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Research and Publications Productivity of the Malaviya National Institute of Technology, Jaipur: A Scientometric Study

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Abstract - **Measuring research productivity and identifying its impact at national and international level is a continuous process of research institutes In view of the hyper competition among higher education institutions, most of them are concerned about their research productivity and quality of education. Productivity and quality of publications of an institution not only depict the ongoing research activities but also play a crucial role in differentiation of the institution from other similar institutions in its standing and ranking. The research productivity of the Malaviya National Institute of Technology, Jaipur is portrayed in this paper based on analysis of this institution's publications output for the period 2010-2015, covered in the Scopus. In all data of 1231publications, pertaining to the said period was assessed into categories, and spelled out to results. This study reflects that the publication output of MNIT Jaipur is continuously increasing since 2010. Data analysis reveals a greater level of collaborative work at this Institute. The collaborative work is not only grounded within MNIT Jaipur but also with other institutions in the country and abroad. The largest number of papers published comprise of three authors followed by two authors and four authors. A look at the analysed data shows that majority of the publications are research articles, followed by papers published in conference proceedings. Which are the preferred journals and conference proceedings for research publications was also analysed and a list of top preferred journals/ conference proceedings is given. A list of highly cited publications is also included.**
Keywords: **Publication Productivity, MNIT Publications, Research Productivity, Scientometric Study, CIFT**

I. INTRODUCTION

The college was established as Malaviya Regional Engineering College, Jaipur in 1963 and Upgraded with Malaviya National Institute of Technology, Jaipur in the year 2002 which is an autonomous institute under Ministry of Education, Government of India, The MNIT offers courses of study leading to Degree Bachelor of Technology, Civil Engineering, Chemical Engineering, Computer Science & Engineering, Electrical Engineering, Electronics & Communication Engineering, Mechanical Engineering, Metallurgical & Materials Engineering, Architecture & Planning, Bachelor of architecture, Master of Science Physics, Chemistry . Mathematics, Master of Technology in Civil Engineering, Chemical Engineering, Computer Science & Engineering, Electrical Engineering, Electronics & Communication Engineering, Mechanical Engineering, Metallurgical & Materials Engineering Architecture, Renewal Energy etc. M. Planning, M.Sc., MBA and Ph.D. (course data has been taken from annual report of 2018-19) Institutions are concerned with their research output because of its contribution to their ranking and standing and accreditation. They often keep track of their research output, measure and evaluate it because whatever can be measured and correctly assessed, can be improved. Productivity and quality of publications of an institution not only depict the ongoing research activities but also reflect the differentiation of an institution from similar other institutions in terms of performance and stature achieved.

II. REVIEW OF LITERATURE

Some studies have been conducted in the past pertaining to the scientometric analysis of research output of institutions of India. Vivek Kumar Singh (2015) undertook the scientometric analysis of research publications of the Pondicherry University for the period of 1990 to 2014 for publications indexed in Web of Science (WoS). This study analysed the collaboration at different levels such as authors, institutions along with the status of collaboration at international level. The major research areas of publications are also analysed (Singh, 2015).

I. V. Malhan and B. M. Gupta (2011) did analysis of publication output of the University of Jammu and analysed the standing of faculty besides assessing research output of the University (Malhan, 2011). Asifa Jan and others (2015) did the analysis of publication output of the University of Kashmir, As per this analysis the University has shown a promising publication growth expect for some years in 1990s. The highest contributing authors are from the disciplines of Science, Majority of papers are published in Indian sources. Articles have remained a prime document type published by the authors from University of Kashmir. Future emphasis on joint research, international collaboration, and publishing in indexed journals is emphasized in the study.

Sumit Kumar Banshal *et al.,* (2017) analysed the research performance of 16 older Indian Institutes of Technology of India, which shows that there is a substantial difference in research performance levels of old IITs vis-à-vis the new

IITs. Nabi Hasan and Mukhtiar Singh (2015) evaluated the trend of research output of five top ranking Indian Institutes of Technology (IITs) based on research papers/articles indexed in Web of Science online database for the five years' period of 2009-13. A total of 215,019 records were retrieved for India which are 2.72% of the global records for the period 2009-13. Subhodip Bid (2016) did analysis of publications of Indian Institute of Technology, Kharagpur for the period 2000 to 2015 and studied the growth and development of research activity of this institution. K. J. Jeevan and B. M. Gupta (2002) analysed the performance and impact of research produced in each department, and the comparison of the impact of research in various departments of the IIT, Kharagpur.

Vimlesh Patel and N. S. Thakur (2018) analysed the growth and development of research activities of the National Environmental Engineering Research Institute, Nagpur from 2012-2016 and studied various parameters like highly productive subject areas. They found that environmental sciences and ecology are the most favoured areas of research among the contributors with 34.34% of total productivity. Vimlesh Patel (2017) did analysis of publications of National Institute of Technology, Kurukshetra (NIT Kurukshetra) from 2012 to 2016 as reflected in Web of Science database. This study included the year wise growth of publications, presented the analysis of publication types, and mirrored the top institutions collaborating with National Institute of Technology, Kurukshetra for research and publication. Ahmad Darmadji, *et al.,* (2018) did bibliometric analysis of the publications of the Islamic University of Indonesia using the scopus database.

III. OBJECTIVES OF THE STUDY

1. To analyse year wise publications productivity of the MNIT Jaipur.
2. To find out authorship patterns of publications.
3. To find out the institutions collaborating with the MNIT Jaipur.
4. To ascertain the research papers collaboratively published with authors of top other countries.
5. To find out the type of publications preferred by researchers to report their research findings.
6. To find out specific titles of journal and conference volumes preferred for publications by the authors of MNIT Jaipur.
7. To identify the highly cited publications of the MNIT Jaipur.

IV. SCOPE AND METHODOLOGY

The data included for this study are derived from Scopus Copyright (2020) a bibliographic and citation database that covers select scholarly publications. The data collection pertained to the period 2010-2015. The sixyears period is a good representative sample to study research productivity. The search was conducted in Scopus as AF-ID ("Malaviya National Institute of Technology, Jaipur") and (Limit-To (Pub year, 2015) or Limit-To (Pub year, 2014) or Limit-To (Pub year, 2013) or Limit-To (Pub year, 2012) Or Limit-To (Pub year, 2011) or Limit-To (Pub year, 2010) in 06 November 2020. The full records were downloaded in the excel format and categorised into articles, proceedings papers, editorial material, titles, author records, affiliation of authors etc. For scientometric study of publications data of MNIT Jaipur, analysis of various parameters like year wise growth rate of papers, highly prolific authors**,** collaboration in publications beyond MNIT Jaipur, authorship pattern was undertaken. The most collaborating institutions and countries have been recognized using extraction of information from the affiliations text.

V. DATA ANALYSIS AND INTERPRETATION

A. Publications Growth

The year wise research growth in terms of total publication given in Table I. It shows that number of publication output is continuously increasing since 2010. The data reflects that highest number of 316 (25.67%) publications in 2015 were indexed in the Scopus and just 112 (9.10%) publications were indexed in 2010. A consistent trend of increase in the publications productivity reflects a continuous increase in the research activities at the MNIT Jaipur.

TABLE I YEAR WISE GROWTH OF PUBLICATIONS

Publication Years	Publications	% of TP
2010	112	9.10
2012	163	13.24
2011	164	13.32
2013	223	18.12
2014	253	20.55
2015	316	25.67
5 year Total	1231	100

B. Authorship Pattern of Publications

The largest number of publications i.e., 444 (36.07 %) comprised of three authors, followed by two authors 290 (23.56%), four authors 258 (20.96%), five authors 133 (10.80%), and so on. The authorship pattern of 1231 publications is given in Table II. Just 28 (2.27%) of total publication were independently written by single authors. Independent publications comprising of single author are lowest in number. Data analysis thus reflects an encouraging trend for collaborative work among the researchers of MNIT Jaipur.

The data shows that 49 publications have six authors, 15 include seven authors, 6 have eight authors and nine or more authors jointly published 8. This also indicates teamwork and team research at MNIT Jaipur.

TABLE II AUTHORSHIP PATTERN OF PUBLICATIONS

Years	One Author	Two Authors	Three Authors	Four Authors	Five Authors	Six Authors	Seven Authors	Eight Authors	Nine Authors = >	Total
2010	3	25	36	24	18	3	1	0	2	112
2011	9	38	56	38	13	6	2	1	1	164
2012	3	39	59	45	12	2	1	0	2	163
2013	6	53	89	39	21	10	1	4	1	224
2014	5	73	91	47	25	6	3	1	1	252
2015	2	62	113	65	44	22	7	0	1	316
5 year	28	290	444	258	133	49	15	6	8	1231
%	2.27	23.56	36.07	20.96	10.80	3.98	1.22	0.49	0.65	100.00

C. Type of Publications

TABLE III DISTRIBUTIONS OF PUBLICATIONS ACCORDING TO TYPE

Document Types	No. of Publications	% of Total No. of Publications
Letter	2	0.16
Erratum	3	0.24
Note	4	0.32
Editorial	10	0.81
Review	25	2.03
Book Chapter	36	2.92
Conference Paper	550	44.68
Article	601	48.82
Total	1231	100.00

Table III show that distribution of publications according to their types. It shows that research articles comprised of the highest number of publications i.e., 601 (48.82%) followed by proceedings papers 550 (44.68%), Book Chapter 36 (2.92%) review papers 25(2.03%) and Note 04 (0.32%) and other reflected in following table.

D. Collaboration of Research Publications with Other Top Countries

Table IV shows the collaboration of the research and publishing with other Top countries authors. It reflects that the USA is at the top with 54 (4.39%) publications followed by United Kingdom with 51 (4.14%) which is at second position and Germany with 32 (2.60%) publications at the third position and collaborations with other countries are given in Table IV.

TABLE IV RESEARCH PUBLICATIONS WITH OTHER TOP COUNTRIES

Sl. No.	Countries/Regions	No. of Publications	% of TP	Rank
1	United States	54	4.39	1
2	United Kingdom	51	4.14	2
3	Germany	32	2.60	3
4	Canada	27	2.19	4
5	Australia	24	1.95	5
6	Singapore	23	1.87	6
7	Saudi Arabia	13	1.06	7
8	Italy	12	0.97	8
9	Finland	10	0.81	9
10	Russian Federation	10	0.81	10
11	South Africa	8	0.65	11
12	Turkey	8	0.65	11
13	Japan	7	0.57	12
14	South Korea	7	0.57	12

Collaboration with authors of countries fairly reflects the global reach of the MNIT, Jaipur and exposure and visibility of its faculty.

E. Top Collaborative Institutions/Organizations: Table V includes the top institutions/ organizations involved in the collaborative work with the MNIT Jaipur. The analysis of top collaborative institutions/organizations with MNIT Jaipur indicates that the MNIT Jaipur researchers largely collaborated with the University of Rajasthan, as they jointly published 56 (4.55%) publications.

TABLE V TOP INSTITUTIONS/ORGANIZATIONS INVOLVED IN THE COLLABORATIVE WORK

Top Collaborative Institutions/Organization Affiliation	No. of Publications	% of TP
University of Rajasthan	56	4.55
Indian Institute of Technology Delhi	42	3.41
Indian Institute of Technology Roorkee	35	2.84
Government Engineering College, Ajmer	27	2.19
University of Saskatchewan	21	1.71
National University of Singapore	20	1.62
Ruhr-Universitat Bochum	18	1.46
Central Electronics Engineering Research Institute India	18	1.46
Indian Institute of Technology Kanpur	18	1.46
North Dakota State University	18	1.46
National Institute of Technology Hamirpur	17	1.38
University of Bath	17	1.38
Rajasthan Technical University	16	1.30
Banasthali Vidyapith	15	1.22

F. Extent of Publication in Open Access Form

Table VI includes the extent of publications in open access from shows that distribution of publications in open access form. Data in table reflect that percentage of open access publication was i.e., 95 (7.72%) of total publication.

TABLE VI EXTENT OF PUBLICATION IN OPEN ACCESS FORM

Access type	No. of Publication	Percentage of TP
Open Access	95	7.72
Other type of access	1136	92.28
Total	1231	100

G. Top Preferred Sources of Publications

Table VII shows the top ten journal titles and conference proceedings preferred by contributors of MNIT Jaipur for publication (2010-2015). It was found that IEEE Power and Energy Society General Meeting published the highest number of 24 publications. Proceedings of SPIE. The International Society For Optical Engineering 20 publications. ACM International Conference Proceeding Series published 18 publications. It indicates that some research work of MNIT Jaipur.

H. Highly Cited Publications

Table VIII reflect the publications of authors of MNIT Jaipur which have been cited by other authors. It shows that most of the articles with multiple authors are highly cited. The article which received the largest number of citations is entitled “A survey on nature inspired metaheuristic algorithms for partitional clustering” by Nanda S.J., Panda G.published in 2014 in Swarm and Evolutionary Computation.

It received 274 citations in Scopus from 2010 to 2015. Another publication entitled “Android security: A survey of issues, malware penetration, and defenses” by Faruki P., Bharmal A., Laxmi V., Ganmoor V., Gaur M.S., Conti M., Rajarajan M. published in IEEE Communications Surveys and Tutorials in 2015s received 255 citations and is second highly cited publication as per Scopus data.

TABLE VII TOP SOURCES PREFERRED FOR PUBLICATIONS

Sl. No.	Source Title	No. of Publications	Percentages % of Total Publications
1	IEEE Power and Energy Society General Meeting	24	1.95
2	"Proceedings of SPIE The International Society for Optical Engineering"	20	1.62
3	ACM International Conference Proceeding Series	18	1.46
4	Green Energy and Technology	18	1.46
5	AIP Conference Proceedings	16	1.30
6	Communications in Computer and Information Science	16	1.30
7	"Lecture Notes in Computer Science Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics"	14	1.14
8	International Conference on Recent Advances and Innovations in Engineering ICRAIE 2014	13	1.06
9	International Journal of Electrical Power and Energy Systems	13	1.06
10	Macromolecular Symposia	13	1.06
11	"International Conference on Signal Propagation and Computer Technology ICSPCT 2014"	12	0.97
12	Advances in Intelligent Systems and Computing	12	0.97
13	Energy and Buildings	12	0.97

TABLE IX HIGHLY CITED PUBLICATIONS

Authors	Title	Source title	Year	Cited by	DOI
Nanda S.J., Panda G.	"A survey on nature inspired metaheuristic algorithms for partitional clustering"	Swarm and Evolutionary Computation	2014	274	10.1016/j.swevo.2013.11.003
Faruki P., Bharmal A., Laxmi V., Ganmoor V., Gaur M.S., Conti M., Rajarajan M.	"Android security: A survey of issues, malware penetration, and defenses"	IEEE Communications Surveys and Tutorials	2015	255	10.1109/COMST.2014.2386139
Rana S., Jasola S., Kumar R.	"A review on particle swarm optimization algorithms and their applications to data clustering"	Artificial Intelligence Review	2011	167	10.1007/s10462-010-9191-9
Shukla P., Wang S., Singh K., Ang H.M., TadÃ M.O.	"Cobalt exchanged zeolites for heterogeneous catalytic oxidation of phenol in the presence of peroxymonosulphate"	Applied Catalysis B: Environmental	2010	164	10.1016/j.apcatb.2010.06.013
Pingale S.M., Khare D., Jat M.K., Adamowski J.	"Spatial and temporal trends of mean and extreme rainfall and temperature for the 33 urban centers of the arid and semi-arid state of Rajasthan, India"	Atmospheric Research	2014	153	10.1016/j.atmosres.2013.10.024
Hoang D.C., Yadav P., Kumar R., Panda S.K.	"Real-time implementation of a harmony search algorithm-based clustering protocol for energy-efficient wireless sensor networks"	IEEE Transactions on Industrial Informatics	2014	143	10.1109/TII.2013.2273739
Bansal V., Misra R., Agrawal G.D., Mathur J.	"Performance analysis of earth-pipe-air heat exchanger for summer cooling"	Energy and Buildings	2010	142	10.1016/j.enbuild.2009.11.001
Gupta T., Chaudhary S., Sharma R.K.	"Assessment of mechanical and durability properties of concrete containing waste rubber tire as fine aggregate"	Construction and Building Materials	2014	130	10.1016/j.conbuildmat.2014.09.102
Kumar R., Sharma D., Sadu A.	"A hybrid multi-agent based particle swarm optimization algorithm for economic power dispatch"	International Journal of Electrical Power and Energy Systems	2011	118	10.1016/j.ijepes.2010.06.021
Thomas B.S., Gupta R.C., Kalla P., Cseteneyi L.	"Strength, abrasion and permeation characteristics of cement concrete containing discarded rubber fine aggregates"	Construction and Building Materials	2014	99	10.1016/j.conbuildmat.2014.01.074

VI. FINDINGS AND CONCLUSION

As per Scopus data the MNIT Jaipur has contributed 1231 publications from 2010 to 2015 and its number of publications is consistently growing as it published 112 publications in 2010 and this number increased to 316 in 2015.

The authorship pattern indicates that maximum number of 444 (36.07%) had joint publications of three authors followed by joint 290 (23.56%) publications of two authors, four authors 258 (20.96%), five authors 133 (10.80%), which shows that contributors of MNIT Jaipur have tendency to publish their works collaboratively. This multi-author pattern also indicates teamwork in research.

Distribution of publications according to their types Most researchers 601 (48.82%) publications prefer to publish their research as research articles followed by proceedings papers 550 (44.68%), Book Chapter 36 (2.92%) review papers 25 (2.03%) and Note 04 (0.32%)

The distribution of collaboration teamwork research and publishing with other Top countries authors. It reflects that the USA is at the top with 54 (4.39%) publications followed by United Kingdom with 51 (4.14%) which is at second position and Germany with 32 (2.60%) publications at the third position and collaborations.

The analysis of top collaborative institutions/organizations with MNIT Jaipur indicates that the MNIT Jaipur researchers largely collaborated with the University of Rajasthan, as they jointly published 56 (4.55%) publications.

Extent of publications in open access from shows that distribution of publications in open access form reveals that percentage of open access publication was i.e., 95 (7.72%) of total publication.

Highly cited publication shows that most of the articles with multiple authors are highly cited. The article which received the largest number of citations is entitled, “A survey on nature inspired metaheuristic algorithms for partitional clustering” by Nanda S.J., Panda G. published in 2014 in Swarm and Evolutionary Computation. It received 274 citations in Scopus from 2010 to 2015. Another publication entitled “Android security: A survey of issues, malware penetration, and defenses” by Faruki P., Bharmal A., Laxmi V., Ganmoor V., Gaur M.S., Conti M., Rajarajan M. published in IEEE Communications Surveys and Tutorials in 2015 received 255 citations and is second highly cited publication as per Scopus data.

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