an important place in science and technology (S&T) policy-making; in particular, it plays a vital role in providing quantitative indicators to measure scientific activities and evaluate the successfulness of programs and plans to improve S&T (Feller, 2011). In fact, the bibliometric indicators are meaningless unless they are used in practice (Leydesdorff, Wouters, & Bornmann, 2016).

Probably in countries with more emphasis on scientific activities and outputs, bibliometrics and its related indicators are widely used and have a significant impact on S&T policy-making. In such countries, policy-makers need quantitative indicators to compare their scientific outputs with others in a certain area. Therefore, bibliometric indicators are the main tools in evidence-based policy-making in the current science ecosystem (Marburger III, 2015). Although, sometimes individuals with different responsibilities at different levels, from a researcher to a research administrative, may abuse quantitative indicators, either intentionally or unintentionally (Gingras, 2016).

In spite of its young age, the scientometrics domain has received a significant attention in practice, in particular in some developing countries with important achievements in scientific areas. The use of bibliometric indicators in these countries is common and various research institutions or research think tanks are attempting to establish their own scientometrics units as well as indicators to monitor research activities.

As Archambault (2010) believes, scientific progress in the Middle East has been remarkable since 1980, led by Iran and Turkey, especially Iran. After the Iranian Revolution of 1978-1979 (also called the Islamic Revolution), the Cultural Revolution Movement had an important role in planning for scientific activities and progress in Iran (Khosrokhavar & Ghaneirad, 2006). Based on this radical program, the whole higher education system was suspended for about three years and the universities were opened after a deep review in the missions and visions of the scholar programs in the country. Two decades later, in the beginning of the 2000s, as *Economist* (2014) reported, Iran's scientific output had increased dramatically and the number of educated people had grown intensely. In addition, during the past three decades, Iran has created and expanded its own research infrastructure (Moed, 2016). According to major indexing databases such as Scopus and Web of Science (WoS), Iran has been among the 30 top countries with the largest number of publications in recent years. United Nations Educational, Scientific and Cultural Organization (2015) emphasized the enormous growth in Iranian publications in

Thomson Reuters' WoS.

In line with the development of attention to scientific publications and innovations, specific S&T policies started to appear in top-level documents of the country immediately after the end of the Iran-Iraq war. Iran's Comprehensive Plan for Science, Vision 2025, the Five-Year Development Plan (FYDP), and so on have played an important role in leading the S&T efforts. The idea of moving from a resource-based economy to a knowledge-based society has played a crucial role in the recent scientific developments in Iran.

The general orientation of the higher education and research policies and activities in Iran has established a potential ground for the development of bibliometrics and scientometrics studies and careers. Accordingly, under the shade of scientific development in the country, scientometrics and related indicators are being used extensively to evaluate the scientific output of Iranian universities and research institutes. This study presents an overview on how bibliometric methods and scientometric methods may receive attention in a developing country like Iran in response to rapid education and scientific progress. The current scientific progress in Iran has resulted in the development of scientometrics in practice, demands for more experts in scientometrics, and the establishment of a dedicated program related to this field in Iranian higher education. While the growth in science and expansion of bibliometrics in Iran is evident (as mentioned above), the question remains how scientometric careers and research have developed in this country in response to the whole scientific movement. The present paper aims to discuss the emergence and development of scientometrics in practice in Iran with emphasis on the major national S&T plans. In particular three research questions will be answered:

Q1 : What national documents and programs have influenced scientometrics research, training, and careers in Iran?

Q2 : What are the specifications of scientometrics research and academic programs in Iran?

Q3 : Who are the main actors and decision makers in S&T in Iran?

2. RELATED WORK

Scientometrics and its indicators play an important role in assessing and planning research in institutions and countries. It's hard to imagine evaluation and policy-making on S&T without bibliometric indicators. Therefore, using scientometrics in practice has become common around the world. For example, national assessment frameworks, such as the Research Assessment Exercise in the United Kingdom and the Excellence in Research for Australia, contain scientometrics data in their evaluations (Leiss & Gregory, 2016). In addition to assessment frameworks, national policies related to S&T, such as the Twenty-Year Vision Document (also commonly called the Vision 2025) (Madarshahi, 2012) and the National Master Plan for Science and Education (also commonly called the Comprehensive Scientific Roadmap of Iran or simply the Scientific Roadmap) (Soofi & Ghazinoory, 2013), contain bibliometric indicators for planning S&T.

Referring to the social and organizational aspects of bibliometrics studies as citizen bibliometrics, Leydesdorff et al. (2016) distinguished four types of actors in use of bibliometric indicators in practice: producers, bibliometricians, managers, and scientists. They concluded that bibliometric indicators may be used or interpreted differently by the four participating stakeholders.

The topic of scientometrics in practice has been studied previously by researchers in different domains. There are three categories of studies: The studies that have been done in academic libraries, those that have been done in other departments (i.e.,, research affairs, office of faculty recruitment, promotion and tenure office, office of the provost, or office of research evaluations) in a university or research institute, and the studies that have been done in companies that carry out scientometrics works. There are several formal or informal scientometrics reports from these three sectors.

There are various studies related to scientometrics analysis in academic libraries. Most of these studies have focused on the capability of academic libraries to play an important role in the evaluation of university research and scientific activities. For example, Ball and Tunger (2006) have focused on academic libraries' new role and business in assessing universities' research outputs. Corrall, Kennan, and Afzal (2013) and MacColl (2010) reported bibliometric activities in academic and research libraries and these libraries' role in university research assessment. In a recent study, Ryś and Chadaj (2016) have confirmed that bibliometric processes have become a vital activity of modern academic libraries. Petersohn (2014) considered scientometrics as a new and added-value service which can strengthen the jurisdiction of academic libraries. However, scientometrics activity in research and academic libraries is now a part of their programs for supporting researchers and research agendas in mother institutions (Richardson, Nolan-Brown, Loria, &

Bradbury, 2012).

However, the role of academic libraries in scientometrics is not limited to conducting evaluation only, but they also have tried to offer comprehensive courses to understand the meaning, applications, and limitations of scientometrics data. As Leiss and Gregory (2016) report, through these services, academic libraries seek to increase the visibility and impact of their activities and that of mother institutions. In additions, librarians have tried to include bibliometric indicators in institutional repositories (Gerritsma et al., 2010).

Another issue related to scientometrics in academic libraries is the knowledge and skills of academic librarians for conducting scientometrics in their libraries. For example, Malone and Burke (2016) measured the knowledge and opinions that academic librarians have of established and emerging research metrics. They concluded that librarians are more familiar with bibliometrics than altmetrics.

According to previous studies, tracking research impact (i.e., reporting citation metrics and h-index) (Corrall et al., 2013; Malone & Burke, 2016; Richardson et al., 2012; Ryś & Chadaj, 2016), finding journals' impact factors (Ryś & Chadaj, 2016), checking validity of a publication (Ryś & Chadaj, 2016), altmetrics (Malone & Burke, 2016), monitoring research performance of institutions (Åström & Hansson, 2013), and training and hosting workshops in the domain of scientometrics (Leiss & Gregory, 2016) are among main activities in academic libraries related to scientometrics.

Practically, doing scientometrics activities is not limited to academic libraries. Other departments in universities have already tried to evaluate teaching and research performance of researchers and institutions as a whole. Research affairs department, office of faculty recruitment, promotion and tenure office, office of the provost, or office of research evaluations are among departments which evaluate academic performance in an institution and do scientometrics activities. Recently, some institutions have tried to establish a dedicated scientometrics department engaged in scientometrics activities. Vienna University, for example, has established its bibliometrics department in 2009 to follow different activities including teaching, consultancy and expert analyses, the organization of events, development partnerships, projects, and scientific output (Gumpenberger, Wieland, & Gorraiz, 2012). Research Impact Measurement Service at the university of New South Wales is another example of such dedicated departments in institutions doing scientometrics activities (Drummond & Wartho, 2016). Centre for Science and Technology Studies in Leiden University is among other departments that are involved in scientometrics activities.

In addition to academic libraries and other departments in academic institutions doing scientometrics activities, the business sector has been engaged in related services in recent decades. The needs of government, educational, non-profit, or private organizations that perform scientific research attract for-profit businesses' attentions to this market. Examples of private sector corporations with bibliometrics and scientometrics products include Clarivate Analytics, Elsevier, ScienceMetrix in Montreal, and VantagePoint in Atlanta (Leydesdorff et al., 2016). Science-Metrix, for instance, is one of those companies specializing in the assessment of S&T activities (Science-Metrix, 2017b). Many organizations from the public or private sectors are among Science-Metrix Inc. clients (Science-Metrix, 2017a).

Increasing demands for hiring scientometrics professionals, either in academic libraries or in other sectors responsible for research evaluation, have made LIS departments in different universities around the globe include some courses related to scientometrics to address students' needs for carrying out research evaluation in practice. As Markscheffel (2016) reports, due to the importance of evaluating scientific research performance and the growing interests of specialists in Informetrics, it is necessary to cover related subjects in the educational curriculum. After analyzing LIS courses in German universities, he found that there are two universities which are offering a special module or course in Informetrics (Markscheffel 2016).

In another new study, Xiao, Zhao, Yin, and Yu (2016) surveyed bibliometrics courses offered by LIS programs in mainland China and they found that more than 27% of Chinese LIS programs offer bibliometrics courses both at undergraduate and graduate levels. It looks like these courses cover theoretical knowledge and practical applications of bibliometric theories, indicators, and methods (Xiao et al., 2016). Although, Zhao (2016) believes that current education of scientometrics in the LIS field is not sufficient and there is an "urgent need for bringing Bibliometrics education to the agenda of the international Bibliometrics and research evaluation communities."

In Iran, also, LIS professionals and researchers in other academic fields are trying to do scientometrics activities in different organizations. In addition, there is a standalone academic program on scientometrics at several Iranian universities. Although there are several reports from different countries around the world about scientometrics in practice, there is no documented study on the development of scientometrics in practice in Iran. In this paper, the authors aim to highlight how scientometrics has received

attention in a developing country like Iran in response to education and scientific progress.

3. METHODOLOGY

Since this research is trying to describe what is happening around scientometrics in practice in more detail, expanding the understanding of this phenomenon, and addressing the 'what' and 'how,' rather than the 'why' of scientometrics in practice, a descriptive approach was conducted. According to Stebbins (2001), descriptive research is intended to address problems that have not been studied more clearly. To describe current practices regarding scientometrics in Iran, the required data were gathered through different methods and sources. The first method was document analysis, in which the key Iranian national high-level policy documents were analyzed. National policies related to S&T, such as the Twenty-Year Vision Plan Document (also commonly called the Vision 2025), National Master Plan for Science and Education, National Policy for S&T, and the FYDPs are the national policies that have been surveyed in this study. The texts of these policies are in Persian and are available publicly. Bibliometric indicators, executive bodies and departments, and policies related to evaluation of science, technology, and innovation (STI) were surveyed in these documents. Furthermore, academic literature related to the subject were reviewed, of which most are published in Persian. For showing the trend of research on scientometrics, the Scopus database was searched to retrieve the trend and proportion of publications related to scientometrics research (the time span was 1990-2016). The total number of Iranian publications as well as the number of scientometrics research publications were extracted respectively.

In addition, the websites of the Ministry of Science, Research and Technology (MSRT)[1] and Ministry of Health and Medical Education (MOHME)[2] (two key ministries for planning, funding, and executing education and research in Iran) were searched for identifying the LIS departments offering academic programs and courses on scientometrics. These websites include all academic programs offered in Iranian public universities. According to these websites, there are three institutes offering academic programs on scientometrics. An email was sent to these three departments to gather student statistics during past years. All emails were exchanged during June and July 2017. The data were organized and reported in a table.

Eventually, an environmental scanning was used to identify those institutes which have a specialized department/unit to do scientometrics activities. The institutes' websites were the main sources for gathering data related to such departments. There are about 3,000 academic institutions in Iran. Since the results of this research are not indented to be generalized in a wider domain, a purposive sampling was used for selecting 30 comprehensive and large institutions which probably have such a department.

In addition, in this step companies and for-profit enterprises involved in scientometrics/bibliometrics services were visited through their websites to list their activities and services related to research evaluation, as well as their key customers and partners. All the gathered data through the different methods and sources were combined to provide a comprehensive image on scientometrics in Iran, which was the main objective of this study.

4. FINDINGS

Q1 : What national documents and programs have influenced scientometrics research, training, and careers in Iran?

According to the United Nations Conference on Trade and Development (2016) report on STI in Iran, the growth of scientific indicators has been considerable in this country during 2005-2015. For higher education, the number of Ph.D. students has been tripled with a massive increase in female students. In the 2012-2013 academic year, over 4.3 million students have been enrolled in tertiary institutes. Producing 1.5% of the scientific publications in the world, Iran secured its position as the sixteenth largest participant in world scientific outputs in 2015, a 19-step improvement compared to 2005. 39 S&T parks and 170 incubators have been reported in 2016 with 3,600 companies in them. The value of knowledge-based products exported by S&T parks was over 50 million dollars, compared to a reported only 0.7 million dollars in 2012.

A glance at previous documents and decisions on national science policy in Iran reveals the fact that there are different authorities for this purpose, mostly with overlapping duties. Such decisions and guidelines may be confirmed by the Supreme Leader or the President or be integrated in the parliament acts. Currently, the main science policy makers in Iran are MSRT, MOHME, the Supreme Council of Science, Research, and Technology, and the Supreme

[1] https://www.msrt.ir
[2] http://behdasht.gov.ir

Council of Cultural Revolution. These authorities have been involved in development of national scientific and higher education plans (Ghazinoory & Ghazinoori, 2006).

Oil, agriculture, and machinery were the main STI priorities in Iran during the twentieth century; however, since 1990, there has been a big investment in aerospace, nanotechnology, and biotechnology (United Nations Conference on Trade and Development, 2016). The rapid growth of science in Iran is an outcome of the Iranian authorities' attention to S&T by providing budget, infrastructure, and human resources in many research fields (Khabarabaf & Abdollahi, 2012).

Since the 1990s, several nation-wide plans have been approved for direction and expansion of research, science, and technology in Iran. Some of these schemes are planned to reach a holistic development for the country (such as the Five-Year Programs); however, there are some high-level documents exclusively developed as national science policies.

4.1. Vision 2025

The 20-Year National Vision of the Islamic Republic of Iran (Vision 2025) is a general high-level act that describes the ideal sociocultural, economic, and scientific position of Iran in the 2025 horizon. According to the document, in 2025 Iran will become a developed country with a significant role in the Southwest Asia region. Vision 2025 predicts Iran to be ranked first among the region in terms of scientific power. According to Madarshahi (2012), Vision 2025 has helped S&T in Iran to be developed in terms of the number of publications; however, the neighboring countries have benefited from the technological outcomes of investment in science and research.

4.2. FYDPs

The step-by-step scheme for socio-economic development, known as the FYDP, is the ongoing strategic program for total development in Iran. Five programs have been completed and the sixth FYDP has been announced in 2017. While FYDP economic goals are illuminated in the public sector, the scientific and innovation targets of FYDP have a direct and indirect impact on higher education, funding, and research priorities in Iran. From the fourth program (2006-2010) onward, S&T have been included in FYDP as a separate chapter for better consideration. Establishment of effective solutions for monitoring, measurement, and evaluation of science and innovation has been forced by law in the public sector. In the fifth FYDP (2010-2015), it has been predicted to reach 3% in GERD/GDP ratio but estimated as 0.86% in 2016 (United Nations Conference on Trade and Development, 2016).

4.3. Comprehensive Scientific Road Map of Iran

The National Comprehensive Scientific Roadmap (NCSR) (also published as National Master Plan for Science and Education) is by far the most exclusive roadmap for science, innovation, and technology in Iran. NCSR is the highest document for coordinating the goals, policies, and strategies in the evolution of science, technology, and innovation in Iran (Larijani et al., 2009). NCSR shows prior areas of research for national investment which include nano-, bio-, aero-, and information technologies.

Engineering, computer science, chemistry, clinical medicine, and pharmacology/toxicology/pharmaceutical sciences are among the fast-growing fields of research in Iran (Abdollahi, 2010) as most of them are explicitly encouraged in high-level science policy documents, especially in NCSR.

4.4. National Policy for S&T

In order to coordinate various programs on science, innovation, and technologies, a legal act on general S&T policies has been published in 2014 which comprises 6 main titles and 34 subtitles. The National Policy for S&T is intended to control input, process, and output of higher education and research activities in Iran in the shade of other national plans such as FYPD and NCSR (Mahdi, 2015).

Q2 : What are the specifications of scientometrics research and academic programs in Iran?

4.5. Bibliometrics Studies

Rapid rise in the number of universities and higher education students as well as special emphasis on publication of scientific content in the 1990s resulted in a considerable increase of Iranian scholar publications, especially in prestigious English journals around the world (United Nations Conference on Trade and Development, 2016). Accordingly, the number of bibliometrics studies has increased at the same time to reflect the scientific movement of the country. As Fig. 1 shows, the scientific publications of Iranian scholars has been growing during 1990-2016 with a pick of about 50 thousand Scopus-indexed documents in the last year. The publications about scientometrics or with bibliometrics approaches grew until 2012 and then dropped in the following years. The reduction in the number of bibliometrics publications can be a topic for further studies but it seems that in more recent years, less research has been conducted with traditional bibliometrics indicators

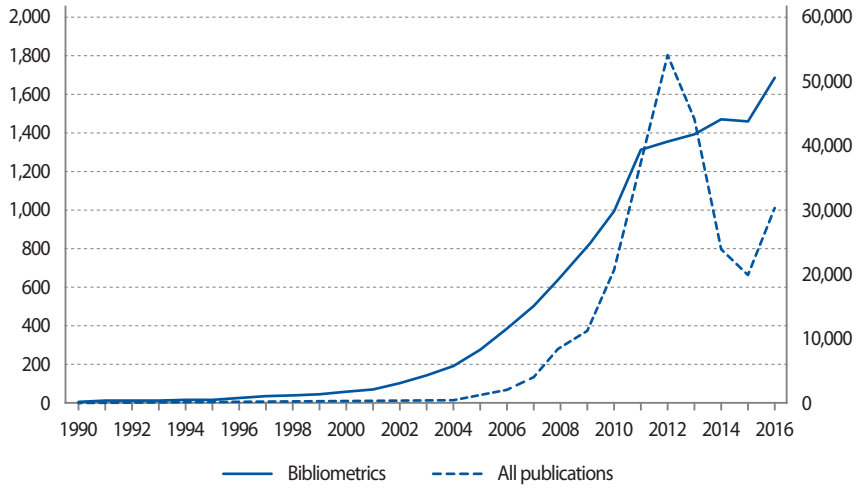

Fig. 1. Trends in publication of Iranian bibliometrics studies in Scopus.

Table 1. Courses in MSc. program on scientometrics

Title	Credits	Topics
Principals of scientometrics	2	Philosophy and social bases for scientometrics
Scientometrics databases	2	Introduction to local and int'l databases for citation analysis, ranking and meta-analysis
Bibliometrics DB architecture	2	In-depth description of data structure and flow in bibliometrics, ranking, and analytical databases
Knowledge mapping	2	Information visualization, exploration of knowledge from large corpuses of bibliometrics data
Sociology of science	2	Scientific communications, personal and institutional collaborations on science, technology and innovation
Programming and SNA SW	2	Handling bibliometrics data in XML, R and social network analysis tools

on collaboration and citation analysis. In its peak year, about 1,800 publications were indexed in Scopus by Iranian researchers about scientometrics (see the numbers on the left vertical axis on Fig. 1).

4.6. Scientometrics as an Academic Program

Modern librarianship and library education came to Iran in 1966 and caused the development of practical experiences and academic research (Horri, 2004). Today, however, the LIS field has been changed in terms of programs, courses, and subjects to cover new knowledge and skills addressing new needs and demands of society and academic communities. The digital library program, for example, is one of the new academic programs in LIS that was established recently to address new demands for developing and maintaining digital libraries (Rasuli & Naghshineh, 2014).

Scientometrics, as other several new topics, is one of the key subjects which has been included in the LIS field during recent decades. Courses on bibliometrics and scientometrics have been included in LIS postgraduate programs in Iran since 1990. Following the social attention towards the development of STI in Iran and also the difficulty of handling new tasks LIS professionals were faced with, the MSRT Committee on LIS Programs reviewed the old curricula and invited LIS academics to discuss what changes needed to be done in order to regulate the LIS profession in response to changing demands on society. Two major decisions were made in the name of the program and the development of special subfields, respectively. Concentrated in Shahed University, a group of Iranian academics with a background in scientometrics teaching and research worked on a new curriculum for postgraduate programs in scientometrics which resulted in a curriculum for Masters in Scientometrics in 2009. The first students were enrolled in 2011. Masters of Science in Scientometrics includes 32 credits and the main courses are related to theoretical and applied aspects of bibliometrics and scientometrics (Table 1). The students also need to study other courses common in all MS programs such as statistics and research methodology, and they also need to complete their theses.

Table 2. Scientometrics programs in iranian universities

University	2011	2012	2013	2014	2015	2016
Shahed university						
Male	1	2	3	1	2	9
Female	6	6	7	5	9	1
University of tehran						
Male	3	0	2	22	27	5
Female	10	0	6	88	15	4
Yazd university						
Male	-	5	5	1	2	3
Female	-	21	20	10	11	12

Table 3. Employment of the graduates

Employment status	Number	Percent
Unemployed	13	21
Employed:		
Scientometrics	7	11.3
Library and information science	15	24.2
Other	9	14.5
Ph.D. candidate	3	4.8
Unknown	15	24.2

Table 2 shows the number of enrolled students in Masters in Scientometrics in three public universities during 2011-2016. The sum of enrolled students in six years is 324; that is, 17 students for each university in a year. In total, 231 female and 93 male students were enrolled which make 71.3% and 28.7% of the population, respectively. Shahed University was involved in the development of a curriculum for M.A. in scientometrics and in 2011, both Shahed University and the University of Tehran started the program. The University of Tehran also started an online program in scientometrics in 2014. In recent years, Shiraz University and Payame Noor University have also started their program in scientometrics.

A survey was done to know about the careers that graduates of the programs have been involved in during and after doing an M.A. in scientometrics. Table 3 shows the results. Out of 62 graduates, only 11.3% had a job related to or named as scientometrics. The majority of the graduates were employed as librarians or had other office jobs. The survey also showed that among 20 graduates with a job before starting their studies in scientometrics, 17 persons had continued their previous jobs which were mostly non-scientometrics careers.

Table 4. Tasks of scientometrics departments (Atash Deligani et al., in press)

Areas	Tasks
Facilitating planning and policy making for scientific development	Identifying research trends
	Planning
	Policy making
Knowledge mapping	Mapping scientific areas
Monitoring and evaluation	Monitoring scientific development
	Preparing policy reports
	Evaluating research performance
	Comparing scientific development of an institution to others

Q3 : Who are the main actors and decision makers in S&T in Iran?

There are four distinguishable groups involved in the whole market of scientometrics in Iran: scientometrics educational and research departments and researchers, scientometrics departments and research deputies in major universities, national authorities in S&T, and the private sector.

4.7. Academic Scientometrics Departments and Researchers

Currently, a great number of Iranian information scientists are involved in conducting research in different fields of scientometrics. Other scientists, especially researchers from different fields in S&T or science policy and sociology, also publish research with a scientometrics approach. As was mentioned in the previous questions, the number of bibliometrics publications is growing gradually.

4.8. Scientometrics Offices and Research Deputies

The Commission for Accreditation and Improvement of Iranian Medical Journals was established in MOHME Deputy of Research in 1994. The commission is responsible for evaluating and accrediting Iranian biomedical journals (Aminpour & Kabiri, 2009).

Scientometrics departments have been established in Iranian medical universities and evaluative bibliometrics reports are made both in each university and in MOHME headquarters. A qualitative study by Atash Deligani, Asadi, and Nourmohammadi (in press) revealed three areas and eight key tasks of scientometrics departments in Iranian medical universities (Table 4).

Environmental scanning shows that academic libraries are also engaged in scientometrics, but they do not pay significant attention to this domain. As previous studies

indicate (Corrall et al., 2013; Malone & Burke, 2016; Richardson et al., 2012; Ryś & Chadaj, 2016; Åström & Hansson, 2013; Leiss & Gregory, 2016), scientometrics services have been implemented in many academic and research libraries in other countries. Probably, scientometric offices and research deputies carry out most of these services so that libraries do not have to provide their users with such services. However, international trends in academic and research libraries imply that these libraries must provide scientometrics services as a new business area to survive in a digital age (White, 2016).

4.9. National S&T Authorities

The governmental organizations are the main authorities for performing bibliometrics studies and publishing national reports about S&T in Iran. There are several departments and organizations in different ministries that have implicit or explicit tasks for monitoring and reporting on the state of science and research in Iran. The Vice-Presidency for Science and Technology (ISTI), the Strategic Headquarters for Application of NCSR, and the Regional Information Center for Science and Technology (RICeST) are probably the highest organizations with formal duties in monitoring, planning, and reporting on progress in S&T in Iran. Other authorities such as MSRT, MOHME, Iranian Research Institute for Information Science and Technology, and the National Research Institute for Science Policy are also involved in different programs related to S&T. National reports on higher education are published annually by the Institute for Research & Planning in Higher Education (IRPHE) and the Statistical Center of Iran.

4.10. Private Business Sector

Exir,[3] established in 2011 in Tehran, Arshit,[4] established in 2013 in Mashhad, and Negasht[5] are three Iranian enterprises which are involved in scientometrics activities and services. Private sector activities on bibliometrics are yet to be developed in Iran because the majority of large research and higher education institutes are either funded by the government or have no desire to invest in bibliometrics projects, especially if they have to deal with enterprises in the business sector. However, the main customers of such enterprises are still universities and research centers and they are mainly engaged in developing technical tools and solutions. They have already developed platforms to monitor institutions' academic performance in indexing databases, including WOS, Scopus, and Google Scholar. Through these platforms, institutions are able to monitor the performance of the institutions as a whole and the performance of affiliated various faculties, departments, or even researchers. Academic institutes from public and private sectors are using such tools for about two-three years. The platforms include some basic metrics such as the number of publications, the number of citations, H-index, and citation per paper.

[3] https://exir.co/
[4] http://arsheet.ir/
[5] http://negasht.net/

5. DISCUSSION AND CONCLUSION

Bibliometric indicators and methods were originally developed in the field of LIS in order to support the decision made by librarians on what to be done with their collections. However, more recent developments in science, research, and innovation programs have resulted in advanced scientometrics studies, databases, and reports. Socially, bibliometric indicators have been used by research institutes, private bibliometrics databases, and S&T policy-making agents. According to Leydesdorff et al. (2016), the producers of bibliometrics data, bibliometricians, managers, and scientists are the major players in social and citizen applications of scientometrics and bibliometric indicators. This can be interpreted in two ways: first, the bibliometrics methods and rules have found their own ways to be used in practice in many fields; and second, social demand for bibliometrics research and reports is increasing, especially among scientists in research organizations. While these observations may be acceptable for developed countries, the motivations for attention to bibliometric indicators may vary in developing countries based on their plans for development in science, research, and innovation.

This study reported on the situation of bibliometrics and scientometrics studies and applications in Iran. As a developing country with a large young population and high rate of university students, bibliometric indicators and studies are developing to support national plans for developments, especially in S&T areas. In summary, the findings of this research show that:

Major historical and social events such as the Islamic revolution in 1979 and post-war plans for the reconstruction of the country since the 1990s have had great influence on the promotion of science and higher education in Iran.

The scientific outputs of Iran have dramatically increased in recent years and this is referred to a sign of scientific development of the country according to national plans for

science, research, and innovation development.

As a field of research, bibliometrics has received attention directly or indirectly in Iran based on the contents of the national documents on science and research policy.

The Iranian LIS community have responded to a nationwide demand for bibliometric indicators by performing advanced studies on national and international outcomes in the country.

National plans for promotion of science, innovation, and technology in Iran have included bibliometric indicators such as the number of publications indexed in well-known citation databases, number of papers in highly cited journals, and so on.

Scientometrics is taught in Iranian universities as a postgraduate degree in relation to LIS. The courses include both theoretical and applied aspects of bibliometric indicators, science policy, and scholarly communications.

Regarding the targets of national S&T plans in Iran and similar nations, the effects of political decisions and events must be considered. For example, international political conflicts, especially sanctions enforced by the US government, have impacted S&T in Iran resulting in isolated research activities with limited access to research materials and tools (Pickett, Leggett, & Chu, 2014). From a bibliometrics perspective, the outcome of this conflict has led to less attendance of Iranian academics in international conferences and a reduction in the number of journal and conference papers co-authored by both Iranians and researchers from other countries. Hence, the government is trying to promote international publications by including some guidelines in academic activities such as requirements for graduation at the Ph.D. level. In all cases, bibliometricians and information scientist are consulted by authorities in order to improve the position of the country in global rankings in S&T.

The experience of the country in the development of academic degrees in scientometrics may be unique or at least different from other countries where bibliometrics courses are included in information science or other similar fields of study. The information science departments in a few Iranian universities now have masters programs in scientometrics, which is basically different from information science academic programs. People who have previously graduated with a degree in scientometrics have been partially successful so as to be employed in proper positions. In spite of the growing number of bibliometrics departments in major universities and research institutes in Iran, there is still a gap in appreciating scientometrics as a special field of study and an academic field. Many positions in those departments are occupied by employees from various fields such as LIS, management, engineering, and so on. Applicants holding a degree in scientometrics have shown less success in being recruited in the mentioned departments and there is a debate whether bibliometrics is eligible to be an academic degree or if is better taught as a part of other programs such as LIS or science and research policy.

In addition to four groups of participants in bibliometrics, i.e., producers, bibliometricians, managers, and scientists as described by Leydesdorff et al. (2016), the findings of this study show that government is a key player in the social application of bibliometric indicators in Iran and this is probably true in similar developing nations where high-level programs for development are planned, performed, and evaluated by governments. As an example, while major global citation and ranking reports of journals, conferences, and universities are published by private sector institutes, the main citation and bibliometric reports in Iran are published by governmental organizations such as ISTI, RICeST, and IRPHE. All major research programs in public universities are planned in harmony with high-level documents, especially the NCSR.

Social application of bibliometric indicators and approaches can open a new horizon to the services that information scientists can offer to society. The concept of citizen bibliometrics (Leydesdorff et al., 2016) and similar notions draw a framework to expand bibliometrics methods from information science to a wider range of applications in academic and enterprise environments. However, the model of socialization of bibliometrics in developing countries such as Iran may be different from that in developed nations. The emphasis of governments on research outputs especially in global indices including Scopus and WoS, as well as their attention to achieving their national development plans, are two major factors that increase the demand for scientometrics and bibliometrics professionals and their services in developing countries.

According to the findings, in spite of the development of scientometrics departments in universities, governmental bodies, and private companies, still there is a shortcoming in evaluating STI in the nation. Probably, managers and staff of these departments are from other fields and are not completely familiar with scientometrics. However, to support this claim, an academic study to investigate their skills and abilities is required. Academic libraries can play a significant role in furthering scientometrics practices in Iran, but it seems they are not interested in doing so.

The current study opens a window to scientometrics in practice in a developing nation. Through constant

monitoring and comparing trends in scientometrics with other countries, it is possible to lead scientometrics practices into a right way. However, there are many examples of misunderstanding and abusing scientometrics and different bibliometric indicators in this domain in the country. Abusing impact factor to evaluate publication in different fields, establishing h-index as an absolute index in tenure regulations regardless of research domains, considering the results of global university rankings systems without certain knowledge about them, and developing local and inappropriate bibliometric indicators to evaluate researchers and institutions are a few examples of abusive scientometrics in practice. Furthermore, this study should help STI policy-makers in Iran, as well as scholars in the field, to have a comprehensive view of scientometrics in practice. They will be familiar with key scientometrics bodies and activities.

Further studies in other developing countries, as well as portraying the social aspects of bibliometrics in developed societies, can show how similar or different those societies are in terms of social implication of bibliometric indicators and scientometrics studies. In additions, content analysis of different policies and plans in order to clarify bibliometric indicators and the use of them could be a subject of future research. Furthermore, there is a lack of knowledge of scientometrics practices in academic and research libraries in Iran, which can be studied in other research with empirical evidence.

REFERENCES

Abdollahi, M. (2010). Perspectives of science in Iran. *Iranian Journal of Pharmaceutical Research,* 9(3), 207-208.

Aminpour, F., & Kabiri, P. (2009). Science production in Iran: The scenario of Iranian medical journals. *Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences,* 14(5), 313-322.

Andrés, A. (2009). *Measuring academic research: How to undertake a bibliometric study*. Oxford: Elsevier/ Chandos.

Archambault, E. (2010). *Thirty years in science: Secular movements in knowledge creation*. Retrieved May 1, 2018 from http://www.science-metrix.com/en/30years-Paper.pdf.

Åström, F., & Hansson, J. (2013). How implementation of bibliometric practice affects the role of academic libraries. *Journal of Librarianship and Information Science,* 45(4), 316-322.

Atash Deligani, F., Asadi, S., & Nourmohammadi, H. A. (in press). Identification and classification of the aims, audiences and challenges of scientometrics departments in Iranian medical universities. *Journal of Scientometrics.* Retrieved May 1, 2018 from http://rsci.shahed.ac.ir/article_503_en.html.

Ball, R., & Tunger, D. (2006). Bibliometric analysis: A new business area for information professionals in libraries? Support for scientific research by perception and trend analysis. *Scientometrics,* 66(3), 561-577.

Corrall, S., Kennan, M. A., & Afzal, W. (2013). Bibliometrics and research data management services: Emerging trends in library support for research. *Library Trends*, 61(3), 636-674.

Drummond, R., & Wartho, R. (2016). RIMS: The research impact measurement service at the University Of New South Wales. *Australian Academic & Research Libraries,* 47(4), 270-281.

Economist (2014, October 30). The revolution is over [special report]. *Economist*. Retrieved May 1, 2018 from https://www.economist.com/special-report/2014/10/30/the-revolution-is-over.

Feller, I. (2011). Science of science and innovation policy: The emerging community of practice. In K. H. Fealing, J. Lane, J. H. Marburger, & S. Shipp (Eds.), *The science of science policy: A handbook* (pp. 131-155). Stanford: University Press.

Gerritsma, W., Loman, M., Renkema, J., van der Togt, P., Veerman, I., & van Veller, M. (2010). Bibliometrics in the library, putting science into practice. In *Proceedings of the 11th International Conference on Science and Technology Indicators: Creating Value for Users* (pp. 98-99). Leiden, 9-11 September 2010.

Ghazinoory, S., & Ghazinoori, S. (2006). Developing Iran's government strategies for strengthening the national system of innovation using SWOT analysis. *Science and Public Policy,* 33(7), 529-540.

Gingras, Y. (2016). *Bibliometrics and research evaluation: Uses and abuses*. Cambridge: MIT Press.

Gumpenberger, C., Wieland, M., & Gorraiz, J. (2012). Bibliometric practices and activities at the University of Vienna. *Library Management,* 33(3), 174-183.

Horri, A. (2004). Bibliometric overview of library and information science research productivity in Iran. *Journal of Education for Library and Information Science,* 45(1), 15-25.

Khabarabaf, S., & Abdollahi, M. (2012). Science growth in Iran over the past 35 years. *Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences,* 17(3), 275.

Khosrokhavar, F., & Ghaneirad, M. A. (2006). Iran's new scientific community. *Iranian Studies,* 39(2), 253-267.

Larijani, B., Majdzadeh, R., Delavari, A., Rajabi, F., Khatibzadeh, S., Esmailzadeh, H., & Lankarani, K. B. (2009). Iran's health innovation and science development plan by 2025. *Iranian Journal of Public Health,* 38(1), 13-16.

Leiss, C., & Gregory, K. (2016). Visibility and impact of research: Bibliometric services for university management and academic staff. In *Proceedings of the International Association of University Libraries 2016 Conference* (pp. 3). Dusseldorf: International Association of University Libraries.

Leydesdorff, L., Wouters, P., & Bornmann, L. (2016). Professional and citizen bibliometrics: Complementarities and ambivalences in the development and use of indicators—a state-of-the-art report. *Scientometrics,* 109(3), 2129-2150.

MacColl, J. (2010). Library roles in university research assessment. *Liber Quarterly,* 20(2).

Madarshahi, M. S. (2012). Iran's "Twenty-Year Vision Document": An outlook on science and technology. *Iranian Studies,* 45(5), 619-643.

Mahdi, R. (2015). Evaluation of national science and technology policies in Iran. *Procedia-Social and Behavioral Sciences,* 195, 210-219.

Malone, T., & Burke, S. (2016). Academic librarians' knowledge of bibliometrics and altmetrics. *Evidence Based Library and Information Practice,* 11(3), 34-49.

Marburger III, J. H. (2015). *Science policy up close*. Cambridge: Harvard University Press.

Markscheffel, B. (2016). Education in informetrics: An overview for Germany and an approach in an information retrieval context. In P. Jain, J. C. Lamirel, & P. Babbar (Eds.), *Trends in bibliometrics and scientometrics studies* (pp. 59-69). London: Athena Academics.

Moed, H. F. (2016). Iran's scientific dominance and the emergence of South-East Asian countries as scientific collaborators in the Persian Gulf Region. *Scientometrics,* 108(1), 305-314.

Nalimov, V. V., & Mulchenko, Z. M. (1969). *Scientometrics*. Moscow: Nauca.

Petersohn, S. (2014). Bibliometric services in research evaluation: A new task area strengthening the jurisdiction of academic librarians. In *Proceedings of the International Association of University Libraries 2014 Conference*. Dusseldorf: International Association of University Libraries.

Pickett, W. E., Leggett, A. J., & Chu, P. C. (2014). Science diplomacy in Iran. *Nature Physics,* 10(7), 465.

Pritchard, A. (1969). Statistical bibliography or bibliometrics? *Journal of Documentation,* 25(4), 348-349.

Rasuli, B., & Naghshineh, N. (2014). Digital library education in Iran: Perspectives of library & information science educators and academic librarians. *Malaysian Journal of Library & Information Science,* 19(3), 51-65.

Richardson, J., Nolan-Brown, T., Loria, P., & Bradbury, S. (2012). Library research support in Queensland: A survey. *Australian Academic & Research Libraries,* 43(4), 258-277.

Ryś, D., & Chadaj, A. (2016). Bibliometrics and academic staff assessment in Polish university libraries-current trends. *Liber Quarterly,* 26(3), 181-199.

Science-Metrix (2017a). *Our clients*. Retrieved May 1, 2018 from http://www.science-metrix.com/en/client-services/our-clients.

Science-Metrix (2017b). *Overview*. Retrieved May 1, 2018 from http://www.science-metrix.com/en/client-services/overview.

Small, H. (2015). Referencing as cooperation or competition. In C. R. Sugimoto (Ed.), *Theories of informetrics and scholarly communication* (pp. 49-71). Berlin: Walter de Gruyter.

Soofi, A. S., & Ghazinoory, S. (2013). *Science and innovations in Iran: Development, progress, and challenges*. New York: Palgrave Macmillan.

Stebbins, R. A. (2001). *Exploratory research in the social sciences*. Thousand Oaks, CA: Sage.

United Nations Conference on Trade and Development (2016). *The Islamic Republic of Iran: Science, technology and innovation policy review*. Geneva: United Nations Conference on Trade and Development.

United Nations Educational, Scientific and Cultural Organization (2015). *UNESCO science report: Towards 2030*. Luxembourg: United Nations Educational, Scientific and Cultural Organization.

White, H. D. (2016). Bibliometrics, librarians, and bibliograms. *Education for Information*, 32(2), 125-148.

Xiao, M., Zhao, D., Yin, Y., & Yu, J. (2016). Bibliometrics course offerings by library and information science programs in China. *Education for Information,* 32(2), 195-209.

Zhao, D. (2011). Bibliometrics and LIS education: How do they fit together? *Proceedings of the Association for Information Science and Technology,* 48(1), 1-4.

Zhao, D. (2016). Bibliometrics education. *Education for Information,* 32(2), 121-124.