

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Library Philosophy and Practice (e-journal)

Libraries at University of Nebraska-Lincoln

Winter 2-1-2021

Saudi Arabian Research Output on big data Publications using the Scopus database: A Scientometric Study

Hashem Hussein Al Attas

Manager, Deanship of Library Affairs, King Fahd University of Petroleum and Minerals, Dhahran, 31261, Saudi Arabia, hattas@kfupm.edu.sa

Md.safiqur rahaman

Librarian, Deanship of Library affairs, King Fahd University of Petroleum and Minerals, Dhahran,31261,Saudi Arabia, mdsafiqur@kfupm.edu.sa

Khadeeja M.N Ansari

College of Design, College of Design, P.O. 1982, Imam Abdulrahman Bin Faisal University, Dammam,Saudi Arabia, kmnansari@iau.edu.sa

Follow this and additional works at: <https://digitalcommons.unl.edu/libphilprac>



Part of the [Library and Information Science Commons](#)

Al Attas, Hashem Hussein; rahaman, Md.safiqur; and Ansari, Khadeeja M.N, "Saudi Arabian Research Output on big data Publications using the Scopus database: A Scientometric Study" (2021). *Library Philosophy and Practice (e-journal)*. 4429.

<https://digitalcommons.unl.edu/libphilprac/4429>

Saudi Arabian Research Output on big data Publications using the Scopus database: A Scientometric Study

Dr Hashem Hussein Al-Attas

*Manager, Deanship of Library Affairs,
King Fahd University of Petroleum and Minerals, Dhahran, 31261, Saudi Arabia*

E-mail: hattas@kfupm.edu.sa

Khadeeja M. N. Ansari

*Lecturer, College of Design,
Imam Abdurrahman Bin Faisal University,
Post Box. No. 1982, Dammam, Saudi Arabia*

E-mail-: kmnansari@iau.edu.sa

ORCID: 0000-0002-1451-3822

Md. Safiqur Rahaman

*Librarian, Deanship of Library Affairs,
King Fahd University of Petroleum and Minerals, Dhahran, 31261, Saudi Arabia*

E-mail: mdsafiqur@kfupm.edu.sa

ORCID: 0000-0003-1367-2618

Abstract

This is a scientometric analysis specifically conducted to analyze the research productivity on big data in the Kingdom of Saudi Arabia for about five years during the period 2015 to 2019. The research data downloaded from the Scopus database and analyzed and represented using Microsoft Excel and Vosviewer. The study focused on different Scientometric tools like most prolific authors, DC, RGR & DT, AGR, year-wise research growth, subject-wise publication, International collaboration and Authorship pattern etc. The study revealed that 2019 recorded maximum research papers 230 (28.12%), the highest annual growth rate was recorded in the Year 2018 (51.724), Half (50%) 409 of the publication published in the form of article, Relative growth rate (RGR) was recorded 2016 (0.866) while in 2019 (0.330), the degree of collaboration by the Saudi Arabian researcher is 0.91, The Journal "IEEE Access" have highest research publication accounted 29 (3.55%) research publications etc.

Keywords

Big data, Scientometric Study, Degree of collaboration, Authorship pattern, Relative Growth Rate, Doubling Time, Annual Growth Rate.

1. Introduction

The term “Big data” is new, but the concept of gathering, storing, organizing and evaluating a large amount of information is quite old enough, the researchers and innovators have been doing it for ages in order to promote business or to develop new varieties of inventions in their respective fields, but big data (huge sized, exponentially growing with time) is a complex form of data which cannot be stored and process efficiently by the traditional data management tools. Therefore Hadoop, an open-source framework has been developed. Big data (having ample information about the company’s products, customers, services and knowledge of preferences of consumers) helps in creating new opportunities to develop new categories in companies and accelerates innovations. Analysis of big data not only leads to a better decision, tuning better strategic business moves and improve customer services but also leads to identifying risks and enhancement in better operational services. Overall big data analyses provide a completely different approach in problem-solving. The concept of big data famed in the Year 2000 with definition 3Vs articulated by analyst Doug Laney, 3V stands for Volume (amount of data), variety (types of data) and velocity (rate of data received), later more dimensions are added to this concept, i.e. variability (varieties of data flow) and veracity (quality of data) etc.

The Saudi vision 2030 aims to raise non-oil revenue by liberalizing policies for business and by taking the initiative to introduce entrepreneurship which leads to the I.T. investment at a high level and the organizations embrace initiatives of digital transformation to improve efficiencies of business process and to optimize the costs. The need for business insight in order to increase performance and better business decision are accelerating big data market of the kingdom. Government of Saudi Arabia is playing a supporting role in the development of big data industry (Alicia Buller, 2016). The Arab news announces in 2018 that Saudi Arabia became a member of the U.N. big data global working group; the membership reflects the results of strategic transformation of the kingdom in statistical sectors (NEWS, 2018).

The present study is a publication analysis calculates the publication growth rate on big data research in Saudi Arabia and focused on different Scientometric parameters including Year wise research growth, annual growth rate, prolific authors, Degree of collaboration, RGR and D.T., the pattern of Authorship, Subject wise publication, Institution wise collaboration etc.

2. Review of Related Literature

Alagu, A, Thanuskodi, S and Dhanya have investigated the research growth and characteristics of big data in India from 2008 to 2017. The bibliographic data has been downloaded from the web of science database on big data research during the study time. A total of 714 articles downloaded and indexed in the web of science on big data. All the data were exported to MS-excel for further

analysis of data according to the objective of the study. The study revealed the most productive Journal names are “Journal of pharmaceutical biological and chemical science research” among the scientist of India, most of the papers are written by multiple authors, contribution by authors are Single authors accounted for 67 (9.38), Two authors 221 (30.95) and Three authors 149 (20.87%) etc. The study also focused on Year-wise distribution of publications, Document wise distribution, Author wise distribution, and top range collaborating institution in the field of big data research. (Alagu, Thanuskodi, & Dhanya, 2017)

Mahendra, M.S has reviewed the pattern of Authorship and collaborative research in the field of biotechnology in ISBA Countries from 2007 to 2016. A total of 24888 articles have been downloaded from the Scopus database and analyzed with the help of different Scientometric tools such as Collaboration coefficient, the pattern of Authorship, and Activity Index. The study revealed that multiple authors had contributed more research paper as compared to single authorship pattern; South Africa is the leading country in the average Index activity among the IBSA countries overt 2007-2016, while India (2nd) and Brazil (3rd) took the position. It was also found that the United States of America is the most dominant international collaboration country among the IBSA countries. (Manendra, 2017)

R, Balasubramani, and G. T. Kohila have reviewed research productivity on big data with especially authorship pattern from 1998 to 2017. It aims to analyze the research performance of the scientist in the field of big data. The study used Scientometric analytical tool to analyze the big data publication over the period of 1998-2017 according to the objectives of the study. The study focused on Scientometric tools as a pattern of Authorship, Year-wise distribution of authorship pattern, degree of collaboration (D.C.), most prolific authors in the field of big data research publications during the Year 1998-2017. The study examined a total of 10641 publications on big data research. The study explored that 1064 publication contributed by 27900 authors in 3193 Journals; it also found that 10641 publications were contributed by 7463 institutions, located in 109 countries. (R.Balasubramani and G.T.Khila, 2018)

Fang, Y, Yin, J and W.U.,B have described the research output in the field of Climate Change and Tourism from 1990 to 2015. The study collected 1976 research publications during 1990-2015 in the areas of Climate change and Tourism Using CiteSpace analyzing Software. Study visualized Collaboration network, Co-Citation Network and recent emerging trends. It was found in the study that the number of research publication has been increased exponentially, and it became an interdisciplinary subject. The highly productive authors and institution belong to Australia, United States of America, Canada, New Zealand and European countries. The study finds out hot topics of Climate Change and Tourism are Consequences of climate change for tourism, necessary adaptations, the vulnerability of the tourism industry, tourist behaviour, demand in response to

climate change and emission reductions in the tourism. The paper highlighted an in-depth analysis of climate change and tourism research activity for understanding global trends and directions in this field over the last 25 years. (Fang, Yin, & Wu, 2018)

Gupta, B.M, Dhawan, S.M and Ahmed, K.K.Mueen has explored the quantitative analysis of global research productivity on Digital Health research from 2007 to 2016. The study examined 6981 bibliographic data indexed in the Scopus database in the field of digital health research during 2007-2016. The study revealed that growth of research 8.03% registered among 109 countries with average citation per paper was 7.33%, top ten countries produce 2.75% to 33.82% Share to global literature output and together accounted for 79.30% share from 2007 to 2016, International collaboration range from 3% to 14.49%, the subject medicine has maximum literature publications (53.55%), followed by Computer Science contributed (33.85%), Engineering subject produce (24.97%) and Health Profession contributed (13.24%), the top 20 most productive organization produce 12.32% of global literature share while top 20 most prolific authors contributed 2.99% of global research share, top 20 journals contributed 12.32% of global research output in the field of digital health research, the research also revealed that 46 (0.65%) publications were highly cited with 257.76 citations per paper, 415 authors from almost 242 reputed organization contributed 46 highly cited papers indexed in 37 Journals. (Gupta, Dhawan, & Ahmed, 2018)

Baskaran, C and Babu, P. R have explored research Productivity of Forensic medicine during the period from 1989 to 2016. The study analyzed different metrics including year-wise growth of publication, Relative growth rate and doubling time of research performance, Collaboration pattern of the authors and collaborative co-efficient etc. The result revealed that the growth of publication was 11 (0.26%) in 1989 while 447 (10.76%) in 2013. The highest research Productivity (447) was recorded in the Year 2013. It was also found a degree of collaboration range between 0.64 to 0.94, and overall degree of collaboration is 23.08 over the period of 1989 to 2016. It was found that the degree of collaboration was increased, but research trends were decreasing during the study period. (Baskaran & Babu, 2019)

Boopathi, P and Gomathi, P have assessed the research output of India on diabetes from 2014 to 2018 appeared in the web of science database. India Published 8016 diabetes journal papers during the period. The study examined author productivity, Journal wise distribution of papers, year wise research output, and country-wise research productivity and institution wise collaboration of research published in the field of diabetes. The study showed that most of the research published in India during 2016 and 2017. AIIMS has published most of the journals papers as compared to other institutions. (Boopathi & Gomathi, 2019)

Lin, Hongli Zhu, Yuming Ahmad, Naveed Han, Qingye have attempted to highlight quantitative analysis of global research on Brownfields during 1995-2017. The study data was collected from

the web of science database using CiteSpace. The total 630 data has downloaded for analyzing on co-authorship, Co-word, Co-citation and cluster analysis. Most of the research carried out on Brownfields in the United States of America, followed by the United Kingdom, Canada, Germany and China. It also revealed the most frequently used words in the studies are “Brownfields”, “Heavy metal,” “Remediation,” “redevelopment” and “Sustainability”. However, the term “Management and Biodiversity” received a maximum citation in recent years. The study examined co-citation cluster, and top topics were Sustainable regeneration, Urban Brownfield’s regeneration, mental distribution, and coal mine brownfield and ecosystem services. The study helped the researcher and practitioner a deep understanding of the salient features and trends of brownfield research globally. (Lin, Zhu, Ahmad, & Han, 2019).

3. Objectives of the Study

The study deals with the following objectives;

1. To know Year wise research publication
2. To find out the relative growth rate and doubling time
3. To identify the most prolific author in Saudi Arabia
4. To see the pattern of Authorship
5. To know the subject wise scattering of Publications.
6. To examine the degree of collaboration pattern
7. To identify the most productive Source in big data.

4. Research Methodology

The research data has downloaded from the Scopus database. It is an International online bibliographic database published by Elsevier in 2004. Following strategy used to collect data:

“TITLE-ABS-KEY (Big AND Data) AND (LIMIT TO (AFFIL COUNTRY, “Saudi Arabia”)) AND (LIMIT TO PUBYEAR, 2019) OR LIMIT TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015))”.

The study data was retrieved on December 8 2019. We have used the following search strategy to collect data from Scopus. A total of 818 research publication was indexed in the Scopus database during the Year 2015 to 2019. All these data have been downloaded and analyzed using Microsoft excel and VOS viewer to meet the research objectives of the present study.

5. Data Analysis and Interpretations

5.1. Yearly Growth of research Publication & Annual growth rate of Publications:

The annual growth rate of the research publication calculated by the formula given by the scientist, namely Kumar and Keliyaperumal in the Year 2015, and the formula is:

End value-First Value

Annual growth rate (AGR) =.....*100 First Value

Table 1: Yearly growth & annual growth rate of publications

| S. N. | Year | Publications | Percentage | Cumulative | AGR |
|--------------|------|--------------|------------|------------|---------|
| 1 | 2015 | 100 | 12.22% | 12.22% | 0% |
| 2 | 2016 | 123 | 15.04% | 27.26% | 23% |
| 3 | 2017 | 145 | 17.73% | 44.99% | 17.887% |
| 4 | 2018 | 220 | 26.89% | 71.88% | 51.724% |
| 5 | 2019 | 230 | 28.12% | 100% | 4.455% |
| Total | | 818 | 100% | | |

Saudi Arabia produced 818 research papers during 2010-2019. Therefore the average annual productivity is 163.6 research papers, and the productivity is increasing steadily. The year 2019 have maximum research papers 230 (28.12%) while the lowest in 2015 with 100 (12.22%) publications. It has been clear that the highest annual growth rate of research publication on big data was recorded in the Year 2018 (51.724) followed by in the year 2017 (17.887) and the lowest AGR was recorded in 2019 (4.455).

5.2. Relative growth rate and doubling time: The relative growth rate and doubling time model is applied to examine the relative growth rate of research publications (Mahapatra, 1985).

a) Relative growth rate: Relative growth rate is the increased in the number of research publications/articles or pages per unit of time, and it can be calculated with the following equations.

$$R (1 - 2) = \frac{W1 - W2}{T2 - T1}$$

Where R (1-2) means the relative growth rate over a specified period of interval

W1=Log w1 (Natural log of the initial number of publications/Pages)

W2=Log W2 (Natural log of the final number of publications/ pages)

T2-T1= the unit difference between the initial time and final time

The relative growth rate for both publications and pages can be calculated separately.

Therefore,

R (a) = Relative growth rate per unit of time (Year)

R (p) = Relative growth rate per unit of pages, per unit of time (Year).

b) Doubling Time: It is found from the equation that there is a direct relation between relative growth rate and doubling time. If the number of research publications/ articles/pages of a subject double during the given period then the difference between the logarithms of numbers at the beginning and end of this period must be the logarithms of number two. If one uses natural logarithms, then this difference has a value of 0.693. Thus the corresponding doubling time for publications and pages can be calculated by the following equations.

$$Dt = \frac{0.693}{R}$$

Where, *D.T.* =Double time, *R*= Relative growth

Therefore, doubling time for publications, data can be calculated as

$$Dt(a) = \frac{0.693}{R(a)}$$

Doubling time for pages can be calculated as

$$Dt(p) = \frac{0.693}{R(p)}$$

Table 2: Relative growth rate and doubling time

| Year | Publications | Cumulative | W1 | W2 | RGR | Doubling time (Dt) |
|------|--------------|------------|-------|-------|-------|--------------------|
| 2015 | 100 | 100 | 0 | 4.606 | 0 | 0 |
| 2016 | 123 | 223 | 4.606 | 5.407 | 0.801 | 0.866 |
| 2017 | 145 | 368 | 5.407 | 5.908 | 0.501 | 1.383 |
| 2018 | 220 | 588 | 5.908 | 6.377 | 0.469 | 1.477 |
| 2019 | 230 | 818 | 6.377 | 6.707 | 0.330 | 2.100 |

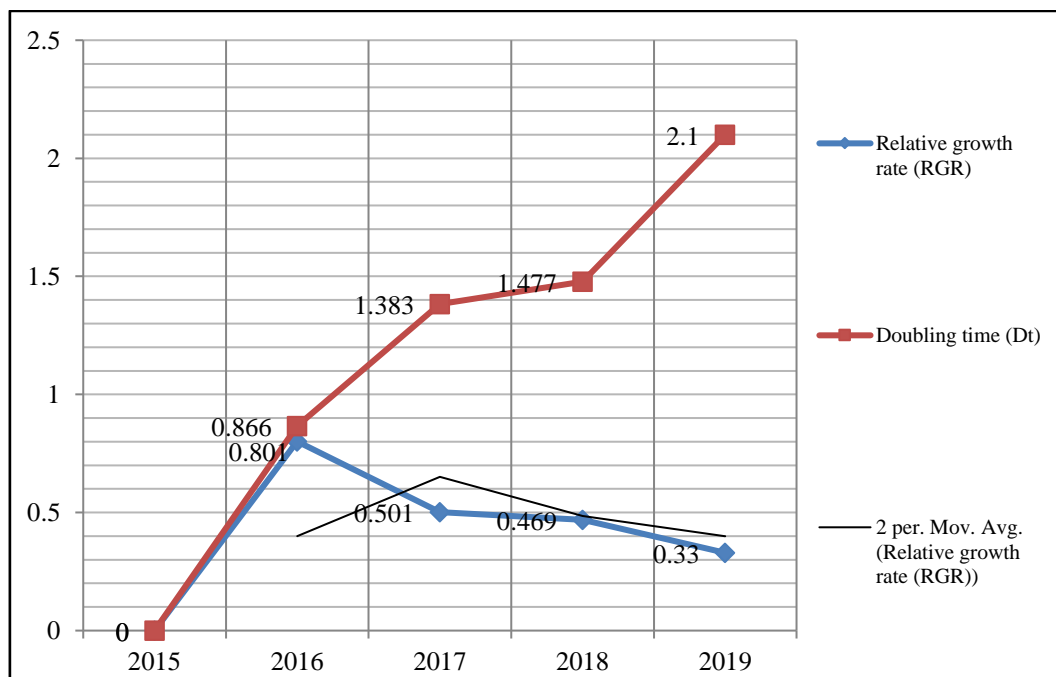


Fig 1: Relative growth rate and doubling time

Relative growth rate (RGR) decreased every year, recorded (0.801) in 2016 and (0.330) in 2019. The maximum doubling time was recorded in 2019 (2.100), and in 2016, it was only (0.866).

5.3. Types of Research Published:

Table 3: Type of research publications

| S. No | Type of Documents | Number of Documents | Percentage |
|-------|-------------------|---------------------|-------------|
| 1 | Article | 409 | 50.00% |
| 2 | Conference paper | 327 | 39.98% |
| 3 | Review | 29 | 3.55% |
| 4 | Book chapter | 22 | 3.69% |
| 5 | Editorial | 07 | 0.85% |
| 6 | Note | 06 | 0.73% |
| 7 | Book | 03 | 0.36% |
| 8 | Short Survey | 01 | 0.12% |
| 11 | Undefined | 14 | 1.70% |
| | Total | 818 | 100% |

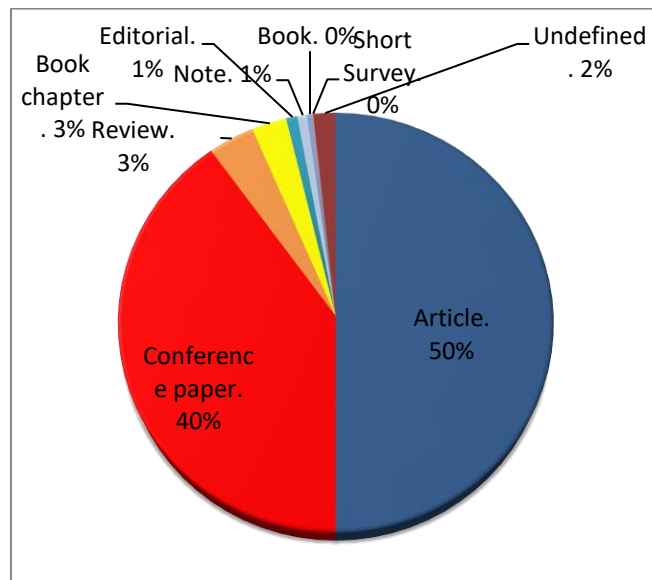


Fig 2: Type of research publications

The half, i.e. (50%) 409 of the publication published in the form of the article followed by conference papers 327 (39.98). Researchers of Saudi Arabia are more inclined to publish their researches on big data more scientific journals and conference proceedings and are less interested in publishing in notes (0.73), Short surveys (0.12) and books (0.36).

5.4. Publication of research by top 10 highly productive Source: The following revealed the Source of publication.

Table 4: Sources of Publications

| Source of Publication | Publication | Percentage (%) |
|---|--------------------|-----------------------|
| IEEE Access | 29 | 3.55 |
| Lecture notes in Computer Science Including Subseries lecture notes in artificial intelligence and lecture notes in Bioinformatics | 24 | 2.93 |
| International Journal of Advanced Computer Science and Applications | 20 | 2.44 |
| Future Generation Computer Systems | 19 | 2.32 |
| Procedia Computer Science | 14 | 1.71 |
| ACM International Conference proceeding Series | 13 | 1.58 |
| Multimedia Tools and Applications | 10 | 1.22 |
| Advances in Intelligent system and computing | 08 | 0.97 |
| Journal of theoretical and Applied information Technology | 08 | 0.97 |
| Cluster Computing | 07 | 0.85 |

The “IEEE Access” has highest research publication in Saudi Arabia, contributed 29 (3.55%) research publications followed by “Lecture Notes in Computer Science Including Subseries lecture notes in artificial intelligence and lecture notes in Bioinformatics” with 24 (2.93%) publications. “International Journal of Advanced Computer Science and Applications “with 20 (2.44%) and Cluster Computing contributed 07 (0.85%) publications. It clear that the researcher prefers to publish their work in the field of “computer science “related Journals.

5.5. Institution wise of research Publication on big data in India: The following table examines the institutional wise big data research publications produced in Saudi Arabia during 2015-2019.

Table 5: Institution wise distributions of research papers

| Name of Institutions | Number of Publication | Percentage (%) |
|--|------------------------------|-----------------------|
| King Saud University | 196 | 23.96 |
| King Abdul Aziz University | 157 | 19.19 |
| King Abdullah University of Science and Technology | 60 | 7.33 |
| King Fahd University of Petroleum and Minerals | 35 | 4.24 |
| Saudi Arabian Oil Company | 33 | 4.03 |

| | | |
|--|----|------|
| King Khalid University | 32 | 3.91 |
| Prince Sultan University | 30 | 3.66 |
| Umm Al Qura University | 29 | 3.54 |
| Imam Abdulrahman Bin Faisal University | 24 | 2.93 |
| Prince Sattam Bin Abdulaziz University | 24 | 2.93 |

The above table5 shows that King Saud University has produced highest 196 (23.96%) number of a research paper in the field of big data followed by King Abdul Aziz University contributed 157 (19.19%) research papers. King Abdullah University of Science and Technology contributed 60 (7.33%) and secured 3rd position among contributors. King Fahd University of Petroleum and Minerals has recorded 35 (4.24%) publications, Saudi Arabian Oil Company 33 (4.03%), King Khalid University 32 (3.91%), Imam Abdulrahman Bin Faisal University and Prince Sattam Bin Abdulaziz University 24 (2.93%) research publications each.

5.6. Country-wise collaboration of research on big data: Following table study the country-wise collaboration on big data research in India from 2010 to 2019.

Table 6: Country-wise collaboration

| County | Publication | Percentage |
|-----------------------|--------------------|-------------------|
| Saudi Arabia | 818 | 100 |
| United State | 103 | 12.59 |
| China | 86 | 10.51 |
| United Kingdom | 77 | 9.41 |
| Pakistan | 59 | 7.21 |
| Malaysia | 55 | 6.72 |
| Australia | 50 | 6.11 |
| Egypt | 45 | 5.50 |
| Canada | 42 | 5.13 |
| India | 37 | 4.52 |

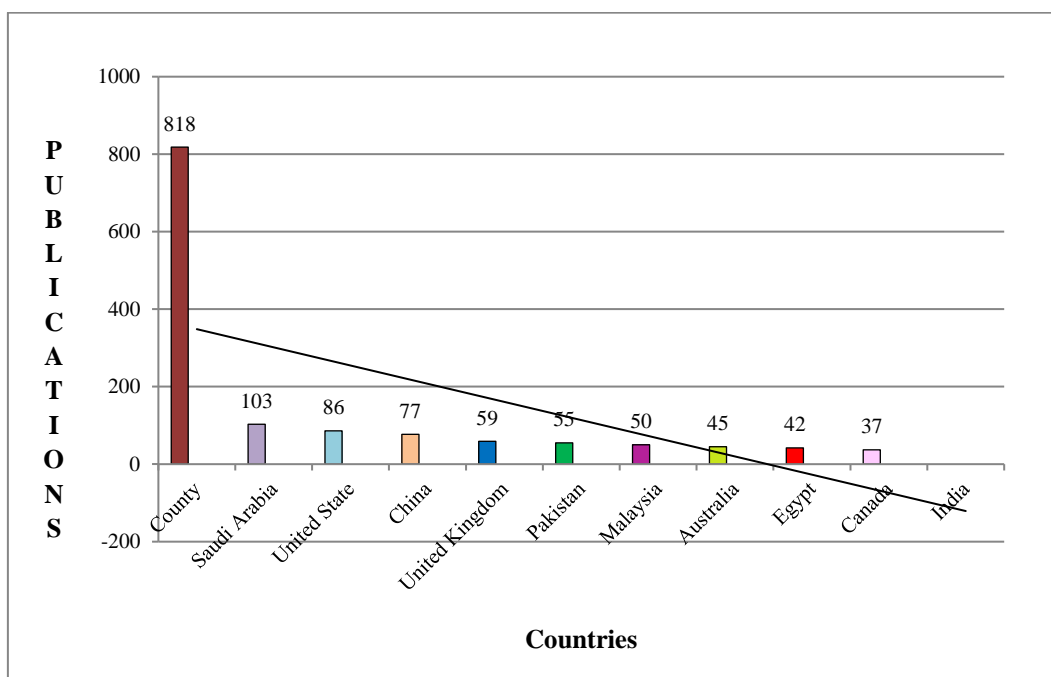


Fig3: Country-wise collaboration

The researchers of the Kingdom of Saudi Arabia collaborated with the researcher/s of the countries like *United States of America*, *China*, and the *U.K.*, *Pakistan*, *Malaysia*, *Australia* etc. The maximum research collaboration of Saudi Arabian Scientist has been found with the United States of America, i.e. 103 (12.59%) Publications followed by Chinese with 86 (10.51%). The United Kingdom contributed 77 (9.41%), Pakistan produced 59 (7.59%), and India contributed 37 (4.52%) etc.

5.7. Top 10 Subject wise Publication of big data: Following table represents the subject or discipline wise distribution of publications by the researcher/s of India on big data 2010-2019.

Table 7: Subject-wise distribution of research papers

| S. No. | Subject area | Number of Publication | Percentage (%) |
|--------|-------------------|-----------------------|----------------|
| 1 | Computer Science | 561 | 68.58 |
| 2 | Engineering | 231 | 28.23 |
| 3 | Mathematics | 138 | 16.87 |
| 4 | Decision Sciences | 80 | 9.77 |
| 5 | Energy | 67 | 8.19 |
| 6 | Medicine | 57 | 6.96 |
| 7 | Social Science | 55 | 6.72 |
| 8 | Material Science | 44 | 5.37 |

| | | | |
|----|-------------------------------------|----|------|
| 9 | Business, Management and Accounting | 41 | 5.01 |
| 10 | Earth and Planetary Science | 39 | 4.76 |

The table no indicated that the Subject “Computer Science” has the highest number of research papers of big data, i.e. 561 (68.58%) followed by Engineering discipline contributed 231 (28.23%) papers. The subject mathematics contributed 138 (16.87%) papers, Decision Sciences with 80 (9.77%), Energy 67 (80.19%), medicine with 57 (6.96%) and material science with 44 (5.37%) etc.

5.8. Prolific author/s on big data: The following table 4 recognizes the top 10 authors/s with their names, number of publication and their ranks.

Table 8: Most prolific author/s

| S. No | Author Name | Number of Publication | Rank |
|-------|--------------|-----------------------|------|
| 1 | Hussain, M.S | 26 | 1 |
| 2 | Imran, M | 20 | 2 |
| 3 | Muhammad, G | 20 | 2 |
| 4 | Mehmood, R | 19 | 3 |
| 5 | Hassan, M.M | 17 | 4 |
| 6 | Sakr, S | 15 | 5 |
| 7 | Alamri, A | 13 | 6 |
| 8 | Albeshri, A | 13 | 6 |
| 9 | Herrera, F | 13 | 6 |
| 10 | Raham, M.A | 12 | 7 |

Table 8 shows the most prolific authors of Saudi Arabia in the field of big data during 2015-2019. It was found in the analysis that Hussain, M.S is the most prolific authors who have contributed 26 research publication in the field of big data, and secured 1st position in producing scientific research papers while Imran, M and Muhammad, G produced 20 research papers each and got 2nd position. Alamri, A, Albert, A and Herrera, F have contributed 13 publications each on the field of big data in Saudi Arabia and manage to secured 6th position etc.

5.9 Authorship pattern: Following table examines the authorship pattern.

Table 9: Authorship pattern

| S. No. | Year | Single Authorship | Joint Authorship | Total |
|--------|------|-------------------|------------------|-------|
|--------|------|-------------------|------------------|-------|

| | | | | Publications |
|----------|--------------|----|-----|---------------------|
| 1 | 2015 | 04 | 96 | 100 |
| 2 | 2016 | 18 | 105 | 123 |
| 3 | 2017 | 13 | 132 | 145 |
| 4 | 2018 | 16 | 204 | 220 |
| 5 | 2019 | 22 | 208 | 230 |
| | Total | 73 | 745 | 818 |

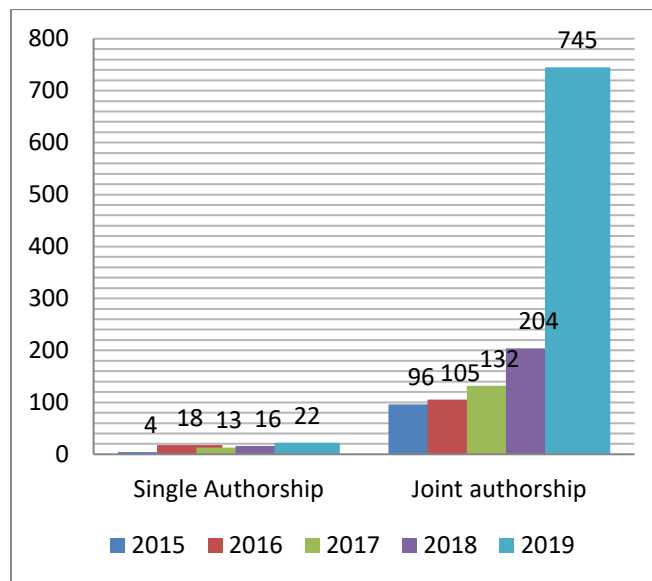


Fig 4: Authorship pattern

Table 9 indicated that Saudi Arabia contributed total 818 research publication during 2010-2019. Out of 818 research publications, Single authors produced only 73 (8.92%) research publications while Joint Authorship produced 745 (91.08) research publications, out of 818 Scientific papers. The above analysis cleared that Scientist of Saudi Arabia in the field of big data prefer in Collaborative research.

5.10 Degree of Collaboration: The degree of collaboration is the ratio of the number of co-author or collaborative research publications to the total number of research publications in a particular subject area during a specific period. The analysis of collaboration of author was given by Subramanyan to find out the degree of collaboration (Subramanyan, 1983). The formula for degree of collaboration

$$DC = \frac{Nm}{Nm + Ns}$$

Following table 7 studies the degree of collaboration during the period 2015 to 2019 on big data research publications.

Table 10: Degree of Collaboration

| S. No. | Years | Single author (Ns) | Multi-Authors (Nm) | Total no. of articles (Ns + Nm) | D.C. |
|--------|-------|--------------------|--------------------|---------------------------------|------|
| 1 | 2015 | 04 | 96 | 100 | 0.96 |
| 2 | 2016 | 18 | 105 | 123 | 0.85 |
| 3 | 2017 | 13 | 132 | 145 | 0.91 |
| 4 | 2018 | 16 | 204 | 220 | 0.93 |
| 5 | 2019 | 22 | 208 | 230 | 0.90 |
| | Total | 73 | 745 | 818 | 0.91 |

The table 10 revealed the degree of collaboration on big data in Saudi Arabia during the 2015-2019 period lies from the range of 0.96 in 2015 to 0.90 in 2019. The study revealed that Joint authors produced 91.08 % publication on big data in India during 2015-2019. Hence the study concludes that collaborative researches are more active than the Single author research which produced only (8.92%) publications.

The degree of collaboration for the five years study period can be calculated as

$$DC = \frac{Nm}{Nm + Ns}$$

(Nm = multi-authored research; Ns= Single authored research)

$$DC = \frac{745}{818}$$

DC = 0.91.

The degree of collaboration (from 2015 to 2019) =0.91.

6. Findings of the Study:

- *Number of Research Published:* Saudi Arabia Produced 818 research papers during 2010-2019 in the field of big data. It found that the Year 2019 recorded maximum research papers 230 (28.12%) while lowest in 2015 with 100 (12.22%) publications.
- *The Annual Growth Rate:* The highest annual growth rate was recorded in the Year 2018 (51.724) followed by in the year 2017 (17.887), and the lowest AGR recorded in 2019 (4.455).
- *Publication Types:* Half (50%) 409 of the publication published in the form of the article followed by conference papers 327 (39.98).

- *Relative Growth Rate*: Relative growth rate (RGR) decreasing every year and it was recorded 2016 (0.866) while in 2019 (0.330)
- *The Doubling Time*: The maximum doubling time was recorded in 2019 (2.100) while in the year 2016, it was only 0.866 DT.
- *Prolific Author*: Hussain, M.S is the most prolific authors who have contributed 26 research publication in the field of big data and secured 1st position while Imran, M and Muhammad, G produced 20 research papers each and got 2nd position.
- *Authorship Pattern*: Single authors produced only 73 (8.92%) publications while Joint Authorship produced 745 (91.08) Publication out of 818 research papers contributed by Saudi Arabian Scholars.
- *Degree of Collaboration*: The degree of collaboration from 2015 to 2019 by the Saudi Arabian researcher is 0.91
- *The Source of Publication*: The Journal “IEEE Access” has the highest research publication accounted for 29 (3.55%) research publications.
- *Institution*: King Saud University has produced the highest 196 (23.96%) number of the research paper in the field of big data followed by King Abdulaziz University e.i 157 (19.19%) research papers.
- *Country-wise Research Collaboration*: The maximum research collaboration by Saudi Arabian Scientist has found with the United States of America, i.e. 103 (12.59%) Publications followed by Chinese with 86 (10.51%)
- *The most preferred discipline*: The Subject “Computer Science” has the highest number of research papers of big data, i.e. 561 (68.58%) followed by “Engineering” discipline contributed 231 (28.23%) papers

Conclusion:

The study revealed that after the implementation vision 2030, the big data market took a leap due to the more business opportunities arising in the kingdom. Therefore, the research productivity of big data in Saudi Arabia has been continuously increasing from 100 publications in 2015 to 230 publication in 2019. It is found in the study that the researchers are highly interested in publishing their research work in the scientific Journal and in the subject of computer science. The pattern of Authorship indicated that researcher in the field of big data dominated by join authorship. The finding of this present Scientometric Study will help the researchers, scientist and policymaker who are directly and indirectly involved in the research work in the field of big data or data science in the future.

References:

- Alagu, A., Thanuskodi, S., & Dhanya, P. (2017). Big Data : A Scientometric Analysis Based on Indian Publications, 29, 84.
- Alicia Buller. (2016). As Saudi Arabia gears up to diversify its economy away from oil, local businesses are turning to big data analytics. Retrieved March 3, 2020, from <https://www.computerweekly.com/news/450402173/Saudi-Arabia-turns-to-big-data-to-boost-business-innovation>
- Baskaran, C., & Babu, P. R. (2019). The substantial research on Quantitative analysis and Publications measure in Forensic Medicine. *Library Philosophy and Practice*, 2019. Retrieved from <https://www2.scopus.com/inward/record.uri?eid=2-s2.0-85060243414&partnerID=40&md5=6abb8b8c978d7ab8479f3a7aa8284109>
- Boopathi, P., & Gomathi, P. (2019). Scientometric analysis of diabetes research output during the year 2014-2018: Indexed by web of science. *Library Philosophy and Practice*, 2019. Retrieved from <https://www2.scopus.com/inward/record.uri?eid=2-s2.0-85066102466&partnerID=40&md5=391b19608f87c9c73af74dfe60e57b69>
- Cerver-Romero, E., Ferreira, J. J., & Fernandes, C. (2018). A scientometric analysis of knowledge spillover research. *Journal of Technology Transfer*. <https://doi.org/10.1007/s10961-018-9698-9>
- Fang, Y., Yin, J., & Wu, B. (2018). Climate change and tourism: a scientometric analysis using CiteSpace. *Journal of Sustainable Tourism*, 26(1), 108–126. <https://doi.org/10.1080/09669582.2017.1329310>
- Gupta, B. M., Dhawan, S. M., & Ahmed, K. K. M. (2018). Digital health research: A scientometric assessment of global publications output during 2007-2016. *INTERNATIONAL JOURNAL OF PHARMACEUTICAL INVESTIGATION*, 8(2), 106–114. https://doi.org/10.4103/jphi.JPHI_31_18
- Lin, H., Zhu, Y., Ahmad, N., & Han, Q. (2019). A scientometric analysis and visualization of global research on brownfields. *Environmental Science and Pollution Research*, 26(17), 17666–17684. <https://doi.org/10.1007/s11356-019-05149-3>
- Mahapatra, M. (1985). On the Validity of the Theory of Exponential Growth of Scientific Literature. In *Proceedings of the 15th IASLIC Conference* (pp. 61–70). Bangalore.
- Manendra, M. S. (2017). Authorship and collaboration pattern in biotechnology research: A study of IBSA countries. *Library Philosophy and Practice*, 2017. Retrieved from <https://www2.scopus.com/inward/record.uri?eid=2-s2.0->

85035799762&partnerID=40&md5=c42be89e24c1fe4b65e1719e101da82e

NEWS, A. (2018, February 7). Saudi Arabia joins U.N. Big Data Global Working Group. *ARAB NEWS*. Retrieved from <https://www.arabnews.com/node/1241501/saudi-arabia>

R.Balasubramani and G.T.Khila. (2018). Authorship Pattern of Big Data Research Output :, 7(1), 15–19.

Subramanyan, K. (1983). Bibliometric studies of research collaboration: a review. *Journal of Information Science*, 6(1), 33–38.