EFFAT UNIVERSITY RESEARCH PROFILE OVER DECADES: A BIBLIOMETRIC ANALYSIS THROUGH SCOPUS DATABASE

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Abstract

Present research aimed to analyze the research output from Scopus database of Effat University from 2006 to 2024. The main focus was to examine research focus, document types, annual publication trends and external collaboration with other researchers across the world. Using VOSviewer, MS Excel, and BiblioShiny, a total of 1539 publications were reviewed and examined through bibliometric analysis.

The study found that the year 2023 was the most productive in terms of research output. It also identifies that amongst all published material research articles were the highest, accentuating significance. Moreover, it also pinpoints widespread research collaboration with researchers across the globe especially, Saudi Arabian and Egyptian institutions. The Holy Spirit University of Kaslik (USEK) in Lebanon emerged as a key international collaborator. Egypt was identified as the primary source of international research collaboration. The term "human" was most frequently used, and "Computer Science" was the leading research domain. The study provides valuable insights into Effat's research performance in computer science, engineering, business science, and humanities.

This analysis provides important insights into Effat University's research performance by highlighting important research fields, fruitful collaboration, and publishing trends. These results can guide activities to increase the effect of university research as well as strategic planning and allocation of resources. The study's scope is limited by its focus on a single institution and its reliance solely on Scopus data. The findings are specific to Effat and may not be representative of other institutions. This study seeks to motivate library and information science professionals and researchers to explore bibliometric analysis as a tool for understanding their universities' research impact.

Keywords: Effat University, Author Productivity, Research Production, Bibliometric Analysis, Data Visualization, Scopus Database

Introduction

The world is rapidly changing as a result of advances in technical research and invention. Today, universities are the leading producers to research, with a concentration on research and technology transfer. Their objective is to increase technology transfer to satisfy the advanced world's needs. Analyzing an institution's research output can help understand the range and depth of the academic contributions made by university researchers and professors in current research period. Scholars around the world regularly publish research papers (Ali, Aslam, et al., 2021; Aslam, Naveed, et al., 2021; Kappi & Biradar, 2019).

The term "bibliometric" has been introduced to measure research output. Researchers conduct bibliometric analyses to obtain data in statistical form (Naveed, Ali, et al., 2021). These studies explore the productivity of various types of published research, such as articles, reviews, editorial notes, letters, and proceedings. Bibliometric analysis helps calculate citations and gather other information regarding publications (Aslam, Naveed, et al., 2022). Bibliometric analysis is used to evaluate research performance within the academic realm. (Ali et al., 2022). It not only enables researchers to contribute information journals (Aslam, Ali, et al., 2021; Aslam, Qutab, et al., 2022) but also evaluates the scientific progress by reviewing literature and identifying research gaps across the disciplines (Lee et al., 2020).

The present study aims to assess Effat University's overall research output across all disciplines (architecture, cinematic arts, engineering, business studies, and humanities) in which the university offers its services. In Saudi Arabia, as a leading private, non-profit higher education institution, Effat University working under the auspices of operating under the umbrella of King Faisal's Charitable Foundation. Initially, it started as a college in 1999, it was inspired by the vision of its founder, Queen Effat Al-Thunayan Al-Saud, wife of the late King Faisal bin Abdulaziz's, the main objective of the college is to make higher education accessible for Saudi Women. It only provides Kindergarten and Computer Science courses to help women get ready for the workforce in the beginning. Soon in 2000, other leading programs such as English language & translation, psychology, and information systems were introduced. Afterward, the college expanded by joining King Faisal Private University in 2002. Whereas 2005 proved to be a turning point for Effat as it initiated business and engineering programs that provided access to Saudi women to be part of practical academic disciplines such as engineering as well as architecture and to contribute to society. Moreover, Effat became independent from King Faisal University, marking a significant step towards its recognition as an official university in 2008.

The newly established university had a total of three faculties: Science & Humanities, Engineering, and Business administration which offers eight programs with several majors. The University's educational framework is aligned with its strategic goals to respond to the evolving needs of Saudi society as well as the worldwide market. Since its inception as a University, Effat encouraged it faculty members and students to contribute to scientific and academic literature. Therefore, the present study was designed to examine the research output by Effat researchers, either faculty members or students published in Scopus-indexed journals and significance on a global scale.

Literature Review

Baskaran (2013) conducted bibliometric examination of research publications of Alagappa University over a decade concluded that 2011 was the most productive year. As per authorship patterns, most of the work was done with collaboration rather than single authorship. Similar work has been done by Aslam, Ali, et al. (2021) discovered that co-authorship papers produced by three or more writers outnumbered those by single authors. A study was conducted on the research output of the Indian Institute of Technology, Delhi, between 2001 and 2010 (Chaurasia & Chavan, 2014). This bibliometric study analyzed 6109 publications. The most popular document type was journal articles, followed by proceeding papers. On the other hand, reviews were the least popular document type. Sa (2015) reported that the Institute of Minerals and Materials Technology produced the most research publications in India from 2004 to 2013. He found that the Institute contributed 7.43% of all publications, and Chemistry was the most prolific subject. Journals were the preferred document type; the most repeated keyword was "article".

Anwar (2018) studied Pakistani researchers' contributions from 2008 to 2017 to Library Philosophy and Practice (LPP). The findings concluded that 2017 was the most productive year. Dr. Rubina Bhatti was the most prominent author with the most publications. Gupta and Sonkar (2019) studied research produced by the University of Mumbai from 2014 to 2018. They concluded that most authors were interested in publishing as single authors. Furthermore, the male authors' contribution was 324 out of the 796 publications analyzed. Kappi and Biradar (2019) reported the research productivity of Kuvempu University, India, and concluded that the research trend was high during 2011-2016. In their bibliometric analysis of communications published in particular informatics journals between 2012 and 2016, Naseer et al. (2019) discovered 459 records. The results indicated that 2016 was worthwhile in terms of research where Max Planck Society of Germany

contributed to highest publications with collaborations where several authors contributed to one paper. Another bibliometric analysis was carried out by Ahmad et al. (2020) to evaluate research output of the Punjab University (PU), one of Pakistan's oldest universities. Doulani (2021) extracted data from Scopus and reported an increase in research tendency in 21st century, highlighting progress as compared with the 19th century). The trend to publish as a single author also changed as collaborative work receives more citations than single-authored work (Ali et al., 2022).

Recently, research scholars across the globe have shown great interest in bibliometric analysis including Pakistani researchers as well. Hussain and Yar (2020) analyzed published data from Google Scholar and found that 84 documents were published between 2000 and 2020. They further analyzed the data based on authorship patterns and citations. They found that almost 28.75% of papers have at least three authors and the papers were cited 372 times making 24.19% of cited text only in 2014. The results of the study also indicated 6 author publications in the field of knowledge management.

Another bibliometric study concluded that among published data types, "articles" comprised two-thirds of the publications, whereas amongst the research area "pharmacology" was the eminent one. (Haq, 2020). Hussain and Yar (2021) work analyzed Pakistani authors' output in LPP from 2008 to 2020 and identified that Punjab province contributed the highest in the publications than other provinces. In terms of years, 2020 was a highly productive year. Amongst the published work, the most cited wof research to Zuberi and Ansari, Siddique et al. (2021) reviewed six decades of research in Pakistan's library and information science (LIS) field. The study found that Punjab University's Information management department contributed most, and the second highest contribution was made by Karachi University's LIS department.

Literature has emphasized the importance of bibliometric analysis in assessing various research topics in academic realms (Ali, Shoaib, et al., 2021). Pakistan recently carried out a bibliometric study on desktop research. The findings found that 2020 was the most fruitful year for desktop research, and many publications were produced through collaboration between American and Pakistani authors (Wahid et al., 2023). Tariq et al. (2023) carried out a science mapping and bibliometric study of the publications that came out of Pakistan's COMSATS University Islamabad (CUI). The finding shows that National collaboration with Quaid-e-Azam University was spearheaded by COMSATS. International collaborations were led by China. The most popular research area was engineering. Miraj et al. (2023) examine the University of Engineering and Technology's (UET) academic output in Lahore, Pakistan. He examined 5502 research outputs, finding a growth in publications, especially in 2022. Most were research articles, often co-authored with other Pakistani researchers, particularly from the University of the Punjab. International collaborations mainly involved China, and funding primarily came from the HEC. Engineering was the most researched area, with "performance" a common focus. However, there is still a substantial gap in the context of Effat University Jeddah, KSA. So, it is necessary to examine this university's research accomplishments and distinctive research environment using in-depth bibliometric data. This study highlights the research outcomes of this renowned university as indexed in the Scopus database.

Research Objectives

Effat's publications data was retrieved from the Scopus database and evaluated to determine:

- The distribution of document types and year-wise research productivity.
- The most productive authors and collaborative institutions.
- Top country collaboration with Effat authors and most relevant countries as corresponding authors.
- The most co-occurrences keywords by authors
- Top cited publications.
- The most productive Journals and Subject area

Research Methodology

Data extracted from Scopus database using the keyword by affiliation name "Effat University" in search query dated July 20, 2024. A total of 1539 publications were retrieved with the author affiliation of Effat University. After screening, we included all the documents, which were 1539 as mentioned in Figure 01. Bibliographic data analyzed through VOSviewer, Biblioshiny, and MS Excel software.

Figure 1.
PRISMA diagram of the study
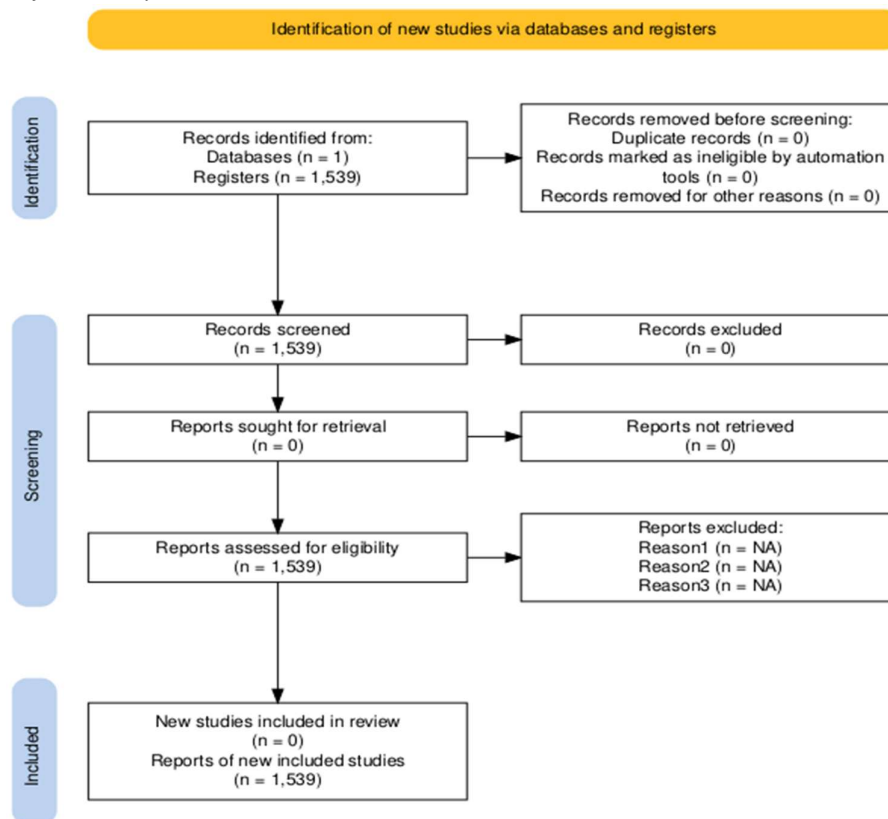
Main Information about Data

Table 1 provides an overview of the publications retrieved from the Scopus database over the last 18 years, from 2006 to 2024. A total of 1539 documents were retrieved, with an impressive annual growth rate of 31.22%. These publications were sourced from 630 different journals, books, and other types of sources. The authorship of these documents involved 2647 contributors, including 196 single-author documents. On average, there were 80 authors per document and 3.81 co-authors per document. Additionally, a total of 4697 keywords were used by the authors in these publications.

Table 1

Main Information about Data

| Description	Results	Description	Results
Sources (Journals, Books, etc.)	630	Keywords Plus (ID)	7208
Organizations	2370	Author's Keywords (DE)	4697
Countries	79	Authors	2647
Documents	1539	Authors of single-authored docs	80
Annual Growth Rate %	31.22	Single-authored docs	196
Document Average Age	3.87	Co-Authors per Doc	3.81
Average citations per doc	12.65	International co-authorships %	52.7

Distribution of Document Types

Figure 1 presents information about the preferred document types among the researchers. Among the 1539 documents retrieved, the most popular choice of publication was articles, accounting for 771 documents (50.10%). This was followed by proceeding papers with 475 documents (30.39%), book chapters with 145 documents (9.42%), reviews with 64 documents (4.16%) editorials with 55 documents (03.57%) and Books

with 25 documents (01.63).
Figure 2
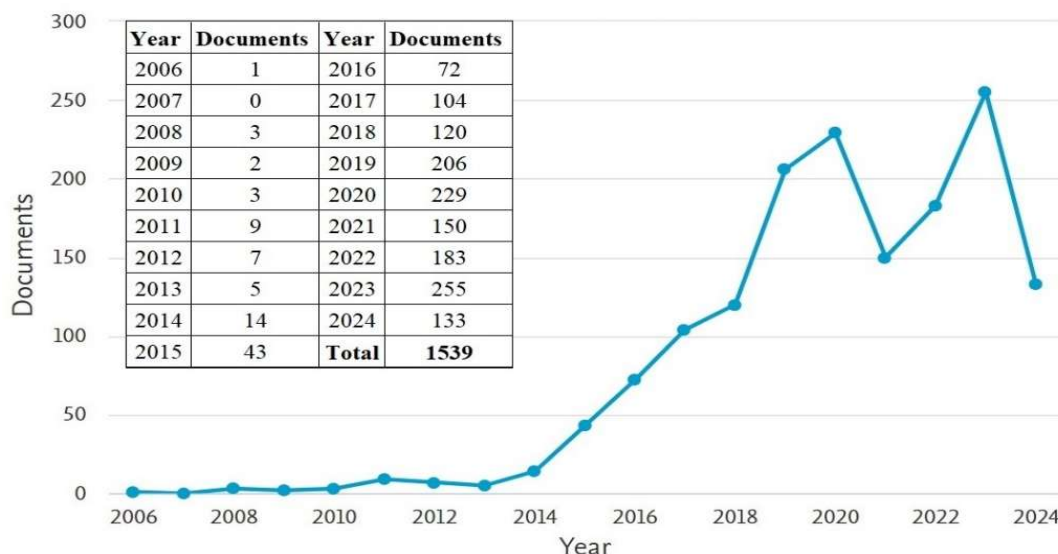*Distribution of Document by Types*
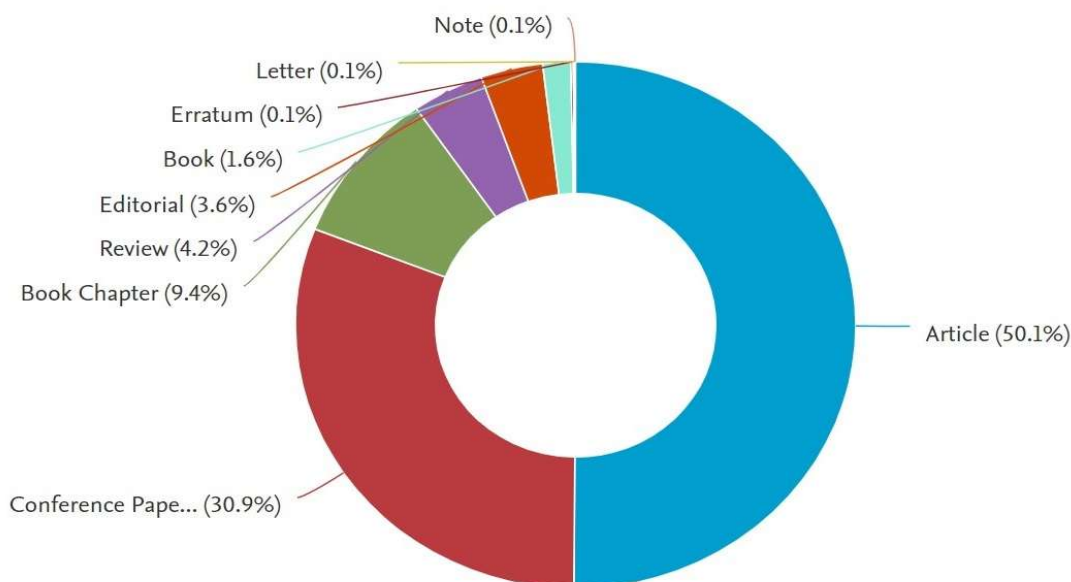
Data Analysis
Distribution of Document by Years

Figure 2 illustrates the year-wise distribution of Effat's publications. The highest number of publications was 255 in 2023, followed by 229 in 2020 and 206 in 2019. The figure indicates a general increase in the publication ratio over time, with the peak number of publications recorded in 2022.

Figure 2
Distribution of Document by Year

Year	Documents	Year	Documents
2006	1	2016	72
2007	0	2017	104
2008	3	2018	120
2009	2	2019	206
2010	3	2020	229
2011	9	2021	150
2012	7	2022	183
2013	5	2023	255
2014	14	2024	133
2015	43	**Total**	**1539**

Most Productive Author

Table 2 highlights the productivity of Effat's authors. The most productive author was Abdulhamit Subasi, with 164 publications and 5230 citations. Saeed Mian Qaisar followed him who had 152 publications

and 1132 citations. Anna Visvizi ranked next with 129 published documents and 2570 citations. Miltiadis D. Lytras had 125 documents and 2412 citations, and Souheil Hallit contributed 91 published documents with 424 citations.

Table 2

Top Productive Author of Effat University

Author	Affiliation	Publication	Citation	h-index	g-index	m-index	PY-start
Subasi, Abdulhamit	College of Engineering	164	5230	36	70	4	2016
Qaisar, Saeed Mian	College of Engineering	152	1132	21	26	1.909	2014
Visvizi, Anna	College of Business	129	2570	26	47	3.714	2018
Lytras, Miltiadis D.	College of Engineering	125	2412	25	47	3.571	2018
Hallit, Souheil	College of Humanities	91	424	10	15	3.333	2022

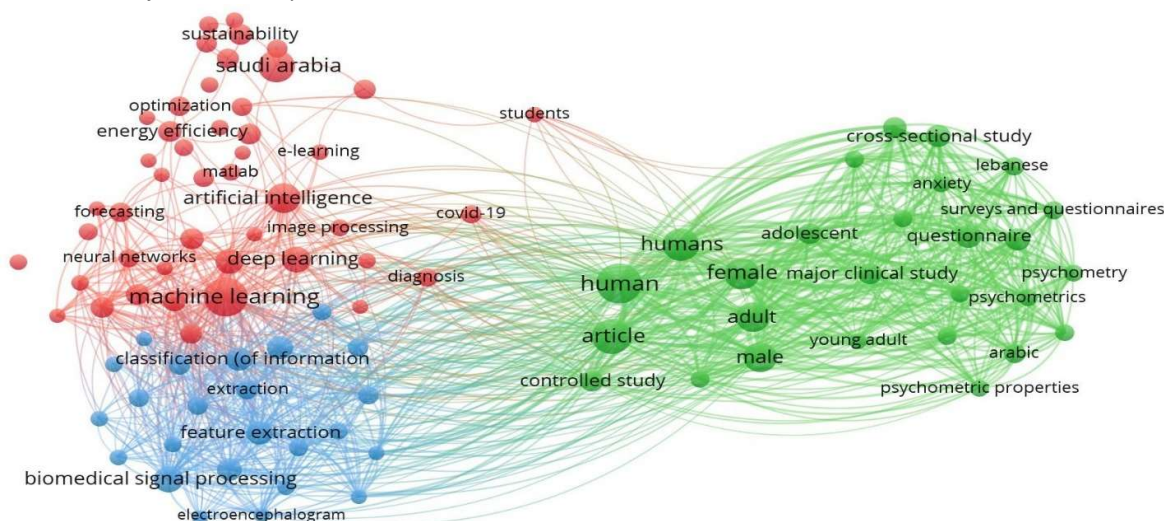**Figure 3**

Author Production over Time
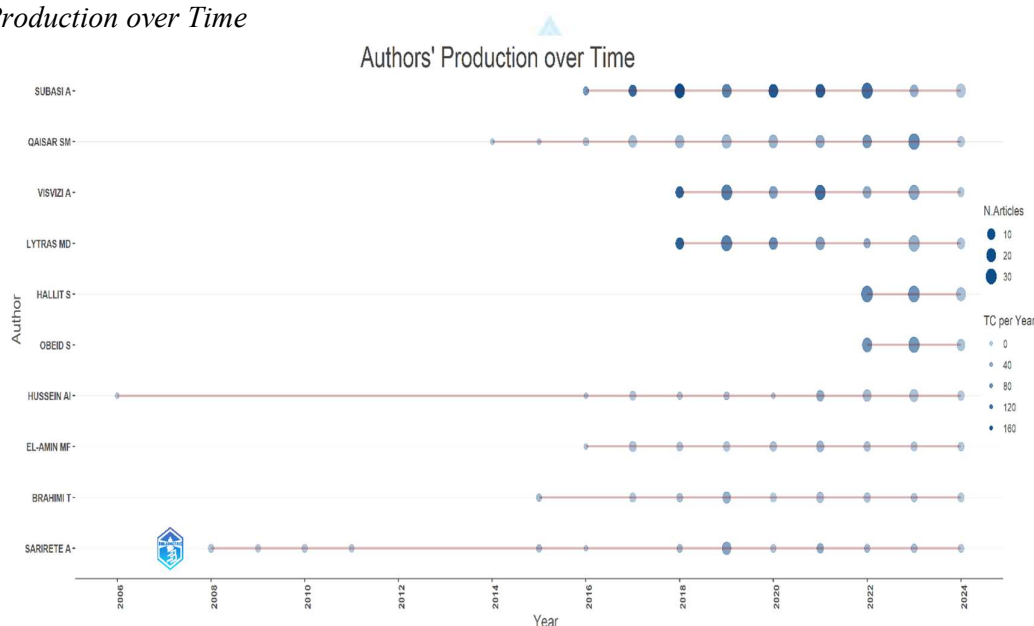
Co-Occurrences of All Keywords

Figure 4 shows the most frequently used all keywords by Effat's authors in their research publications. "Human" has been the most frequently repeated keyword with 148 occurrences and 1526 TLS, followed by "Machine Learning" with 136 occurrences and 863 TLS, "Article" with 115 occurrences and 1296 TLS, "Humans" with 98 occurrences and 1144 TLS, "Saudi Arab with 97 occurrences and 83 TLS, "Female" with 87 occurrences and 1127, Artificial Intelligence with 83 occurrences and 342 TLS, "Male" with 82 occurrence and 1096 TLS, Adults with 81 occurrences and 1064 TLS and "Deep Learning" with 63 occurrences and 251 TLS.

Minimum occurrences 20, Items 97, Cluster 3, Links 2169 and Total Link Strength 14603

Figure 4
*Co-Occurrences of Author Keywords*

Co-Occurrences and Overlay of Author Keywords

Keywords are the most significant part of a publication because they are associated with the query and indicate the core content of a manuscript (Kaur & Gupta, 2010). Figure 5 shows the most frequently used keywords by Effat's authors in their research publications. "Machine Learning" has been the most frequently repeated keyword with 102 occurrences and 273 TLS, followed by "Saudi Arab" with 82 occurrences and 111 TLS, "Artificial Intelligence" with 48 occurrences and 128 TLS, "Deep Learning" with 41 occurrences and 85 TLS, "Classification" with 35 occurrences and 114 TLS, "Arabic" with 34 occurrences and 55 TLS, "Sustainability" with 32 occurrences with 47 TLS, "Architecture" with 27 occurrences and 36 TLS, "Psychometric Properties with 26 occurrences and 40 TLS and "Smart cities" with 25 occurrences and 34 TLS.

Minimum occurrences 7, Items 92, Cluster 8, Links 444 and Total Link Strength 1087.

Figure 5
Co-Occurrences and Overlay of Author Keywords
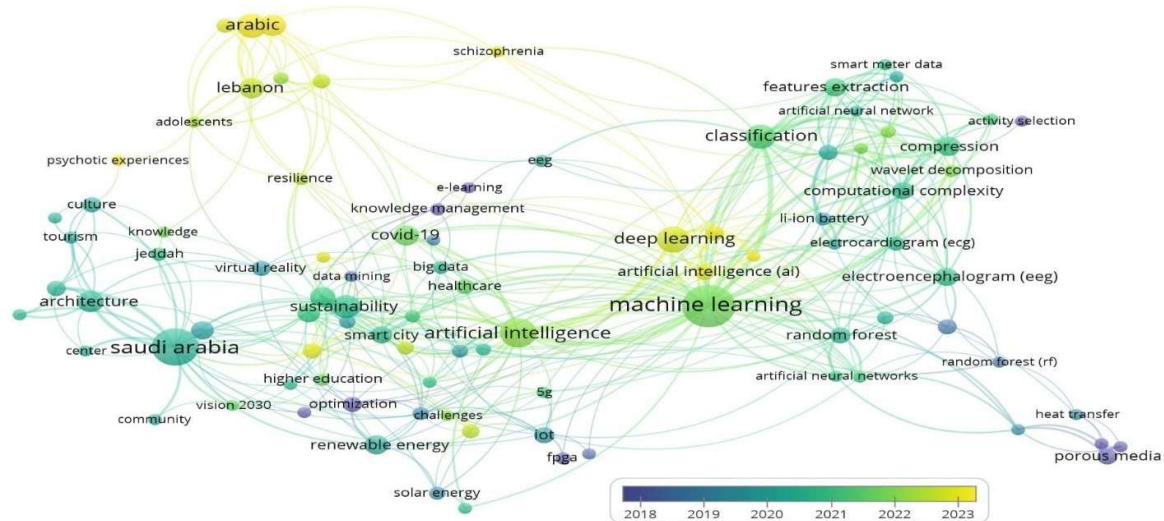
Bibliographic Coupling of Countries

Figure 6 provides information on the collaborative countries linked to Effat's authors. The highest number of collaborations occurred with Egypt, totaling 186 documents and 1273 citations, underscoring the significant involvement of Egyptian researchers in Effat's research activities. Pakistan ranked second with 99

collaboratively published documents and 1337 citations, followed by Lebanon with 95 documents and 457 citations, United States with 89 documents and 2189 citation, Greece with 84 documents and 2242 citations, UAE with 81 documents and 674 citations, Tunisia with 79 documents and 645 citations, Poland with 77 documents and 787 citations and Finland with 75 documents with 879 citations. All other documents are less than 70.

Minimum occurrences 5, Items 42, Cluster 6, Links 655 and Total Link Strength 318400

Figure 6
*Bibliographic Coupling of Countries*
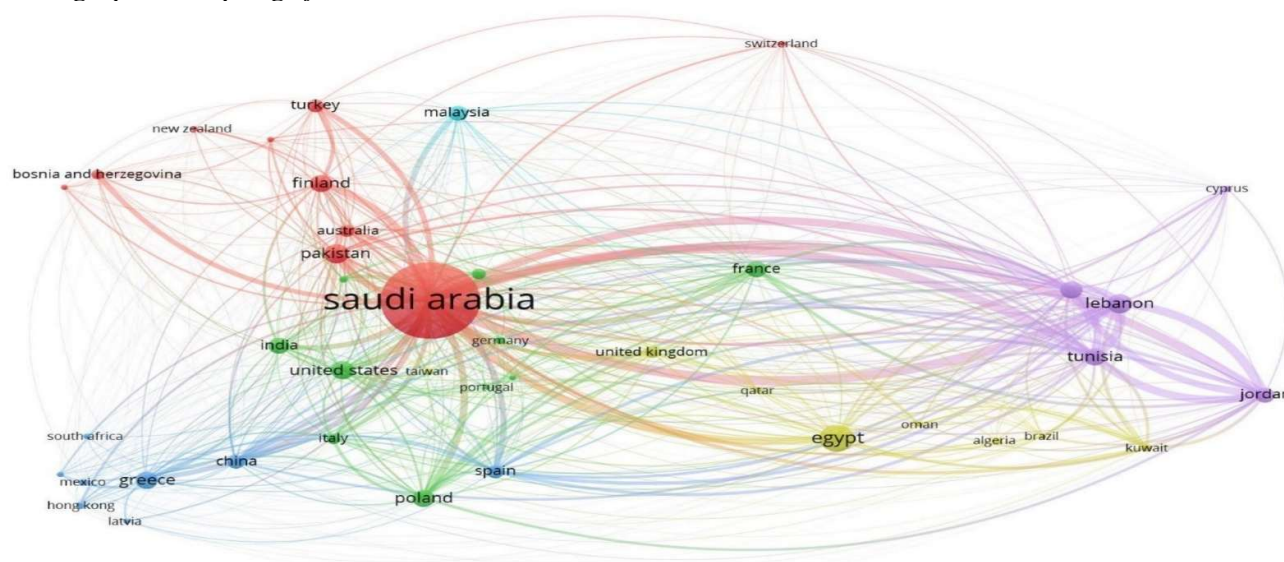
Most Productive Organizations

Figure 7 highlights the collaborative work of the institutions under study. Most of the 1539 publications were produced by authors affiliated with two or more universities. It is apparent from the table that Holy Spirit University of Kaslik has been the most collaborative institution, with 93 publications. King Abdullah University of Science and Technology collaborated on 83 published documents, King Abdulaziz University collaborated on 82 documents, The American College of Greece collaborated on 78 documents, Turun yliopisto and Lebanese American University collaborated on 71 documents, Lääketieteellinen Tiedekunta and Psychiatric Hospital of the Cross collaborated on 70 documents and Szkola Glówna Handlowaw Warszawie collaborated on 56 documents.

Figure 7
*Most Productive Collaborative Organizations*
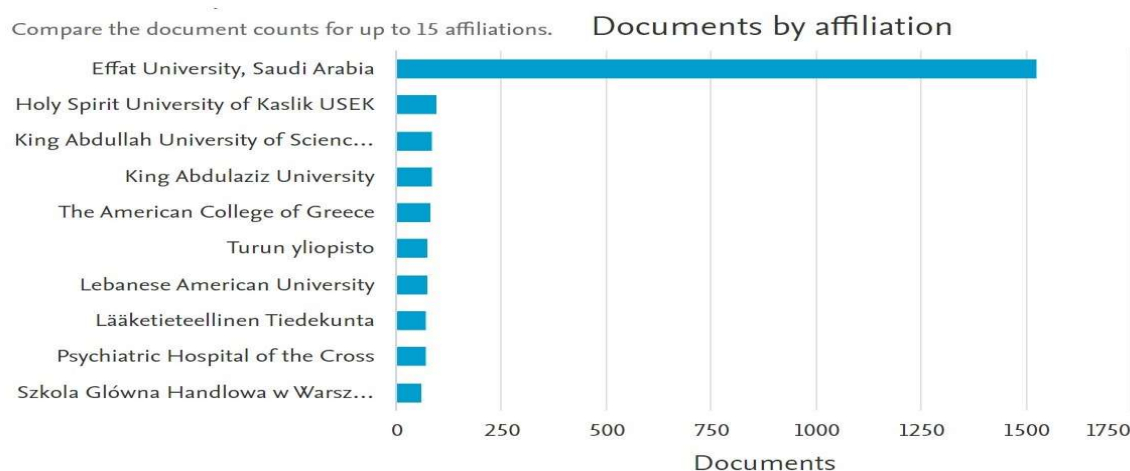
Productive Research Area of the Scientific Publications

Figure 08 revealed that Computer science has been the most attractive area for the researchers with a count of 699 (21.4%) documents followed by Engineering with 559(17.2%), social science with 294 (9%), Mathematics with 224 (6.9%), Energy with 173(5.3%), Business, Management and Accounting with 151(4.6%) publications, Decision Sciences with 148(405%), Medicine with 142(4.4%), Biochemistry, Genetics & Molecular 125(3.8%) and Environmental Science with 125(3.8%). All other research areas had below 100 research publications.

Figure 8

Evaluation of Subject Area

Documents by subject area
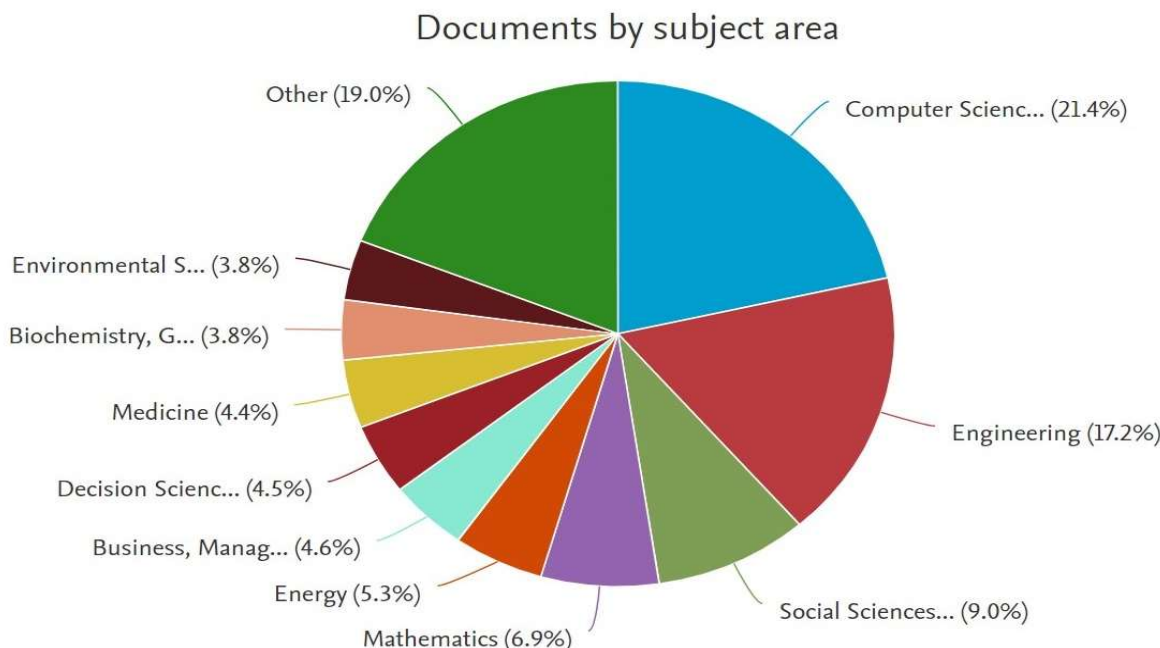
Top Productive Journals

Table 3 shows that "Journal of Critical Reviews" with 86 documents, 8 citations and 1 h-index, followed by "Procedia Computer Science" with 53 publications, 833 citation and 16 h-index, "Sustainability" with 42 publications, 1234 citations and 15 h-index, "Springer Proceedings in Complexity" with 30 publications, 53 citations and 3 h-index and "IEEE Access" with 28 scientific publications, 967 citations and 15 h-index and "Civil Engineering and Architecture" with 27 documents, 23 citations and 3 h-index . All other journals are below 27 publications, published in Scopus during 2006-2024. The journal named "Procedia Computer Science" ranked high 16 with citations of 833 and "Sustainability" is rated high in citation 1234 with h-index of 15.

Table 3

Top Productive Journals

Journal	Publication	Citation	h-index	g-index	m-index	PY-start
Journal of Critical Reviews	86	8	1	1	0.2	2020
Procedia Computer Science	53	833	16	26	1.143	2011
Sustainability (Switzerland)	42	1234	15	34	1.875	2017
Springer Proceedings in Complexity	30	53	3	6	0.5	2019
IEEE Access	28	967	15	28	1.875	2017
Civil Engineering and Architecture	27	23	2	2	0.667	2022
BMC Psychiatry	24	75	5	7	1.667	2022
Proceedings of the International Conference on Industrial	24	37	3	5	0.333	2016

Journal	Publication	Citation	h-index	g-index	m-index	PY-start
Engineering and Operations Management						
Journal of Ambient Intelligence and Humanized Computing	18	220	11	14	2.75	2021
Applications of Artificial Intelligence in Medical Imaging	17	36	4	4	1.333	2022

Three Field Plot Analysis (Affiliation, Authors, and Country)

A three-factor analysis was performed using Biblioshiny to identify key authors' affiliations and authors and associated with the affiliated countries. Relationships between top 10 affiliated institutions, 10 top authors and 10 top countries were summarized by a Sankey plot (three-fields plot) as shown in Figure 9. The analysis highlighted the top institutions authors engaged in research collaboration. It was found that the top 10 institutions (Effat University, Holy Spirit University, Lebanese American University, Lebanon internation University, Miani University, King Abdul Aziz University) Tunis University, Jeddah University, King Abdul Aziz science & Technology) and their top authors (Hallit S, Qaisar SM, Obeid S, Sabasi, Vizvizi A, Lytraz) had a strong relationship with the top countries (Saudia Arab, Lebanon, Egypt, Tunisia, Italy, Pakistan, China, India, USA and Malaysia) research collaboration and preferred to publishing.

Figure 9

*Three Field Plot Analysis (Affiliation, Authors, and Country)*
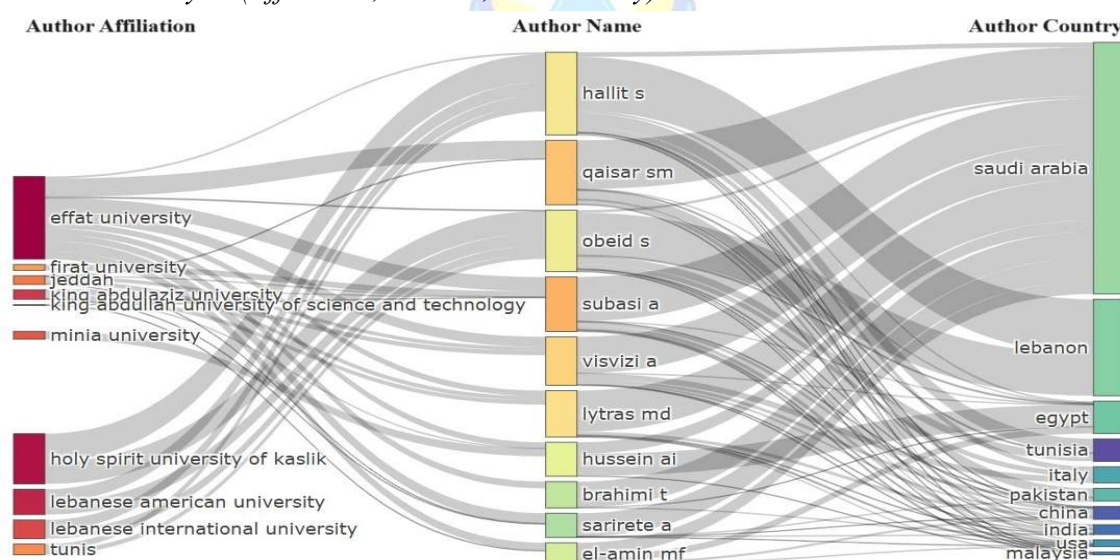
Thematic Evaluation with keywords

Figure 10 presents a thematic evaluation map, categorizing research themes into four quadrants based on their relevance (centrality) and development (density). Motor Themes, characterized by high centrality and density, include these clusters "machine learning," "deep learning," and "artificial intelligence," representing well-established and actively researched areas. Niche Themes, which have high density but low centrality, such as "porous media" and "two-phase flow," are specialized areas with growing interest but limited research. Basic Themes like "Saudi Arabia," "architecture," and "education" are foundational but exhibit lower research activity compared to Motor Themes. Emerging or Declining Themes, with low centrality and density, including "entropy" and "Arabic," are either newly emerging or declining in research focus.

Figure 10
Thematic Evaluation Map
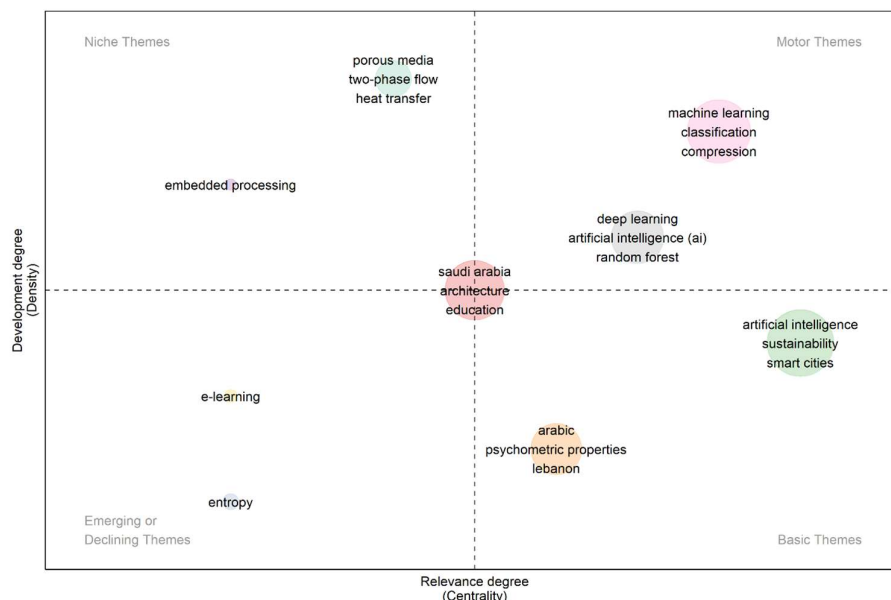
Most cited article

Table 4 shows that the article "Renewable energy for sustainable development in India: Current status, future prospects, challenges, employment, and investment opportunities" by Charles Rajesh Kumar J. and Majid M.A had the most citations (422). This article was published in 2020 in the "Energy, Sustainability and Society" journal. The second article entitled "Comparison of signal decomposition methods in classification of EEG signals for motor-imagery BCI system" by Kevric J. and Subasi A. is ranked second on the list with a citation count of 350. This article was published 2017 in the journal "Biomedical Signal Processing and Control" The third-ranked article, "Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations," by Rashid T. and Asghar H.M. with 346 citations, was published in 2016 in "Computers in Human Behavior. The fourth ranked article "Performance evaluation of empirical mode decomposition, discrete wavelet transforms, and wavelet packed decomposition for automated epileptic seizure detection and prediction" by Alickovic, Kevric and Subasi A. with 330 citations was published in 2018. The fifth ranked article "Discriminant Correlation Analysis: Real-Time Feature Level Fusion for Multimodal Biometric Recognition" by Haghighat, Abdel-Mottaleb M. and Alhalabi W. with 315 citation was published in 2016. All other articles received below 300 citations.

Table 4

Most Cited Articles

Citation	Title	Authors	Journal	Vol. (Issue)	Year
422	Renewable energy for sustainable development in India: Current status, future prospects, challenges, employment, and investment opportunities	Charles Rajesh Kumar J.; Majid M.A.	Energy, Sustainability and Society	10	2020
350	Comparison of signal decomposition methods in classification of EEG signals for motor-imagery BCI system	Kevric J.; Subasi A.	Biomedical Signal Processing and Control	31	2017

Citation	Title	Authors	Journal	Vol. (Issue)	Year
346	Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations	Rashid T.; Asghar H.M.	Computers in Human Behavior	63	2016
330	Performance evaluation of empirical mode decomposition, discrete wavelet transform, and wavelet packed decomposition for automated epileptic seizure detection and prediction	Alickovic E.; Kevric J.; Subasi A.	Biomedical Signal Processing and Control	39	2018
315	Discriminant Correlation Analysis: Real-Time Feature Level Fusion for Multimodal Biometric Recognition	Haghighat M.; Abdel-Mottaleb M.; Alhalabi W.	IEEE Transactions on Information Forensics and Security	11	2016

Discussions

Universities have a significant impact on human life and society, playing a pivotal role in economic, social, cultural, and technological development (Doulani, 2020). Therefore, understanding the research output and trends of universities is crucial. This study aimed to analyze the scientific publications from Effat University Jeddah, indexed in the Scopus database, published between 2006 and 2024. "Articles" are the most common document type among the nine categories of documents published by Effat University authors, according to the findings. While Aslam et al. (2021) as well as Ali et al. (2021) proclaimed nine and five types of publications, respectively, whereas the present study identified five types. Present study findings are a little bit different than earlier studies. However, all studies concluded that amongst all publications, research articles are the most common form of publication.

Moreover, study results showed a steady increase over the years in scientific publications that are in lined with previous research (Tariq et al., 2023; Miraj et al., 2023; Ali et al., 2021; Aslam et al., 2021; Naveed et al., 2005). Effat University researchers not only collaborated within Effat but also collaborated with research scholars worldwide from Egypt Pakistan, Lebanon, the USA, Greece, the UAE, Tunisia, and many more. Collaborative work and academic ties also described in prior studies (Baskaran, 2013; Doulani, 2020).

Along with the collaborative work, most of the published research is from the computer science & engineering field for Effat researchers, whereas Effat research also focuses on social sciences, Mathematics, Energy, and Business Management. It indicates that research areas focus is one of the important aspects to be evaluated in bibliometric analysis and in lined with prior literature Moreover, study results regarding citation showed a gradual increase in citations, aligning with other studies (Gupta & Sonkar, 2019; Kappi, 2019). Notably, publications have received more citations in recent years, particularly in 2023.

Recommendations

Based on the study results, recommendations for future studies are as follows:

Scopus is one of the prestigious databases that are being used all over the world. World famous institutions and researchers prefer to publish in Scopus-indexed journals. Over the years, Effat University has demonstrated substantial research output on the Scopus database. The university should continue to support its faculty and researchers in their ongoing research efforts and encourage them to publish within Scopus-indexed journals. For this, the Research Council should maintain funding to ensure the sustainability of research initiatives. Moreover, researchers from various disciplines should coordinate with each other as well as collaborate with eminent researchers from the field to align with recent research trends and to get

recognition nationally and internationally. International collaboration will not only improve the quality of the work but also contribute towards the betterment of societal wellbeing.

Conclusion

The present study analyzes almost 18 years of published data spanning from 2006-2024. The study results identified a steady increase in publication over the years that is indicative of increased quality as well as quantity of work and it is evident through increased number of citations. The University is committed to boosting its research profile. For that, it is encouraging fraternization with international partners. The university also invested in hiring non-resident researchers who facilitate Effat researchers to continue their efforts for research work. Effat identified research on recent trends aligned with Saudi Vision 2030 as key component of academic excellence and innovation. The results of the present study signify strategic insights related to research activities either in terms of planning, resource allocation etc.

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Informed Consent Statement

Every participant in the study gave their informed consent.

Statement of Data Availability

The corresponding author can provide the data used in this study upon request.

Conflicts of Interest

The authors declare no conflict of interest.

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