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A Comparative Study of Science Rankings and Environmental Performance Index (EPI) of the Persian Gulf Countries

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ABSTRACT

Nowadays, science production through the use of knowledge management has been identified as a top priority for growth and development in almost any society while scientific development is considered as a prerequisite to development in various sectors, which can consequently lead to economic prosperity and social welfare. With this view, the Islamic Republic of Iran's vision plan 2025 (Solar Calendar Year 1404) targets the first economic and scientific ranking in the region. A closer study of scientific products and science ranking of countries has provided a suitable tool for proper policy-making and planning as well as a better understanding of the past situation. Analysis of scientific products and science ranking of countries has also paved the ground for purposeful scientific practices and research priorities besides contributions to the recognition of weaknesses and insufficiencies in science production. Additionally, the environmental performance index of countries is indicative of countries' commitment to sustainable development and human life. Meanwhile, countries with lower science ranking will doubtlessly fail to manage ecological issues effectively. This study makes a comparison of science ranking and environmental performance index among Persian Gulf countries. The results show that Iran and Saudi Arabia, despite their first and second place, respectively, in science ranking in the region, have not been able to fully utilize this capacity for effective protection and management of the environment. In contrast, countries such as Kuwait and Bahrain, despite their lower science ranking, at the bottom of the table, have attained higher values concerning environmental performance index than Iran and Saudi Arabia thanks to their proper planning and policy-making practices. **©authors**

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1. Introduction

In the present era, information and effective access to it is one of the key elements of progress and development, so that almost all processes in countries, particularly the process of science production, rely mainly on access to information.

Rapid advances in information and communication technology and the possibility of faster and wider access to the world of information have also opened new horizons for professionals and government officials (Farahani, 2009: 16).

Considering knowledge as a resource in organizations has led to the emergence of a new field of knowledge management in information systems in many countries. These developments clearly show that knowledge in various forms is an asset and human capital can lead to scientific productions in various fields if used properly (Allen, 2002: 31).

Therefore, knowledge management can be defined as a systematic process that uses the right combination of information technology and human interaction to identify, manage and share a country's information assets and ultimately produce new science. One of the obstacles to the effective use of knowledge in countries is that the necessary and adequate information is not provided to the appropriate applicants. However, advances in emerging knowledge management (KM) have made it possible for organizations to provide the right information for the right person at the right time (Wernick, 2002: 7).

Therefore, the participation of different sectors in the processes of innovation and knowledge management can trigger effective steps to improve the scientific standing of a country. Another salient function for the application of knowledge management in various organizations in countries is deemed to be the rapid adoption to changes in the environment and the given context (Pouyanzadeh and Zahedi, 2016: 214).

The quality of the environment is also very important in countries. One of the human's most important achievements in rationalizing environmental issues is to identify activities that might bear harmful consequences in the future. Many intellectuals believe that if the man gains effective knowledge for sustainable development in the environment, and does his best to apply that knowledge, he will have registered his greatest discovery and invention records in the world and this will not happen without the proper management of the knowledge (Sohrabi and Bagherian, 1394: 208). Nowadays, knowledge is increasingly considered as one of the essential components of success in the world, and specific examples of its manifestations, usefulness and role, especially in the field of environmental management have been demonstrated in countries (Boiral, 2002: 302).

Multiple factors such as population growth and development with unbalanced distribution patterns, diversified lifestyles and inappropriate human interplay with the physical environment have endangered human habitat at local, regional, national and international levels. These risks can be manifested in three dimensions: "resource depletion", "resource exploitation" and "environmental pollution", which can in turn lead to rivalry and confrontation between different parties and political actors at national and transnational levels. Environmental geopolitics is sometimes interpreted as environmentalism or green geopolitics, and some may also consider it synonymous with resource geopolitics (Hafeznia, 1396: 137-135).

When we want to examine the existing explicit and implicit knowledge with the aim of improving the environmental performance in a country, the issue of "environmental knowledge management" is raised (Sepahvand, 2012: 139). In fact, the integration of environmental goals with knowledge management tools leads to the creation of an Environmental Knowledge Management (EKM) system. This system uses the existing knowledge in the organization and thus reduces information barriers, to improve environmental performance. Therefore, the question that arises here is whether EKM systems align

the environment with other existing forces? Will these forces contribute effectively to the process of new scientific productions (in various fields, including the field of environment)? In what areas and by what methods can the development of EKM systems be implemented to improve the scientific state of a country? (Wernick, 2002: 8). In the continuation of this article, we will introduce the Persian Gulf region and then we will review and compare the Science Ranking as well as the Environmental Performance Index of the countries in this region.

2- Method
The present study analyzes the environmental performance of the Persian Gulf countries and compares the results with these countries' scientific potentials. Relying on expert views in the fields of geopolitics and information management, this article focuses on the indicators of environmental performance and the ability of the Gulf countries to produce scientific texts while attempts are made to establish a comparative study in this field.

This study, defined under a scientometric type, is applied in terms of purpose that examines the quality of scientific products and environmental performance indicators in the Gulf region. In this research, attempts have been made to collect the required information to accurately describe the phenomenon under study, leading ultimately to a comparative analysis. Due to the nature of the study, the population data comprises two categories: Science Ranking and Environmental Performance Index of Persian Gulf countries. For the first category, data were collected from 240 countries based on the classification of Simgo citation database and the second category, EPI index of 8 Gulf countries were examined.

Also, the data from the related population were compared with each other and the results provide a comprehensive comparative pattern of the environmental performance and scientific potentials of the countries in the region. In terms of data collection, the study enjoys an integrative approach, which analyses the data from 8 Persian Gulf countries during the year 2020.
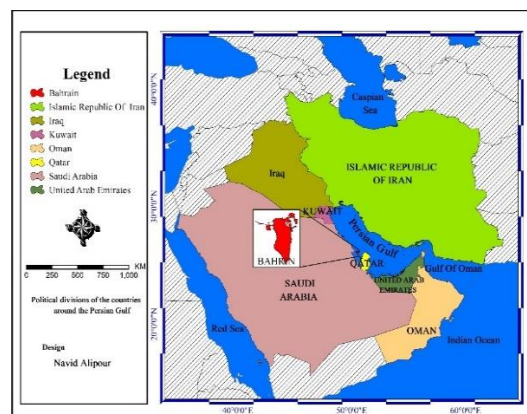
It should be noted that in this study, to determine the countries' science ranking in the region, instead of their ranking in the world and the region, the number of citable documents produced by each country has been used as the main criterion, which is deemed to provide a more precise image of their scientific standing.

3- Findings
3-1- Ecology of the study setting
The Persian Gulf region is surrounded by eight coastal states, from north to south, respectively: Iran, Iraq, Kuwait, Saudi Arabia, Bahrain, Qatar, the United Arab Emirates and Oman. Iran is the most populated gulf country while Saudi Arabia is the largest country and Bahrain is the smallest and least populated country in the region (Asadi, 2014: 213).

This region is basically important because of the existence of rich oil resources in the Persian Gulf and its surroundings. Due to its importance and applications in many cases such as the energy supply, as the main important driving force of industries and transportation vehicles, and the raw material for the production of many basic goods, oil has played a very important role in the military, political and economic developments in the world (Elahi, 1384: 26).

Map 1. Persian Gulf Countries
(drawing by authors)

3-2-Science Rankings of the Persian Gulf Countries

Among knowledge management studies in Iran, those involving components of knowledge management have provided more valid results in explaining the state of science and technology and the scientific competitiveness of the country. Therefore, the need to use the components of knowledge management to determine the science ranking of Iran in comparison with other countries in the region for more effective policy is felt and this is an accepted view in the emerging science of knowledge management (Genavi and Shahmoradi, 1398: 80).

To determine the Science Ranking of the countries in the region, it is necessary to analyze the scientific products of these countries and the number of citations of these products. The SCImago Journal Rank Index, or SJR for short, is a new index and one of the most comprehensive in the Simgo rating system. The SJR is a measure of the scientific impact of scientific journals that simultaneously assesses the number of citations to articles in a journal as well as the validity of citation articles. In fact, SJR is a numerical value that represents the average number of citations to countries' scientific output. In the following, based on the information obtained from this index, we will compare the ranking of the countries in the Persian Gulf region in terms of the production of scientific documents in 2020.

Table1.
Science Rankings of Persian Gulf Countries in 2020

Country	World Rank	Regional Rank	Citable Documents
Iran	16	1	69754
Saudi Arabia	25	2	36301
Iraq	45	3	18711
United Arab Emirates	52	4	10079
Qatar	67	5	5081
Oman	80	6	2543
Kuwait	83	7	2345
Bahrain	100	8	1066

https://www.scimagojr.com/countryrank.php

Table1 shows the data on the status of scientific production in the Persian Gulf

countries in 2020. This table presents the data including the number of scientific documents produced, number of citable documents, number of citations from citable documents, and the like in the 8 Persian Gulf countries in terms of their regional and world rankings.

With a brief look at Figure 1, the ranking of each country studied in this article is clearly understood in terms of the amount of scientific production in the world. The data collected from the SJR index, showed that in the world science ranking, Iran ranked 16th and Bahrain ranked 100th, which represent the first and last places in the gulf region science ranking, respectively.
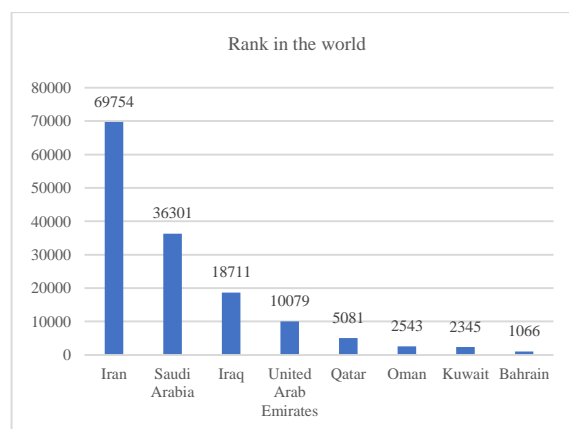

Figure1. Persian Gulf Countries 2020 Science Rankings in the World

Figure 2 specifically reveals the scientific status of Persian Gulf countries and shows where each country stands in the region in 2020 in terms of the production of citable documents, the number of citations to these documents, etc. By looking at the following chart, it is clear that among the countries in the region, Iran has the highest rank in the field of production of scientific documents and Bahrain is in the lowest state.
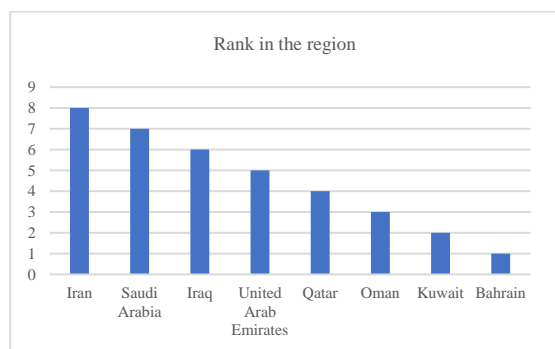
Figure 2. Persian Gulf Countries 2020 Science Rankings in the Region

Table1.
Persian Gulf Country Rankings Based on EPI 2020

Country	Global Rank	Regional Rank	Index Score (out of 100)
United Arab Emirates	42	1	**55.6**
Kuwait	47	2	**53.6**
Bahrain	56	3	**51**
Iran	67	4	**48**
Saudi Arabia	90	5	**44**
Iraq	106	6	**39.5**
Oman	110	7	**38.5**
Qatar	122	8	**37.1**

https://epi.yale.edu/epiresults/2020/component/epi.

3. Environmental performance index of the Persian Gulf countries

The EPI index is based on two central environmental policies: environmental health, which measures environmental stresses on human health, and ecosystem vitality, which measures ecosystem health and natural resource management. The index is estimated using 22 indicators that are reflected in several policy categories. These policy categories include the following 10 items:

1. Environmental health
2. Water (its effects on human health)
3. Air pollution (its effects on human health)
4. Air pollution (environmental effects)
5. Water resources (environmental effects)
6. Biodiversity and habitat
7. Forest
8. Fisheries
9. Agriculture
10. Climate change and energy

Man's ability to preserve his living space or to destroy its landscapes reflects the fact that man is an important factor in the construction, destruction, composition and disruption of biological realms. Protecting the environment and providing a healthy and peaceful environment for human beings has necessitated the presentation of many programs and initiatives by governments, organizations, groups and individuals. The ranking of the countries in the Persian Gulf region according to the EPI index in 2020 is shown in Table 2.
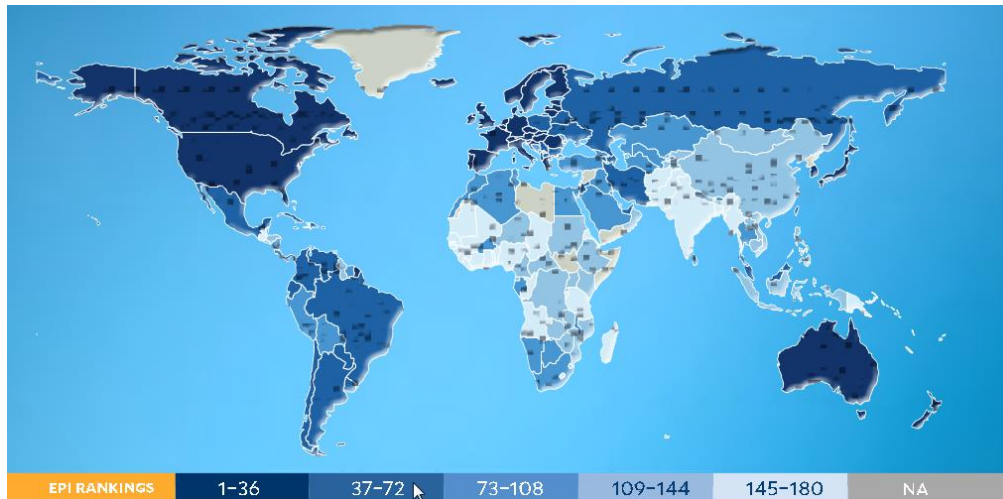
The EPI index is set from zero to 100, where a score of 100 represents the best and zero shows the worst environmental condition in a country. In the 2020 EPI rankings, Denmark with a score of 82.5, Luxembourg with 82.3, Switzerland with 81.5 and the United Kingdom with 81.3 round out the top five countries. Among the Persian Gulf countries, the average score is 45.9 out of 100, which indicates a low level of EPI in the region. Map No. 2 shows the EPI ranking of countries in the gulf region.

Map 2. EPI Rankings of the world countries in 2020
https://epi.yale.edu/downloads/epi2020report20210112.pdf.

Some of the reasons for the poor environmental performance of the countries in the Gulf region can be listed as follows:

1. Weak cultural understanding of environmental protection;
2. Individual-oriented environmental management;
3. Poor or lack of civil environmental institutions in the Middle East**.**

It is important to note that environmental conflicts and crises are not limited to the relationship between governments and countries. There is also competition, conflict, and strife within countries and across ethnic, indigenous, or local groups for scarce resources or biological foundations such as water, soil, space, energy, mines, pastures, and other resources. Therefore, considering the importance of biological foundations, natural and human resources and capital, to maintain ecological balances and sustainable development, as well as its close relationship with security, political issues and competition between human groups and political actors, especially governments seems necessary (Hafeznia, 1396: 137).

Economic development requires considering both the use of resources for production and its consequence- the production of waste, above all, the production of greenhouse gases, which is one of the most important consequences of globalization in the present century (Everett and others, 2010: 16).

The growing trend of environmental degradation is creating new global requirements for governments in the field of environmental cooperation and will lead to convergence that pursues the following goals: 1. Identifying key links between globalization and the environment; 2. Identifying problems and multilateral international agreements in the field of finance, investment, and intellectual property rights that affect environmental sustainability; 3. Prioritize reviewing policies that affect multilateral economic agreements. In this way, we will be able to analyze the incentives that implicitly play a role in policy-making criteria for trade and investment and also affect environmental sustainability (Alizadeh and Pishgahifard, 1390: 114).

In recent years, efforts to reach international agreements on a large list of global environmental issues have accelerated, signaling an understanding that global environmental degradation is a real threat to all nations and peoples of the world. Agreements on population control, reducing greenhouse gas emissions, preserving and preventing the destruction of tropical rainforests, controlling ocean pollution, and protecting endangered species are all necessary (Botkin and Keller, 2007: 601).

4 – Conclusion

With the independence of the countries on the southern shores of the Persian Gulf in 1971, the region has witnessed many regional and trans-regional treaties and agreements, many of which have been formed for the economic interests of these countries and security considerations. In the meantime, environmental issues and fighting against environmental challenges and threats in the region are what which have not been at the center of attention. Although these countries have considerable economic potentials and ability for environmental management to reduce the risks, environmental performance statistics are indicative of unfavorable conditions and performance of the countries in the Persian Gulf region.

In the meantime, there is a contradiction regarding the countries' scientific potentials and their science ranking, being that countries with more favorable scientific states are expected to have more appropriate environmental performances. However, the correlation between the countries' science rankings and their environmental performance in the region does not reflect this comparative logic. Iran and Saudi Arabia, which enjoy the first and second scientific ranking in the region, are ranked fourth and fifth in terms of environmental performance in the region.

In an overall comparison, Iran ranked 16th in the world in scientific rankings, while its environmental performance score is 67, the fact that is not consistent with a logical comparison. Likewise, the UAE, which ranked 4th in the region and 52nd in the world science ranking, stands in 1st place in terms of EPI in the region. Whereas the UAE, which tops the EPI index among the 8 countries in the region, it ranked 42nd in the world EPI.

Finally, despite the fact that the gulf countries have relatively appropriate states in the world science rankings, it is evident that environmental issues and long-term management plans to fight environmental hazards and to prevent the spread of human pollution are not among these countries' top priorities.

5- Acknowledgement

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