UNDERSTANDING THE GROWTH AND TRENDS OF SAUDI ARABIA'S PATENT THROUGH BIBLIOMETRIC TECHNIQUE

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Abstract: This study aims to investigate the collaborative networks and knowledge diffusion of Saudi Arabia's patents using bibliometric methods. A comprehensive dataset of patents granted from 1983 and 2022 will be analyzed using bibliometric techniques, Publication Trends, including type wise and document wise trends, Owner wise analysis and year wise patent citation analysis. The analysis will also examine the trends and patterns of Saudi Arabia's patenting activities over time.

Methods: This paper presents an overview of Saudi Arabian patent Investigation based on bibliometric analysis using LENS Database from 1983 to 2022. Saudi Arabian patent published by the USPTO (United States Patent and Trademark Office) patents are used for this research.

Findings: The findings of the study are presented in the form of tables, charts, and graphs. The statistical analysis provided insights into the trends and patterns of patenting activity in Saudi Arabia over time by the leading patent production companies in the country.

Conclusion: The study concluded that Saudi Arabia has experienced a significant increase in patent activity over the past few decades, with a focus on technology areas such as information technology, healthcare, and energy. The study also identified the leading inventors and companies in the country and provided insights into the factors driving patent activity in Saudi Arabia. *Overall, this study will contribute to the understanding of the dynamics of patenting activities in Saudi Arabia and their implications for research, innovation, and economic development in the country.*

Keywords: Patent, Bibliometric Study, Saudi Arabia

Introduction:

A patent is a type of intellectual property that gives its owner the legal right to exclude others from making, using, or selling an invention for a limited period of time in exchange for publishing an enabling disclosure of the invention ('Patent', 2023). In other words, it's a legal document that grants an inventor exclusive rights to their invention for a certain period of time (*What Is a Patent in Simple Terms?*, n.d.).

Patents are granted by governments and are intended to encourage innovation by providing inventors with a way to protect their inventions from being copied by others. Patents can be granted for a wide range of inventions, including machines, processes, chemical compositions, and designs. *Patents are a valuable resource for innovators,* (Islam & Miyazaki, 2010; Jin et al., 2011; Mogoutov &Kahane, 2007)*, R&D engineers*(Lai & Wu, 2005; Morris et al., 2002)*, corporate executives, and policymakers in technology. Patents are a crucial indicator of scientific and technological innovation, reflecting the efforts of individuals, institutions, and countries to develop new products, processes, and services* (Archibugi, 1992). *Bibliometric analysis, which involves the quantitative and qualitative assessment of scholarly publications, has become a powerful tool for evaluating research impact, identifying research trends, and mapping research networks. In recent years, bibliometric analysis has been increasingly applied to patent databases to examine*

the scientific and technological landscape of countries and regions, and to identify the key players and trends in various fields (Abbas et al., 2014). Patents describe new inventions in a specific field of technology and research shows that a significant portion of the information presented in patents are relatively new.

Saudi Arabia has been investing heavily in research and development in recent years, with the aim of becoming a leading player in the global knowledge economy. According to the World Intellectual Property Organization (WIPO), the number of patents granted by the Saudi Patent Office has been steadily increasing over the past decade, reflecting the country's growing research and innovation capabilities (World Intellectual Property Organization., n.d.). *However, little is known about the research and innovation landscape of Saudi Arabia's patents, the most productive and impactful authors and institutions, and the most significant research areas and technologies associated with these patents.*

Review of Literature:

(Sjögren et al., 2020) describes how structured chemometric principles of multivariate data analysis can be applied in the context of text analysis in a novel combination with common machine learning preprocessing methodologies. The authors demonstrate their methodology in two case studies. They conclude that using machine learning to transform unstructured data into structured data provides a good preprocessing tool for subsequent chemometric multivariate data analysis and provides an easily interpretable and novel workflow to understand large collections of patents.

(Bamakan et al., 2021) The authors use text mining techniques such as text segmentation, summary extraction, feature selection, term association, cluster generation, topic identification, and information mapping . They conclude that their approach can be used to identify technological gaps in blockchain technology. (Abbas et al., 2014)that presents the state-of-the-art in patent analysis and also presents taxonomy of patent analysis techniques. The key features and weaknesses of the discussed tools and techniques are presented and several directions for future research are highlighted. It discusses patent retrieval which is considered the pillar of almost all patent analysis tasks. It is concerned with developing techniques and methods that effectively and efficiently retrieve relevant patent documents in response to a given search request.

Methodology:

Data Collection: The LENS database was used to collect Saudi Arabian patent data from 1983 to 2022 for the bibliometric study. The search criteria were based on Saudi patent applications and Saudi patents granted to Saudi inventors.

Data Preprocessing: Data were downloaded from the LENS database on 11.01.2023 in Excel format for statistical analysis using SPSS.

Data Analysis: The statistical analysis was carried out using SPSS. Descriptive statistics such as frequency, cumulative percent, mean, and standard deviation were used to analyze the patent data.

Table 1 Publication Trend

Year	Patent Frequency	Patent Percent
1983	2	0.01
1986	2	0.01
1987	2	0.01
1988	2	0.01
1989	3	0.02
1990	4	0.02
1991	2	0.01
1992	1	0.01
1993	1	0.01
1994	2	0.01
1995	6	0.04
1996	4	0.02
1997	2	0.01
1998	4	0.02
1999	4	0.02
2000	16	0.10
2001	9	0.05
2002	27	0.16
2003	42	0.26
2004	50	0.30
2005	62	0.38
2006	70	0.43
2007	85	0.52
2008	104	0.63
2009	117	0.71
2010	212	1.29
2011	301	1.83
2012	493	3.00
2013	748	4.55
2014	766	4.66
2015	931	5.66
2016	1095	6.65
2017	1262	7.67

2018	*1332*	*8.09*
2019	*1843*	*11.20*
2020	*1944*	*11.81*
2021	*2438*	*14.82*
2022	*2467*	*14.99*
Total	*16455*	*100.00*

*The table shows that year wise publication trends and their percentage between 1983 and 2022. In 1983-1990, the number of patents each year were relatively low, wit*h an average of around 2-4 per year. However, there was a slight increase in the number of patents between 1991-1999, with an average of around 3-4 per year.

In 2000, there was a significant increase in the number of patents with 16 patents accounting for 0.1% of the total number of patents. The number of patents continued to increase each year, with a particularly large increase between 2010-2012.

In 2019 and 2020, there were over 1800 patents each year, accounting for 11.20% and 11.81% of the total number of patents, respectively. In 2021 and 2022, the number of patents continued to increase, with 2438 and 2467 patents, respectively, accounting for 14.82% and 14.99% of the total number of patents.
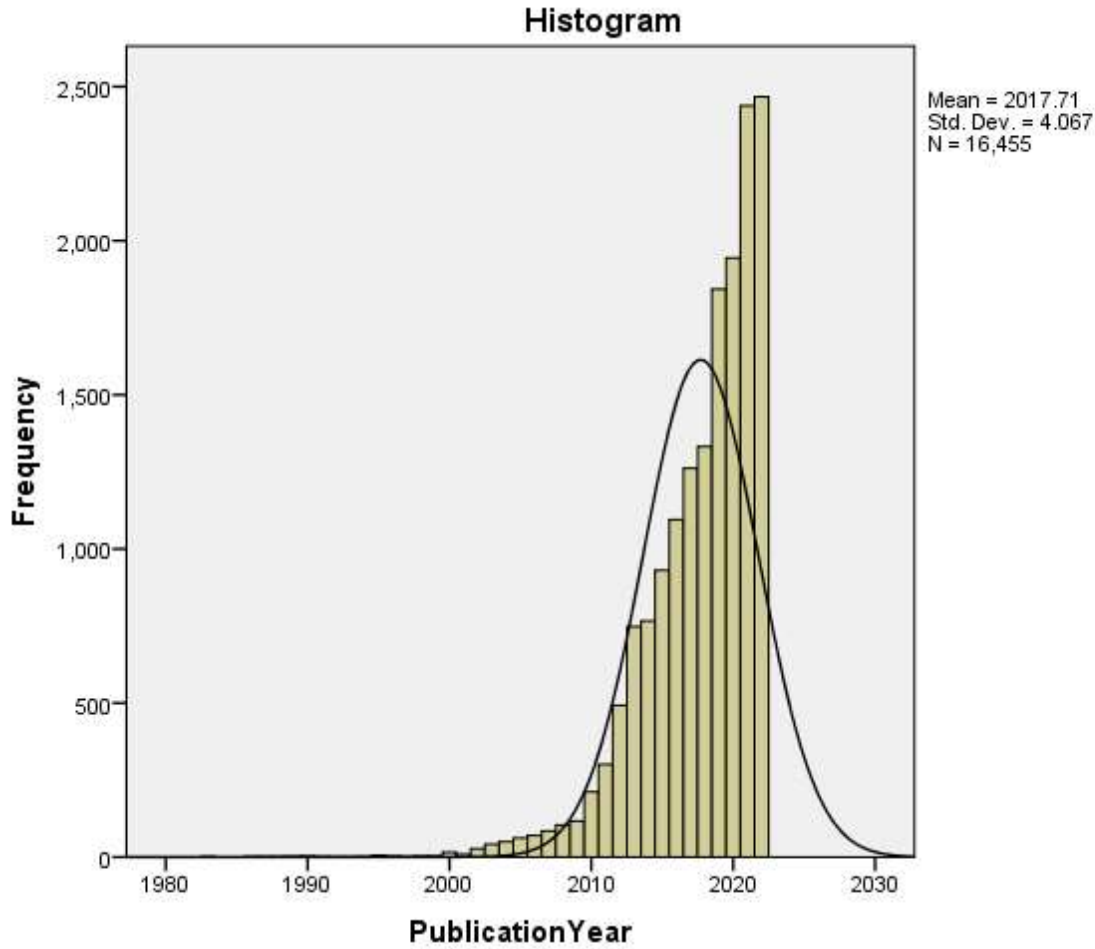
Table.2 Publication Trends by Type

Patent Type	Frequency	Percent	Cumulative Percent
A - Utility Patent Grant issued prior to January 2, 2001.	56	.3	.3
A1 - Utility Patent Application published on or after January 2, 2001	8846	53.8	54.1
A2 - Second or subsequent publication of a Utility Patent Application	6	.0	54.1
A9 - Correction published Utility Patent Application	6	.0	54.2
B1- Utility Patent Grant (no pre-grant publication) issued on or after January 2, 2001	1269	7.7	61.9
B2- Utility Patent Grant (with pre-grant publication) issued on or after January 2, 2001	6244	37.9	99.8

P1 - Plant Patent Application published on or after January 2, 2001	1	.0	99.8
S1 - Design Patent	27	.2	100.0
Total	16455	100.0	

The table shows the frequency and percentage of different types of patents issued or published, as well as their cumulative percentage.

A-type of patents are the most common type, with 56 (0.3%) issued prior to January 2, 2001. P1type patents are much less with only 1 (0.0%) of patent published on or after January 2, 2001, and 27 (0.2%) S1-design patents. There are also several types of utility patents listed, including A1, A2, A9, B1, and B2. A1 represents the largest subcategory, with 8,846 (53.8%) followed by B2 with 6,244 (37.9%). The majority of patents issued are A1 (53.8%), followed by B2 (37.9%). Utility patents account for the vast majority of all patents issued, with design patents making up a small portion (0.2%).

Overall, most patents are utility patents, with a significant increase in the number of patents published or granted on or after January 2, 2001. Design and plant patents represent a much smaller proportion of patents.

Table.3 Publication Trend by Document Type

Document Type	Frequency	Valid Percent	Cumulative Percent
Amended Application	12	0.1	0.1
Design Right	27	0.2	0.2
Granted Patent	7569	46.0	46.2
Patent Application	8847	53.8	100.0
Total	16455	100.0	

The table shows the patent document type with valid percent, and cumulative percent. Out of a total of 16,455 documents, 12 (0.1%) were amended applications, 27 (0.2%) were design rights, 7,569 (46.0%) were granted patents, and 8,847 (53.8%) were patent applications. The cumulative percentage for granted patents is 46.2%, which includes the 46.0% for granted patents plus the 0.1% for amended applications and 0.2% for design rights. Overall, most documents are patent applications (53.8%), followed by granted patents (46.0%).

Table .4 Top owner patent publication and Citations trends

Patent owner	Doc	Cites Patent Count		Cited by Patent Count		NPL Citation	
		Citation	% per doc	Citation	% per doc	Citation	% per doc
Saudi Arabian Oil Company (1933)	9003	177457	19.71	32939	3.66	53072	5.89
King Fahd University of Petroleum And Minerals (1963)	2181	16979	7.78	12154	5.57	4475	2.05
King Abdullah University of Science and Technology (2009)	927	5553	5.99	2393	2.58	6042	6.52
King Saud University (1957)	828	7431	8.97	2395	2.89	2099	2.54
Saudi Basic Industries Corporation (1976)	737	13498	18.31	4578	6.21	3167	4.3
King Abdulaziz University (1967)	547	4030	7.37	774	1.41	1777	3.25
King Abdulaziz City Science and Technology (1977)	347	4028	11.61	1357	3.91	865	2.49
Imam Abdulrahman Bin Faisal University (2015)	289	1905	6.59	586	2.03	598	2.07
Umm Al-Qura University (1949)	200	1516	7.58	1058	5.29	207	1.04
Saudi Arabian Oil Company (1933)	163	2838	17.41	640	3.93	825	5.06

This table shows that the lists of top patent owners in with frequency of patents they own Cites Patent Count, cited by other patents (Cites by Patent Count) and non-patent literature (NPL Citation). The percentage of citations per document is also provided for each category.

The patent owners listed in the table are all based in Saudi Arabia, and they are ranked in descending order of the number of patents they own. The top patent owner is the Saudi Arabian Oil Company, with 9,003 patents, which have been cited 177,457 times Cites Patent Citation Count, Cited by patent Citation count with 32939 and non-patent literature (NPL) 53,072 times. The table shows that this company has a high number of citations per document in all three categories, indicating that their patents are highly influential in the field.

The second and third largest patent owners are the King Fahd University of Petroleum and Minerals and the King Abdullah University of Science and Technology, with 2,181 and 927 patents respectively. The remaining patent owners listed in the table include King Saud University, Saudi Basic Industries Corporation, King Abdulaziz University, King Abdulaziz City Science and Technology, Imam Abdulrahman Bin Faisal University, Umm Al-Qura University, and Sabic Global Technologies B.V.

Table .5 Year wise Cites patent and Cited by Patent count.

Year	Patent Frequency	Cites Patent Count	Cited by Patent Count
1983	2	9	69
1986	2	23	24
1987	2	22	7
1988	2	4	10
1989	3	32	73
1990	4	45	177
1991	2	25	118
1992	1	5	26
1993	1	0	2
1994	2	8	220
1995	6	109	416
1996	4	31	307
1997	2	37	74
1998	4	26	146
1999	4	46	89
2000	16	277	345
2001	9	136	254
2002	27	231	736
2003	42	421	1194
2004	50	723	868
2005	62	1714	1053
2006	70	1178	1504
2007	85	1891	1411
2008	104	2111	1545
2009	117	2281	1952
2010	212	4195	3031
2011	301	5214	3633
2012	493	5161	4997
2013	748	7237	8379
2014	766	8939	5093

2015	*931*	10732	6149
2016	*1095*	12419	5821
2017	*1262*	18702	5581
2018	*1332*	20534	4533
2019	*1843*	29059	4050
2020	*1944*	32769	1992
2021	*2438*	36095	1120
2022	*2467*	47245	209
Grand Total	*16455*	**249686**	**67208**
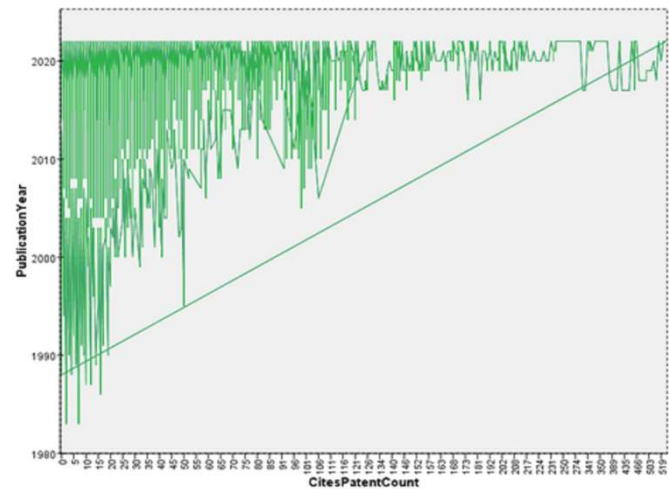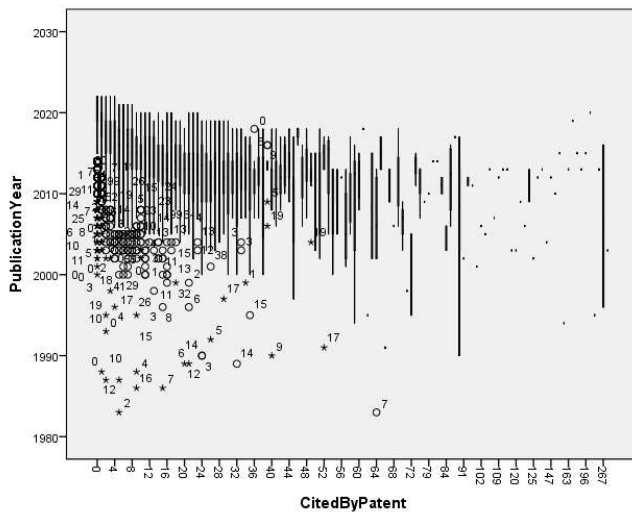
This table shows the number of times patents have been cited and the number of times patents have cited other patents in each year from 1983 to 2022 with a grand total of 249,686 citations and 67,208 patents cited. The number of Cites Patent Counts and Cited by Patent Counts varies greatly from year to year. In the early years (1983-1990), there were relatively few Cites Patent Counts and Cited by Patent Counts are received. However, in the mid-1990s, there was a significant increase in both categories, with over 100 Cites Patent Count and 400 Cited by Patent Count in some years. This trend continued into the early 2000s, with some years seeing over 1,000 citations and nearly 1,500 patents cited. The highest number of Cites Patent Count received by patents was in 2022 with 47,245 citations, indicating the continued importance of patents in driving innovation. In 2022, there were 2467 patents published, but only 209 of them have been cited by other patents so far, indicating that it is still too early to determine their impact on subsequent technology.

Conclusion: The study aims to examine the publication trends and knowledge diffusion of Saudi Arabia's patents through bibliometric methods. The analysis will involve bibliometric techniques, including type wise and document wise trends, company wise analysis and year wise patent citation analysis. One of the main factors contributing to the Saudi Arabian oil company's top ranking with 9003 patents is the founding year. The study will explore the trends and patterns of Saudi Arabia's patenting activities over time and provide valuable insights into the research and

innovation landscape of Saudi Arabia. The results of the study will help in understanding the dynamics of patenting activities in Saudi Arabia and their implications for research, innovation, and economic development in the country. The number of patents in Saudi Arabia has increased significantly over the years, with a particularly large increase in recent years, indicating a growing interest in innovation and the protection of intellectual property rights.

References:

Abbas, A., Zhang, L., & Khan, S. U. (2014). A literature review on the state-of-the-art in patent analysis. *World Patent Information*, *37*, 3–13. https://doi.org/10.1016/j.wpi.2013.12.006

Archibugi, D. (1992). Patenting as an indicator of technological innovation: A review. *Science and Public Policy*, *19*. https://doi.org/10.1093/spp/19.6.357

Bamakan, S. M. H., BabaeiBondarti, A., BabaeiBondarti, P., & Qu, Q. (2021). Blockchain technology forecasting by patent analytics and text mining. *Blockchain: Research and Applications*, *2*(2), 100019. https://doi.org/10.1016/j.bcra.2021.100019

Islam, N., & Miyazaki, K. (2010). An empirical analysis of nanotechnology research domains. *Technovation*, *30*(4), 229–237. https://doi.org/10.1016/j.technovation.2009.10.002

Jin, J. H., Park, S. C., &Pyon, C. U. (2011). Finding research trend of convergence technology based on Korean R&D network. *Expert Systems with Applications*, *38*(12), 15159–15171. https://doi.org/10.1016/j.eswa.2011.05.088

Lai, K.-K., & Wu, S.-J. (2005). Using the patent co-citation approach to establish a new patent classification system. *Information Processing & Management*, *41*(2), 313–330. https://doi.org/10.1016/j.ipm.2003.11.004

Mogoutov, A., &Kahane, B. (2007). Data search strategy for science and technology emergence: A scalable and evolutionary query for nanotechnology tracking. *Research Policy*, *36*(6), 893–903. https://doi.org/10.1016/j.respol.2007.02.005

Morris, S., DeYong, C., Wu, Z., Salman, S., &Yemenu, D. (2002). diva: A visualization system for exploring document databases for technology forecasting. *Computers & Industrial Engineering*, *43*(4), 841–862. https://doi.org/10.1016/S0360-8352(02)00143-2

Patent. (2023). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Patent&oldid=1144866077

Sjögren, R., Stridh, K., Skotare, T., &Trygg, J. (2020). Multivariate patent analysis—Using chemometrics to analyze collections of chemical and pharmaceutical patents. *Journal of Chemometrics*, *34*(1), e3041. https://doi.org/10.1002/cem.3041

What Is a Patent in Simple Terms? With Examples. (n.d.). Investopedia. Retrieved 7 April 2023, from https://www.investopedia.com/terms/p/patent.asp

World Intellectual Property Organization. (n.d.). *World Intellectual Property Indicators 2021.* Unknown. https://doi.org/10.34667/TIND.44461