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Analysis of the Research Output of IISER Kolkata with Special Reference to Web of Science (WoS) During 2006-2020

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Abstract

Purpose: The aim of this analysis is to quantify the research productivity of the Indian Institute of Science Education and Research Kolkata (IISER Kolkata) as it appears in the Web of Science (WoS) database from 2006-2020.

Design/Methodology/Approach: The necessary data for the research was drawn from the Web of Science (WoS) database in order to achieve the study's objectives. The bibliographical data presented with MS-Excel 2007 sheet in tabular format for analysis and interpretation.

Findings: The overall research output from 2006 to 2020 was 3,495 publications, with the year 2020 appearing to have the highest research output with 504 publications out of a total of 3,495, followed by 458 in 2019—the lowest number of research output 2 in 2006.

Research Limitations/Implications: The current analysis is limited to IISER Kolkata's research production from 2006 to 2020, which is available in the WoS database, and the research findings are limited to this database.

Originality/Value: The study looks at the research performance of IISER Kolkata over a 15-years period, from 2006 to 2020, with an emphasis on the WoS database. Furthermore, the paper is applicable to those interested in the analysis of research output of the institution. It also provides a detailed overview of various aspects of the literature, such as year-by-year development, language, research area, institutional collaboration, and so on.

Keywords: IISER, IISER Kolkata, Research Productivity, Web of Science, WoS, Research Output, Research Performance

1. Introduction

The Ministry of Human Resource Development, now known as the Ministry of Education, Central Government, launched the Indian Institute of Science Education and Research Kolkata (IISER Kolkata) in 2006. IISER Kolkata began as a temporary project at IIT Kharagpur's Kolkata extension centre at Salt Lake. In 2009, IISER Kolkata relocated its main campus to Mohanpur, Nadia district. The distance between Kolkata and this location is 55 kilometers. IISER Kolkata has been in operation for over fifteen years and has delivered high-quality basic science education and research publications. In physical sciences, earth sciences, chemical sciences, mathematics & statistics, and biological sciences, it offers Integrated PhD, PhD, MS by Research, Integrated BS-MS and academic courses. There are 1480 students enrolled. The IISER Kolkata library primarily focuses on basic sciences, with online and print journals, e-books, print books, multimedia, DVD. Virtua, VTLS, and library software are used in the IISER Kolkata library.

Analysis of research output conducted on many intuitions and universities in Indian and various part of the world. Still, no study was conducted on Indian Institute of Science Education and Research Kolkata (IISER Kolkata).

2. Literature Review

The aim of a literature review is to provide an outline of the articles that have been published on the topic.

Though various authors have conducted studies on measuring and assessing research output, evaluating research efficiency, and citation effect on IITs and other institutions from time to time, the following are a few that are relevant to the current investigation and deserve mention.

Arif (2015) DBLP, a computer science bibliography website, was used to compare and contrast the quantitative research effectiveness of four IITs' Computer Science and Engineering Departments over a five-year period (2011-2015).

Bid (2016) In his paper, he looked at the growth and development of IIT Kharagpur's scientific.

Chaurasia and Chavan (2014) aimed to concentrate on the development, contribution, and impact of IIT Delhi's research activity from 2001 to 2010, as measured by Web of Science.

Hadimani et. al. (2015) With the help of the Web of Science database, author conducted bibliometric analysis on research productivity from the IISER (Indian Institute of Science Education and Research), Thiruvananthapuram, India, from 2008 to 2013.

Hasan and Singh (2015) On the basis of the publication of research papers indexed in Web of Science over a five-year period, the trend of scientific publications of five top-ranked IITs was assessed (2009-13).

Jeevan and Gupta (2002) Using scientometric methods, authors evaluated and compared the influence of research papers from some of IIT Kharagpur's departments from 1994-95 to 1996-97.

Kumar et al (2018) As per data from Web of Science, the research output of 23 IITs in India was measured over a 29-year period (1989-2018).

Mohanty and Jena (2019) performed a scientometric analysis of IIT Bombay's engineering research output from 2006 to 2016.

Prathap (2013) Bibliometric databases Web of Science and Scopus were used to compare the research growth of seven IITs research from 2000 to 2015, as measured by Scopus.

Wani et. al. (2013) attempted to assess IIT Delhi's research output from 1964 to 2010, as indexed by SCOPUS, and revealed the institution's average citation statistics in highly cited different areas.

3. Objectives of the Study

To determine the year-by-year growth of IISER Kolkata publications.

To measure the types of documents publication of IISER Kolkata during 2006-2020.

To measure authorship pattern of IISER Kolkata during 2006-2020

To identify the most highly cited publications of IISER Kolkata during 2006-2020.

To determine other countries' and institutes' levels of collaboration from 2006 to 2020.

To recognize the highly cited publications from 2006 to 2020 of IISER Kolkata

4. Methodology

Web of Science, a well-known bibliographic indexing database, was used to collect the data. The basic search option was used with the search string “Affiliation = Indian Institute of Science Education & Research (IISER) - Kolkata” and "Year Published = 2006-2020". A total 3,495 records retrieved from Web of Science database and entered into excel sheet 2007 for further processing and analysis and presented in tabular form.

5. Data Analysis and Interpretation

5.1 Year-wise Publication

Table 1 shows year-wise publication from 2006 to 2020 for IISER Kolkata productivity has increased substantially since 2006. 2 records produced in 2006 after that 11 in 2007, 42 in 2008, 73 in 2009, 122 in 2010, 152 in 2011, 206 in 2012, 212 in 2013, 288 in 2014, 286 in 2015, 360 in 2016, 289 in 2017, 390 in 2018, 458 in 2019 and 504 in 2020.

Year	Record	% of 3,495
2006	2	0.057
2007	11	0.315
2008	42	1.202
2009	73	2.089
2010	122	3.491
2011	152	4.349
2012	206	5.894
2013	212	6.066
2014	288	8.24
2015	286	8.183
2016	360	10.3
2017	389	11.13
2018	390	11.159
2019	458	13.104
2020	504	14.421

Table: 1 Year-wise Publication

5.2 Area of Research

Table 2 shows 25 the area of research for IISER Kolkata produced 335 records in astronomy astrophysics, 366 in materials science, 988 in physics 1207 records in chemistry on the top level.

Research Area	Record	% of 3,495
Chemistry	1207	34.535
Physics	988	28.269
Materials Science	366	10.472
Astronomy Astrophysics	335	9.585
Science Technology Other Topics	310	8.87
Optics	227	6.495

Mathematics	157	4.492
Engineering	151	4.32
Biochemistry Molecular Biology	139	3.977
Polymer Science	138	3.948
Geology	136	3.891
Crystallography	103	2.947
Environmental Sciences Ecology	96	2.747
Geochemistry Geophysics	58	1.66
Computer Science	45	1.288
Biophysics	42	1.202
Physical Geography	39	1.116
Biotechnology Applied Microbiology	37	1.059
Life Sciences Biomedicine Other Topics	37	1.059
Marine Freshwater Biology	37	1.059
Zoology	37	1.059
Energy Fuels	36	1.03
Cell Biology	31	0.887
Microbiology	30	0.858
Pharmacology Pharmacy	30	0.858

Table : 2 Area of Research

5.3 Language of Publication

IISER Kolkata produced 3495 scientific records in English language indicates in Table 3. The English language is known as a world language.

Language	Record	% of 3,495
English	3495	100

Table : 3 Language of Publication

5.4 Institutional Collaboration

The publication 12.904% (451) produced collaboration with Indian Institute of Technology System followed by 8.04% with Department of Science Technology India, 5.036% with Tata Institute of Fundamental Research, 4.721% with Council of Scientific Industrial Research India, 4.664% with Max Planck Society and so on. Table 4 shows 21 institutions that are collaborated with IISER Kolkata for research productivity.

Affiliations	Record	% of 3,495
Indian Institute of Technology System	451	12.904
Department of Science Technology India	281	8.04
Tata Institute of Fundamental Research	176	5.036
Council of Scientific Industrial Research India	165	4.721
Max Planck Society	163	4.664
Inter University Centre for Astronomy Astrophysics	152	4.349
Centre National De La Recherche Scientifique	150	4.292
University of Cambridge	146	4.177
State University System of Florida	144	4.12
University of Texas System	142	4.063
Massachusetts Institute of Technology	139	3.977
Russian Academy of Sciences	136	3.891
University of Michigan System	136	3.891
University of Minnesota System	135	3.863
Universite Paris Saclay	134	3.834
Montana State University System	132	3.777
University of Florida	132	3.777
University of Minnesota Twin Cities	132	3.777

University of Wisconsin System	132	3.777
National Aeronautics Space Administration	131	3.748
University System of Maryland	131	3.748

Table : 4

5.5 Funding Agency

Table 5 presents 24 funding agency for the research of IISER Kolkata. 28.469% records published with the funding from Council of Scientific Industrial Research India followed by (27.411%) Department of Science Technology India, (14.506%) IISER Kolkata, (14.306%) University Grants Commission India and so on.

Funding Agency	Record	% of 3,495
Council of Scientific Industrial Research India	995	28.469
Department of Science Technology India	958	27.411
IISER Kolkata	507	14.506
University Grants Commission India	500	14.306
Science Engineering Research Board India	208	5.951
European Commission	194	5.551
National Science Foundation	160	4.578
UK Research Innovation	137	3.92
Natural Sciences and Engineering Research Council of Canada	129	3.691
Royal Society of London	125	3.577
Science Technology Facilities Council	118	3.376
Scottish Universities Physics Alliance	116	3.319
Leverhulme Trust	115	3.29
Scottish Funding Council	115	3.29
Orszagos Tudomanyos Kutatasi Alaprogramok	104	2.976
National Natural Science Foundation of China	100	2.861
Province of Ontario, The Ministry of Economic Development and Innovation	96	2.747
National Research Foundation of Korea	95	2.718
Russian Foundation for Basic Research	95	2.718
Australian Research Council	94	2.69
Ministry of Higher Education Scientific Research	94	2.69
European Commission Joint Research Centre	93	2.661

National Science Center Poland	92	2.632
Department of Biotechnology India	91	2.604

Table : 5 Funding Agency

5.6 Document Type

Table 6 shows 12 type of documents published by IISER Kolkata during 2006 to 2020. The maximum documents of IISER Kolkata is in article form. The document 3130 (89.557%) published in article form followed by 175 (5.007%) proceedings papers, 103 (2.947%) review articles, 49 (1.402%) meeting abstracts, 45 (1.288%) book chapters, 28 (0.801%) editorial materials, 20 (0.572%) corrections, 9 (0.258%) early access, 8 (0.229%) letters, 3 (0.086%) biographical-items, 1 (0.29%) data papers and news items.

Document	Record	% of 3,495
Articles	3130	89.557
Proceedings Papers	175	5.007
Review Articles	103	2.947
Meeting Abstracts	49	1.402
Book Chapters	45	1.288
Editorial Materials	28	0.801
Corrections	20	0.572
Early Access	9	0.258
Letters	8	0.229
Biographical-Items	3	0.086
Data Papers	1	0.029
News Items	1	0.029

Table : 6 Document Type

5.7 Country Collaboration

Table 7 presents 24 collaborated countries with IISER Kolkata. 432 (12.361%) records produced with USA followed by 337 (9.642%) with Germany, 227 (6.495%) with England, 224 (6.409%) with Peoples R China, 189 (5.408%) with Canada, 183 (5.236%) with Spain, 169 (4.835%) with France, 157 (4.492%) with Russia, 154 (4.406%) with Italy and Japan, 149 (4.263%) with Scotland, 148 (4.235%) with Australia and Netherland, 141 (4.034%) with South Korea, 140 (4.006%) with Belgium, 138 (3.948%) with Brazil, 136 (3.891%) with Taiwan, 127 (3.634%) with Wales, 126 (3.605%) with Poland, 125 (3.577%) with Hungary, 84 (2.403%) with Switzerland, 54 (1.545%) with Monaco, 46 (1.316%) with Sweden, 45 (1.288%) with Israel.

Country/Region	Record	% of 3,495
USA	432	12.361
Germany	337	9.642
England	227	6.495
Peoples R China	224	6.409
Canada	189	5.408
Spain	183	5.236
France	169	4.835
Russia	157	4.492
Italy	154	4.406
Japan	154	4.406
Scotland	149	4.263
Australia	148	4.235
Netherland	148	4.235
South Korea	141	4.034
Belgium	140	4.006
Brazil	138	3.948
Taiwan	136	3.891
Wales	127	3.634
Poland	126	3.605
Hungary	125	3.577
Switzerland	84	2.403
Monaco	54	1.545
Sweden	46	1.316
Israel	45	1.288

Table : 7 Country Collaboration

5.8 Medium of Communication

IISER Kolkata published 3495 records in the top 25 highly productivity journals as mention in Table 8. 98 (2.804%) records in Physical Review D followed by 68 (1.946%) in RSC Advances, 65 (1.86%) in Chemical Communications, 62 (1.774%) in Astrophysical Journal, 53 (1.516) in Proceedings of SPIE, 47 (1.345%) in Journal of Physical Chemistry C and Physical Review A, 42 (1.202%) in Physical Review Letters, 41 (1.173%) in Dalton Transactions, 40 (1.144%) in Chemistry A European Journal, 39 (1.116%) in ChemistrySelect, 37 (1.059%) in ACS Omega and Scientific Reports, 36 (1.03%) in AIP Conference Proceedings, 35 (1.001%) in Inorganic Chemistry, 32 (0.916%) in CrystEngComm, 30 (0.858%) in Quantum Information Processing; 29 (0.83%) in Journal of Physical Chemistry Chemical Physics, Chemical Physics, Physical

Review B, Polymer Chemistry; 28 (0.801%) in Astrophysical Journal Letters; 26 (0.744%) in Crystal Growth Design, Current Science, European Physical Journal C.

Title	Record	% of 3,495
Physical Review D	98	2.804
RSC Advances	68	1.946
Chemical Communications	65	1.86
Astrophysical Journal	62	1.774
Proceedings of SPIE	53	1.516
Journal of Physical Chemistry C	47	1.345
Physical Review A	47	1.345
Physical Review Letters	42	1.202
Dalton Transactions	41	1.173
Chemistry A European Journal	40	1.144
ChemistrySelect	39	1.116
ACS Omega	37	1.059
Scientific Reports	37	1.059
AIP Conference Proceedings	36	1.03
Inorganic Chemistry	35	1.001
CrystEngComm	32	0.916
Quantum Information Processing	30	0.858
Physical Chemistry Chemical Physics	29	0.83
Journal of Chemical Physics	29	0.83
Physical Review B	29	0.83
Polymer Chemistry	29	0.83
Astrophysical Journal Letters	28	0.801
Crystal Growth Design	26	0.744
Current Science	26	0.744
European Physical Journal C	26	0.744

Table : 8 Medium of Communication

5.9 Authorship Pattern

Table 9 indicates authorship collaboration for 3495 research output of IISER Kolkata from 2006 to 2020. Single authors published 138 (3.948%). Three authors published the highest 787 (22.518%), followed by joint authors 658 (18.827%), four authors 625 (17.883%), five authors 427 (12.217%).

Author	Record	% of 3495
Single	138	3.948
Joint	658	18.827

Three	787	22.518
Four	625	17.883
Five	427	12.217
Six	271	7.754
Seven	169	4.835
Eight	117	3.348
Nine	61	1.745
Ten	44	1.259
More than Ten	198	5.665

Table : 9 Authorship Pattern

5.10 Maximum cited publication

The top ten highly cited publications of IISER Kolkata from 2006 to 2020 indicated in Table 10. Prof R. K. Nayak, Department of Physical Sciences, IISER Kolkata, published all ten highly cited records. Eight of them collaborated with his research scholar A. Samajdar, IISER Kolkata. Title: Observation of Gravitational Waves from a Binary Black Hole Merger received highest citation 4737 followed by 3128 for GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral, 1812 citation for GW151226: Observation of Gravitational Waves from a 22-Solar-Mass Binary Black Hole Coalescence, 1411 citation for GW170104: Observation of a 50-Solar-Mass Binary Black Hole Coalescence at Redshift 0.2, 1345 citation for Multi-messenger Observations of a Binary Neutron Star Merger, 1078 citation for Gravitational Waves and Gamma-Rays from a Binary Neutron Star Merger: GW170817 and GRB 170817A, 1020 citation for “Advanced LIGO”, 1004 citation for “GW170814: A Three-Detector Observation of Gravitational Waves from a Binary Black Hole Coalescence, 776 citation for Binary Black Hole Mergers in the First Advanced LIGO Observing Run, 606 citation for GWTC-1: A Gravitational-Wave Transient Catalog of Compact Binary Mergers Observed by LIGO and Virgo during the First and Second Observing Runs.

Author(s) of IISER Kolkata	Department	Title	Source	Citation up to 2020
Nayak, R. K.; Samajdar, A.	Physical Sciences	Observation of Gravitational Waves from a Binary Black Hole Merger	Physical Review Letters, vol.116(6), 2016	4737
Nayak, R. K.; Samajdar, A.	Physical Sciences	GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral	Physical Review Letters, vol.119(16), 2017	3128

Nayak, R. K.; Samajdar, A.	Physical Sciences	GW151226: Observation of Gravitational Waves from a 22-Solar-Mass Binary Black Hole Coalescence	Physical Review Letters, vol.116(24), 2016	1812
Nayak, R. K.; Samajdar, A.	Physical Sciences	GW170104: Observation of a 50-Solar-Mass Binary Black Hole Coalescence at Redshift 0.2	Physical Review Letters, vol.118(22), 2017	1411
Nayak, R. K.; Samajdar, A.	Physical Sciences	Multi-messenger Observations of a Binary Neutron Star Merger	The Astrophysical Journal Letters, vol.848(2), 2017	1345
Nayak, R. K.; Samajdar, A.	Physical Sciences	Gravitational Waves and Gamma-Rays from a Binary Neutron Star Merger: GW170817 and GRB 170817A	The Astrophysical Journal Letters, vol.848(2), 2017	1078
Nayak, R. K.	Physical Sciences	Advanced LIGO	Classical and Quantum Gravity	1020
Nayak, R. K.; Samajdar, A.	Physical Sciences	GW170814: A Three- Detector Observation of Gravitational Waves from a Binary Black Hole Coalescence	Physical Review Letters, vol.119(14), 2017	1004
Nayak, R. K.; Samajdar, A.	Physical Sciences	Binary Black Hole Mergers in the First Advanced LIGO Observing Run	Physical Review X, vol.6(4), 2016	776
Nayak, R. K.	Physical Sciences	GWTC-1: A Gravitational-Wave Transient Catalog of Compact Binary Mergers Observed by LIGO and Virgo during the First and Second Observing Runs	Physical Review X, vol.9(3), 2019	606

Table : 10 Maximum cited publication

6. Findings & Conclusions:

IISER Kolkata faculty and research scholars have conducted high-quality research in a number of fields. Following are several significant research efficiency results based on this concluding remark.

- Faculties and research scholars of IISER Kolkata produced 3495 scientific records from 2006 to 2020.
- In 2020, IISER Kolkata published 504 highest scientific records, followed by 458 in 2019.
- The lowest 2 scientific records published in 2006.
- Chemistry research area published 1207 scientific records followed by 988 in physics, 366 in materials science.
- All 3495 publications of IISER Kolkata is in the English language.
- IISER Kolkata produced 451 records in collaboration with Indian Institute of Technology System followed by 281 with the Department of Science Technology India, 176 with the Tata Institute of Fundamental Research.
- IISER Kolkata published 995 records with the fund grant from the Council of Scientific Industrial Research India followed by 958 from the Department of Science Technology India, 507 from IISER Kolkata.
- The record 3130 published in the form of the article followed by 175 proceedings papers, 103 review articles.
- IISER Kolkata scholars had foreign partnerships with countries all over the world. According to Table 7, the majority of IISER Kolkata's international research partnerships are with the US (12.361%), Germany (9.642%), England (6.495%), China (6.409%), and other nations.
- The maximum number of paper of IISER Kolkata published in Physical Review D (2.804%) followed by RSC Advances (1.946%), Chemical Communications (1.86%).
- Three collaborative authors published the maximum number of records (22.518%) of IISER Kolkata.
- Joint and four collaborative authors published 18.827% and 17.883% respectively.
- The maximum number of citations 4737 received by the title: Observation of Gravitational Waves from a Binary Black Hole Merger.

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