The Effective Trends and Driving Forces in The Future of Research Performance Evaluation Based on Scoping Review and Interview

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Abstract

In this qualitative study, the trends analysis based on scoping review and interview used to identify the driving forces affecting the future of research performance evaluation. MAXQDA version 10 and thematic analysis were used to analyze the interviews and documents. The social trends included the research social impact, the social development of society, increasing researchers’ awareness of the research evaluation importance, lack of research culture in society, the gender gap in society, and employing human resources. The technological trends were the development of information and communication technology, scientometric indicators, and open science. The economic trends and driving forces included not emphasize on the oil economy merely, research grant, economic evaluation of research, and research budget. The environmental trends and driving forces were increased emphasis on green information, using the green environment components in research institutes, and a favorable organizational environment. The political trends and driving factors included scientific diplomacy, a country's domestic policy, war and political sanctions, research performance evaluation system, optimal research policy, and increased research collaboration. The results showed that various social, technological, economic, environmental, and political factors and indicators must be included and normalized in the national and international research performance evaluation system.

Introduction

Performance is a multidimensional concept and evaluated by different criteria (Ford & Schellenberg, 1982). The performance evaluation is always controversial, so defining and assessing research performance is not an exception (Froghi et al., 2012; Moed, 2002). The construct of research performance subdivides into two components including the research activity and performance. The outcome of research activity made visibly and passed to others. On the other hand, the research performance defined as the anticipated research outcomes of researchers in concrete products (e.g., publications), academic standing, personal understanding, and benefits to the community (Bazeley, 2010). The research performance evaluation plays a substantial role in scientific development, providing benchmarks for recruitment, promotion, funding, and rewards. Various bibliometric indicators have successively proposed to make scientific and reasonable research evaluation (Agarwal A et al., 2016).

Many researchers suggested that measures of research performance may include bibliometric measures, awards, academy memberships, research funding, activity measures, royalty income, mid-term impact measures, long-term measures, and other metrics of competitiveness (García & Sanz-Menéndez, 2005; Hicks, Wouters, Waltman, De Rijcke, & Rafols, 2015; Potì & Reale, 2007; Roessner, 2002). The research performance evaluation is doing based on bibliometric indicators that may include both quantitative and qualitative metrics and measure the performance of a journal, researcher, or research group. Quantity may include the number of publications and citations, while quality includes the journal's impact factor (IF), immediacy index, H-index, etc (Durieux & Gevenois, 2010). The bibliometric indicators do not reflect the scientific quality and only provide useful supplementary tools for evaluating academics research (Kurmis, 2003; Milesi, Brown, Hawkley, Dropkin, & Schneider, 2014; Moed, 2002; Smith, 2012). These
indicators have many strengths and weaknesses and are not complete. Many scholars strongly advocate for non-bibliometric measures (García & Sanz-Menéndez, 2005; Hicks et al., 2015; Roessner, 2002). The bibliometric indicators are always used because they're easier to use, more accessible (Bordons, Fernández, & Gómez, 2002), and defended by numerous scholars (Bornmann & Williams, 2017; Durieux & Gevenois, 2010; Garfield, 1999, 2001; Moed, 2002).

In addition to scientometrics indicators, other factors such as the science and technology progress for sustainable social development, allocating the human resources, infrastructure and budget (Kharabaf S & M, 2012), the sufficient Gross Domestic Product (GDP) for research (M, 2010), and the international research collaboration networks (Wuchty S, Jones BF, & B, 2007) are the essential factors that can be effective in the research performance evaluation. Besides, the world is evolving, the information and communication technology, economic resources, environment elements all are constantly changing and new challenges and trends are emerging. But what exact trends and drivers affect the future of research performance evaluation has not been studied in detail.

On the other hand, analyzing the scientific performance of institutions, universities, and researchers has become an inevitable and essential priority (Franceschini F, 2011). The result of bibliometrics and scientometrics analysis can be used for policymaking on research funding and promotion. Moreover, the results could prove useful for ranking universities and institutions (Durieux & Gevenois, 2010). So, the proper research policy-making requires identifying the emerging trends and factors influencing the research and the research performance evaluation. However, the most important concern in this field is to identify effective trends and driving forces that can affect the future of research performance evaluation. In other words, the process of research performance evaluation will change in the future under the influence of which trends and driving forces is the most important issue that must be answered. This research seeks to answer these questions that determine the effective trends and driving forces in the future of research performance evaluation.

**Methods**

In this qualitative study, the trend analysis used to identify the driving forces affecting the future of research performance evaluation. These forces have an indirect effect on the research performance evaluation in the long run. The scoping review of documents and the interview with experts done to analyze these trends. The qualitative trends analysis emphasizes social, technological, economic, environmental, and political driving forces and trends based on STEEP. The scoping review was conducted according to the “Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews” (PRISMA-ScR) guideline (Tricco et al., 2018). The research community in this stage included all related gray literature and articles in Iranian databases, Magiran, Iranian Research Institute for Information Science and Technology (IranDoc), Scientific Information Database, Barakat Knowledge Network System as well as available international databases such as Web of Science, Scopus, Pubmed, Embase, Proquest databases, Library Information Technology Association (LITA), Library, Information Science & Technology Abstracts (LISTA), Springer databases, Institute of Electrical
and Electronics Engineers (IEEE) along with the Google Scholar search engine at January 2020. Inclusion criteria for the scoping review were:

- Gray literature and articles that study social, technological, economic, environmental, political and macro trends or driving forces related to the research performance evaluation;
- Published in Persian or English languages;
- Available full-text of the document.

Exclusion criteria for this review were:

- Descriptive scientometrics and bibliometric studies without emphasizing these trends;
- Letter to editors, reports, commentary, and notes.
- Studies in other languages than Persian or English;
- Lack of access to the full text of the document.

The data collection tool for the scoping review was a data extraction form. The research team designed this form in four parts. The first part included the assigning code to each article with the abbreviation D plus the number. For example, D1 means that it's the first full-text document. The bibliographic details for each document in the second part included the title, the first author, the publication year, the place of study, and the research method. The third and fourth parts included the trends and the main results related to the impact of these trends and drivers on the research performance evaluation respectively. The sample search strategy on the Web of Science database is as follows:

\[(TS=("research performance") OR TS=("research performance assessment") OR TS=("research performance evaluation") OR TS=("research performance measurement") OR TS=("research performance ranking") OR TS=("research evaluati") OR TS=("research assessment") OR TS=("research measure") OR TS=("research evaluation system") OR TS=("research indicator") OR TS=("research metric") AND (TS=(scientometric) OR TS=(bibliometric) OR TS=(informetric)) AND (TS=("social trend") OR TS=("economical trend") OR TS=("political trend") OR TS=("technological trend") OR TS=("environmental trend") OR TS=("trend") OR TS=("driving force") OR TS=("determinant") OR TS=("factor"))\]

The search strategy was confirmed and replicated by two other members of the research team. Then, the search results were downloaded to EndNote Edition 8. After deleting the duplicate items, the two researchers screened the title and abstract of the documents based on the inclusion and exclusion criteria. The two researchers resolved the conflict through negotiations. Otherwise, a third researcher decided to include an article in the study or not. The quality assessment of studies wasn’t performed due to the type of review that was scoping review. The researchers get the full-text of documents by searching in the databases, search engines, social networks like ResearchGate, and sending an e-mail to authors.

In the interview phase based on the purposeful and heterogeneous sampling, 11 experts out of 20 ones entered to the study. Table 1 shows the number and characteristics of participants in the study. Inclusion
criteria were:

- At least two-years work experience in the library and information science, medical library and information science, scientometrics, and the medical or non-medical research performance evaluation;
- Availability and responsiveness;
- Having the scientific outputs published in the field of scientometrics and medical or non-medical research performance evaluation, and the educational experience in this regard;

| Level of stakeholders | Duty | Number of participants |
|-----------------------|------|------------------------|
| The research performance evaluation management and policy-making at the national level | Ministry of Health and Medical Education | 2 |
|                       | Ministry of Science, Research, and Technology | 4 |
| Level of colleagues (faculty members of universities, researchers) | Vice-Chancellor for Research and Technology in medical sciences university | 1 |
|                       | faculty member | 1 |
|                       | Scientometric researcher | 1 |
| Experts              | Scientometric expert in medical sciences universities | 2 |

Table 1
number and characteristics of participants in the interview

In this section, the mobile phone voice recorder (the voice recording program installed on the mobile phone for telephone-based interviews) and the interview guideline were used. The interview guide was designed based on the literature review and the research objectives for the semi-structured interviews. The research team deleted the shortcomings of this guideline. The guideline consisted of 19 questions and four sections of personal and work experience information, existing challenges of the research performance evaluation, trend analysis, and intellectual models. Six experts were interviewed face-to-face, two by telephone, and two by WhatsApp (done by N.S in January to March 2020).

The time allocated for interviews ranged from 13 to 51 minutes. After recording each interview and listening to them, one of the researchers wrote them exactly in the Microsoft Word 2016 edition. The interviewing continued until the data was saturated. The participants that didn't like to continue the interview at any stage, were excluded from the study. The interviews were coded with the letter "M" and the number to maintain the confidentiality of the data. MAXQDA version 10 and thematic analysis were used to analyze the interviews. So, the social, technological, economic, ecological, and political trends
related to the research performance evaluation based on the scoping review and interviews were extracted and re-categorized based on semantic similarity and thematic overlap. We have reported the main and sub-categories of these trends and driving forces in the results.

**Results**

In this section, the results of the environmental scanning of trends and its relationship with the research performance evaluation based on the scoping review and the intellectual models of experts are presented. In the scoping review step, related keywords were combined into a search strategy for each of the nine English databases and four Iranian databases, and the Google scholar. Figure 1 shows the process of selecting documents for the scoping review. The descriptive specifications of each document are reported in Appendix 1 (44 documents). The titles and abstracts of these documents were screened and approved by two researchers. Based on the type of review, the quality assessment was not performed.

In the interview analysis, the trends and driving forces based on initial coding and merging the similar codes were determined, and the unrelated codes dropped. Finally, 248 codes were assigned in the form of nine main categories, 64 subcategories, and 47 dimensions (Appendix 2). The trends included social, technological, economic, environmental, and political ones. The following tables show the results of trend analysis based on the scoping review and interview (Tables 2 to 6)

**A. Social trends and driving forces**

In this section, the social trends and driving forces affecting the future of research performance evaluation, as well as the evidence obtained from the interviews and the scoping review are presented (Table 2).
| Main category | Sub-category | Dimension | Evidence of the interviews and the scoping review |
|---------------|--------------|-----------|--------------------------------------------------|
| Social trends and driving forces | The social development of a society | - | “The progressive society that is advanced and has met the basic needs of its people. Democracy and religious democracy prevail in that society. Human and transcendent human values are important. People are looking for research. Being a university student is important and sanctity. The university has a scientific authority, and in this regard, research can progress day by day. And to answer your question, research performance evaluation and better indicators will be produced, and communities will pay much more attention to this issue.” M11 |
| increasing researchers’ awareness of the research evaluation importance | - | “About ten years ago, there were very few indicators and limited indicators for research performance evaluation in the world and even in our country. Very few persons were familiar with these indicators, but now I see that the level of awareness of research performance and research indicators has grown very well and very significantly.” M11 |
| Lack of research culture in society | - | “One of the professors said that the problem here is that whatever we produce, whatever our measure is, whatever our research is when society doesn’t want it, neither proper research nor proper evaluation is produced.” M1 |
| Main category | Sub-category | Dimension                                                                                                                                                                                                 | Evidence of the interviews and the scoping review                                                                                                                                                                                                 |
|---------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The gender gap in society | Global, social, organizational, and personal factors | "Well, the women encountered the glass ceiling in our society or all countries. It will create a limit for those who want to have a role." M 2                                                                 | Women’s research performance in the early years of employment is low. Women are less inclined to cooperate internationally and earn international grants. There is a gender difference in organizations in terms of funding and research performance (Abramo & D’Angelo, 2015) |
|               |              | The productivity of both men and women has increased based on scientific rankings, and there was no difference between them. Women are less productive in the middle of their careers than men, and women will promote later. Women produce fewer but higher quality articles. In the future, a more balanced distribution of women in each academic rank will occur (Mauleón, Bordons, & Oppenheim, 2008). | Despite the control of personal and organizational factors, there is a lot of difference between male and female researchers in terms of publication in journals with high impact. Gender differences in research productivity decrease over time. Controlling personal and organizational factors reduces the impact of gender on the research performance (Mayer & Rathmann, 2018). |

Table 2. Social trends and driving forces affecting the future of research performance evaluation
| Main category                        | Sub-category                              | Dimension                                      | Evidence based on the interviews and the scoping review |
|-------------------------------------|-------------------------------------------|------------------------------------------------|-------------------------------------------------------|
| Social trends and driving forces    | Research social impact                    | Increasing emphasis on the research social impact | “Our research should be an applied one and its consequences are seen in the community. Perhaps another effective trend is research application in education, problem-solving...” M 7 |
|                                     |                                          | Increased society demand-based research         | “It should be noted that we must see the needs of society because our trends have changed. Today, for example, there is Covid-19, It is not only related to the experts, the community, the people in social networks, this and that are all in this field.” M 8 |
|                                     |                                          | Lack of social impact culture in organizations  | “Perhaps many times, the researchers are actually under pressure because of their promotion and rising their university position. They are all doing based on those indicators. My purpose may not to present my research everywhere and actually have a social impact, or that the necessary context or culture has not yet been created to translate knowledge. That is to make it comprehensible to the public. Well, because my institution policy is not knowledge translation.” M 2 |
| Human resources employment          | Personal factors                          | Older staff publish fewer articles. The increase in doctoral and postdoctoral students compensates for the aging of staff (Kyvik & Olsen, 2008). |
|                                     | Organizational factors                    | Some factors such as changing the staff selection process, age structure, educational load, relationship between education and research, and research management programs affect research performance (Soo, 2008). |

B. Technological trends and driving forces

In this section, the technological trends and driving forces affecting the future of research performance evaluation, as well as the evidence obtained from the interviews and the scoping review are presented (Table 3).
| Main category                                      | Sub-category                                      | Dimension                                      | Evidences based on the interviews and the scoping review |
|---------------------------------------------------|---------------------------------------------------|------------------------------------------------|----------------------------------------------------------|
| Technological trends and driving forces           | Information and communication technology          | Development of information technology          | “We all know, the better future for humanity is by technology. With the development of technology, especially in these areas, I think it can be the development of information technology. These technologies in the interdisciplinary fields will certainly have an impact on the research performance evaluation.” M 8 |
|                                                   |                                                   |                                                | Creating a decision support system based on the research performed within the organization helps in allocating research budget and strategic planning and provides the correct ranking at the individual, research group, and educational groups (Abramo & D'Angelo, 2011). |
| Lack of technology in society (university)        |                                                   |                                                | “The technology depends on our economy. Sometimes, we have good ideas, but we don't have a suitable technological infrastructure. Our ideas are very fashionable for our country because I say we don't have good condition. When the world is doing well along with the acceleration of technology, it will be time-consuming if we want to reach them quickly” M 2 |
| Increased documentation                           |                                                   |                                                | “In my opinion, the documentation and control of documents will be done more, and we will see them day by day…” M 6 |
| Lack of comprehensive research performance evaluation system |                                                   |                                                | “We now don't have a system that we can take data, for example, comparing the universities in a specific field” M 6 |
| Increased use of big data                         |                                                   |                                                | “In the future, in my opinion, these tools that are related to data analysis, mega-trends, mega-big data, etc., they'll be developed. Now, our goal is that the research evaluation should be done based on data mining and big data.” M 4 |
| Creating national scientific social networks      |                                                   |                                                | “Let's move on to the application of science and use new software in new electronic services. Well, it helps to measure one dimension that we don't just measure the global impact alone. Measure the local impact as well. Well, this is a good step. So, we can convey the results of the research to the people better.” M 7 |
| Main category | Sub-category | Dimension | Evidences based on the interviews and the scoping review |
|---------------|--------------|-----------|--------------------------------------------------------|
|               |              | Increasing presence on international social networks | “Now you need to be able to find someone in a scientific and virtual space. I mean, if you can't find a person, something has gone wrong. You should be able to find him on several social networks. Because it is not possible, for example, a person is a reviewer of international articles, but he's not a member of Publons...” M 6 |

Table 3. Technological trends and driving forces affecting the future of research performance evaluation
| Main category                              | Sub-category                        | Dimension                                                                 | Evidences based on the interviews and the scoping review                                                                                                                                                                                                 |
|-------------------------------------------|-------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Technological trends and driving forces   | Information and communication technology | Increased the connection between social networks and citation databases | “In my opinion, the altmetric indicators which now is extracted somewhat in Scopus! But beyond that, it will be extracted…” M 6                                                                                                                                 |
|                                           |                                     | Increased use of data mining                                              | “The evaluation systems seem to be becoming more professional in data analyzing, you know the analytical data, in fact, more advanced results, which may have extracted by data mining or machine learning.” M 5                                                                                   |
|                                           |                                     | Increased use of artificial intelligence                                  | “In the future, I think it will go toward artificial intelligence. One of the things that can be done manually now, for example, statistical analysis can be done using a computer and artificial intelligence. Tools related to science mapping and information illustration are getting better” M 4 |
| Scientometric indicators                  | Not using of problem-oriented metrics |                                                                              | “Therefore, it is essential to note that social trends are so important. The indicators that exist in this area should be extracted and used anyway.” M 8                                                                                                                                 |
|                                           | Normalization of scientometric indicators |                                                                              | “The indicators need to be normalized. That happens, I think it's a good thing.” M 9                                                                                                                                                                   |
|                                           | Lack of proper use of evaluation indicators |                                                                              | “Some organizations may prevent to use of some of the indicators that should be applied in policy-making and research evaluation. These organizations because the benefits of top managers and other persons don't use the proper or some qualitative indicators in the research evaluation” M 10 |
|                                           | Creating new scientometric indicators |                                                                              | Too much emphasis on quantitative indicators such as the number of scientific productions and citations can affect the strategy of publishing of the young researchers (Cheung, 2008; Sile & Vanderstraeten, 2019). |
|                                          |                                     | The digitalization of scientific communication has led to the emergence of new research performance indicators in altmetrics, webometrics, scientific mapping, and authors’ network analysis (Moed, 2018). |                                                                                                                                                                                                                                                      |
| Main category | Sub-category | Dimension | Evidences based on the interviews and the scoping review |
|---------------|--------------|-----------|-------------------------------------------------------|
|               | Increasing the use of technology-oriented indicators | “In addition to the articles that are currently receiving a lot of attention, we should also evaluate and review other types of research studies and the growth and development of countries. For example, in the field of patents, I can point out that the issue of patentometrics has been discussed for a long time, but it has not yet reached a deserved position.” M 11 |
|               | Increased use of altmetric in research evaluation | “Another social factor that we would like to consider is the social networks, which has recently been discussed in the altmetrics. That is how much personal visibility is rising in society? how much it affects his social impact, how this impact should be evaluated and measured? All altmetric indicators are not the same. They are used differently in different societies.” M 2 |

Table 3. Technological trends and driving forces affecting the future of research performance evaluation

| Main category | Sub-category | Dimension | Evidences based on the interviews and the scoping review |
|---------------|--------------|-----------|-------------------------------------------------------|
| Technological trends and driving forces | Open science | Information filtering | This social evaluation like scientometrics indicators in different countries cannot be a good evaluation criterion. For example, in Iran or some other countries, they don’t have access to several social networks, such as, YouTube or Facebook. Information filtering and unavailability means unequal access to these tools” M 9 |
| | | | The organizational depositories increase the citation because of free access to the publications of an university (Bonilla-Calero, 2014). |

C. Economic trends and driving forces

In this section, the economic trends and driving forces affecting the future of research performance evaluation, as well as the evidence obtained from the interviews and the scoping review are presented (Table 4).
Table 4
Economic trends and driving forces affecting the future of research performance evaluation

| Main category                                      | Sub-category                                      | Dimension                                      | Evidences based on the interviews and the scoping review                                                                |
|---------------------------------------------------|---------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Economic trends and driving forces                | Not emphasize on the oil economy merely           | The economic development of a society         | “Even their economies are not oil or gas dependent or depending on a particular industry. It means that if they lose one industry at a time, their ranking will not go down.” M 2 |
|                                                   |                                                   |                                               | The challenge of extracting natural resources and changing the global demand is leading to the emergence of a knowledge-based economy. The production of national knowledge leads to the development of innovation, knowledge-based companies, and the economic progress of that country. A country’s scientific specialization depends on historical and cultural properties, the strengths of scientific institutions, the size of the scientific system, incentives, and government budgets (Confraria & Vargas, 2019). |
|                                                   | Increased collaboration between university and industry |                                               | “Even in the field of science, we all talk about the fact that science must become wealth...” M 8 |
|                                                   |                                                   |                                               | University’s researchers collaborate with industry researchers have a better research performance (Abramo, D’Angelo, Di Costa, & Solazzi, 2009). |
| Research grant                                    | Reduction the non-governmental investment for research |                                               | “Now, there are many non-governmental organizations and institutions abroad that are the sponsors of research, but this is not the case in our country. Mostly, the governmental organizations support research projects in Iran” M 10 |
|                                                   |                                                   |                                               | Determining a suitable domestic research policy based on external budgeting patterns can increase research impact and productivity (Van den Berghe et al., 1998). |
Table 4
Economic trends and forcing drivers affecting the future of research performance evaluation

| Main category                                    | Sub-category                          | Dimension                                | Evidences based on the interviews and the scoping review |
|--------------------------------------------------|---------------------------------------|------------------------------------------|----------------------------------------------------------|
| Economic trends and driving forces               | Research grant                        | Reduction of international research grant | “In the current situation, foreign organizations do not even give us a research budget. We face a scientific sanction, that we will see its full effect in two or three months.” M 1 |
|                                                  |                                       |                                          | The younger grant recipients in countries with lower research performance have a lower diversity of research outputs and collaboration networks (Ghaseminik & Gazni, 2019). |
| An economic evaluation of research               | Economic analysis of research performance evaluation |                                           | “What are the costs, economic estimates, and results of these research evaluations? Is it in our interest at all? Then the economic trend will be defined…” M 9 |
| An economic evaluation of research impact        |                                       |                                          | “For example, there is a problem with the research evaluations economically that analyzing research in the long-term as a longitudinal process is many expensive…” M 4 |
| Research budget                                  | waste of research funding              |                                           | “Now, one of the important issues in the world is the waste of money in the research. It seems that many researches have attracted a lot of budgets in the world but for any reason could not reach the desired result.” M 5 |
| Lack of research budget                          |                                       |                                          | “The main part of the research is the budget. So, when some events affect the budget, it affects the country's budget and the research funding.” M 1 |
|                                                  |                                       |                                          | Research with financial support has more citations, which vary depending on the field and the type of sponsor (Ghaseminik & Gazni, 2019). |
| Investment in all fields of science               |                                       | Leading countries have research diversity. They don't research in one field of technical or medical sciences. They determine their competency and have research diversity for creating their network in all areas.” M 2 |
| Funding based on research performance            |                                       |                                           | “Given the limited financial resources for research around the world, it is possible that in the future, organizations, corporations, and research funding providers, will move to assign the research resources based on the research performance. If this happens, the position of these rankings and research performance evaluation systems will become more prominent.” M 5 |
|                                                  |                                       |                                          | A combined research evaluation system can be effective in allocating funds, one based on performance (motivating) and the other on an institutional size to reduce costs (Geuna & Martin, 2003). The government is allocating the research budgets based on the performance indicators (Moed, 2018). |
| Main category                               | Sub-category                                      | Dimension | Evidences based on the interviews and the scoping review |
|--------------------------------------------|---------------------------------------------------|-----------|--------------------------------------------------------|
| Funding based on research priority         | “The budget should be allocated for research that is a priority not just for increasing the number of articles.” M 7 |

**D. Environmental trends and driving forces**

In this section, the environmental trends and driving forces affecting the future of research performance evaluation, as well as the evidence obtained from the interviews and the scoping review are presented (Table 5).

**Table 5**

Environmental trends and driving forces affecting the future of research performance evaluation

| Main category                               | Sub-category                                      | Dimension | Evidences based on the interviews and the scoping review |
|--------------------------------------------|---------------------------------------------------|-----------|--------------------------------------------------------|
| Environmental trends and driving forces    | Increased emphasis on green information           | -         | “We are the information specialists, green information or environmental information suggests that future research should be environmentally compatible and have less polluting effects.” M 4 |
|                                            | Using the green environment components in research institutes | -         | “I have heard that professors in universities of some countries have a break in the summer to rest, think, and get creative in the forest. These environmental factors help a person's mind to relax.” M 2 |
|                                            | A favorable organizational environment            |           | "Many of our researchers want a very cozy and relaxing environment, where they can think well. It means that they need to think more than reading and writing, have an environment without worries, and job security and calm. Well, I have job security. I can work in a place where it respects and values me, its appearance the color of the walls and the hall, the colleagues, and the city where the researcher lives all are important.” M 2 |

**E. Political trends and driving forces**

In this section, the political trends and driving forces affecting the future of research performance evaluation, as well as the evidence obtained from the interviews and the scoping review are presented (Table 6).
## Table 6
Political trends and driving forces affecting the future of research performance evaluation

| Main category                          | Sub-category | Dimension                                                                 | Evidences based on the interviews and the scoping review |
|----------------------------------------|--------------|---------------------------------------------------------------------------|--------------------------------------------------------|
| Political trends and forcing drivers   | Scientific diplomacy | -                           | “In the past, there were international relations between countries, but now, we are facing political sanctions and constraints. Many countries don’t want to communicate with other countries like Iran because of their political regulations. Recently, we see that a lot of things have been blocked. Unfortunately, we have encountered problems in publishing our articles and research.” M 2 |
|                                        |               | Articles resulting from international collaboration are of higher quality in terms of citations and journal impact factor (Abramo, D’Angelo, & Solazzi, 2011). The international collaboration affects the research quality (Aldieri, Guida, Kotsemir, & Vinci, 2019). Scientific diplomacy increases the international collaboration of domestic researchers with compatriot researchers in other countries (Fangmeng, 2016). |
| A country’s internal policy            |               | -                           | “Political issues affect our research. At least, altmetrics shows that when The USA government wants to interpellate Trump, a lot of research is about this. So, this is very effective.” M 1 |
| War and political sanctions            |               | -                           | “Political events certainly have a special effect. When a country is at war, from a political point of view, it takes precedence over defensive issues no other fields such as philosophy, social, and humanities sciences.” M 1 |
| Research Performance Evaluation System | Balanced inclusion of different dimensions in research evaluation | -                           | “All dimensions are important because I can’t say that society is important, but politics not. If everything is fine in society but war is accrued, then we’ll encounter to economic and political problems” M 1 |
|                                        |               |                            | “We'd better look at all of these factors that you count individually from the social factors to the environmental factors in the form of a system and chain that affects each other.” M 2 |
| Localization of research performance evaluations |               |                            | “I think a comprehensive and localized evaluation of academic, institution, and faculty performance it’s a good option. We don’t just consider the English articles in Web of Science. So what do we do with Persian articles and books, observations, workshops, meetings, and conferences? Because all of these are research activities.” M 9 |
| International research evaluation     |               |                            | “Therefore, the research will be evaluated at the international than at the national or local levels. Assessments are now usually local or institutional ones.” M 1 |
| Main category | Sub-category | Dimension | Evidences based on the interviews and the scoping review |
|---------------|--------------|-----------|--------------------------------------------------------|
|               |              | Parallelism in research performance evaluation | “For years, some persons are saying that we are working, but it is not clear who is responsible for it. Everyone said that I am not responsible for it. It is unknown at this time who is responsible for it” M 6 |
|               |              | The increased emphasis of evaluations on the efficiency and effectiveness of research | “The research evaluation based on efficiency, effectiveness, or scientific productivity has not considered now. In my opinion, more emphasis will be placed on these issues in the future.” M 6 |

Table 6. Political trends and driving forces affecting the future of research performance evaluation
| Main category          | Sub-category                                | Dimension                                      | Evidences based on the interviews and the scoping review |
|-----------------------|---------------------------------------------|------------------------------------------------|---------------------------------------------------------|
| Research Performance  | The importance of the macro research policy in a country | “I think the first thing is to have a macro national research policy. We have defined educational policy to some extent for example, in the Ministry of Health. But at a higher level, we must have a macro policy, and then this will be announced to the other organizations.” M 7 |
| Evaluation System     |                                             | The existence of a national strategic research plan and the scientific national and international collaboration can be effective in the research performance of research centers (Ebadifar et al., 2017). |
|                       |                                             | In the future, instead of articles and their metrics, we will focus more on the final research products such as commercialized products, patents, or a change in a country's health system and using their related indicators.” M 5 |
| Suitable research     | Research prioritization                      | “We research without knowing the aim of the research and its evaluation and spend money on it. In my opinion, this is the main priority.” M 10 |
| policy                |                                             | Research equality                               | “Policies always affect the research process. For example, our goal is to make a policy to encourage the best researchers that having international collaboration, professors, and innovators, etc. All of them make new indicators.” M 6 |
| Increased research    | scientific complexity and competition        | “In my opinion, the important issues in research will be scientific competitions and complexities. You may have read about this. The more scientific complexity helps to advance the country, produce science that few countries or institutions can do it. We call it the scientific complexity.” M 8 |
| collaboration         |                                             | Research networking and Variety                 | “The new issue in all fields of science is interdisciplinary research. The knowledge edge of each field and research evaluation will move towards interdisciplinary and applied research in the future.” M 5 |

**Discussion**

This study aimed to determine the effective trends and driving forces in the future of research performance evaluation by the interview and the scoping review. The 44 documents were reviewed, and 11 persons interviewed. Then, the social, technological, economic, environmental, and political trends and driving forces extracted and reported. The findings showed that the effective social trends and driving forces in the future of the research performance evaluation are the social development of society, increasing researchers’ awareness of the research evaluation importance, the gender gap in society, the research social impact, and employing human resources. The social growth of a society, democracy, and the increasing importance of research and researchers in it will affect the research performance.
evaluation in that community. In that researchers are sensitive about their scientific role and strive to improve it. M1, M11

Besides, the research performance evaluation should be normalized based on individual, organizational, cultural, and social factors. For example, lack of gender normalization in the research performance evaluations causes men to be superior. Because women face many issues such as the roles of spouse and maternity, social, and organizational factors in their societies, etc. These factors can cause the Matilda effect in research publication and don't improve the scientific and organizational positions of them, affecting their research collaboration, getting research grants, and so on. Therefore, it is necessary to consider the gender normalization of research performance evaluation in the future (Abramo, Cicero, & D'Angelo, 2015; Abramo & D'Angelo, 2015; Aksnes, Piro, & Rørstad, 2019; Larivière, Vignola-Gagné, Villeneuve, Gélinas, & Gingras, 2011; Mauleón et al., 2008; Mayer & Rathmann, 2018; Nielsen, 2016; Symonds, Gemmell, Braisher, Gorringe, & Elgar, 2006; Van Den Besselaar & Sandström, 2016; Waaijer, Sonneveld, Buitendijk, van Bochove, & van der Weijden, 2016).

On the other hand, the analysis of the interviews showed that the research application in society and its cultural and social impact has become many important. It means that to what extent does research solve the problems of society and help to promote its position in various dimensions? This requires strengthening the university's relationship with society and creating a culture of research impact in universities and research institutes so that researchers can research to meet the needs of society and convey it to the people in an understandable way. In other words, knowledge translation and its culture should be performed and created. The important issue is the indicators used in the research performance evaluation that measure the short-term effects of research, and universities only pay attention to meet the quantitative indicators and their improvement in the university rankings. Therefore, it is necessary to create indicators that measure the long-term research social impact and the application of research in society. M2, M4, M7, M8

In human resource employment, individual variables (age, marriage, gender, motivation, interest in cooperation, personal research style, etc.) and organizational variables (educational and research infrastructure, university reputation, job position, organization size, financial resources, Ph.D. and post-doc students, job satisfaction, etc.) should be considered. The inclusion of these factors in the selection of skilled and capable human resources leads to the promotion of research and affects the research performance evaluation (Kyvik & Olsen, 2008; Lee & Bozeman, 2005; Soo, 2008; Wood, 1990). Therefore, the research performance evaluation should be normalized based on these factors.

On the other hand, the main technological trends and driving forces are information and communication technology, scientometric indicators, and open science. Given the daily change in communication and information technologies M8, (28), it is necessary to pay attention to the use of big data, data mining, artificial intelligence, and machine learning in the research performance evaluation M4, M5. With the help of these new tools and methods, it is made more accurate evaluations and spent less time. This requires the development of advanced technology infrastructure in the community, especially in
universities M 2, the documentation of all scientific, technological, and research products M 6. Researchers and faculty members should also be encouraged to the presence in international and national scientific social networks that will help increase scientific collaboration and improve their scientometrics indicators. To accurately assess the research social impact at the national level, it is necessary to create integrated national social networks and establish a link between scientific social networks and citation databases M 6, M 7. This will help to better extract scientometrics and altmetrics data. Finally, the existence of an integrated research performance evaluation system will contribute to more accurate research evaluations of universities and individuals, for example, comparing universities in a specific field M 6.

Besides, the digitalization of scientific communication has led to the emergence of new research performance indicators in the fields of altmetrics, webometrics, scientific mapping, and author network analysis (Moed, 2018). However, some organizations may not use the performance indicators properly due to the policies of their country and the interests of some people, and this affects the correct evaluation of the research performance of individuals and the country M10. Too much emphasis on quantitative indicators such as the number of scientific productions and citations can affect the strategy of publishing of the younger researchers (Cheung, 2008; Sīle & Vanderstraeten, 2019). Today, research outputs appear in various forms of articles, books, patents, knowledge-based companies, presence on social networks, and so on. Therefore, it is necessary to introduce and normalize new indicators that can calculate the impact of research on society, technology, and industry M 2, M 8, M 9, M 11. Proper use of these indicators requires free access to social networks and information. This open access and lack of information filtering improve scientific metrics and research performance evaluation. Therefore, every organization must provide a depository that has open access to the scientific and research documents and products of its researchers and faculty members and are available worldwide. This prevents duplicated research and improves the scientometric indicators of the organization. Besides, creating a decision support system based on the research performed within the organization helps in allocating research budget and strategic planning and provides the correct ranking at the individual, research, and educational groups (Abramo & D'Angelo, 2011).

The economic trends and driving forces show that countries should not rely only on natural resources economics such as oil and gas, move towards developing a knowledge-based economy M 2, strengthening the relationship between university and industry, specializing in some scientific fields. A country's scientific specialization depends on its historical and cultural factors, the strengths of its scientific institutions, the size of the scientific system, and the government's motivation and budget (Confraria & Vargas, 2019). The scientific impact of a country increases with the increase of research and development budget (Cimini, Zaccaria, & Gabrielli, 2016). A country's strong economic infrastructure will contribute to its research growth. The growth of research will also lead to the promotion of the scientific status of universities and research institutes and will affect the research performance evaluations M 11.

Today, the knowledge commercialization and research based on industrial demand is of great importance M 3, M5, M 7, M 8. Various factors affect the relationship between university and industry, such as
geographical, cultural, and social distance, compliance of university and industry policies, innovative capabilities of universities, market-based policies, and industrial structure of a country. The triple helix between government, industry, and universities has increased the research income of universities, which can be used in applied and basic research. On the other hand, industries publish their research less in the form of articles or books and are presented more in the form of products (Abramo, D'Angelo, & Solazzi, 2010; Abramo et al., 2009; Confraria & Vargas, 2019; de Moya-Anegón, López-illescas, & Moed, 2014; Gulbrandsen & Smeby, 2005; Soo, 2008; Tijssen, 2004). Therefore, universities should not rely only on the scientific outputs as article or book and consider the economic and technological products of knowledge-based companies and the university-industry cooperation in evaluating research performance. This needs to introduce and normalize the new scientometric indicators that measure these outputs and outcomes.

On the other hand, attracting foreign investment and grants can have a positive effect on research performance. But countries with political and economic sanctions face difficulties in attracting international grants, and as a result, international collaboration and the diversity of their research outputs are diminishing M 1, M 10, (Ghaseminik & Gazni, 2019; Van den Berghe et al., 1998). It is also necessary to determine the cost-effectiveness of research performance evaluation before doing it. How much do these evaluations cost? how effective their results are in measuring the research performance of universities and researchers? This requires the close cooperation of scientometrician and economists as a team. It is also necessary to include the economic impact indicators of research in the research performance evaluation M 4, M 9.

Also, many countries face a lack of financial resources due to economic and political sanctions and consequently a lack of research funding M 1, M 2, M 6, M 8, M 9. The universities are facing an increase in students and a lack of budget is increasing on. This lack of budget also has adverse effects on research funding. As a result, it can reduce membership in journals and databases and publication in open access journals, as well as slow down the development of libraries, hospitals, laboratory infrastructures, research. All of these affect the research performance evaluation. It is necessary to take actions such as separating education and research budgets, increasing the share of research budgets in GDP, financial support for interdisciplinary and multidisciplinary research, and creating a performance-based reward system, and don’t waste money. The type of sponsor (government, organizational, international) can also affect citation indicators (Bourke & Butler, 1999; Gao, Su, Wang, Zhai, & Pan, 2019; Ghaseminik & Gazni, 2019; Sidoroff, Paraschiv, Amarioarei, & Paun, 2016). Therefore, it is better to use an integrated funding system based on the institution size, the research performance, R & D products, and research priority, which will also be effective in the research performance evaluation M 5, M 7, M 9, (Geuna & Martin, 2003; Moed, 2018).

Besides, one of the things that has been neglected in the university ranking and research performance evaluations is the lack of attention to including the environmental indicators by universities and research institutes. The library and information science now suggest green information, paperless research compatible to the environment, and reducing its polluting effects on the environment. An organization that has a green and relaxing environment while saving energy resources can have a positive effect on
the research and the researchers. In addition to the research funding, this organization values the researcher and provides a relaxing environment where one can think well and do research. Therefore, it is necessary for research performance evaluations to pay attention to environmental factors and provide environmental indicators for measuring universities M 2, M 4, (Harris & Kaine, 1994).

On the other hand, a country's domestic policies, wars, and political sanctions affect scientific diplomacy and interaction with other countries to research M 1, M 2, M 4, M 7, M 8, M 9, M 10, M 11. Networking and international research collaboration strengthen scientific competition, interdisciplinary and applied research, and countries' specialization in some fields of science, which is called scientific complexity M4, M 5, M 8. In this case, researchers will not have a problem to publish their articles in international journals M 2. Domestic policies including interaction with other countries cause a country's researchers to travel to developed countries to gain scientific experience and bring new knowledge into their country. As a result, countries can turn brain drain into brain gain (Fangmeng, 2016). Therefore, these factors affect the research and we should include them in the research performance evaluation (Abramo et al., 2011; Aldieri et al., 2019; Aldieri, Kotsemir, & Vinci, 2020; Barjak & Robinson, 2008; Cimini et al., 2016; Sadegh Vishkaem, Esmaili Givi MR, & M, 2018).

There are also many organizations in the world and even in the countries that are responsible for evaluating research performance and have created a kind of parallel work. So that each of them uses different criteria and indicators based on their goals, which may be different in many countries. Therefore, it is necessary for each country to determine its strategic research performance evaluation plan and research policy and develop its national research performance evaluation system that evaluates its researchers in individual, organizational, national, and also at the international levels. Instead of merely emphasizing quantitative scientometric indicators, research impact indicators should be created and used. This integrated system for research performance evaluation should be a country-specific concerning social, technological, economic, environmental, and political characteristics, and consider the efficiency and effectiveness of research and research equality M1, M 2, M 3, M 5, M 6, M 7, M 9, M 10, (Abramo & D’Angelo, 2011; Benner & Sandström, 2000; Ebadifar et al., 2017).

Finally, we encountered some limitations in our research. One of the limitations was the lack of access to the full text of some articles in the scoping review step, which was requested through correspondence with their authors on social networks and sending E-mails. In the interview step, due to the Coronavirus (Covid-19) pandemic and the lack of face-to-face interview situations, WhatsApp and telephone interviews were used.

**Conclusion**

This study aimed to determine the effective trends and driving forces in the research performance evaluation through scoping reviews and interviews. The results showed that various social, technological, economic, ecological, and political factors and indicators must be included and normalized in the national and international research performance evaluation system. The social trends and factors were
research social impact, the social development of society, increasing researchers’ awareness of the research evaluation importance, lack of research culture in society, the gender gap in society, and human resources employment. The technological trends and driving forces were the development of information and communication technology, scientometrics indicators, and open science. The economic trends and driving forces included not emphasize on the oil economy merely, research grant, economic evaluation of research, and research budget. The environmental trends and driving forces were increased emphasis on green information, using the green environment components in research institutes, and a favorable organizational environment. Eventually, the political trends and driving factors included scientific diplomacy, a country’s domestic policy, war and political sanctions, research performance evaluation system, optimal research policy, and increased research collaboration. We suggest researching and study more deeply to define and normalize the new indicators for each social, technological, economic, environmental, and political dimension in the national and international research performance evaluation system.

**Declarations**

**Ethics approval and consent to participate**

This study is the result of the fourth phase of a doctoral thesis entitled "Futures study of the research performance evaluation using the scenario approach" and Code of Ethics IR.IUMS.REC.1398.229 at Iran University of Medical Sciences, Tehran, Iran

**Consent for publication**

Not requires

**Availability of data and materials**

There is the data study in the appendix section of article. The qualitative Persian data in MAXQDA software.

**Competing interests**

Not applicable

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**Authors’ contributions**

NS analyzed and interpreted the data of studies and interview. All authors written, read, and approved the final manuscript.
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Figures
Figure 1

The selecting documents process for the scoping review