

A Bibliometric Analysis of Research in Science and Technology in Federal University Otuoke, Bayelsa State, Nigeria

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ABSTRACT: *Research in science and technology is a very key component in the development of any country. It helps birth creativity and innovation which are essential for the economic and social progress of the country. The study set out to empirically document the research productivity and impact of research in science and technology, emanating from the Federal University Otuoke. The research adopted a mixed methodology with quantitative and qualitative tools to elicit data for the study and analysis. Researchers engaged in science and technology in Federal University Otuoke- Faculties of Engineering, Science, and Education made up the study population. To elicit data for the study, an online questionnaire was designed and shared on the existing social academic platforms in the university. A qualitative content analysis of the Google Scholar profiles of researchers in these Faculties was also carried out. The study further conducted interview sessions with the Heads of related Departments. Findings reveal that a total of 2,124 publications are visible from 102 science and technology researchers in Education, Engineering and Science. Chemistry is leading with a citation frequency of 5,649 from 500 publications. A significant relationship has been established between publications output and citation frequency/impact.*

KEYWORDS: Bibliometric Analysis, Research, Science & Technology, Nigeria

INTRODUCTION

Acknowledging the use of bibliometric indicators as a tool for measuring impact has become a norm in the era of research evaluation. Counts in terms of the number of publications, patents owned, and number of citations accumulated over time advance science and technology as they are key performance indicators. The indicators measure science and technology accomplishments which over time has shown a steady growth in scope, complexity and power since the introduction of Science Indicators 1972 report (U.S. National Science Board, 1973). A basic tenet behind bibliometric analysis is activity measurement: this is a count of articles and patents that provide

valid indicators of Research and Development activity in the subject areas surveyed while indicating institutions of origin. another tenet is impact measurement, that is, the number of times research outputs and patents are cited in subsequent publications is also a valid indicator of the impact and importance of those articles. Linkage measurement is another tenet: this gives further credence to the performance of the publication through citations gained from articles to articles showing knowledge and intellectual linkages between the organizations that are producing the patents and articles.

Nigeria with a population already over 200 million people (Kamer, 2022), has the potential to become the leader in science and technology as well as research and development in Africa. however, comparing the population and what obtains on the global stage, Nigeria is doing very poorly in terms of research output even in Africa. However, the inadequacy of science and technology and the lack of visible research on science and technology have been seriously contributing to the underdevelopment of the nation. This raises concerns as to whether Nigeria is truly ready for the digital economy if only those from the older generation are addressing critical matters around research and innovation for the country (Ndiomewese, 2019). The investigation of Bibliographic analysis of research in science and technology holds the key to the present and future development of Nigeria or any other country for that matter. The ideas will help researchers and all other stakeholders in determining the number of papers published by a research discipline as an indication of productivity. The frequency of citation of a published paper in later publications is also seen as an indication of interest raised in the field and the quality of the paper. These factors play a fundamental role in wealth improvement of the quality of life and real economic growth and transformation in any society through adequate access to research of interest. Essentially, technology is the primary engine of economic growth. It is the key and fundamental requirement for value addition to raw materials and people. It provides the key to unlocking any country's potential in terms of decreasing overhead costs associated with outsourcing and creating employment opportunities. This research is aimed at identifying, collating and analyzing the research output in Science and technology from Federal University Otuoke in Bayelsa State, South-South Nigeria. The following are the specific objectives:

1. To identify the number of publications in different areas of Science and Technology at Federal University Otuoke.
2. To examine the frequency and citation patterns in the publications output in Federal University Otuoke in Science and Technology.
3. To establish if there is a significant relationship between citation patterns and publications output in Science and Technology Research in Federal University Otuoke.

Background of Study

Federal University Otuoke is a public university owned by the Federal Government of Nigeria, established by the administration of President Goodluck Jonathan, one of twelve new universities to increase access to quality higher education across the regions of the country. It is located in

Otuoke, a town in Ogbia Local Government Area of Bayelsa State. The University was established in 2011. The university establishment Act was accented to by the National Assembly in March 2015. The university started with about two hundred and eighty-two (282) pioneer students in 2012. In 2023, it has about 14,000 students in 38 programmes hosted by 8 Faculties, institutes and research centres. The Directorate of Research and Quality Assurance, one of the directorates in the office of the Vice-Chancellor was established in 2016 with the mandate to develop, and operate the research policy, oversee research affairs and develop blueprints of areas of intervention for donor support from both the government and private sector for the promotion of research activities in the university. The overall objective is to significantly enhance the research productivity of the institution and the technology development of the State and Nigeria at large.

RELATED LITERATURE ON BIBLIOMETRIC STUDIES

There have been several bibliometric studies in several countries. Djeki, Degila, Bondiombouy, and Alhassan (2022), titled “E-learning bibliometric analysis from 2015 to 2020” Tried to exhaustively examine the e-learning exploration field by conducting a bibliometric analysis of 12,272 publications between 2015 and 2020 from the Web of Science database. The study aimed to analyse collaborations between authors, universities, and countries in the field, to identify the most influential authors, universities, countries, and reference papers; to know the exploration motifs on which experimenters have been working in recent times, and to examine African donation in the field. The findings showed that the USA, Spain, England, and China were the most productive countries one-learning. A. Tarhini is the most influential author, and e-Learning experimenters host Universities are substantially from the UK, USA, and China. Computers and Education, and International Journal of Emerging Technologies in Learning were set up to be the most represented journals; Islamic Azad University, Universidade Nova de Lisboa, and King Abdulaziz University were the most influential universities. The analysis showed that the collaboration between authors, universities, and countries working one-learning was low, and COVID- 19 had a significant impact one-learning. Africans contributions and exploration on e-learning and its security were shown to be low.

Another study by Lee, Lee, Chen and Chae (2020), titled “Bibliometric Analysis of Research Assessing the Use of Acupuncture for Pain Treatment over the past 20 years”. The study was a bibliometric approach using quantitative logical styles was applied to explore the development of exploration probing acupuncture for the treatment of pain. This study also estimated the current status of acupuncture analgesia with a visualization analysis of journal papers. The data for the study concentrated on papers on acupuncture for pain control that were published from 2000 to 2019 were recaptured from the Web of Science database. uprooted records were anatomized in terms of time of publication, country, journal, exploration area, authors, and organizational confederations. The VOS bystander program was used to fantasize trends in exploration on acupuncture for pain control. Analyses of 4595 original and review papers revealed that the total number of publications has continually increased over the last 20 times. The country producing

the most papers in this field was the United States, followed by China and South Korea. A network analysis grounded on the cooccurrence of keywords revealed the following three major types of studies clinical studies, pain operation studies, and medium studies. The study estimated exploration on acupuncture for pain control using bibliometric styles and revealed current trends in acupuncture analgesia exploration, as well as implicit unborn hot spots of exploration in this field.

Sweileh (2020) reported a study titled “Bibliometric analysis of peer-reviewed literature on climate change and human health with an emphasis on infectious diseases”. The study assessed that exploration exertion is important for planning unborn defensive and adaptive programs. The ideal of the current study was to assess exploration exertion on climate change and health with an emphasis on contagious conditions. A bibliometric system was applied using SciVerse Scopus. Documents on climate change and mortal health were called “ health-related literature” while documents on climate change and contagious conditions were called “infection- related literature”. The study period was from 1980 to 2019. The hunt query set up 4,247 documents in the health-related literature and 1,207 in the infection-related literature. The growth of publications showed a steep increase after 2007. Documents published in the Environmental Health Perspectives journal entered the highest citations per document. An aggregate of 1,416 (33.3) documents in the health-related literature were funded while 419 (34.7) documents in the infection- related literature were funded.

A similar study by Zahra, Nurmandi, Tenorio, Rahayu, Benectitos, Mina, and Haictin (2021), titled “Bibliometric Analysis of Trends in Theory-related Policy Publications”. The study's bibliometric analysis estimated the compass and trends of proposition-related policy publications in colourful transnational journals. The system used the Scopus hunt machine on arbitrary journals in relating policy-related publications. The study also used a data visualization software called VOS Bystander to dissect the results, underpinning network liaison, and information product trends in policy analysis. The findings showed that only many proportions of policy-related inquiries apply propositions in their study. Field-specialized journals having interpreters publish lower exploration as compared to interdisciplinary wisdom and technology journals.

Another research carried by Mejia, Wu, Zhang, and Kajikawa (2021) titled “Exploring topics in Bibliometric Research through Citation Networks and Semantic Analysis”. The study surveyed content distributions of the academic literature that employs the terms bibliometrics, Scientometrics, and Informetrics. The exploration allowed apprising on the relinquishment of those terms and publication patterns of the authors admitting their work to be part of the bibliometric exploration. they recaptured 20,268 papers related to bibliometrics and applied methodologies that exploit colourful features of the dataset to face different content representations. Across them, they observed major trends including conversations on proposition, indigenous publication patterns, databases, and tools. They noted a great increase in the operation

of bibliometrics as wisdom mapping and decision-making tools in operation, public health, sustainability, and medical fields.

A study by Gao, Wong, Khambari, and Noodin (2022), titled “A Bibliometric analysis of online faculty professional development in advanced education. The study concentrated on Research on online faculty professional development (OFPD) in advanced education which they noted had increased in recent times. As there is, nonetheless, a failure of quantitative examinations on exploration publications in this area, a bibliometric analysis of 248 publications collected from the Scopus database was conducted. Biblioshiny and VOSviewer software tools were used for descriptive and network analyses. The exploration results showed that the overall trend of publication in this sphere increased steadily at a periodic growth rate of 14.11 during the once 25 times. Journal of Asynchronous Learning Network and Computers and Education ranked the loftiest among journals with regard to publication number and citation number, independently. With an aggregate of 298 citations to his paper, Peter Shea was ranked the most poignant author while Maria Northcote, with five publications, was the most productive. In terms of the geographical position of exploration exertion, America played the commanding part, with Asia arising in this field. The publication entitled “A Research Agenda for Online Teacher Professional Development” by Dede et al. outgunned the list for both total citations and average monthly citations. As to recent trends, schoolteacher professional development through online tutoring was imperative incompletely due to the outbreak of COVID-19. Pedagogy training, online community ructure, and easing online preceptors were the themes that experimenters favoured.

In Nigeria , there have been some bibliometric studies. Salisu and Salami (2020), carried out a study titled “A Bibliometric Analysis of Nigeria’s Research Performance, 1901-2016. The study was an analysis of Nigerian publications indexed in Scopus database over a 115-year period, 1901 to 2016 . The study elucidated Nigerian research performance, publication trends, publications patterns and collaboration patterns at national and international levels. A total of 95,304 publications were analysed with underlying bibliometric indicators and statistics. Results showed a steady increase in Nigerian publications after independence; predominant article publications compared to conference papers and reviews as well as frequent collaboration within the country when compared to outside the country; and that most research publications in Nigeria emanate from universities.

Another study by Amzat, Kanmodi, and Egbedina (2023), titled “Infoveillance and bibliometric analysis of COVID-19 in Nigeria. this study aimed to assess the patterns of internet hunt and exploration interests in COVID-19 in Nigeria. This was an infoveillance and bibliometric exploration of COVID-19 in Nigeria using systemic hunt through Google Trends to gain COVID-19 information frequency and exploration prevalence through bibliometric analysis using SCOPUS database. The data attained were analysed using the Microsoft Excel 2021 software. The findings showed that the information hunt shaft started one week before the first indicator case. Search volume indicator inequalities were observed across the country, with Northern Nigeria

having an advanced hunt volume for COVID-19. This study also uncovered several top hunt terms, including “COVID-19, ” “ COVID loan ” and “ vaccine, ” and queries, including “ COVID-19 Nigeria, ” “ COVID loan ” and “COVID-19 in Nigeria, ” among others, which showed critical infodemiologic enterprises in Nigeria. The interests of Nigerian experimenters concerning COVID-19 cut across colourful disciplines. The top three subject areas with the most significant volume of these publications were Medicine, Social Sciences and Biochemistry. This study set up expansive exploration collaboration with over 150 countries coupled with external funding..

A study by Adedayo, Adio, and Oboirien (2021) was titled “Energy Research in Nigeria A Bibliometric analysis”. The study examined the spare force of energy in Nigeria in relation to its energy demand which touched off interest in the scientific disquisition of colourful energy exploration. This study reported on the bibliometric analysis of energy publications from Nigerian experimenters from 1974 to 2019 (45 times) from the Elsevier Scopus database. The analysis included publication types, languages of publication, institutions of authors and collaborators. Grounded on the analysis, the number of publications has increased in the 45 times period. With significant changes being from the period 2006 – 2015 from a number of 113 publications per time, to a normal of 326 publications per time from 2016 to 2019. The benefactions of institutional energy publications by region showed that the South-Western States region had the loftiest number of publications. A global chart showed energy collaboration in transnational situations Nigerian authors substantially co-authored energy publications with South Africa, Malaysia, the United States and the United Kingdom institutions. The publications were substantially in solar energy, wind energy and biomass energy and lower in gas and hydro energy which are the main sources of electricity generation in Nigeria.

Apparently, there has not been bibliometric analyses of publications of researchers based in universities in Nigeria. It is that gap that this study has set out to bridge.

RESEARCH METHODOLOGY

Federal University Otuoke has a total academic staff population of 358 as at January 2023. 170 of these are involved in science and technology research domiciled in the Faculties of Engineering, Science and Education. Instrument for this study was sent to the entire population of 170 academic staff involved in science and technology research. 102 staff surveyed either filled the questionnaire or presented access to their research through ResearchGate and Google Scholar platforms. This represents 60% of the target population.

Table 1 Population Distribution of S & T Researchers in FUO

S/ NO ·	FACULTY	DEPARTMENT	NUMBER OF FUO STAFF IN S & T	NUMBER OF FUO POPULATION in S & T
1.	Engineering	1. Chemical Engineering 2. Civil Engineering 3. Elect/Elect 4. Mechanical Engineering 5. Pet and Gas 6. Mechatronics	12 15 14 13 9 10	5 7 6 5 6 1
2.	Science	1. Biology 2. Biochemistry 3. Chemistry 4. Computer Science 5. Microbiology 6. Mathematics & Statistics	7 8 20 14 13 14	7 5 18 7 11 7
3.	Education	1. Science Education 2. Library and Information Science	9 12	6 11
		Total	170	102

Source: Research Data

Research Instruments were three. First, there was a Google form that was tested and content validated by a cross section of the FOU academic staff in the Faculties not participating in the study. Target academic staff who have been cited in Google Scholar database were also assessed. Deans and Heads of Departments of Science & Technology disciplines were also interviewed.

RESULTS AND ANALYSIS**Science & Technology Publications in Federal University Otuoke***Table 2 Number of Publications in Different Areas of Science & Technology in FUU*

S/ N	Faculty	Department	Number of FUU Population in S & T	Number of Publications
	Engineering	Chemical Engineering	5	184
		Civil Engineering	7	104
		Elect/Electronics	6	117
		Mechanical Engineering	5	53
		Pet and Gas	6	58
		Mechatronics	1	1
	Science	Biology	7	124
		Biochemistry	5	170
		Chemistry	18	500
		Computer Science	7	65
		Microbiology	11	321
		Mathematics & Statistics	7	169
	Education	Science Education	6	48
		Library and Information Science	11	210
		Total	102	2,124

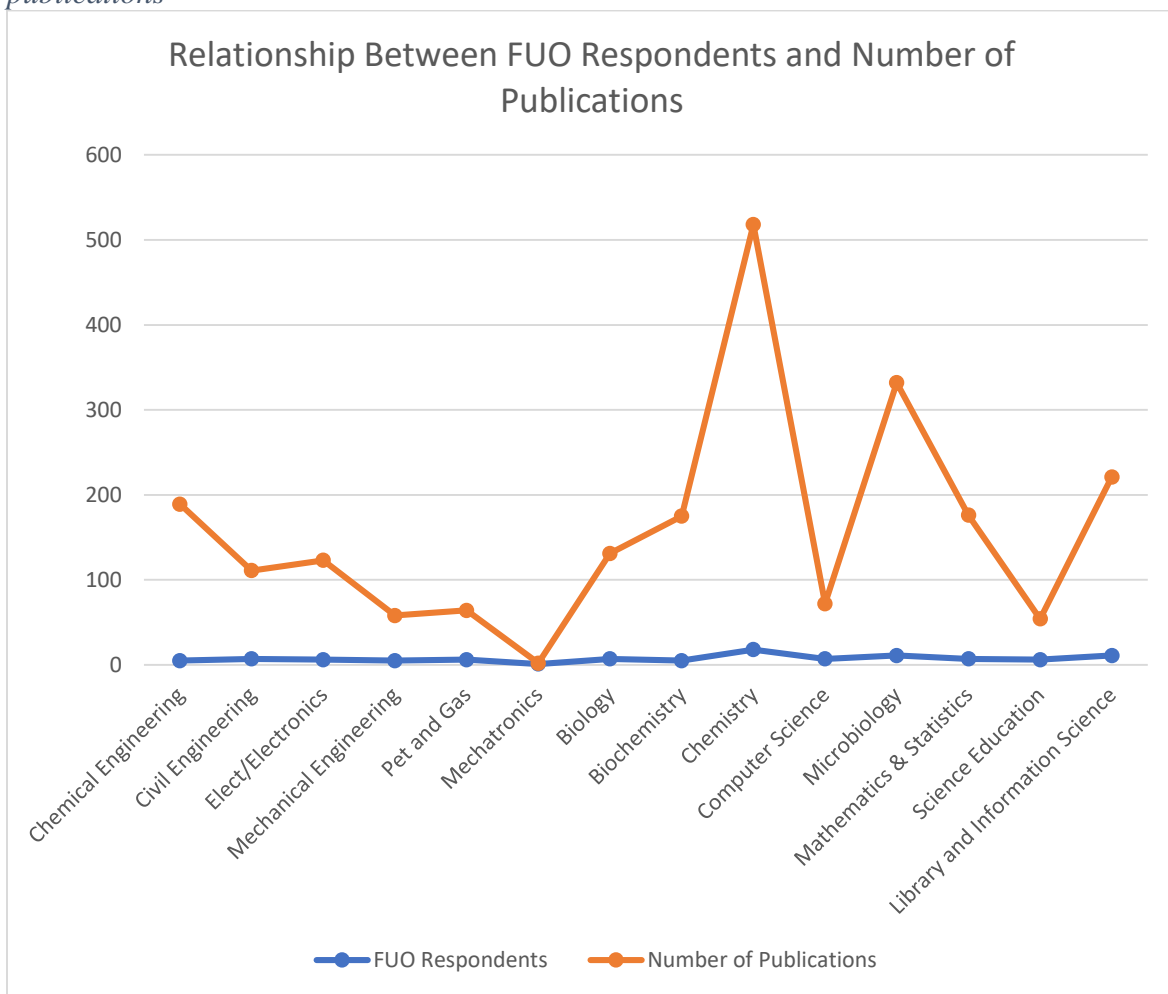
Source: Research Data

The result shows that Chemistry has the highest number of publications of 500 from 18 staff assessed. Chemistry is a science that deals with the study of substances, composition, structure and the transformations they undergo. The major sub-disciplines in chemistry are organic chemistry,

Publication of the European Centre for Research Training and Development -UK

biochemistry, inorganic chemistry, analytical chemistry and physical chemistry. Chemistry is followed by Microbiology with 321 publications from 11 staff. Library and Information Science, an interdisciplinary field of study that deals generally with the organization, access, collection, protection/ regulation of information, both in physical or digital forms came third with 210 publications from 11 staff.

Figure 1 : Graphic representation of the relationship between Study Population and number of publications



Source: Research Data

The figure above shows a representation of the number of publications from the Respondents in Science and Technology, in relationship with the number of staff of the departments under study.

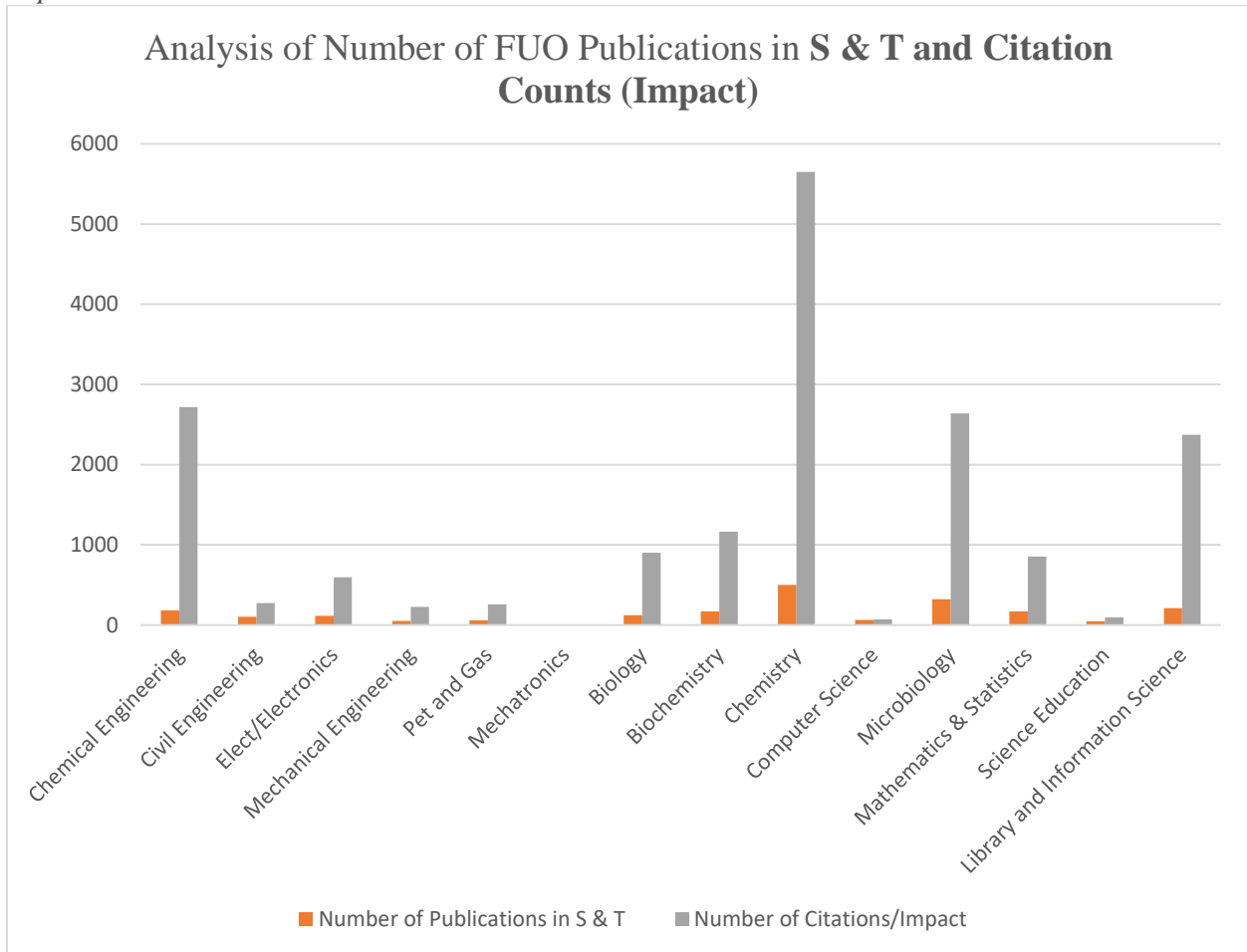
Table 3 Quantitative and citation analysis of Publications in Science & Technology in FOU

S / N	Faculty	Department	Number of FOU staff in S & T	Number of Publications	Frequency of Citations/Impact
	Engineering	Chemical Engineering	5	184	2,717
		Civil Engineering	7	104	274
		Elect/Electronics	6	117	594
		Mechanical Engineering	5	53	226
		Pet and Gas	6	58	259
		Mechatronics	1	1	1
	Science	Biology	7	124	902
		Biochemistry	5	170	1,165
		Chemistry	18	500	5,649
		Computer Science	7	65	71
		Microbiology	11	321	2,637
		Mathematics & Statistics	7	169	853
	Education	Science Education	6	48	94
		Library and Information Science	11	210	2,371
		Total	102	2,124	17,813

Source: Research Data

Table 3 reveals that Chemistry research is leading with a frequency citation of 5,649 from 500 publications. This is citation count is followed by Chemical Engineering with 2,717 from 184 publications, ahead of Microbiology and Library and Information Science with more publications. This could be attributed to more impact of chemical engineering publications on the Science and Technology community worldwide.

Figure 2 : Graphic representation of relationship between number of publications and citations/ impact



The figure above is a graphical representation of the citation performance of the participating departments in Science and Technology in Federal University Otuoke. The University has over two thousand (2000) publications in Science and Technology and over seventeen thousand (17,000) citations from 2012 – to date. However, the performance of the Department of Chemistry was remarkable.

Relationship Between Citation Patterns and Publications Output*Table 4 Relationship between Citation Patterns and Publications Output*

Source: Research Data

SUMMARY OUTPUT FOR NUMBER CITATION AND PUBLICATIONS								
Regression Statistics								
Multiple R	0.955557948							
R Square	0.913090992							
Adjusted R Square	0.905848575							
Standard Error	486.3703185							
Observations	14							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	29823914.17	29823914.17	126.0754462	1.01049E-07			
Residual	12	2838673.04	236556.0867					
Total	13	32662587.21						
	Coefficients	Standard Error	t Stat	p-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	498.910902	204.4061819	2.440781866	0.031113322	94.2737131	53.54809093	94.2737131	53.54809093
Publications	11.67502478	1.03978262	11.2283323	1.01049E-07	9.409533067	13.94051649	9.409533067	13.94051649

Table 4 depicts that there is significant relationship between the number of publications and the number of citations/impact. The table above gives the multiple R as 0.955557948(95.6%), which is the correlation coefficient between the number of citations/impact and publications. The value of R Square is 0.913090992, which means 91.31% variation of citations/Impact can be explained

by the publications for various departments in FUIO and 8.69% is unexplained. The F-value shown in the table gives the statistics for the variance ratio test of regression model. The significance of F, which is given as 1.01049E-07, is the p-value of the F-test carried out in ANOVA. Since the p-value is less than 0.05, we conclude that the regression is statistically significant at 5% level of significance. Hence the regression is significant, which means there is a relationship between number of citations/impact and publications.

CONCLUSION

This study set out to conduct a bibliometric analysis of research in science and technology in Federal University Otuoke, Bayelsa State, Nigeria. The study found a total number of 2,124 publications in Science and Technology at Federal University Otuoke from 102 researchers in the Education, Engineering and Science Faculties. The study also revealed that the Department of Chemistry is leading with a citation frequency of 5,649 from 500 publications, followed by Chemical Engineering with a citation count of 2,717 from 184 publications leading Microbiology with 2,637 citations from 321 publications. The study also established a significant relationship between publications output and citation frequency/impact.

From the above findings, the study recommends that Science and Technology researchers be encouraged to publish in peer-reviewed open-access journals, to elicit more visibility. Researchers should be encouraged to upload their work to which they have copyrights on academic social platforms like ResearchGate, Scholar Works by BePress, Mendeley, and so on. It is also proposed that researchers should collaborate with NGOs and other sponsoring agencies for increased community-based impact. The Federal and State governments are called on to provide more research infrastructure to motivate research in Science and Technology.

REFERENCES

- Adedayo, H. B., Adio, S. A., and Oboirien, B. O. (2021). Energy research in Nigeria: A bibliometric analysis. *Energy Strategy Reviews*. 34. <https://doi.org/10.1016/j.esr.2021.100629>
- Amzat, J., Kanmodi, K. K., and Egbedina, E. A. (2023). Infoveillance and bibliometric analysis of COVID-19 in Nigeria. *Public Health Challenges*. 2 (1). <https://doi.org/10.1002/puh2.77>
- Djeki, E., Degila, J., Bondiombouy, C., & Alhassan, M. H. (2022). E-learning bibliometric analysis from 2015 to 2020. *Journal of Computers in Education*. 9 (4), 727-754. <https://doi.org/10.1007/s40692-021-00218-4>
- Gao, Y., Wong, S. L., Khambari, M. N., and Noordin, N. (2022). A Bibliometric Analysis of the Scientific Production of e-Learning in Higher Education (1998-2020). *International Journal of Information and Education Technology*. 12 (5), 390-399.

- Kamer, L. (2022). Population in Africa 2020, by country. Retrieved from Statista: <https://www.statista.com/statistics/1121246/population-in-africa-by-country/>
- Lee, I., Lee, H., Chen, Y., Chae, Y. (2020). Bibliometric analysis of research assessing the use of acupuncture for pain treatment over the past 20 years. *Journal of Pain Research*. 13. 367-376.
- Mejia, C., Wu, M., Zhang, Y., and Kajikawa, Y. (2021). Exploring Topics in Bibliometric Research Through Citation Networks and Semantic Analysis. *Frontiers in Research Metrics and Analytics*. 6, 1-16.
- Ndiomewese, I. (2019, April 5). Nigeria has a National Research and Innovation Council that oversees matters of innovation in the country. Retrieved from Techpoint Africa: <https://techpoint.africa/2019/04/05/national-research-and-innovation-council>
- Salisu, S. A. and Salami, M. O. (2020). A Bibliometric Analysis of Nigeria's Research Performance, 1901-2016. *African Journal of Library, Archives and Information Science*. 30 (1), 23-36.
- Sweileh, W. (2020). Bibliometric analysis of peer-reviewed literature on climate change and human health with an emphasis on infectious diseases. *Globalization and Health*. 16 (1) 1-17. <https://doi.org/10.1186/s12992-020-00576-1>
- Zahra, A., Nurmandi, A., Tenorio, C. B., Rahayu, R., Benectitos, S. H., Mina, F. L., and Haictin, K. M. (2021). Bibliometric Analysis of Trends in Theory-related Policy Publications. *Emerging Science Journal*. 5 (1), 96-110.