

Evolution of innovation and sustainability research Among the arab world's universities

Evolución de la investigación sobre innovación y sustentabilidad en las universidades del mundo árabe

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Abstract

Scientific research on innovation and sustainability in Arab world universities has become a topic of increasing importance in recent decades. The objective of this study is to investigate publications focusing on innovation and sustainability using a bibliometric approach. The study uses the Web of Science Core Collection database and VOS viewer software to analyze bibliometric data from 1995 to 2023. Findings reveal significant growth in innovation and sustainability research in Arab countries over the past decade, with notable contributions from Saudi Arabia, United Arab Emirates (UAE), and Egyptian universities. Collaborations in Saudi Arabia and the UAE are mainly with Chinese academics, while Egyptian research extends to the USA, Europe, and Turkey. Scientific production in innovation and sustainability in the Arab region has grown significantly more than the average in other disciplines, undoubtedly due to the influence of global agreements such as the SDGs of United Nations and the Paris Agreement.

Keywords: Bibliometrics, Arab universities, Innovation, Sustainability

Resumen

La investigación científica sobre innovación y sostenibilidad en las universidades del mundo árabe se ha convertido en un tema de creciente importancia en las últimas décadas. El objetivo de este estudio es analizar las publicaciones centradas en innovación y sostenibilidad utilizando un enfoque bibliométrico. El estudio emplea la base de datos Web of Science Core Collection y el software VOSviewer para analizar datos bibliométricos desde 1995 hasta 2023. Los resultados revelan un crecimiento significativo de la investigación en innovación y sostenibilidad en los países árabes durante la última década, con contribuciones destacadas de universidades de Arabia Saudita, Emiratos Árabes Unidos (EAU) y Egipto. Las colaboraciones en Arabia Saudita y los EAU se realizan principalmente con académicos chinos, mientras que la investigación egipcia se extiende a Estados Unidos, Europa y Turquía. La producción científica en innovación y sostenibilidad en la región árabe ha crecido considerablemente más que el promedio de otras disciplinas, sin duda debido a la influencia de acuerdos globales como los ODS de las Naciones Unidas y el Acuerdo de París.

Palabras clave: Bibliometría, universidades árabes, innovación, sostenibilidad.

1 Introduction

In different universities around the world, scientific research on topics of innovation and sustainability has shown continuous growth in recent years (Merigó et al., 2016; Cancino et al., 2017a, 2017b). This trend has also been

observed in Arab world universities, an important region whose countries have actively sought ways to promote sustainable development and innovation in various sectors, including energy, agriculture, technology, and business management.

Some focal areas of scientific research in innovation and sustainability among Arab world universities may encompass subjects such as food waste as a valuable resource to produce chemicals, materials, and fuels (Lin et al., 2013). Also, topics about green innovation and organizational performance aims to analyze the influence of big data with a focus on the moderating role of management commitment and human resources practices (El-Kassar & Singh, 2019). Others explore comprehensive reviews of challenges and potential applications of integrated systems in the realm of renewable energy-driven desalination technologies (Ghaffour et al., 2015). A broader perspective is provided by studies that examine the linkages between natural resources, human capital, globalization, economic growth, financial development, and ecological footprint (Jahanger et al., 2022). In this latter work, the moderating role of technological innovations is particularly analyzed. In addition to these themes, diverse scientific studies are being conducted in Arab world universities to analyze the effects and opportunities of innovation and sustainability in the region, their impact on productive development, and their influence on business performance.

In the Arab world, there is an increasing concern about sustainability and growth, which is evident in the investments made by various economies. For instance, the UAE has invested approximately \$16.8 billion in renewable energy projects across 70 countries (Josefson & Rotar, 2023), with a particular focus on developing nations. This investment is part of an ambitious plan related to the Climate Action Journey in the Energy sector, aiming to achieve net-zero emissions by 2050. Specific actions include the initiation in 2022 of updating the UAE Energy Strategy 2050, the commencement of developing the National Hydrogen Strategy 2050 in the same year, and the declaration of 2023 as the Year of Sustainability by the UAE President, HH Sheikh Mohamed bin Zayed Al Nahyan.

To understand the trends in academic research on innovation and sustainability in Arab world universities, this paper aims to investigate publications with a specific focus on these topics using a bibliometric approach. Bibliometric studies are very common in the scientific community in a wide range of fields including innovation (Podsakoff et al., 2008). To achieve this, the study utilizes the Web of Science Core Collection database and the Visualization Similarities (VOS) viewer software to analyze bibliometric data from January 1995 to September 2023. The focus is exclusively on countries within the Arab world. The keywords employed in the database to select the papers were 'innovation' and 'sustainability,' for the specified time and countries mentioned. Only academic papers were taken into consideration, excluding conference papers or research notes. A total of 1,769 academic papers are analyzed.

The results indicate that over the past decade, research on

innovation and sustainability in Arab countries has experienced significant growth. This exponential growth mirrors trends observed in other global regions, particularly in the United States and Europe. Notably, the findings highlight that it was particularly after the 2015 Paris Agreement and the United Nations declaration of the 17 Sustainable Development Goals (SDGs) in the same year that universities in the Arab region began consistently and significantly developing academic studies in the fields of innovation and sustainability.

Out of the 15 Arab countries analyzed (Saudi Arabia, United Arab Emirates - UAE, Egypt, Tunisia, Morocco, Qatar, Jordan, Lebanon, Iraq, Algeria, Bahrain, Oman, Palestine, Yemen, and Syria), only the first three, Saudi Arabia, UAE, and Egypt, stand out significantly due to the number of papers published by their universities. While Saudi Arabia accounts for just over 30% of the total papers on innovation and sustainability in the region, the UAE and Egypt each contribute approximately 15%. In addition to the results, it is noteworthy to examine the networks Arab world universities have with other international institutions. In their studies on innovation and sustainability, the networks of Saudi Arabia and the UAE primarily involve academics from Chinese universities, while the research collaborations of Egyptian universities extend to academics or researchers from the USA, Europe, and Turkey.

Broadly, keyword analyses of the published papers reveal that the topics studied in Arab universities can be categorized into three major domains concerning innovation and sustainability. Firstly, there is a focus on sustainable innovation management. Secondly, there is an examination of the current effects and impacts of consumption, production, and trade practices. Thirdly, there is an exploration of the performance of companies and economies that promote innovation and sustainability.

The discussion and analysis of the results presented in this paper may be of significant interest to academics in the region who wish to deepen their studies on innovation and sustainability in the Arab world. This is especially relevant at a time when each country is formulating its long-term strategy to address a post-oil world, where new forms of development and competitiveness are crucial to confront emerging global challenges and competitive scenarios.

Following this introduction, Chapter 2 provides a literature review on innovation and sustainability. Chapter 3 outlines the methodology for bibliometric analysis. Chapter 4 presents the paper's results, and Chapter 5 offers a discussion of these findings. The final chapter presents the study's conclusions.

2 Literature review

Academic literature in the Arab Middle East is not only increasing in productivity but also in influence (Jamali et al., 2023), offering an opportunity to drive innovation and entrepreneurship in the region, ultimately leading to potential transformation of its economies and enhancement of its quality of life (Zahra, 2012).

According to Ryan and Daly (2019) the Middle East makes fewer contributions to the creation of new knowledge compared to other regions of the world. Because the Middle East region is characterized by extremely diverse cultures, heavy turmoil, political diversity, differences in the language, economies, and religions, knowledge production in the form of publications and patents has been under expectation (Gul et al., 2015).

Similarly, numerous academic research has been undertaken to comprehend the dynamism in scientific publications across diverse knowledge domains in the Arab world. According to Tamara (2021), the past two decades have witnessed a surge in research efforts directed towards

exploring the behavior, governance, growth, and prosperity of family businesses in the Arab Middle East. This form of family business study is of particular significance in this region as family enterprises constitute 90% of all businesses. In a similar view, Román et al. (2023) also conduct an extensive review of academic literature worldwide about Intellectual Property Rights, with a pronounced emphasis on the Arab world's concerns, particularly from the perspective of the UAE, regarding an issue of significant importance to economic development. Ibrahim (2020) also examines scientific research conducted in the Arab world, specifically in Egypt. Ibrahim paper investigates the role of national awards in the Egyptian scientific research system, aiming to identify the characteristics of State Award laureates in science and technology, determine their international literature, and explore the implications of receiving a national award using bibliometric indicators.

In the following Figure 1, it is possible to observe that the evolution in scientific productivity in the Arab world is significant and steadily increasing over time. In fact, over a decade, the quantity of papers published on scientific topics in the region has multiplied by five or nearly six times.

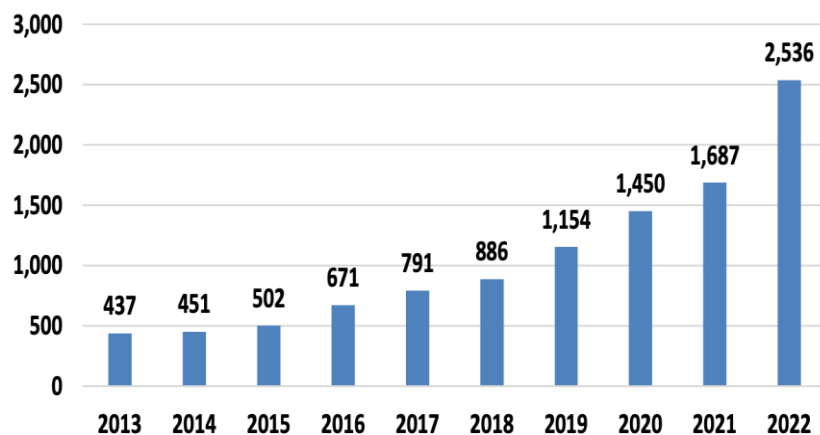


Figure 1. Growth in articles among the 30 accredited Arab business schools. Source: Jamali et al. (2023)

According to Jamali et al. (2023), trends in the two most relevant academic categories for business research, "Business, Management, and Accounting" and "Economics, Econometrics, and Finance" are observed in the Arab region. Research growth in the Arab region is nearly double that of global growth during the same period. In relative terms, the increase in publications in the region has been significant, which can be attributed to the continuous expansion of faculty in Arab business schools and normative pressures on these academics to publish. This indicates the emergence of a research culture and positive trends toward increased productivity among academic institutions in the Arab world. Now, what topics are attracting attention in research? Without a doubt, they are issues related to innovation,

sustainability, and growth, as there is a growing concern in the agendas of Arab countries that aligns with these areas of interest. As mentioned in the Introduction, there are examples of initiatives in all Arab economies, like the ones presented for the UAE below, which then attract researchers' attention to analyze and conduct scientific work on them.

As mentioned in the Introduction, there are examples of initiatives in all Arab economies, like the ones presented for the UAE below, which then attract researchers' attention to analyze and conduct scientific work on them (Table 1).

Table 1. Initiatives in UAE related to innovation, sustainability, and growth.

UAE Vision 2021	UAE Sustainable Development Agenda 2030	UAE Energy Strategy 2050
The Vision aims to make the UAE among the best countries in the world by the Golden Jubilee of the Union. In order to translate the Vision into reality, its pillars have been mapped into six national priorities which represent the key focus sectors of government action in the coming years.	To effectively implement the SDGs, the UAE adopted a whole of government approach that entailed the creation of a National Committee on SDGs. The committee is responsible for promoting sustainable development and creating ownership of the goals.	Building on national policies relevant to green growth and sustainable development, particularly the UAE Green Agenda 2015-2030, and reflecting on valuable inputs received from stakeholders from public, private, and non-governmental sectors, the Climate Plan is envisaged to strengthen the momentum going forward
National Climate Change Plan of the UAE 2017 - 2050	National Policy for Reducing Transport Sector Emissions	UAE Green Agenda – 2015 – 2030
The primary objectives are to manage greenhouse gas (GHG) emissions while sustaining economic growth, minimize risks and improve capacity of adaptation to climate change and enhance the UAE's economic diversification agenda through innovative solutions.	Initiatives focus on leveraging advanced technologies to boost the safety and prepare the infrastructure for autonomous vehicles and high-speed means of transportation, while seeking sustainable and environment-friendly alternatives.	The UAE's Green Agenda - 2030 is a long-term plan to achieve the goals of sustainable development in the UAE and make its economy more environment-friendly. It has strategic objectives and includes various programmes and initiatives to achieve them.

Considering the above, there is an undeniable opportunity to further investigate whether this increased productivity is observed in specific areas of research, such as themes related to innovation and sustainability. As with various studies on publications in the field of innovation within universities worldwide and their diverse regions (Roman et al., 2017; Cancino et al., 2017a, 2017b, 2018, 2023; Farías & Cancino, 2021), it is pertinent to examine the progress that has been made in scientific publications in the Arab world concerning innovation. Today, more than ever, this analysis is crucial, especially in its connection with sustainability, which holds significant relevance for global markets and the world economy (United Nations, 2015).

Based on the previous analysis, and in order to gain a comprehensive understanding of the evolution of innovation and sustainability research within Arab universities, this paper aims to analyze scientific papers with a focus on innovation and sustainability in Arab universities through a bibliometric approach.

3 Methodology

In recent years, in the Arab context bibliometric analysis has gained increasing popularity among scholars as a powerful and adaptable quantitative tool for examining bibliographic data (Román et al., 2023; Jamali et al., 2023). Various

researchers have provided diverse definitions, but for instance, foundational studies by Pritchard (1969) and Broadus (1987) established bibliometrics as a field within library and information sciences that employs quantitative methods to explore bibliographic materials. While this methodology has been in use for nearly half a century, it has seen a growing resurgence of interest among researchers. This revival can be attributed, in part, to the significant advancements in technology over the past few years, which have greatly enhanced the capabilities and applications of bibliometric analysis. These developments, coupled with the increasing recognition of the insights and value that bibliometrics can offer in research contexts, have contributed to its continued relevance and utility in the scholarly community.

In bibliometric studies, the indicators typically analyzed include total publications, total citations, and the h-index. While the first measures productivity and the second measures influence, the h-index represents a metric that combines productivity and influence in a discipline, making it an interesting indicator for the analysis of the growth of a knowledge area (Hirsch, 2005). In this current study, we employ total publications, total citations, and the h-index as bibliometric indicators to present a more comprehensive set of findings.

The database utilized for this study is the Web of Science Core Collection. Our search process commenced with the query: "innovation" AND "sustainability" OR "innovat*" OR "sustain*". The entire search process and analysis were conducted in September 2023. Through this study, we identified a total of 1,769 documents as publications within the analyzed period (from January 1995 to August 2023). Furthermore, in this bibliometric investigation, we incorporate a visual component to aid in the interpretation of bibliometric indicators. VOS viewer provides visual reports that illustrate university collaboration and the co-occurrence

of author keywords. University collaboration visualizes the most frequent co-authorships among different universities in the same papers, while co-occurrence of author keywords reveals the most commonly occurring keywords typically found beneath the abstracts. In the following Table 1, it can be observed the results for total publications (TP), total citations (TC), and the *h*-index across three time periods (1995-2005, 2006-2015, 2016-2023). Additionally, it is feasible to analyze the total number of publications that have received more than 100, 50, 20, 10, and 1 citation.

Table 2. Ranking of countries on innovation and sustainability research in Arab universities.

Period	≥100	≥50	≥20	≥10	≥1	H-Index	TP	TC
1995-2005	0	0	0	4	8	5	9	63
2006 - 2015	7	12	30	44	65	25	65	4,249
2016 - 2023	31	101	290	527	1,294	65	1,695	19,087
Total	38	113	320	575	1,367	68	1,769	26,062
Percentage	2,15%	6,39%	18,09%	32,50%	77,28%			

Note: > 100, > 50, > 20, > 10, > 1 = Number of papers with equal or more than 200, 100, 50, 20, 10 and 1 citations. H = h-index; TP = total number of publications; TC = total number of citations

Source: Own elaboration

Table 2 shows that a total of 1,769 papers were published between 1995 and 2023, with the last decade exhibiting the highest levels of productivity and influence. Only a small number of articles, a total of 38, have garnered more than 100 citations, but approximately one-third of the publications have received at least 10 citations. This phenomenon underscores the increasing influence that academic papers on innovation and sustainability have accumulated over time.

4 Results

This section presents a complete interpretation of the results of the bibliometric analysis. The Figure 2 below depicts the evolution of published articles from 1995 through 2023, which illustrates a significantly greater growth in scientific articles compared to the average growth rate presented in Figure 1, which represented the growth in academic articles across all knowledge areas in the Arab world.

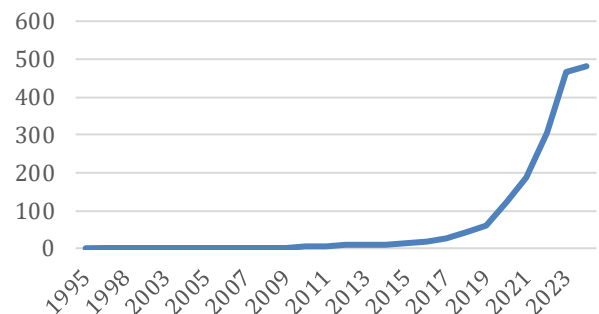


Figure 2. Evolution of innovation and sustainability research in Arab universities.

Source: Own elaboration

Figure 2 displays a conspicuous surge in the publication of papers focused on innovation and sustainability within Arab countries, particularly following two momentous events in 2015. Firstly, in September 2015, the United Nations General Assembly ratified the 2030 Agenda for Sustainable Development. This landmark agreement delineates a transformative vision for economic, social, and environmental sustainability, supported by the 193 Member States who embraced it. Secondly, on December 12, 2015, during the COP21 summit in Paris, the participants in the United Nations Framework Convention on Climate Change (UNFCCC) achieved a historic accord known as the Paris Agreement. The Paris Agreement is designed to combat climate change and expedite the

necessary actions and investments for a sustainable, low-carbon future. It signifies the first-ever collective commitment of all nations to pursue ambitious endeavors aimed at mitigating climate change and adapting to its impacts.

4.1 Publication on innovation and sustainability research by Arab countries

In this section, we present the leading Arab countries with universities actively publishing research on innovation

and sustainability. The ranking is organized by h-index and provides the total number of publications and total citations for each country in the topic under consideration. Additionally, we compare the total publications and citations with the overall population of each country to assess the scientific output adjusted for the size of each economy. While this does not imply a greater or lesser commitment as an economy to the study of a specific topic, it does allow for an initial assessment of the effort made by universities with measurable outcomes in scientific publications.

Table 3. Ranking of countries on innovation and sustainability research in Arab universities.

R	COU	TP	TC	H	TC/TP	POPULATION	TP/POP	TC/POP
1	SAUDI ARABIA	645	10,245	50	15.88	36,947,025	17.46	0,00028
2	UAE	313	4,687	33	14.97	9,537,538	32.82	0,00049
3	EGYPT	297	4,909	30	16.53	113,206,750	2.62	0,00004
4	TUNISIA	130	1,461	20	11.24	12,487,268	10.41	0,00012
5	MOROCCO	122	2,506	26	20.54	37,943,332	3.22	0,00007
6	QATAR	120	2,199	21	18.33	2,722,089	44.08	0,00081
7	JORDAN	102	934	17	9.16	11,350,401	8.99	0,00008
8	LEBANON	94	1,425	16	15.16	5,315,754	17.68	0,00027
9	IRAQ	92	1,026	15	11.15	45,783,454	2.01	0,00002
10	ALGERIA	50	774	10	15.48	45,791,152	1.09	0,00002
11	BAHRAIN	34	343	9	10.09	1,489,146	22.83	0,00023
12	OMAN	30	199	9	6.63	4,663,383	6.43	0,00004
13	PALESTINE	26	260	8	10.00	5,405,416	4.81	0,00005
14	YEMEN	17	75	5	4.41	34,660,561	0.49	0,00000
15	SYRIA	15	194	8	12.93	23,532,985	0.64	0,00000

Note: R = ranking; COU = country; TP = total number of publications; TC = total number of citations.

H = h-index; TC/TP = total number of citations over total number publications; TP/POP = total number publications over population; TC/POP = total number citations over population.

Source: Own elaboration

Table 3 reveals that Saudi Arabia, the UAE, and Egypt stand out as the countries with the highest number of university researchers publishing research on innovation and sustainability. Saudi Arabia stands out with over 30% of the publications and more than 33% of the citations on the subject being analyzed. In the case of the UAE and Egypt, both countries contribute 15% of the research effort in both aspects, respectively. Undoubtedly, these three economies among Arab countries exhibit the most significant scientific research efforts in innovation and sustainability.

Particularly noteworthy is the effort put forth by the UAE in terms of the number of publications and citations it maintains when compared to its population. The research effort as a percentage of the population is remarkably high (32.82), second only to Qatar (44.08), albeit with fewer than half the publications.

4.2 Publications on innovation and sustainability research by Arab universities

In this section, we present the leading Arab universities actively publishing research on innovation and sustainability. Table 3 presents a ranking of Arab universities in the field of innovation and sustainability research.

In addition to the established indicators of h-index, total publications, and total citations, Table 3 also provides information about each university's standing in the ARWU (The Academic Ranking of World Universities, also known as the Shanghai Ranking) and the QS (World University Rankings by Quacquarelli Symonds) rankings.

Table 4. Ranking of Arab universities on innovation and sustainability research.

R	UNIVERSITY	COU	TP	TC	H	TC/T P	ARWU	QS
1	King Saud U.	Saudi Arabia	125	1,529	21	12.23	101-150	-
2	King Abdulaziz U.	Saudi Arabia	78	1,432	20	18.36	151-200	143
3	Qatar U.	Qatar	77	1,199	18	15.57	501-600	173
4	Prince Sattam Bin Abdulaziz U.	Saudi Arabia	61	897	14	14.70	501-600	-
5	U. of Sharjah	UAE	58	1,040	17	17.93	901-1000	364
6	Lebanese American U.	Lebanon	52	1,041	12	20.02	-	661-670
7	U. de Carthage	Tunisia	43	396	10	9.21	-	-
8	Abu Dhabi U.	UAE	39	1,140	14	29.23	-	580
9	Cairo U.	Egypt	37	472	11	12.76	301-400	371
10	King Faisal U.	Saudi Arabia	37	353	8	9.54	801-900	851-900
11	King Fahd U Pet. Minerals	Saudi Arabia	33	275	7	8.33	-	-
12	King Khalid U.	Saudi Arabia	33	454	8	13.76	401-500	761-770
13	Princess Nourah Bint Abdul. U.	Saudi Arabia	33	303	6	9.18	301-400	661-670
14	Khalifa U. Sc. Technology	UAE	32	582	9	18.19	-	-
15	Prince Sultan U.	Saudi Arabia	31	719	13	23.19	-	-

Note: R = ranking; COU = country; TP = total number of publications; TC = total number of citations;

H = h-index; TC/TP = total number of citations over total number publications; ARWU = Shanghai Ranking;

QS = Quacquarelli Symonds ranking.

Source: Own elaboration

Table 4 shows that out of the 15 leading Arab universities in scientific publications on innovation and sustainability, 8 of them are from Saudi Arabia, 3 from the UAE, and one each from Egypt, Qatar, Lebanon, and Tunisia. In the case of the top two universities in the Table 4 ranking, King Saud University and King Abdulaziz University, they also happen to be the best Arab universities according to the ARWU ranking, both ranking within the top 150 and 200 best universities in the world, respectively.

It is intriguing to analyze the case of Abu Dhabi University, which may not rank at the top in terms of the number of publications, but it demonstrates a noteworthy citation-to-publication ratio of 29.23. This indicates that while it may not be the most prolific in terms of output, it is among the universities that wield greater influence in terms of citations whenever a paper is published. In other words, each paper authored by academics from Abu Dhabi University garners significantly more citations on average than those from other universities in the ranking. It underscores the notion that academia is not solely about sheer publication volume but also about exerting influence within the scientific community

through research.

4.3 Most Influential Papers on Innovation and Sustainability Research

In this section, we showcase the leading papers or publications emanating from Arab universities in the field of innovation and sustainability. Table 5 compiles the top 15 most influential papers in the subject of analysis, providing details regarding their total citations and average citations per year. This allows for the comparison of data across papers published in different years.

Table 5. Ranking of most Arab influential paper on innovation and sustainability research

R	TC	Title	Author/s	Year	C/Year
1	1,388	The IPBES Conceptual Framework - connecting nature and people	Díaz, S; Demissew, S; Carabias, J; Joly, C;	2015	173.50
2	736	Food waste as a valuable resource for the production of chemicals, materials and fuels. Current situation and global perspective	Lin, CSK; Pfaltzgraff, LA; Herrero-Davila, L; Mubofu, EB; Abderrahim,	2013	73.60
3	451	Green innovation and organizational performance: The influence of big data and the moderating role of management commitment and HR practices	El-Kassar, AN; Singh, SK	2019	112.75
4	351	Renewable energy-driven desalination technologies: A comprehensive review on challenges and potential applications of integrated systems	Ghaffour, N; Bundschuh, J; Mahmoudi, H; Goosen, MFA	2015	43.88
5	272	The effect of nano-additives in diesel-biodiesel fuel blends: A comprehensive review on stability, engine performance and emission characteristics	Soudagar, MEM; Nik-Ghazali, NN; Kalam, MA; Badruddin, IA;	2018	54.40
6	278	Functional graphene nanosheets: The next generation membranes for water desalination	Mahmoud, KA; Mansoor, B; Mansour, A; Khraisheh, M	2015	34.75
7	244	The linkages between natural resources, human capital, globalization, economic growth, financial development, and ecological footprint: The moderating role of technological innovations	Jahanger, A; Usman, M; Murshed, M; Mahmood, H; Balsalobre-Lorente, D	2022	244.00
8	208	Role of big data analytics in developing sustainable capabilities	Singh, SK; El-Kassar, AN	2019	52.00
9	207	Recent trends in membranes and membrane processes for desalination	Goh, PS; Matsuura, T; Ismail, AF; Hilal, N	2016	29.57
10	198	Offering an innovative composited material for effective lead(II) monitoring and removal from polluted water	Awual, MR; Hasan, MM; Islam, A; Rahman, MM; ...	2019	49.50
11	190	Innovations and technology disruptions in the food sector within the COVID-19 pandemic and post-lockdown era	Galanakis, CM; Rizou, M; Aldawoud, TMS; ...	2021	95.00
12	182	Who Uses Smart City Services and What to Make of It: Toward Interdisciplinary Smart Cities Research	Lytras, MD; Visvizi, A	2018	36.40
13	183	Absorptive capacity and green innovation adoption in SMEs: The mediating effects of sustainable organisational capabilities	Aboelmaged, M; Hashem, G	2019	45.75
14	168	Investigating influence of green innovation on sustainability performance: A case on Malaysian hotel industry	Asadi, S; Pourhashemi, SO; Nilashi, M; Abdullah, R; Samad, S;	2020	56.00
15	160	A Secure Cloud Computing Based Framework for Big Data Information Management of Smart Grid	Baek, J; Vu, QH; Liu, JK; Huang, XY; Xiang, Y	2015	20.00

Note: R = ranking; TC = total number of citations; C/Year = total number of citations by year.

Source: Own elaboration.

One of the most significant characteristics of the papers displayed in Table 5 is their high impact, with all of them surpassing 160 citations, and the leading paper in the ranking exceeding a thousand citations. In terms of their content, the majority of the papers do not specifically address a particular Arab economy but rather explore topics of interest in the Arab region, with the involvement of academics affiliated with Arab universities. Therefore, the most important aspect is to analyze the primary areas of study, which can be investigated through the analysis of keywords within the

analyzed papers.

4.4 Typical keywords used in innovation and sustainability Arab research.

Next, Figure 3 shows the most frequently co-occurring keywords in innovation and sustainability research conducted at Arab universities.

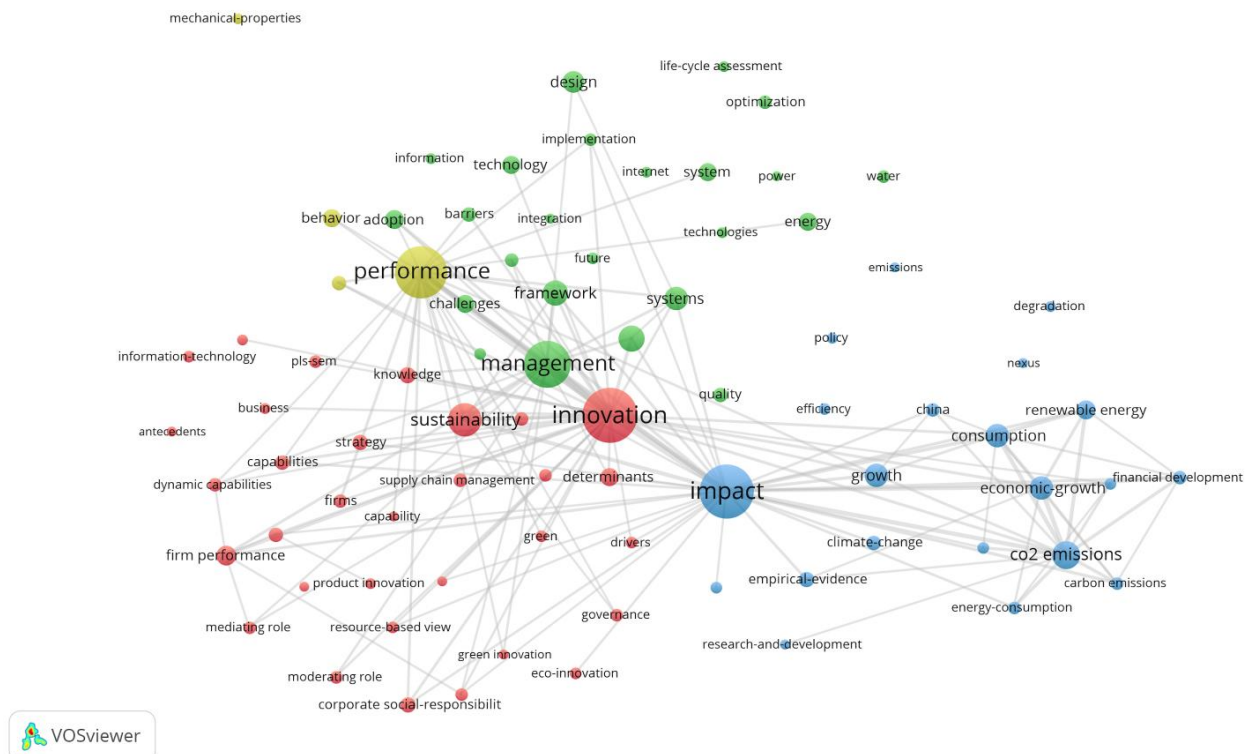


Figure 3. keywords used in innovation and sustainability Arab research.

Source: Own elaboration using VOSviewer program

According to Figure 3, within academic studies on innovation and sustainability in Arab universities, the most frequently co-occurring keywords are innovation, management, impact, and performance. Evidently, in the Arab region, three major clusters of topics of interest to researchers can be observed. These themes are as follows. Firstly, at the center of Figure 3, there is a cluster related to the management of innovation and sustainability, encompassing the analysis of determinants, strategies, and systems, among other factors. Secondly, a second cluster pertains to topics concerning impacts, whether in terms of economic growth, consumption, renewable energy, climate change, and more. Finally, a third cluster focuses on everything related to performance, involving the examination of challenges, barriers, and issues associated with the

implementation of actions that promote innovation and sustainability in various markets.

4.4 Leading universities which Arab universities collaborate.

Now, Figure 4 presents the world universities with which Arab universities collaborate, maintaining joint publication developments.

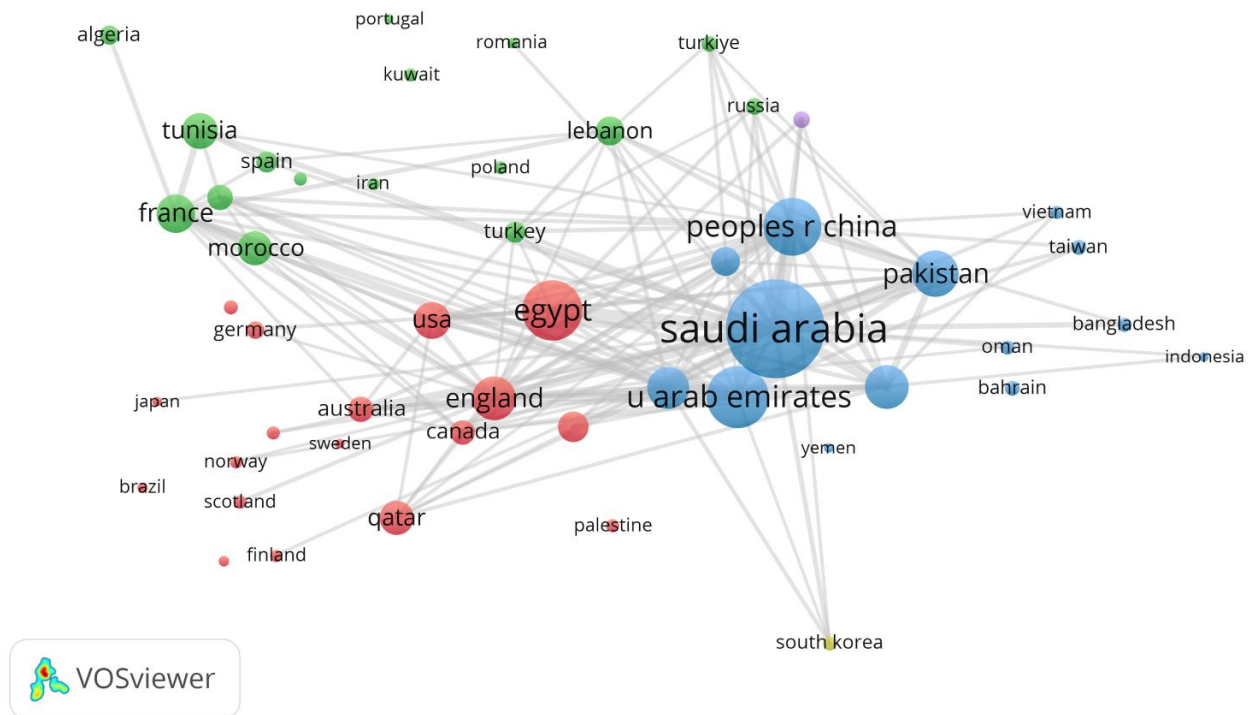


Figure 4. Universities worldwide with which Arab universities collaborate.
Source: Own elaboration using VOSviewer program

Figure 4 reveals two evident clusters characterized by extensive collaboration among countries linked to the Arab region. Particularly, scholars from the UAE and Saudi Arabia predominantly collaborate with peers in China and Pakistan. Conversely, Egyptian academics exhibit stronger affiliations with North American and European counterparts, including the USA, Canada, England, and Australia. The degree of collaboration among nations is particularly remarkable, especially in times of heightened trade tensions, where a competitive struggle for commercial dominance and economic advancement is noticeable, notably between the USA and China.

5 Discussion

In the wake of global agreements, such as the 17 Sustainable Development Goals (SDGs) set by the United Nations and the Paris Agreement with its environmental targets, academic discourse has seen a significant surge in scholarly papers concerning innovation and sustainability within the Arab countries. The year 2015 marked a pivotal point when universities in the Arab world began expressing a heightened interest in exploring the implications of sustainable business

practices, placing innovation at the core of this discourse. This academic trend mirrors the growing concern about global environmental issues and the need for innovative solutions (Jamali et al., 2023).

Arab nations like Saudi Arabia, the UAE, and Egypt have emerged as trailblazers in advancing research on innovation and sustainability in the region. Their commitment is not limited to specific areas but extends to various academic disciplines. These countries have demonstrated leadership not only in the realm of environmental sciences but also in economics, engineering, and social sciences (see Figure 3 and Figure 4). The surge of academic publications from scholars in these regions reflects their proactive efforts to address pressing global challenges through innovative research and multidisciplinary collaboration.

The research output stemming from Saudi Arabia, the UAE, and Egypt manifests their dedication to fostering innovation and sustainability. In fields such as environmental engineering and renewable energy, these nations have emerged as prominent contributors, generating valuable

insights to tackle environmental challenges. Simultaneously, their researchers have made significant strides in areas like economics and management, promoting sustainable business practices and guiding the international community towards a more ecologically conscious future. This academic leadership underscores the commitment of these nations to the global pursuit of innovation and sustainability across diverse academic domains.

Our results are consistent with Jamali et al. (2023), who show that Arab region business schools are actively addressing several significant United Nations SDGs. Among these, SDG 8, focusing on decent work and economic growth, emerges as a critical area of research interest. Furthermore, SDG 17, emphasizing partnerships for the goals, and SDG 9, centering around industry innovation and infrastructure. When analyzing the titles of 15 academic papers (Table 4), common patterns and themes emerge, which can be grouped as follows:

In the first group, papers such as "Green innovation and organizational performance: The influence of big data and the moderating role of management commitment and HR practices" (El-Kassar & Singh, 2019), "Role of big data analytics in developing sustainable capabilities" (Singh & El-Kassar, 2019) and "A Secure Cloud Computing Based Framework for Big Data Information Management of Smart Grid" (Baek et al., 2015) indicate a strong focus on data management and analytics, highlighting the significance of handling and deriving insights from large datasets.

The second cluster revolves around environmental sustainability, with titles like "Renewable energy-driven desalination technologies: A comprehensive review on challenges and potential applications of integrated systems" (Ghaffour et al., 2015), "Functional graphene nanosheets: The next generation membranes for water desalination" (Mahmoud et al., 2015), "Recent trends in membranes and membrane processes for desalination" (Goh et al., 2016) and "Offering an innovative composited material for effective lead (II) monitoring and removal from polluted water" (Awual et al., 2019). These papers underline the importance of sustainable practices, particularly in the context of water treatment, biofuels, and waste management.

The third group explores sustainable energy solutions, as evident from titles such as "Who Uses Smart City Services and What to Make of It: Toward Interdisciplinary Smart Cities Research" (Lytras & Visvizi, 2018), "Innovations and technology disruptions in the food sector within the COVID-19 pandemic and post-lockdown era" (Galanakis et al., 2021), "Absorptive capacity and green innovation adoption in SMEs: The mediating effects of sustainable organizational capabilities" (Aboelmaged & Hashem, 2019) and "Investigating influence of green innovation on sustainability performance: A case on Malaysian hotel industry" (Asadi et al., 2020). This group emphasizes innovative energy technologies and their integration into urban and business systems.

The analysis of these paper titles reveals a coherent thematic

structure. The first group underscores the significance of data and analytics, the second places an emphasis on environmental sustainability, and the third centers on innovative energy solutions. These categorizations shed light on prevailing research trends, showcasing the synergy between data-driven insights, environmental consciousness, and sustainable technological advancements in academic discourse.

In addition to the thematic groupings of academic papers, it is noteworthy that these clusters are to some extent interconnected with a detailed analysis of the most frequently used keywords in academic literature from Arab universities. Figure 3 prominently displays three major keyword clusters that align with the previously identified paper groupings.

- Firstly, at the center of Figure 3, there is a cluster related to the management of innovation and sustainability, encompassing the analysis of determinants, strategies, and systems, among other factors. This aligns closely with the first thematic group of papers, emphasizing data management and analytics, as well as the integration of innovative technologies in the quest for sustainability.
- Secondly, a second cluster pertains to topics concerning impacts, whether in terms of economic growth, consumption, renewable energy, climate change, and more. This resonates with the second thematic cluster highlighting environmental sustainability, reflecting a focus on the consequences and effects of sustainable practices on economic and environmental parameters.
- Finally, a third cluster focuses on everything related to performance, involving the examination of challenges, barriers, and issues associated with the implementation of actions that promote innovation and sustainability in various markets. This mirrors the third thematic group centered on sustainable energy solutions, emphasizing the practical aspects and hurdles related to the deployment of sustainable technologies.

The convergence between these keyword clusters and the thematic groupings in academic literature from Arab universities underscores the comprehensive exploration of innovation, sustainability, and their multifaceted impacts in the academic discourse. This interconnectedness demonstrates a holistic approach to addressing the complex challenges of the contemporary world.

6 Bibliometrics in transit: epilogue of a sowed gaze

From a complementarity perspective, this study's results offer a privileged starting point to undertake a transdisciplinary reading that broadens its scope. The quantitative mapping achieved here not only records the evolution of a field, but also enables a fruitful dialogue between the precision of the data and the interpretative

openness demanded by complex thinking. The metrics, citations, and indicators compiled should be understood not as static figures,

but as dynamic expressions of an expanding scientific framework, whose richness multiplies when integrated with new epistemic perspectives. In this sense, Carías Escoto (2024), in his bibliometric study on artificial intelligence in higher education, emphasizes that this type of analysis not only measures scientific production, but also reveals patterns of collaboration, thematic trends and research gaps that can guide the articulation of academic networks and the connection between regions with different degrees of research development. This approach reinforces the idea that bibliometrics, in addition to quantifying, can serve as a strategic bridge between empirical evidence and the projection of new scientific agendas.

The bibliometrics in transit proposed here is conceived as a bridge between the certainty of data and a broadening of meaning, by articulating the rigor of measurement with the interpretative framework of complex thinking, which

recognizes that knowledge is always under construction. In this sense, to understand the evolution of research on innovation and sustainability is not only to register its growth, but also to investigate how these notions can be re-signified as forms of presence, relating, and ways of being in the contemporary world. Such resignification opens the way to what we call *ontological transitions*: possible shifts from functional understandings to more relational, ethical, and civilizing dimensions.

As an interpretative seed, two tables illustrating these possible transitions in the Asian context are presented below, not as results of the present study, but as prospective input for future research that wishes to explore not only the quantitative evolution of these fields, but also their deepening at the ontological level. As Morin (1999) points out, "*the purpose of the education of the future must be to teach the human condition*" (p. 15), and in this framework, innovating and sustaining cannot be limited to technical labels, but must become principles that guarantee the habitability of the planet and the dignity of the future.

Table 6. Resignification of Innovation

From	To
Isolated technological product	Creative relationship between beings, knowledge, and territories
Speed and disruption	Meaning, coherence, and connection with the collective well-being
Competition between actors	Conscious and ethical collaboration
Innovation as an end	Innovation as a means to human fulfillment
Technology for its own sake	Technology with purpose and soul

Source: Own elaboration

Table 6 induces redefining innovation as a relational and ethical act, not as a goal of technical progress, but as a way

to respond with creativity and care to the challenges of this new era.

Table 7. Resignification of Sustainability

From	To
Technical environmental balance	Existential and cultural balance of ways of life
Development strategy	Civilizational and spiritual commitment to life
Agenda of indicators	Ecosystem of human and non-human ties
Responsible consumption	Re-enchantment of habitat and the reciprocity with Earth
Natural resources	Relational goods with symbolic and vital value
Speed and disruption	Meaning, coherence, and connection with the collective well-being
Competition among actors	Conscious and ethical collaboration
Innovation as an end	Innovation as a means to human fulfillment
Technology for its own sake	Technology with purpose and soul

Source: Own elaboration

This table suggests assuming sustainability not as a strategy of "*less damage to the planet*," but as an integral reconfiguration of life itself, of desire, need, and sense of belonging. Along the same lines, innovation is redefined as a relational and ethical act, and sustainability as a civilizing principle of shared living, beyond its dominant technical-economic interpretations.

From a trialectical perspective, this space is not an endpoint, but a third place where quantitative data and epistemic reflection dialogue to pave the way for new possibilities. Without seeking to broaden the objectives of this study, we do envision future scenarios in which both concepts—innovation and sustainability—cease to be merely analyzed categories and become vectors for transforming the very meaning of knowledge. In this transit, bibliometric observation not only shows evolution, but also poses the challenge of exploring how these notions are integrated in academic life, institutional policies, and in the configuration of a renewed civilizational conscience.

In this horizon, one could ask if they are already operating as curricular foundations. Are they translating into cross-sector practices that respond to the common good? Are they part of the ethical narrative of our digital societies?

Therefore, the "*bibliometrics in transit*" proposed here is understood as a bridge: not only to continue measuring what is growing in production, but also to perceive what is germinating in purpose. Innovating and sustaining, in this sense, imply cultivating ways of being in the world capable of sustaining life, equity, and intergenerational responsibility. This final pause does not pose an immediate research demand, but rather an ethical and metacognitive call to continue thinking of science as a bridge between knowledge, innovation, sustainability, and a shared future. Perhaps, in this transit, knowledge will approach its highest form of shared responsibility: a form of *amānah* (ethical stewardship) that, in dialogue with data and their interpretation, contributes to a more conscious and co-responsible world.

7 Conclusions

The analysis of this paper of academic studies conducted by universities in the Arab world over the past two decades highlights the profound interest and commitment of the region to the pivotal themes of innovation and sustainability. The whole volume of research in these areas is an indicator to the importance attached to addressing global challenges and advancing the principles outlined in international agreements like the Sustainable Development Goals (SDGs) and the Paris Agreement. It is evident that Arab universities have made significant contributions to the global body of knowledge on innovation and sustainability. This is not

merely an academic exercise but reflects a genuine concern for the region's growth, development, and sustainability, as well as its active participation in the global discourse on these critical issues.

Furthermore, the research findings emphasize the symbiotic relationship between scientific development, economic growth, and sustainability. The extensive body of work from Arab universities serves as a valuable resource for policymakers, businesses, and scholars, providing insights into practical strategies and innovative technologies that can foster sustainable development. These insights have the potential to influence decision-making at national and regional levels, ultimately contributing to the broader objectives of a more sustainable and equitable future. This comprehensive analysis underscores the region's intellectual and practical investment in driving innovation, fostering sustainability, and enhancing their position on the global stage. It is a proof to the Arab world's commitment to not only addressing its unique challenges but also to making substantial contributions to the broader global sustainability agenda.

Limitations of this paper and its analysis include a potential language bias towards English publications, a focus on research from the last two decades, and a limited geographic scope. To advance this field, future research should consider interdisciplinary approaches, conduct in-depth case studies of specific Arab countries or universities, engage in comparative analyses with non-Arab regions, include non-English publications, assess the practical impact of academic research, analyze emerging trends such as the implications of emerging technologies, circular economy models, and post-pandemic sustainability, and explore the intersections of innovation and sustainability with other crucial domains like public health, governance, and education, to provide a more comprehensive understanding and ensure broader inclusivity in Arab academic representation.

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