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Research Productivity of Mizoram University during 2004-2017: A Scientometric Study Based on Indian Citation Index

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ABSTRACT

Indian Citation Index is a major web-based citation database that provides access to the Indian publications across all disciplines published in journals/serials or other documents. The current study evaluated the research productivity of Mizoram University based on the data collected from Indian Citation Index for fourteen years from 2004-2017. This study endeavours to analyse the overall performance of the faculty members of the Mizoram University in research productivity. During the study, a total of 265 articles were collected from Indian Citation Index between the years 2004-2017. The study endeavours to measure the year-wise distribution of publication output, co-authorship index, and collaborative index, degree of collaboration, collaboration coefficient, modified collaboration coefficient, most productive author, top-ranked subjects and top-ranked publications based on the collected data. The result of the study indicates that the average research output is 18.93 articles per year. The most productive author was U. K. Sahoo department of Forestry with 25 publications. The highest rank publication was Current Science with 16 publications. Highest publications have been given by Biological Science subject which is 54 and research article 230 was a preferred document by the scientists of Mizoram University during 2004-2017.

Keywords: Scientometric; Co-authorship index; Collaborative index; Degree of collaboration; Collaboration coefficient; Productive author; Indian citation index.

1. INTRODUCTION

The research productivity of the university in the form of research articles in a peer-reviewed journal is being considered as one of the main benchmarks for measuring the performance of the university. The generation and transmission of knowledge through research has long been recognised as an essential requirement for a university to long term growth and competitiveness as well as creating a capacity to solve educational problems, in the present era university play an important role in the generation and dissemination of research and development. Research is the crucial and significant function of any higher education system and faculty members of the higher institutions are encouraging the growth of research by the construction of a research team consisting of junior and senior students. In any educational institution, tacit knowledge is present in the form of published sources for example journal articles, books, research report, course materials, etc. and faculty members, research scholars, decision-makers, administrators share the knowledge.

Scientometric assessment evaluates scientific research productivity for research it is referred as a science about science; it is a distinct, recognised and well-established scholarly field with its own identity, history, theories, and methodologies. Hence in this context the present study is an attempt to categorise the research performance of the scientists of Mizoram University by analysing the scholarly publications.

Mizoram University was established in the year 2000 by an act of parliament. The university accredited with 'A' grade by the National Assessment and Accreditation Council (NAAC). Mizoram University was started functioning from 2nd July 2001 to foster research, development, and dissemination of knowledge in various branches of learning. Mizoram University has 8 schools of studies and 33 academic departments, 1 constituent college, and 31 affiliated college. A total of 3886 students were enrolled during the year 2017-2018 (https://mzu.edu.in/index.php/about-mzu/)[1].

2. LITERATURE REVIEW

Siwach and Parmar[2] conducted publishing behaviour of researchers of CCS Haryana Agricultural University, Hisar during 2001-2015 with the help of the Scopus database. A total of 2649 articles were calculated and total 15282 citations were receiving. The average publication was 177 per year and an average citation was 5.77 per. It was also observed that the publication of five-year slabs was nearly equal numbers in 2001-2005, 2006-2010, and 2011-2015. The Agricultural and Biological Sciences subject was dominating subject with 2038 publications. College of Veterinary Science was the highest collaborative institution with 141 articles and the top ten collaborative institutions are from India. Annals of Biology 325 was the most preferred journal and N. Khetarpaul

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Department of Food and Nutrition with 63 publications was the most prolific author during the study period. 97.17 per cent publication was with two or more than two authored articles. Three authors' collaboration dominated and the collaboration coefficient was calculated to be 0.668.

Gautam and Mishra[3] lead a scientometric study of Banaras Hindu University based on Indian Citation Index from 2004 to 2013, a total of 1041 articles were found from ICI. It found that the research productivity was increasing at the average rate of 104.1 publications per years and maximum articles were contributed by joint authors. The most prolific author was A. K. Singh, Department of Physics with 18 articles. Out of 1041 publications, 60 (5.76 %) articles have collaborated with 18 different countries of the world. The USA was the highest collaborative country. Indian Agricultural Research Institute (IARI) was the topmost collaborative institute. Journal of Food Science and Technology was the topmost impact factor journal, dominating journal was Current Science with 25 publications and the multi-authorship pattern was dominated in the study. Journal articles contribution was more in comparison to other forms of publications. The most productive author was T.S. Anirudhan from the Department of Chemistry with 114 (10.67 %) articles from 2000-2012.

Gopikuttan and Aswathy[4] evaluated a scientometric study on the publication output of the University of Kerala based on the records collected from the Web of Science database during 2000-2012. It was found that at the early stage of publication was less but it was increasing gradually but there was very ups and down in few years and the year 2011 was the highest publication year which was 126 (11.80 %) articles out of 1068 articles during the study period. Maximum articles were published in Indian journals, USA and Netherlands. The collaboration coefficient varied from discipline to discipline and the highest collaboration coefficient was counted in the subject Chemistry (0.37) and the lowest collaboration coefficient was counted in the subject Mathematics (0.22).

Baskaran[5] analysed a bibliometric study on the research productivity of Alagappa University from 199-2011 based on the Web of Science database. It found that the growth of the research productivity was increased in the number of the publication. The relative growth rate was in fluctuating trend and doubling time was found in increasing and decreasing trend. Multi-authored articles were more which is 750 (96.64 %) and single-authored papers were only 26 (3.35 %) from a total of 776 published articles. Degree of collaboration was fluctuating from 0.92 to 0.98 and the mean observed 0.96. South Korea was the most collaborative country with 7.61 per cent articles from total research output. Central Electrochemical Research Institute was the dominating institution with 129 (16.62 %) publications and Material Science with 172 (22.26 %) articles was the most dominating subject in the study.

Majhi and Maharana[6] conducted a scientometric study on the research productivity of Physical Science disciplines at Sambalpur University Orissa during 1971-2010 based on the data collected from the Scopus database. A total of 417 articles were published with 3.48 per capita productivity. It found that the highest 92.35 per cent publication was the multi-authored articles and only 7.65 per cent of articles were single-authored articles which very low in comparison to multi-authored articles during the study period. Chemistry and Physics were highly productivity subjects over the other subjects in Physical Science disciplines. B. K. Mishra Department of Chemistry was the most productivity author in Physical Science and the most preferred journal was Journal of the Indian Chemical Society with 34 articles from the Physical Science disciplines of Sambalpur University during 1971-2010.

Kumabr[7], *et al.* analysed the research activity in the University of Mysore in Science and technology based on published data consisting of 1581 articles published by the scientists during 1996-2006. It found that the average growth rate of the publication was 23 per cent per annum. The average citation per paper was found increasing from 1.53 in 1996 to 2.62 in 2003. Chemistry, Physics, and astronomy were the top three most dominating research areas, and Chemical Engineering, Energy and Molecular Biology were emerging areas of research. The university has only 14 per cent international collaboration and the USA (51 %) was the largest collaborative country during the study period. The most productive author was H. S. Yathirajan department of Chemistry with 41 articles from a total of 139 articles of Chemistry.

Nafukho[8], *et al.* examine the research productivity of faculty in selected two leading public universities in Kenya and showed that the research growth varied by gender, institution, terminal degree, work experience, rank, etc. It was found that experienced faculty were not productive but research students were more productive in comparison to experienced faculty members in the study. Currently in Kenyan public universities enhance research productivity to achieve their vision, mission, and goals.

Bapte and Gedam[9] analysed the scientometric profile of Sand Baba Amravati University during 1996-2017 from the SCOPUS database. It was found that a total of 1130 with 10.65 per cent average citation per paper published. 20.08 per cent publication was with international collaboration, the university had the largest collaboration with Brazil (69) and United States (21) and the highest H-index was count (17) in the year 2009. Collaborative authors pattern was received maximum (89.17 %) citation in the study. Degree of collaboration was 0.96 while the average modified collaboration coefficient was 0.62 and the journal article was the most popular source for research expression. Mahendra Rai was the most productive author and the maximum article was published in the domain of Physics and Astronomy in the study.

Mondal[10], *et al.* evaluated the publication output of the scientist of Indian Association for the Cultivation of Science during 2008-2017 based on the Web of Science database. A total of 4304 articles included 22.58 per cent of international collaboration found in the study. It found that the majority of articles was produced by three authored and maximum citation received by international collaboration articles. The most favoured countries was USA, Japan, Germany, and England by the scientists and Journal of Physical Chemistry C with an average impact factor 3.798 was given the highest articles in the study. Examine the scattering of journals and articles Pareto's 80/20 principle was applied in the study.

3. SCOPE

The scope of the present study is limited to the scholarly literature of Mizoram University which is published in Indian journals listed in Indian Citation Index database based on scientometric parameters. The scope is further limited to the period of 14 years during 2004-2017 because the university was started since 2001 and after that the faculties started of publications and publications are available in the portal of Indian Citation Index from 2004 which is the reason, I have taken the date from 2004-2017.

4. OBJECTIVES

The objectives of the study are to:

- Find out the growth of research productivity from MZU during 2004-2017
- Examine the authorship pattern and collaboration coefficient of research productivity
- Observe the most productive authors from MZU
- Find out the highly preferred publication in which authors prefer to publish their research articles
- Examine the subject distribution of the publication from MZU
- Find out the type of document preferred by the MZU scientist.

5. METHODOLOGY

The present study aims to calculate scholarly literature of Mizoram University which is published in Indian journals listed in Indian Citation Index (ICI) database. The data was retrieved from an online database Indian Citation Index (ICI) (http://www.indiancitationindex. com/)[11]. Data were retrieved on 9th November 2018 and the search term Mizoram University (MU) was used in the institutional analyser search option for the period 2004-2017. A total of 265 articles was downloaded and then the collected data were scrutinised with the help of MS-Excel. The calculated data has been scrutinised by the scientometrics tools and techniques to determine the achievement of objectives and measurement by using following formulas:

5.1 Collaborative Index

The methodology of Collaborative Index (CI) has been suggested by (Lawani, 1980)[12].

Which is represented by:

$$CI = \frac{\sum_{j=1}^{A} jfj}{N}$$

Where,

j = the number authors in an article i.e. 1, 2, 3 ……

fj = the number of j authored articles

N = the total number of articles published in a year, and

A = the total number of authors per articles

5.2 Degree of Collaboration

The degree of collaboration (DC) counted by the formula which is suggested by (Subramanyam, 1983)[13].

Which is given below:

$$DC = 1 - \frac{f1}{N}$$

Where,

f_1 = the number of single-authored articles

N = the total number of articles published in a year

5.3 Collaboration Coefficient

The collaboration coefficient (CC) counted by the formula which is suggested by (Ajiferuke, et al., 1988)[14].

Which is given below:

$$CC = 1 - \frac{\sum_{j=1}^{A} \frac{1}{j}(fj)}{N}$$

Where,

j = the number authors in an article i.e. 1, 2, 3 ……

fj = the number of j authored articles

N = the total number of articles published in a year, and

A = the total number of authors per articles

5.4 Modified Collaboration Coefficient

The modified collaboration coefficient (MCC) counted by the formula which is suggested by (Savanur and Srikanth, 2010)[15].

Which is given below:

$$MCC = \left(\frac{N}{N-1}\right)\left\{1 - \frac{\sum_{j=1}^{A} \frac{1}{j}(fj)}{N}\right\}$$

Where,

j = the number authors in an article i.e. 1, 2, 3 ……

fj = the number of j authored articles

N = the total number of articles published in a year, and

A = the total number of authors per articles

5.5 Co-Authorship Index

The co-authorship index (CAI) counted by the formula which is suggested by (Garg and Padhi, 2001)[16].

Which is given below:

$$CAI = \left\{\frac{\left(\frac{Nij}{Nio}\right)}{\left(\frac{Noj}{Noo}\right)}\right\} \times 100$$

Where,

N_{ij} = number of papers having j authors in block i

N_{io} = Total output of block i

N_{oj} = number of papers having j authors for all blocks

N_{oo} = Total number of papers for all authors and all blocks

j = 1, 2, 3…

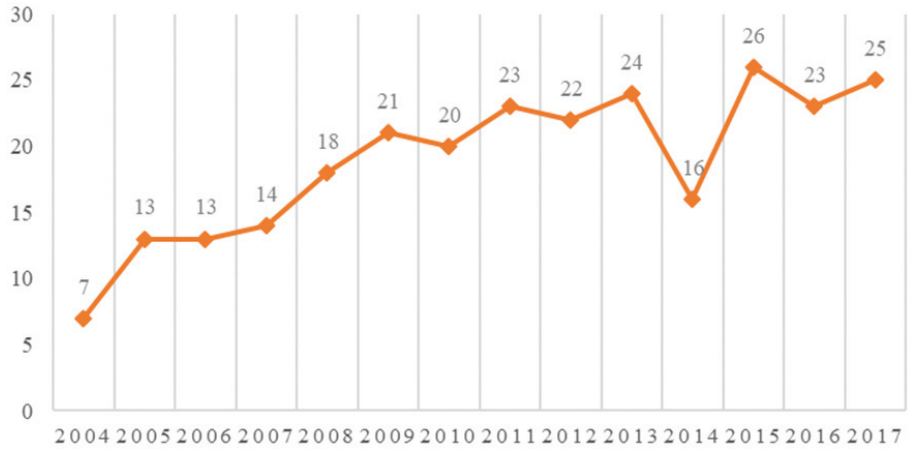

Figure 1. Year-wise Distribution Of Research Productivity.

Table 1. Year-wise authorship distribution of research productivity

Year	Single	Two	Three	Four	Five	More than Five	Total
2004	1	4	2	0	0	0	7
2005	3	2	6	2	0	0	13
2006	5	3	3	2	0	0	13
2007	3	2	4	4	0	1	14
2008	3	7	4	1	3	0	18
2009	5	4	4	6	1	1	21
2010	2	3	4	3	6	2	20
2011	6	5	3	4	2	3	23
2012	10	7	1	1	1	2	22
2013	5	10	5	2	0	2	24
2014	1	8	2	4	0	1	16
2015	7	5	5	2	3	4	26
2016	2	10	4	1	3	3	23
2017	2	11	7	3	2	0	25
Total	55	81	54	35	21	19	265

6. DATA ANALYSIS

6.1 Year-wise Distribution of Research Productivity

Year-wise research output of Mizoram University is given in Fig. 1. A total, 265 publications were published during the study. It is seen that only 7 articles published in the year 2004 from the university. During 2015, a maximum number of articles were included in ICI i.e. 26 (9.81 %) followed the year 2017 with 25 (9.43 %) publications and year 2013 with 24 (9.06 %) articles published during the period of study. Hence the highest publication came in the year 2015 and the lowest publication was in the year 2004.

6.2 Year-wise Authorship Distribution Of Research Productivity

Table 1 described the year wise authorship distribution of research productivity which was published in Mizoram University during the study period 2004-2017. It found that the highest 11 articles published in the year 2017 by double authors, highest 10 articles published in the year 2012 by a single author, highest 7 articles published by three authors in the year 2017, in the year 2009 highest 6 articles published by four authors, also 6 articles published by five authors in the year 2010 and maximum 4 articles published in the year 2015 by more than five authors. And it also found that the maximum 81 articles were published by double authors during the study period, followed by 55 articles published by single authors, 54 articles published by three authors, 35 articles published by four authors, 21 articles published by five authors during the study period, while only 19 articles published by more than five authors during a period of study 2004-2017.

6.3 Co-Authorship Index

Table 2 demonstrates the co-authorship index (CAI) of publications for Mizoram University during the period of study. The co-authorship index has been measured by calculating the proportional output of single, double, etc. authored papers in Mizoram University during the study period. The highest co-authorship index has been founded with five authorship articles which are 378.57 in the year 2010. It found that in the single authorship the highest co-authorship index 219.01 in the year 2012, in two authorship the highest co-authorship index 186.95 has been founded in the year 2004, in three authorship the highest co-authorship index 226.50 has been founded in the year 2005, in four authorship the highest co-authorship index 216.33 has been founded in the years 2007 & 2009, and in more than five authorship highest co-authorship index 214.57 has been founded in the year 2015.

6.4 Measures of collaboration of research productivity

Figure 2 has been designed to examining the collaborative index, degree of collaboration, collaboration coefficient, and modified collaboration coefficient during the period of study 2004-2017 from MZU. From the observation, it found that the average collaboration index 2.78, the average degree of collaboration 0.79, and the average collaboration coefficient & modified collaboration coefficient 0.51 has been counted during the study period. It also has been founded that highest collaborative index 3.70 calculated in the year 2010, the highest degree of collaboration 0.94 calculated in the year 2014, highest collaboration coefficient 0.64 calculated in the year 2010 and highest modified collaboration coefficient 0.68 calculated in the year 2010 during the period of study. Hence it found that the year 2010 has been the common year with maximum CI, CC, and MCC while the highest DC has been counted in the year 2014. Figure 2 shows that there is a difference in the collaborative index, degree of collaboration, collaboration coefficient, and modified collaboration coefficient but in between collaboration coefficient and modified collaboration coefficient there is the

Table 2. Co-Authorship Index (CAI)

Year	Single (CAI)	Two (CAI)	Three (CAI)	Four (CAI)	Five (CAI)	More than Five (CAI)	Total
2004	1 (68.83)	4 (186.95)	2 (140.21)	0 (0.00)	0 (0.00)	0 (0.00)	**7**
2005	3 (111.19)	2 (50.33)	6 (226.50)	2 (116.48)	0 (0.00)	0 (0.00)	**13**
2006	5 (185.31)	3 (75.50)	3 (113.25)	2 (116.48)	0 (0.00)	0 (0.00)	**13**
2007	3 (103.25)	2 (46.74)	4 (140.21)	4 (216.33)	0 (0.00)	1 (99.62)	**14**
2008	3 (80.30)	7 (127.23)	4 (109.05)	1 (42.06)	3 (210.32)	0 (0.00)	**18**
2009	5 (114.72)	4 (62.32)	4 (93.47)	6 (216.33)	1 (60.09)	1 (66.42)	**21**
2010	2 (48.18)	3 (49.07)	4 (98.15)	3 (113.57)	6 (378.57)	2 (139.47)	**20**
2011	6 (125.69)	5 (71.12)	3 (64.01)	4 (131.68)	2 (109.73)	3 (181.92)	**23**
2012	10 (219.01)	7 (104.10)	1 (22.31)	1 (34.42)	1 (57.36)	2 (126.79)	**22**
2013	5 (100.38)	10 (136.32)	5 (102.24)	2 (63.10)	0 (0.00)	2 (116.23)	**24**
2014	1 (30.11)	8 (163.58)	2 (61.34)	4 (189.29)	0 (0.00)	1 (87.17)	**16**
2015	7 (129.72)	5 (62.92)	5 (94.37)	2 (58.24)	3 (145.60)	4 (214.57)	**26**
2016	2 (41.90)	10 (142.24)	4 (85.35)	1 (32.92)	3 (164.60)	3 (181.92)	**23**
2017	2 (38.55)	11 (143.95)	7 (137.41)	3 (90.86)	2 (100.95)	0 (0.00)	**25**
Total	**55**	**81**	**54**	**35**	**21**	**19**	**265**

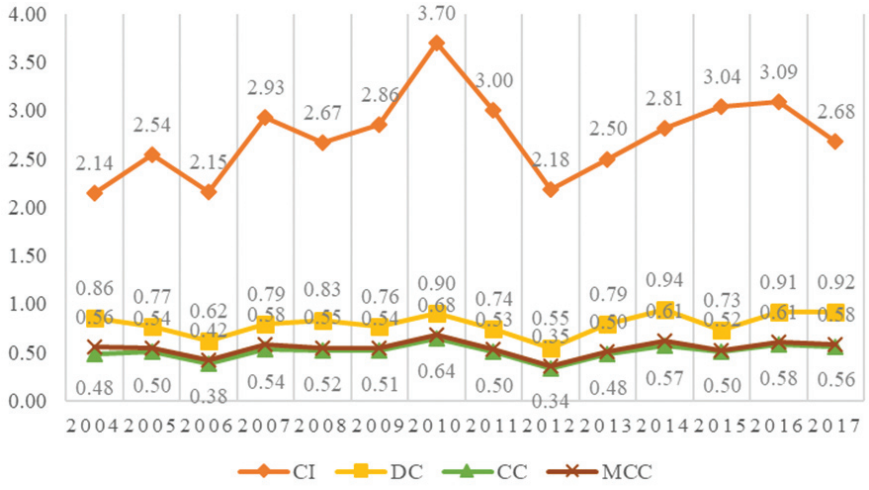

Figure 2. Measures of collaboration of research productivity.

negligible difference found but from the observation of Fig. 2, it is found that there is no difference in collaboration coefficient and modified collaboration coefficient.

6.5 Most Productive Author in the Mizoram University

Table 3 shows that the most productive author at Mizoram University during the period of study. It has been found that the most productive author was U. K. Sahoo from Forestry department with 25 (9.43 %) publications engaged 1st rank followed by R. P. Tiwari from Geology department with 14 (5.23 %) publications, R. K. Thapa department of Physics & B. P. Nautiyal department of Horticulture with 13 (4.91 %) publication was occupied 3rd and 4th rank respectively and Manoj Kumar Verma Department of Library and Information Science with 12 publications occupied 5th rank during the period of study. Lowest 10th rank was occupied by R. C. Laha department of Botany with 6 (2.62 %) publications. Which shows that the Department of Forestry and Horticulture, Aromatics & Medicinal Plants contribution was maximum respectively in comparison of all the top ten ranked authored department.

6.6 Top Ten Ranked Publication Name

Table 4 represents the top ten ranked publication name which published most of the articles contributed by the authors of Mizoram University. From the observation of a particular table, it has been found that current science was a top-ranked selected journal for publication of articles with 16 (6.04 %) articles during the study period. Followed by Indian Journal of Physics and Journal of Nature Conservation with 10 (3.77 %) articles each publication consuming 2nd and 3rd rank respectively. It has been also found that three publications Environment and Ecology, The Indian Forester, Journal of the Paleontological Society of India with 8 (3.02 %) articles and next three publications Indian Journal of Tropical Biodiversity, Journal of Geological Society of India, and Journal of Tropical Forestry 6 (2.26 %) articles each. While Asian Journal of Chemistry with 7 (2.64 %) articles taking 7th rank during the study period.

6.7 Subject Category Top Ten in Mizoram University

The top ten subject categories of Mizoram University during 2004-2017 has been shown in Table 5. Which shows that Biological Science subject is securing top rank with 54 (20.38 %) publications, trailed by Environmental Science with 46 (17.36 %) publications securing the second position, Agriculture with 31 (11.70 %) publications occupying the third rank, General Science and Technology and Library and Information Science subjects occupying fourth

Table 3. Top ten ranked author

Author	Department	Articles	Per cent
U. K. Sahoo	Forestry	25	9.43
R. P. Tiwari	Geology	14	5.28
R.K.Thapa	Physics	13	4.91
B. P. Nautiyal	Horticulture, Aromatics & Medicinal Plants	13	4.91
Manoj Kumar Verma	Library & Information Science	12	4.53
T. K. Hazarika	Horticulture, Aromatics & Medicinal Plants	10	3.77
G. S. Solanki	Zoology	8	3.02
Kalidas Upadhyaya	Forestry	7	2.64
N. Mohandas Singh	Chemistry	7	2.64
R.C. Laha	Botany	6	2.26

Table 4. Top 10 ranked publication name

Publication Name	Articles	Per cent
Current Science	16	6.04
Indian Journal of Physics	10	3.77
Journal of Nature Conservation	10	3.77
Environment and Ecology	8	3.02
The Indian Forester	8	3.02
Journal of the Paleontological Society of India	8	3.02
Asian Journal of Chemistry	7	2.64
Indian Journal of Tropical Biodiversity	6	2.26
Journal of Geological Society of India	6	2.26
Journal of Tropical Forestry	6	2.26

and fifth rank respectively with 30 (11.32 %) publications and lowest tenth rank has been occupied by Physics Subject with 15 (5.56 %) publications.

6.8 Type of Document

Table 6 represents the type of document contributed by the authors of Mizoram University during the period of study. After observation Table 6, it has been found that the highest 230 (86.79 %) records were research articles, followed by short communication with 16 (6.04 %) records, editorial with 8 (3.02 %) records, research note with 4 (1.51 %) records, case study and review articles with 3 (1.13 %) records both an opinion paper with 1 (0.38 %) record. This shows that the maximum contribution was researched articles contributed by the authors of Mizoram University with 86.79 per cent articles. Research articles were the priority of the authors other were very few in the comparison of research articles which was only 13.21 per cent.

Table 5. Top 10 ranked subject category

Subject Category	Record Count	Per cent
Biological Science	54	20.38
Environmental Science	46	17.36
Agriculture	31	11.70
General Science and Technology	30	11.32
Library and Information Science	30	11.32
Forestry	27	10.19
Social Science	26	9.81
Earth and Geological Science	19	7.17
Chemistry	17	6.42
Physics	15	5.66

Table 6. Type of document

Document Type	Record Count	Per cent
Research article	230	86.79
Short communication	16	6.04
Editorial	8	3.02
Research note	4	1.51
Case study	3	1.13
Review article	3	1.13
Opinion paper	1	0.38

7. FINDINGS

The major findings of the study are:

- There are a total of 265 research articles contributed by the faculty of Mizoram University during 2004-2017 which tabled publications in the Indian Citation Index. A significant publication found with an average of 18.93 articles per year during the study period
- During the study it found that the highest number of publications was in the year 2015 with 26 (9.81 %) articles and the lowest number of publications was in the year 2004 with 7 (2.64 %) articles only
- The majority of publications index in the Indian Citation Index was double authorship pattern during 2004-2017 and then the single authorship pattern has been chosen by the faculty members. The highest 81 articles have been written by double authorship pattern and the lowest 19 articles have been written by more than five authorship patterns
- The highest co-authorship index has been counted in the year 2010 with five authorship patterns which are 378.57 and the lowest co-authorship index has been counted in the year 2012 with three authorship patterns which are 22.31 during the whole study of 2004-2017
- The average collaborative index 2.78 has been counted, the average degree of collaboration 0.79, average collaboration coefficient, and modified collaboration coefficient 0.51 respectively has been counted during the period of study 2004-2017

- The most productive author was U. K. Sahoo department of Forestry with 25 publications. The highest rank publication was Current Science with 16 publications. Highest publications have been given by Biological Science subject which is 54 and research article 230 was a preferred document by the scientists of Mizoram University during 2004-2017.

8. CONCLUSIONS

The current study attempted to examine the publication trends of Mizoram University based on the journals indexed in the Indian Citation Index. The result of the current study has directed that Mizoram University has indeed progressed in these short years of establishment in terms of scholarly literature. This study analysed scientific collaboration among professionals. The present study defined that an average of 19 articles published per year during the period of study and the trend of co-authorship patterns are dominating over the single-authored articles. Biological Science, Environmental Science, General Science & Technology and Library and Information Science are the most leading areas of research. Current Science, Indian Journal of Physics, Journal of Nature Conservation, etc. are the most preferred journals by the scientists of Mizoram University.

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