For NEDO
Summary Report

Measures for Promotion of Indo Japan Joint R&D

Automotive Industry Consulting Group

NRI Consulting & Solutions India Pvt. Ltd.

27, April, 2023

NRI

Share the Next Values!

Executive Summary

Purpose of the study:

- Research collaboration between India and Japan is limited as compared to India & West
- Limited knowledge of the Indian research ecosystem is one of the key reasons
- In order to increase awareness of Japanese researchers, funding organizations & industry players about the Indian research ecosystem, this study was undertaken by NEDO in collaboration with Nomura Research Institute

The study touches upon four key pillars:

Introduction to Indian Institutions

- A brief overview of the different types of Indian Institutions is provided, along with number of institutions in each type, their entrance methodology, and the top institutes
- This will provide the end users a glimpse into the Indian research ecosystem

Ranking Institutions & Researchers

- Commonly used researcher indices such as **h index**, i10 index, m index, **total citations** are explained
- Overview of prominent ranking systems for Institutions across the globe are explained
- **QS ranking system** was suggested as the preferred ranking system for the Indian context as it balances between the number of ranked Indian Institutions and key ranking parameters
- This will help in Identifying the most relevant researchers from a longlist

Database Introduction & Recommendation

- Information on various Indian researcher databases was provided
- **VIDWAN and Scopus Researcher Discovery** were suggested as suitable databases for the Indian context
- A guide to search researchers through VIDWAN was created for new users

Domain wise case study

- Insights into the trend and growth of research in a field is provided by capturing research statistics, institutions, researchers, and highly cited publications
- A guide to create the case study through Scopus was created for new users

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Purpose of the study

This study aims to increase awareness of Japanese users about Indian research Institutions, researcher & institute rankings and finding Indian researchers

- In order to increase awareness of Japanese researchers, funding organizations & industry players about the Indian research ecosystem, this study was undertaken

Key Areas

Information about Indian Institutions

- Insights about the Indian Institute would help Japanese users in
  - Selecting a researcher based on their institute
  - Developing overview of the institute for a preferred researcher

Ranking (Researcher, institute, etc.)

- Overview on some widely accepted rankings (for researchers & institutes) would help Japanese users in
  - Identifying the most relevant researchers from a longlist

Finding Researcher

- Information on Indian researcher databases and guide would help Japanese users in
  - Finding longlist of researchers based on area of expertise
  - Searching & contacting the relevant researcher

Contents

Indian Research Institutions can be divided in educational & R&D institutions Profs. & students in educational & Scientists in R&D institutions are key researchers

About

- Indian research organisations can be categorised in two types, educational institutions and R&D institutions
- Educational Institutions:
  - Indirectly controlled (jointly or individually) either by **Ministry of Education, state govt., or Union govt.**
  - Different type of educational institutions receive different levels of investment and hence have varying level of research outputs
- R&D Institutions:
  - Come under umbrella of Council of Scientific and Industrial Research (CSIR), Indian Council of Agricultural Research (ICAR), Department of Atomic Energy (DAE), and other ministries supporting certain research laboratories

Key Institutions Types

Indian Research Institutions

Central Universities	State Universities	State Private Universities	Deemed to be Universities	Institute of National Importance	R&D Institutions
# Researchers: 10.7k # Institutes: 54	# Researchers: 21.6k # Institutes: 457	# Researchers: 13.7k # Institutes: 428	# Researchers: 17.7k # Institutes: 128	# Researchers: 15.4k # Institutes: 161	# Researchers: 7.6k # Institutes: 300

Source: Information & Library Network (INFLIBNET), Ministry of Education (MoE), University Grants Commission (UGC)

54 Central Universities in India with ~10,756 researchers remain under the purview of Ministry of Education (MoE)

About

- Categorized under Centre (Union Government), (funds are allocated by the Ministry of Education through UGC)

Key Statistics

# Institutions	54 (40 under MoE, 9 autonomous)
Incorporated under	Certain Acts of Parliament
Govt. Department	Department of Higher Education in Ministry of Education
# Researchers	~10,756
Oldest Institution	Allahabad University

Top 5 Institutes (as per NIRF)

1	Jawaharlal Nehru University	*NIRF University Rank: 2*
2	Jamia Millia Islamia	*NIRF University Rank: 3*
3	Banaras Hindu University	*NIRF University Rank: 6*
4	University of Hyderabad	*NIRF University Rank: 10*
5	Aligarh Muslim University	*NIRF University Rank: 11*

University Structure

Main University	→ Domain wise Schools	→ Department	→ Researcher
Eg. Jamia Millia Islamia	*Eg Faculty of Engineering & Technology*	*Eg. Department of Civil Engineering*	*Eg. Dr. Akil Ahmed Professor*

Entrance Methodology

- Common University Entrance Test or CUET is a common entrance test for admission to UG courses in all central universities

Source: Information & Library Network (INFLIBNET), Ministry of Education (MoE), University Grants Commission (UGC)

457 State universities across India with ~21,679 researchers remain under the purview of State & Union Territory governments

About

- These are public universities run by state government of each of the state & territories of India

Key Statistics

# Institutions	457
Incorporated under	Local Legislative Assembly Act
Govt. Department	State Governments
# Researchers	~21,679
Oldest Institution	University of Calcutta, Madras & Mumbai (1857)

Top 5 Institutes (as per NIRF)

1. Jadavpur University — *NIRF University Rank: 4*
2. Calcutta University — *NIRF University Rank: 8*
3. Savitribai Phule Pune University — *NIRF University Rank: 12*
4. Bharathiar University — *NIRF University Rank: 15*
5. Anna University — *NIRF University Rank: 20*

University Structure

Main University	Domain wise Centres	Department	Researcher
Eg. Calcutta University	*Eg Institute of Agricultural Science*	*Eg. Seed Science & Technology*	*Eg. Anindya Kumar Hembram*

Entrance Methodology

- All the state universities in India conduct different entrance exams for admissions to a variety of courses

Source: Information & Library Network (INFLIBNET), Ministry of Education (MoE), University Grants Commission (UGC)

428 State private universities across India with ~13,747 researchers, these are recognised by central/state governments and run by sponsoring bodies

About

- Established through a central/state act
- Run by a sponsoring body viz. A Society (registered under the Societies Registration Act 1860), or a Public Trust or a Company (registered under the Companies Act, 1956)

Key Statistics

# Institutions	428
Recognized under	Central/Local Legislative assembly act
Govt. Department	Department of Higher Education, MoE/State Governments
# Researchers	~13,747
Oldest Institution	Sikkim Manipal University (1995)

Top 5 Institutes (as per NIRF)

1	Amity University, Noida	*NIRF University Rank: 22*
2	Chandigarh University	*NIRF University Rank: 29*
3	Lovely Professional University	*NIRF University Rank: 47*
4	Shiv Nadar University	*NIRF University Rank: 61*
5	University of Petroleum and Energy Studies	*NIRF University Rank: 65*

University Structure

Main University	→	Department	→	Researcher
Eg. Shiv Nadar University		*Eg. School of Engineering*		*Eg. Dr. Nagarajan T*

Entrance Methodology

- Multiple private universities conduct different entrance exams for admissions to a variety of courses

Source: Information & Library Network (INFLIBNET), Ministry of Education (MoE), University Grants Commission (UGC)

128 Institutions both of public (central/state) & private with ~17,736 researchers are declared by Central Govt as 'deemed-to-be-university'

About

- Institutions working with high standard in specific area of study, are sometimes declared as 'Deemed-to-be-university'by Central Govt.
- Enjoy academic status and privileges of a university and can be either private or public (central/state)

Key Statistics

# Institutions	128
Recognized under	Central/Local Legislative assembly act
Govt. Department	Department of Higher Education, MoE/State Governments
# Researchers	~17,736
Oldest Institution	IISc Bangalore, Indian Agricultural Research Institute (1958)

Top 5 Institutes (as per NIRF)

1. Amrita Vishwa Vidyapeetham — *NIRF University Rank: 5*
2. Manipal Academy of Higher Education — *NIRF University Rank: 7*
3. Vellore Institute of Technology — *NIRF University Rank: 9*
4. Institute of Chemical Technology — *NIRF University Rank: 14*
5. Siksha `O` Anusandhan — *NIRF University Rank: 16*

University Structure

Main University	Department	Researcher
Eg. Institute of Chemical Technology	*Eg. Dept of Chemistry*	*Eg. Dr. P. M. More*

Entrance Methodology

- Multiple public & private universities conduct different entrance exams for admissions to a variety of courses

Source: Information & Library Network (INFLIBNET), Ministry of Education (MoE), University Grants Commission (UGC)

161 Institutions with ~15,461 researchers receive special recognition as Institute of National Importance; Have high overall institute ranking

About

- Status conferred on premier public higher education institutions by an act of Parliament
- They receive special recognition, higher autonomy and funding from the Government of India

Key Statistics

# Institutions	161
Established under	Central act
Govt. Department	Department of Higher Education, MoE
# Researchers	~15,461
Oldest Institution	Indian Institute of Technology, Kharagpur (1956)

Top 5 Institutes (as per NIRF)

1	Indian Institute of Technology Madras	*NIRF Overall Rank: 1*
2	Indian Institute of Science	*NIRF Overall Rank: 2*
3	Indian Institute of Technology, Bombay	*NIRF Overall Rank: 3*
4	Indian Institute of Technology, Delhi	*NIRF Overall Rank: 4*
5	Indian Institute of Technology Kanpur	*NIRF Overall Rank: 5*

University Structure

Main University	Schools / Department	Researcher
Eg. Indian Institute of Technology, Bombay	*Eg. Dept of Mechanical Engineering*	*Eg. Prof. Amit Agrawal*

Entrance Methodology

- Key competitive exams like Joint Entrance Examination (JEE), National Eligibility cum Entrance Test (NEET), Common Entrance Test (CAT), Graduate Aptitude Test in Engineering (GATE), etc. are entrance exams for Institutes of National Importance

Source: Information & Library Network (INFLIBNET), Ministry of Education (MoE), University Grants Commission (UGC)

~300 institutions with ~7667 researchers from R&D institutions specialize in research; Funded & incorporated under variety of Govt. Acts & Depts.

About

- Do not grant a degree nor are affiliated to a degree granting university
- Engaged in pure or applied research across areas

Key Statistics

# Institutions	~300
Incorporated under	Acts across years & industries
Govt. Department	Multiple govt. department
# Researchers	~7,667
Oldest Institution	Indian Association for the Cultivation of Science (1876)

Notable Institutes

1. Indian Space Research Organization
2. Bhabha Atomic Research Centre
3. Tata Institute of Fundamental Research
4. Central Rice Research Institute
5. Indian Agricultural Research Institute

University Structure

Main University	Center / Department	Researcher
Eg. Tata Institute of Fundamental Research	*Eg. Dept of Biological Sciences*	*Eg. Debasis Das*

Entrance Methodology

- Fellowships for starting off research at R&D institutes
- Job openings for higher positions

Source: Information & Library Network (INFLIBNET), Ministry of Education (MoE), University Grants Commission (UGC)

Contents

h-index and total citations are most widely accepted and commonly used indices to evaluate researchers quantitatively

Indices	Description	Advantages	Disadvantages
★ h index	• Captures total count and impact by citation of publications	• Assesses quantity (no. of papers) and quality (citations of papers) • Ignores extreme low & high-citations	• Ignores # authors & individual author contribution
i10 index	• No. of publications with at least 10 citations	• Very simple and straightforward to calculate • Assesses quantity & quality of papers	• Used solely by Google Scholar • Becomes stagnant once all papers reach 10 citations
g index	• Alternative for h-index, gives more weightage to highly cited papers	• Averages citations of highly cited papers • Variance of g-index > h-index (comparing authors is more apparent)	• Not as widely accepted as h index • Saturates when avg. no. of citations for papers exceeds total no. of papers
m index	• h index divided by no. of years the researcher has been active	• Compare researchers with different career lengths	• Averages productivity throughout career (may not reflect current situation) • Can be a fraction
★ Total citations	• Total no. of citations of all documents authored by the researcher	• Very simple and straightforward to calculate • Assesses quantity & quality of papers	• Does not review citation text • Can be inflated by large no. of low cited papers
Citations per paper	• Average citation received per document	• Not skewed by few low & high citation articles	• Does not review citation text • Does not account for # of publications
Altmetrics	• Complementary to traditional metrics • Indicates how often scholarly outputs are discussed and used around world	• Augment traditional metrics • Broader measurement for impact of research	• Easily distorted or misinterpreted • Attention indicators that may not measure scholarly quality or impact

★ Most widely accepted and commonly used indices (by Scopus, VIDWAN, WoS);

Ranking Institutions & Researchers | Researcher ranking (2/2)

h-index and total citations are calculated using citations in such a way that they measure both productivity and impact of the researcher's research output

h-Index

The highest number of publications that received h or more citations each while the other publications have not more than h citations each

Calculating h-index of Researcher A

Publication ID	Citations
1	8
2	29
3	4
4	15
5	105
6	3
7	42
8	17
9	20

Descending order of no. of Citations

Publication ID	Citations
5	105 >7
7	42 >7
2	29 >7
9	20 >7
8	17 >7
4	15 >7
1	8 >7
3	4 ≯7
6	3 ≯7

7

Total citations

The total number of citations of all documents authored by the researcher

Calculating Total Citations of Researcher A

Publication ID	Citations
1	7
2	29
3	4
4	15
5	105
6	3
7	42
8	17
9	20
Total (Total Citations)	**242**

- Citation is an indicator of research impact; Total count of documents measures productivity
- Thus h-index and Total Citations are a measure of both impact & productivity

Source: lib.guides.umd.edu;

QS balances between the # Indian Institutions and key ranking parameters, it has 118 institutions and captures research parameter of citation per faculty

Ranking	Developed by	# Indian Instn. ★	Year Started ★	Key Ranking Parameters	Limitations
QS	Quacquarelli Symonds *(British Company)*	118	2004	• Academic Reputation (40%) • Faculty Student Ratio (20%) • **Citations per Faculty (20%)**	Captures institutions with >1000 papers and >50 papers indexed by Scopus (in 5yr period)
THE WORLD UNIVERSITY RANKINGS	Times Higher Education magazine	101	2004	• Teaching, Research, Citations, International Outlook, Industry Income	Disproportionately **high (33%) weightage** to reputation captured by **survey**
nature index	Springer Nature *(academic publishing company)*	409	2015	• Count of articles • Capture universities, private and govt. organisations	**Limited to Natural sciences** Does not account for quality of output (articles)
SCIMAGO INSTITUTIONS RANKINGS	SCImago Lab *(Consulting company & Network of Research Groups)*	341	2009	• Research (50%), • Innovation (30%) • Societal (20%)	Captures institutions with >100 publn. in SCOPUS in prev. year **Lack of international comparison**
Webometrics RANKING WEB OF UNIVERSITIES	Cybermetrics Lab *(Research group of CSIC)*	5444	2004	• Visibility • Transparency • Excellence	**High reliance on web metrics** (page views, time on links, link mentions, etc.)
nirf	National Board of Accreditation, India	50	2015	• Teaching, Learning & Resource (TLR) (30%) • Research, Professional Practice & Collaborative perf. (RPC) (30%)	**Relies on institute reported data** Lack of international comparison
ARIIA ATAL RANKING OF INSTITUTIONS ON INNOVATION ACHIEVEMENTS	Ministry of Education, India	1403	2018	• Budget & Expenses • Awareness Activities • Entrepreneurship Support	Focuses only on innovation Relies on institute reported data; Lacks international comparison

★ Key Parameters

Contents

VIDWAN, NSTMIS, Scopus, ORCID, IEEE Explore, Google Scholar, Semantic Scholar are the key sources for obtaining researcher information

Database	Developed by	About
VIDWAN Expert Database & National Researcher's Network	Information and Library Network Centre (INFLIBNET)*	• **Find experts** in given expertise / geography • Database of researchers at Indian R&D org. • Aims to Improve faculty collaboration globally
NSTMIS	Dept. of Science & Technology, GoI.	• Collects data for S&T policy planning • Database of **R&D institutions, extramural projects & Indian origin academicians** • Not updated frequently
Scopus®	Elsevier (Dutch company)	• **Search literature and experts** • Largest abstract and citation database • Only peer reviewed scientific literature from over 5000 publishers
ORCID	ORCID *Open Researcher & Contributor ID*	• Provides a **unique persistent id (can be shared)** can be connected to ORCID ID • Affiliations, grants, publications, peer review • Researchers can keep information private
IEEE Xplore® Digital Library	IEEE Society *Institute of Electrical & Electronics Engineers)*	• **Search scientific & technical literature** from IEEE and its publishing partners • Over 5 million academic & technical papers
Google Scholar	Google	• **Search scholarly literature** across the web • Sources: publishers, professional societies, online repositories, other web sites, etc.
Semantic Scholar	Allen Institute for AI	• AI driven **search tool for scientific literature** • Indexes over 200 million academic papers • Source: publisher, web crawl, data provider

*Information & Library Network (INFLIBNET) Centre, is an Autonomous Inter-University Centre (IUC) of University Grants Commission (MoE), New Delhi

For key terminologies used, refer Appendix page 71 & 72; Homepages across Appendix page 76-86

VIDWAN, ORCID and Scopus Researcher Discovery are the databases that allow filtering by country and searching by expertise

Databases	Access type	Filter by country	Search by Expertise
VIDWAN Expert Database & National Researcher's Network	Open access	✓	✓
	Funding Agency access	✓	✓
NSTMIS	Open access	X	X
Scopus®	Open access	X	X
	Researcher Discovery	✓	✓
ORCID #	Open access	X	X
	Public Data file	✓ *	✓ *
	Public API	✓ *	✓ *
	Member API	✓*	✓ *
IEEE Xplore® Digital Library	Open access	X	✓
Google Scholar	Open access	X	X
Semantic Scholar	Open access	X	X

* subject to information being public; For key terminologies used, refer Appendix page 71 & 72

VIDWAN funding access & Scopus RD provide contact details & allow sorting of researchers; As Scopus RD is in pilot phase, VIDWAN is a more suitable solution

★ Key Parameters

Databases	Contact ★	Elaborate keyword search	Ongoing projects	Sort by metrics ★	Pricing	IDs linked	Challenges
VIDWAN	✓	○	✓	X	Free	ORCID, Scopus, ResearcherId, Google Scholar	• No researchers sorting by metrics • Searches not based on research publication abstract
VIDWAN Funding agency access	✓	○	✓	✓	-	ORCID, Scopus, ResearcherId, Google Scholar	• Only available to agencies in India • Limited to a single user
Scopus Researcher Discovery	✓	◎	X	✓	NA	ORCID	• Feature **in pilot phase**
ORCID Public Data file	X	○	X	X	Free[#]	ORCID, Scopus, ResearcherID, Google Scholar, Academia, etc.	• Data in XML format; • UI not researcher friendly; • Not all data is publicly available
ORCID Public API	X	○	X	X	Free[#]	ORCID, Scopus, ResearcherID, Google Scholar, Academia, etc.	• UI needs to be created; • Not all data is publicly available
ORCID Member API	X	○	X	X	USD 1365-4370[#]*	ORCID, Scopus, ResearcherID, Google Scholar, Academia, etc.	• UI not researcher friendly; • Researcher permission mandatory for accessing restricted information

Note: RD: Researcher Discovery; For key terminologies used, refer Appendix | Databases Introduction & Recommendation
*Basic membership fees varies based on organization type
[#]UI needs to be created

 # Parameters: ◎ High ○ Medium △ Low

Contents

Database Guide

VIDWAN
Expert Database & National Researcher's Network

Vidwan is a free to use, publicly available database of Indian researchers developed & maintained by INFLIBNET

Primary Users:

Japanese Researchers, Companies, Non-Governmental organizations, Funding Agencies, etc.

Primary Use cases :

- **Search for researchers with relevant research interest** for collaboration
- Find researchers in a particular university or research institution
- Fetch **contact details**, affiliation, Qualification, publications, co-authors, researcher metric, etc. of a researcher

Stages in User Journey

Search

Filter

Sort Profiles

Select and View Detailed Researcher profile

URL : https://vidwan.inflibnet.ac.in/searchc/search

Going to the website and selecting the type of search

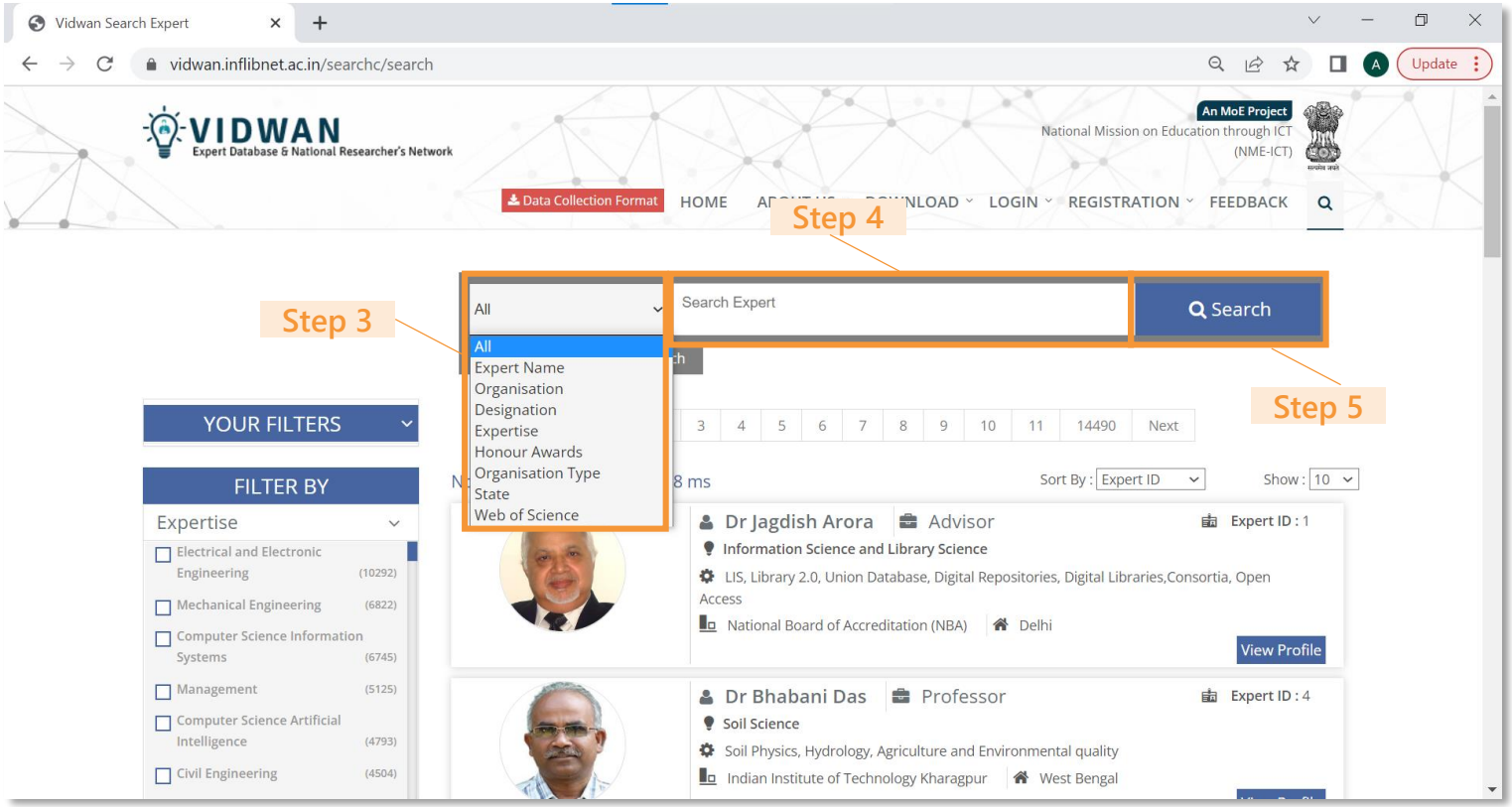
- **Step 1:** Go to the URL: https://vidwan.inflibnet.ac.in/searchc/search through a web browser
- **Step 2:** Click on the type of search : "Free Search" or "Exact Search"

- **Free Search:** Returns all profiles containing either word of the phrase, both words or words embedded in another word
- **Exact Search:** Returns all profiles that contain the exact phrase as typed; Returns no results if the exact phrase is not found

URL : https://vidwan.inflibnet.ac.in/searchc/search

Searching Researchers using Name, Organisation, Designation, Expertise, Honour Awards, Organisation Type, State, Web of science

- **Step 3**: Select the field by which you want to search researchers, by clicking on the dropdown menu
- **Step 4**: Type the keyword to be searched in the search bar
- **Step 5**: Click on the "Search" button
- This would return a list of expert profiles



Search Criteria

- **Expert Name**: Researcher name
- **Organisation**: Present researcher organization
- **Designation**: Present designation of researcher
- **Expertise**: Areas of expertise of the researcher
- **Honour Awards**: Researcher awards and fellowships
- **Organisation Type#**: Researcher organization type
- **State**: Researcher's state in India
- **Web of Science**: Subject of expertise as per WoS*

URL : https://vidwan.inflibnet.ac.in/searchc/search

* WoS: Web of Science; # For the types of organizations in India, refer Appendix page 74 & 75

Researcher profile preview contains Name, Designation, Expertise, Organization, State and Expert ID of the researcher

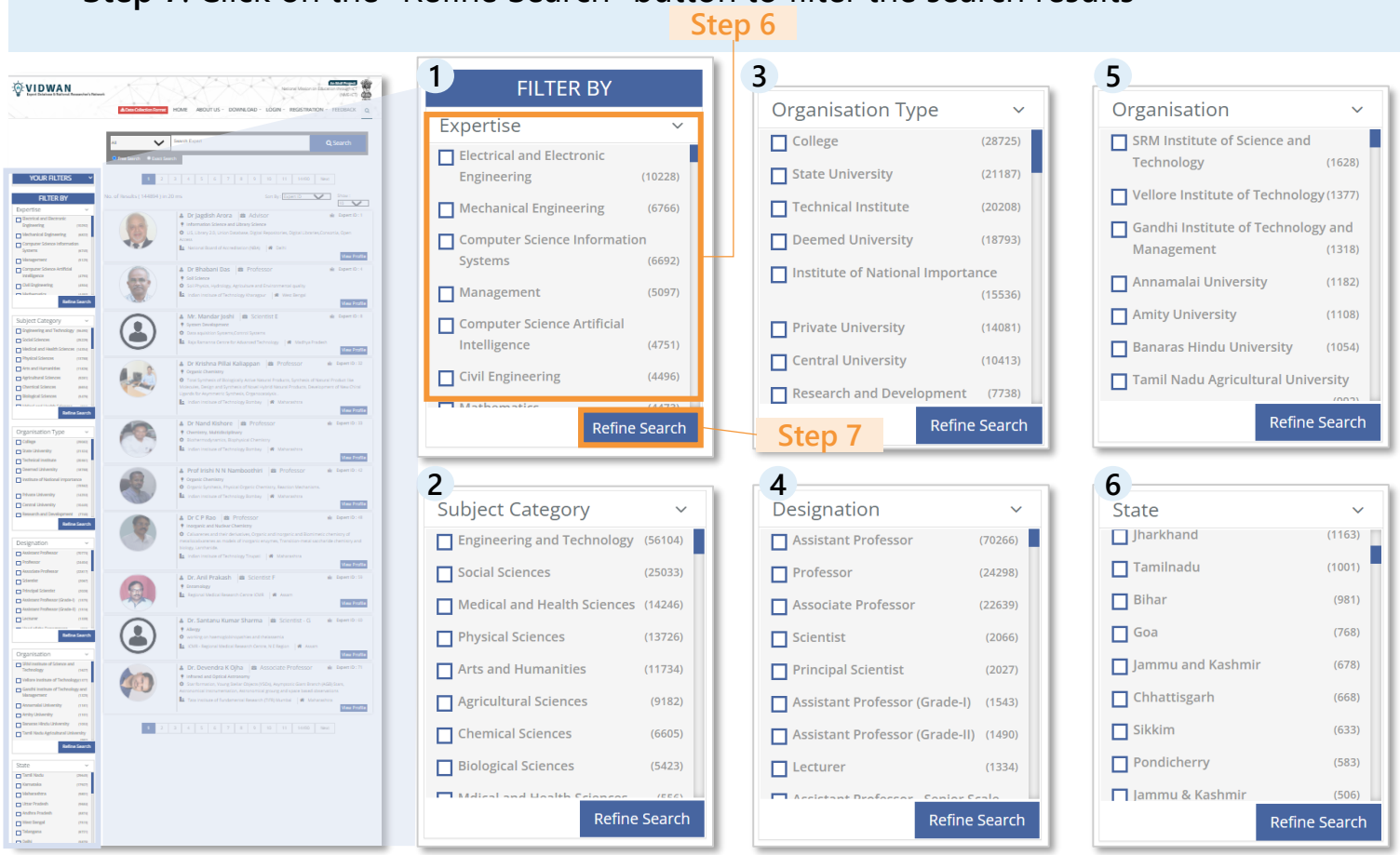
- The search results contain a preview of the researcher profile

1. **Expert Name**: Researcher Name
2. **Designation:** Present designation of researcher
3. **Expertise Category**: Subject area of expertise
4. **Brief Expertise**: About researcher's specialization in the expertise category
5. **Organisation**: Present researcher organization
6. **State**: Researcher's state in India
7. **Expert ID**: Unique Identifier similar to VIDWAN ID

URL : https://vidwan.inflibnet.ac.in/searchc/search

Filter Researcher profiles by Expertise, Subject Category, Organisation Type, Designation, Organisation, State

- **Step 6**: Filter the search results by selecting all the relevant options from the filters (Expertise, Subject Category, Organisation Type, Designation, Organisation, State)
- **Step 7**: Click on the "Refine Search" button to filter the search results



1 **Expertise**: Subject area of expertise

2 **Subject Category**: 8 subject areas of expertise as divided by WoS*

3 **Organisation Type#**: Researcher organization type (given in next page)

4 **Designation**: Present designation of researcher

5 **Organisation**: Present researcher organization

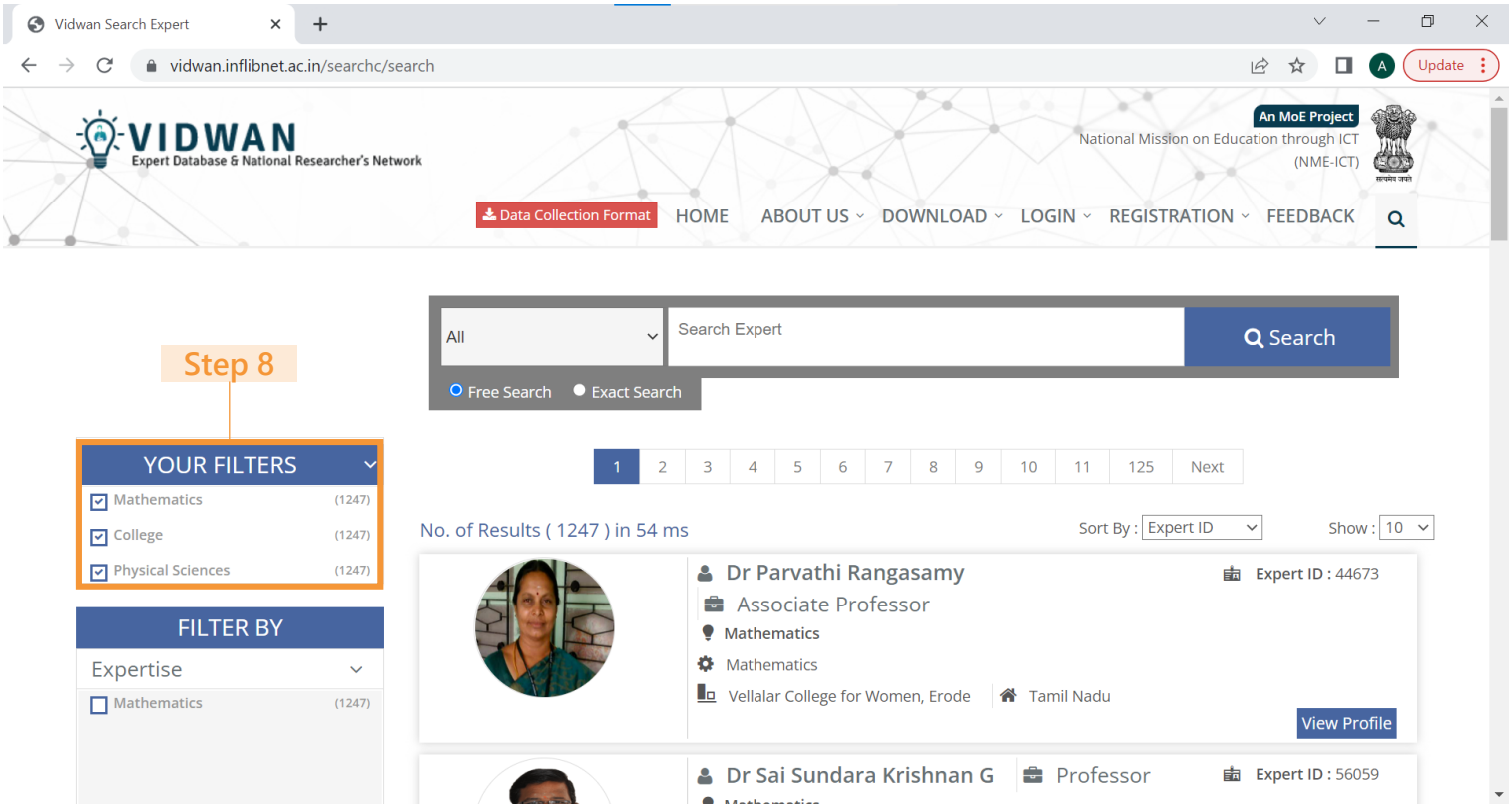
6 **State**: Researcher's state in India

URL : https://vidwan.inflibnet.ac.in/searchc/search

* WoS: Web of Science; # For the types of organizations in India, refer Appendix page 74 & 75

Remove Filters

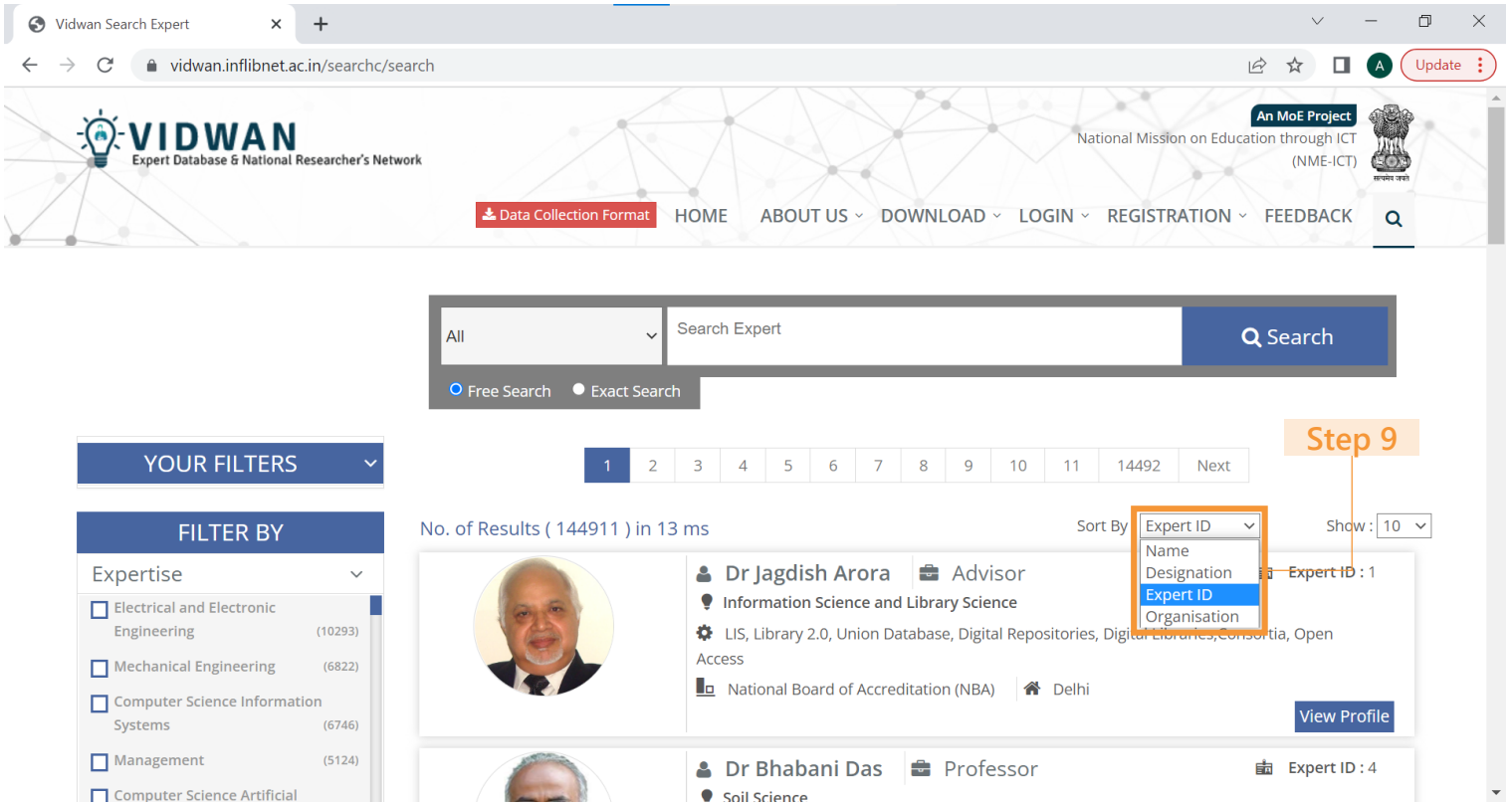
- **Step 8 (Optional)**: After applying the filters, one can remove the filters that are not necessary by unchecking the boxes in the "YOUR FILTERS" section



URL : https://vidwan.inflibnet.ac.in/searchc/search

Sorting Results by Name, Designation, Expert ID, Organisation

- Search results are by default sorted in ascending order of Expert ID. To sort results by other options, follow step 9
- **Step 9:** Select the option by which you would like to sort the results by from the "Sort By" menu
- This would sort the researcher profiles as desired



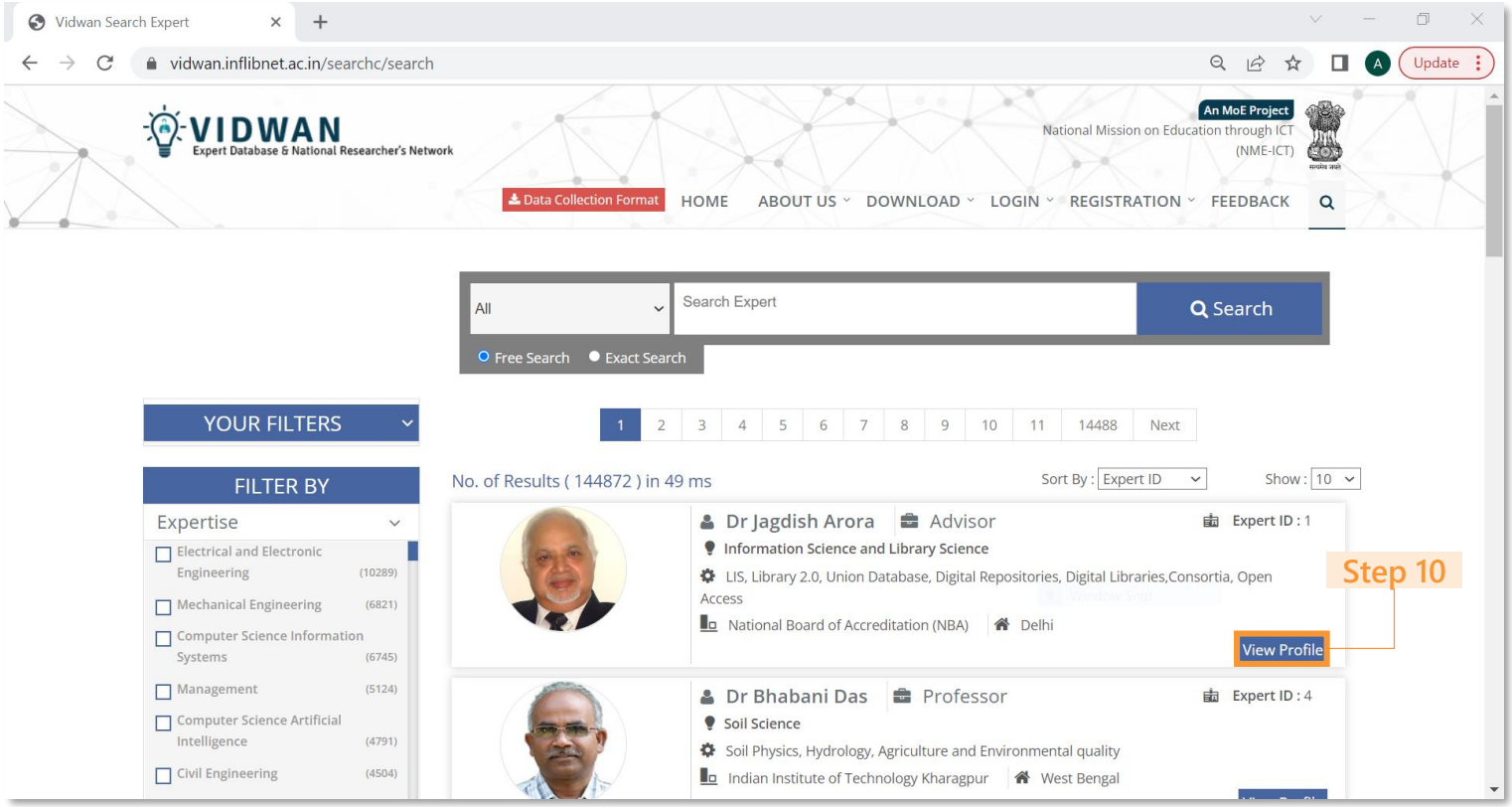
Researcher Sort Criteria

- **Name**: Alphabetical order of names
- **Designation**: Alphabetical order of designation
- **Expert ID**: Ascending order of Expert ID
- **Organisation**: Alphabetical order of organisation

URL : https://vidwan.inflibnet.ac.in/searchc/search

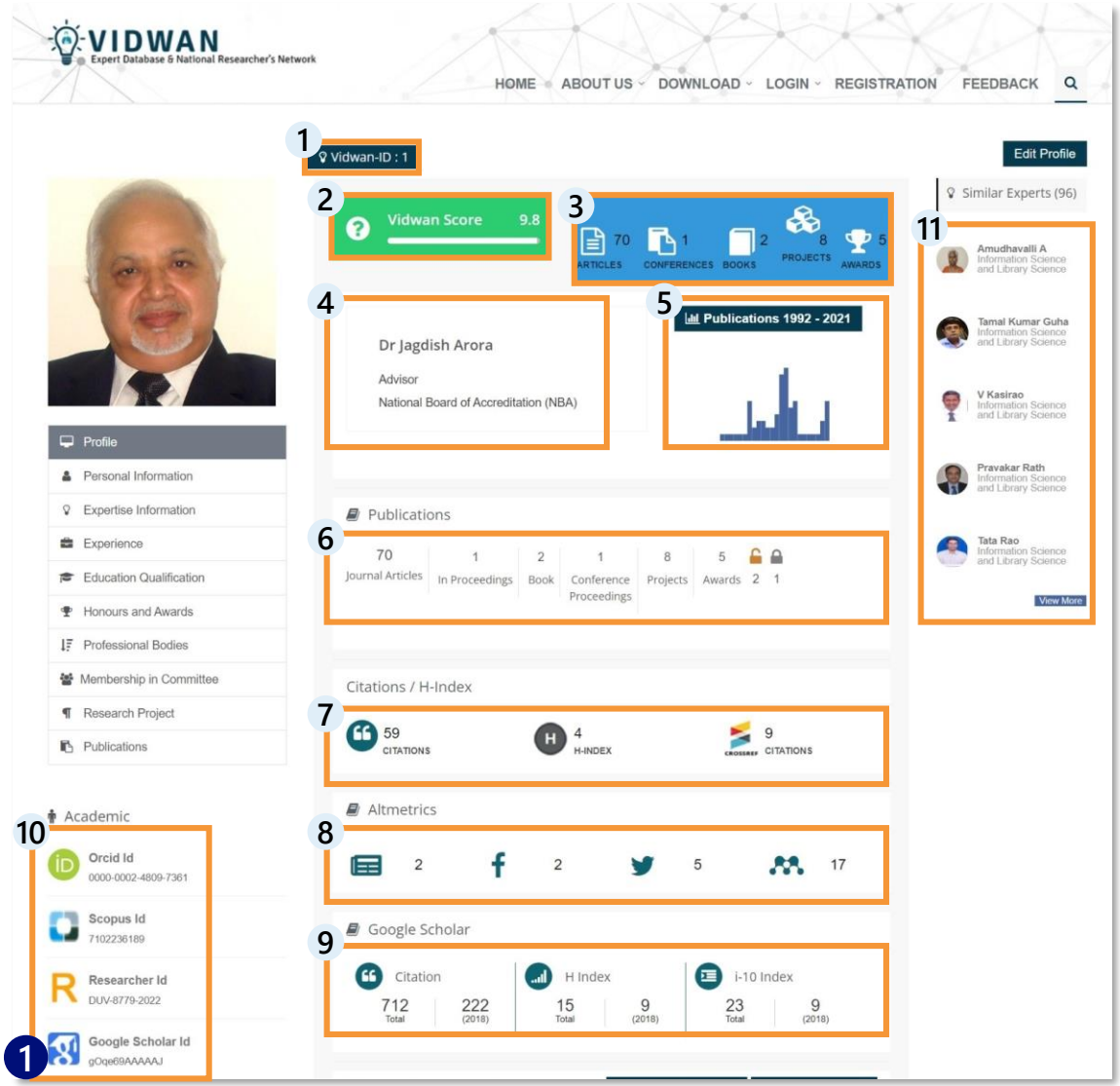
Researcher Profile

- **Step 10:** Click on the “View Profile” button of the desired researcher to view detailed profile of the researcher



URL : https://vidwan.inflibnet.ac.in/searchc/search

1. Researcher detailed profile



1 **Vidwan ID**: Unique Identifier similar to Expert ID

2 **Vidwan Score**: Based on factors like completeness of Vidwan profile, citations, honours, project funding, etc

3 # of articles, conferences, books, projects and awards

4 **Name, Current Designation and Organisation**

5 Year on year **publications**

6 Key publication statistics

7 **Citations, h-index & Crossref citation**

8 Synopsis of the **Altmetrics**

9 **Citation, h & i-10 indices**

10 Key database identifiers

11 Researchers working in similar expertise area

URL : https://vidwan.inflibnet.ac.in/searchc/search

Search Filter Sort View

2. Co-author network and researcher expertise

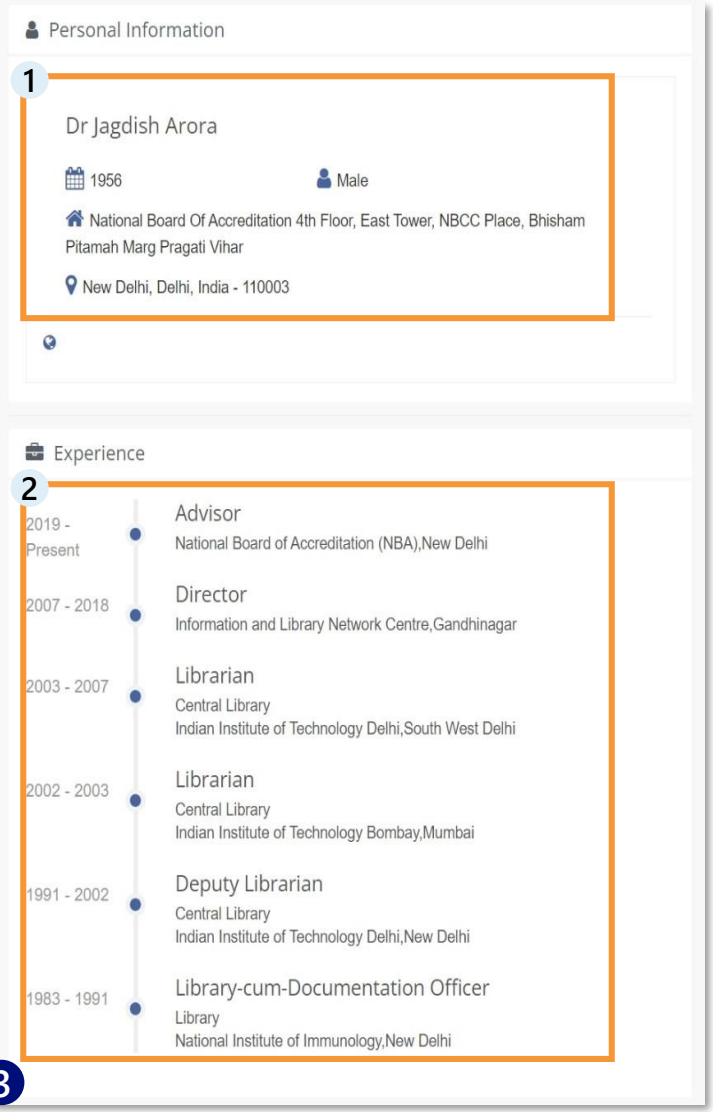
1 **Co-author Network**: Social networks reflecting researcher collaboration nodes in the diagram represent different researchers

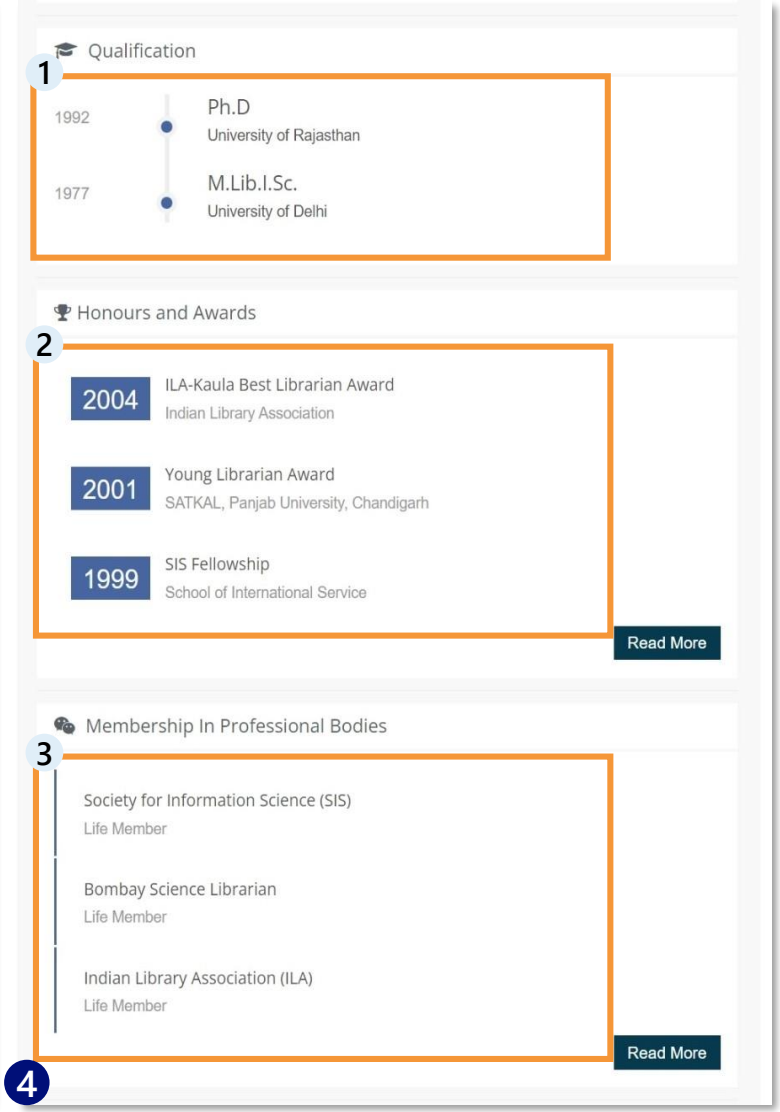
2 **Subject of Expertise Category**

3 **Brief Expertise:** Researcher specialization

URL : https://vidwan.inflibnet.ac.in/searchc/search

3. Personal information and experience of the researcher
4. Qualification, honours, awards, and membership in professional bodies





3 Personal information and experience of researcher

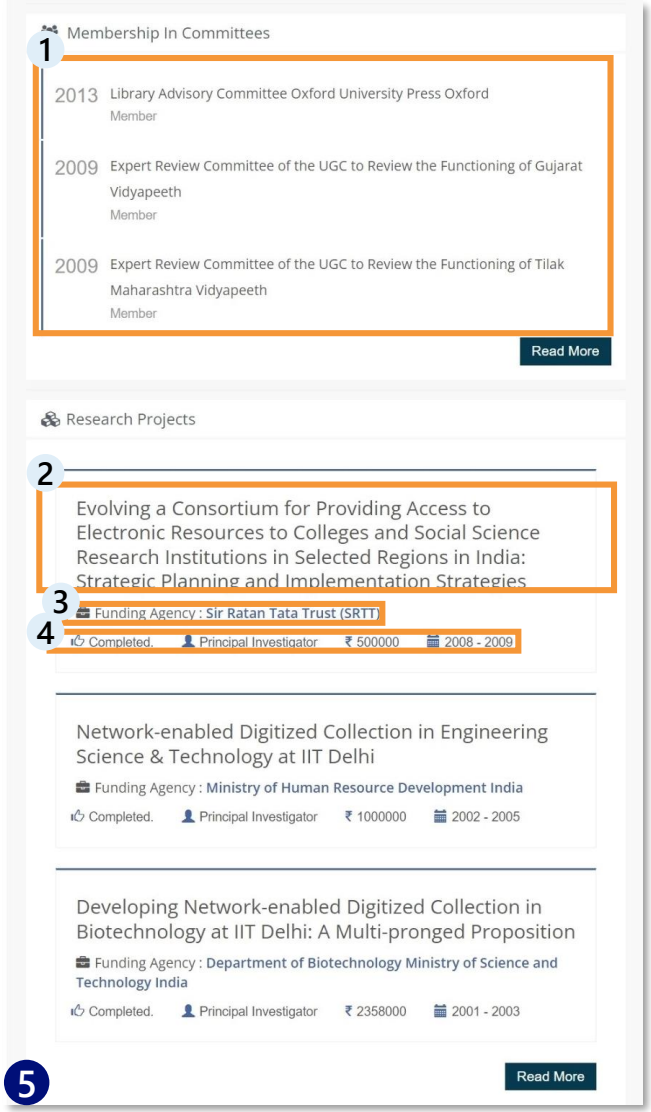
1. **Personal Information**: Name, Year of Birth, Gender, Organisation, location of the researcher
2. **Experience**: Professional experience of the Researcher in reverse chronological order

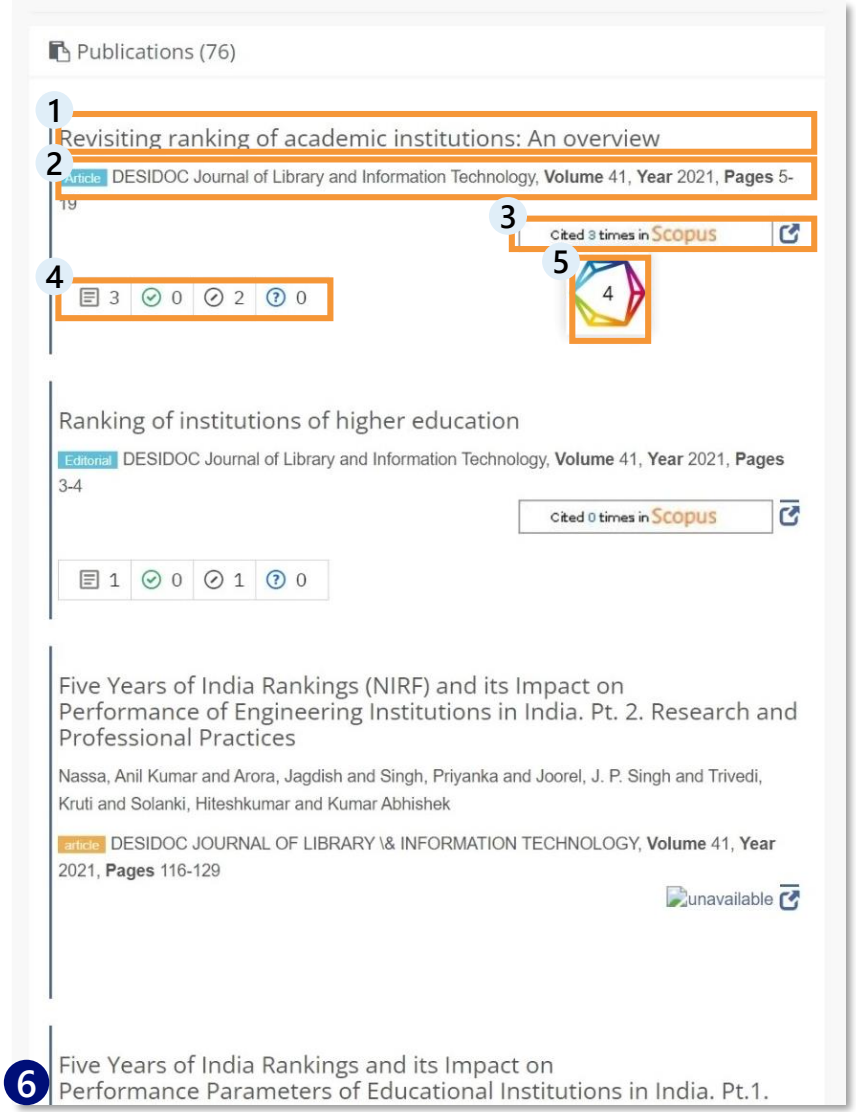
4 Qualification, honours, awards, and membership in professional bodies

1. **Qualification**: Researcher educational qualification, institution and year of study
2. **Honours and Awards**
3. **Membership in Professional Bodies**

URL : https://vidwan.inflibnet.ac.in/searchc/search

5. Committee membership and projects by researcher
6. Researcher publications





5 Committee Membership and projects by Researcher

1. **Committees** researcher is or has been a member
2. **Research projects** of the Researcher
3. **Funding Agency** for the project
4. Project Status, Researcher Contribution, fund allocated and project timeline

6 Researcher Publications

1. **Title** of publications
2. **Journal** of the publication
3. **Link** to the article in **Scopus**
4. **Smart citations** sourced from **scite.ai**
5. **Citations** sourced from **Dimensions**

URL : https://vidwan.inflibnet.ac.in/searchc/search

Contents

Case studies included 1. Publications Statistics, 2. Institutions, 3. Researchers, and 4. Highly Cited Publications; Scopus captured 4/4 while VIDWAN captured 1/4

About:

The case studies aim to provide insights into the trend and growth of research in a field by capturing key aspects of statistics, institutions, researchers, and highly cited publications in addition to connecting with researchers

Key elements of the Case Study	Vidwan	Scopus
About	Database of Indian researchers, developed for finding researchers	Database of research publications with multiple capabilities (including finding relevant publications, researchers, and institutions among others)
Statistics Publications per year from 2014-2022	X	✓
Institutions Institutions in dec. order of total relevant pubs.	X	✓
Researchers Top 10 researchers with highest relevant pubs.	✓ Lists researchers in order of VIDWAN ID	✓
Publications Highest cited publications in given research area	X	✓

Since the purpose of case studies is broader than finding and connecting with researchers and also includes learning about publications and citations, **Scopus tool is more suited for this section**

Note: Pubs.: Publications

Domain wise case study | Guide | User Journey

Scopus

Login to Scopus via subscription access

Search the research topic through keywords

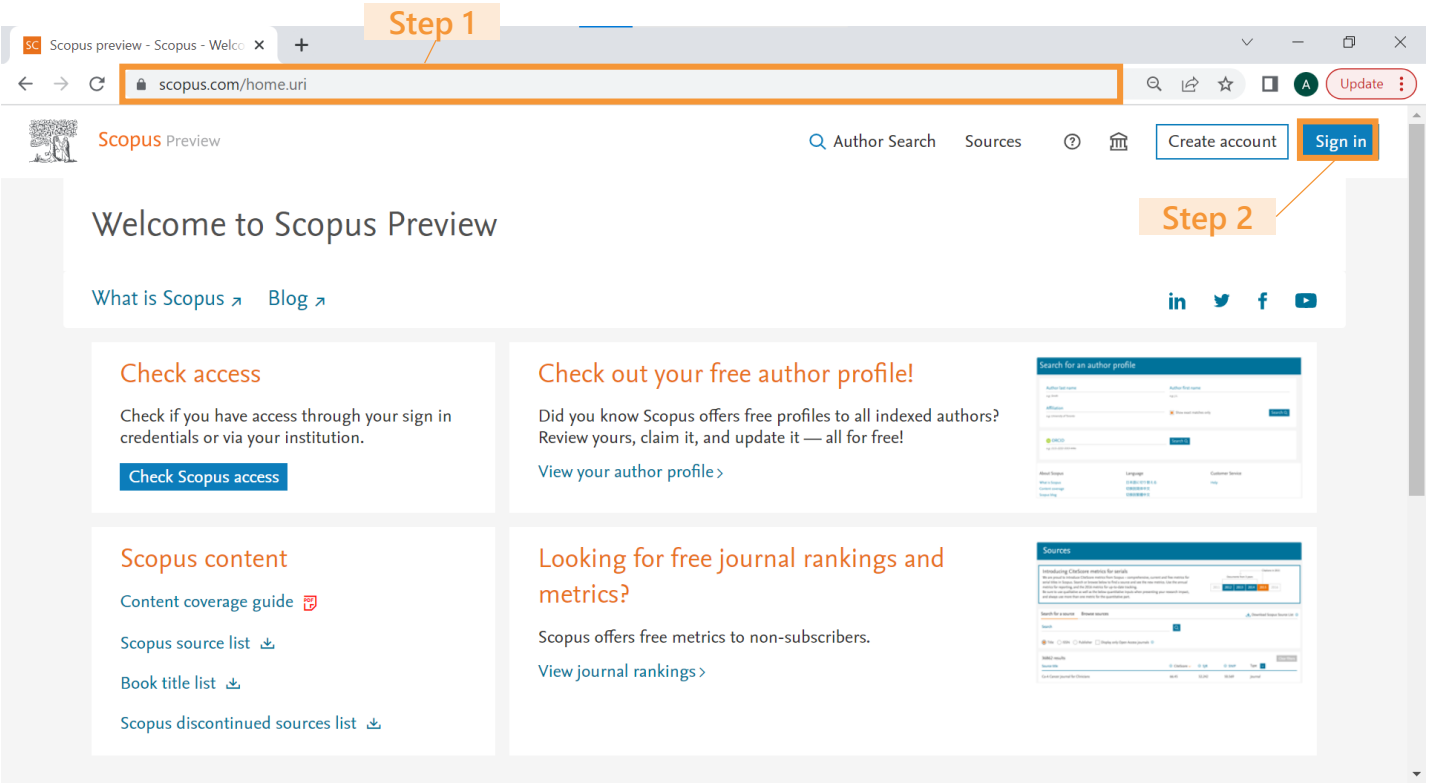
Filter results for India

View detailed information on the research topic

Domain wise case study | Guide | User Journey

Access the url using a web browser and click on “Sign in”

- This case study was prepared using Scopus, leading abstract and citation database (subscription access)
- **Step 1:** Go to the URL: https://www.scopus.com/home.uri through a web browser
- **Step 2:** Click on “Sign in” button



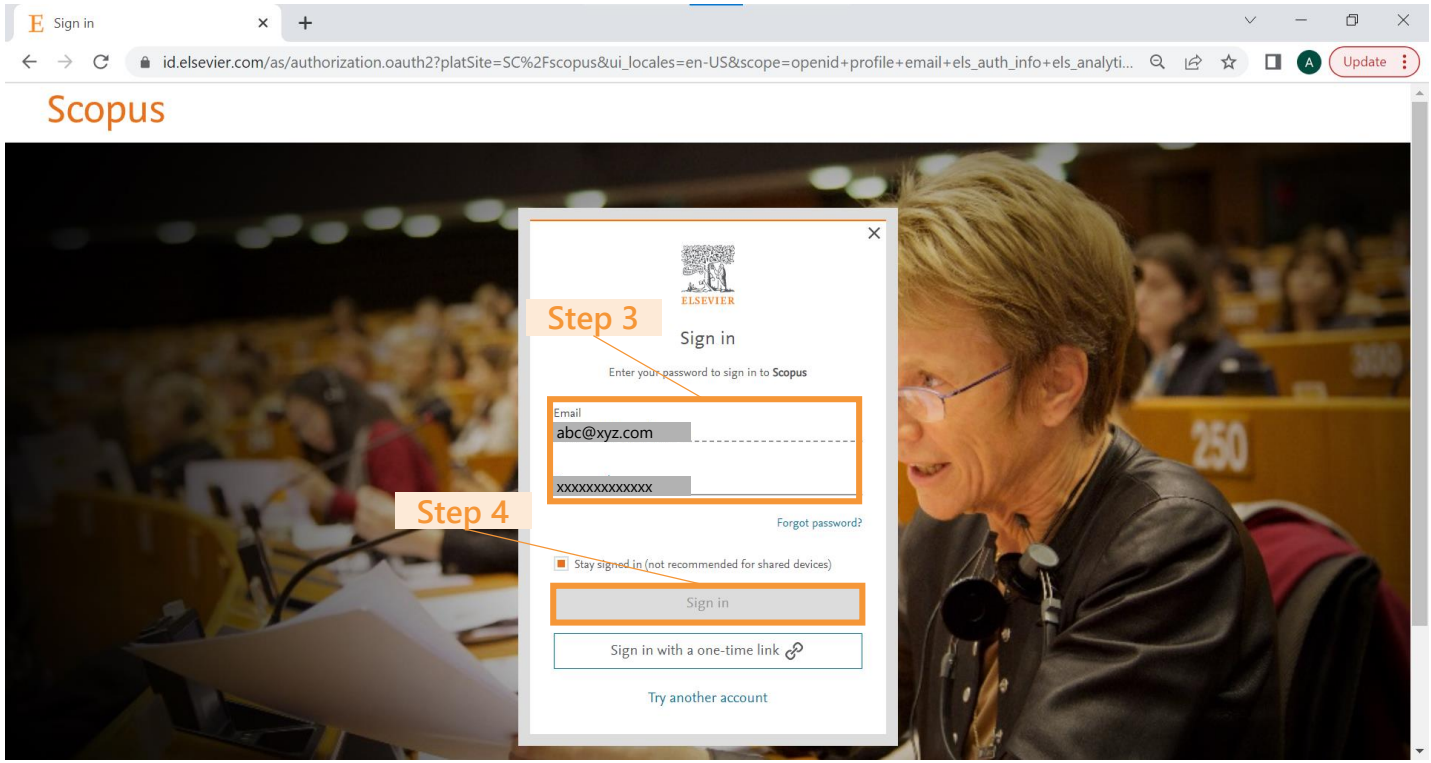
- To utilize all of Scopus' features, it is essential to have a Scopus subscription
- The majority of universities and research institutions have an active subscription to Scopus database

URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

Enter the user credentials for the subscription access to login to Scopus

- **Step 3:** Enter the login credentials in the given location
- **Step 4:** Click on “Sign in” button

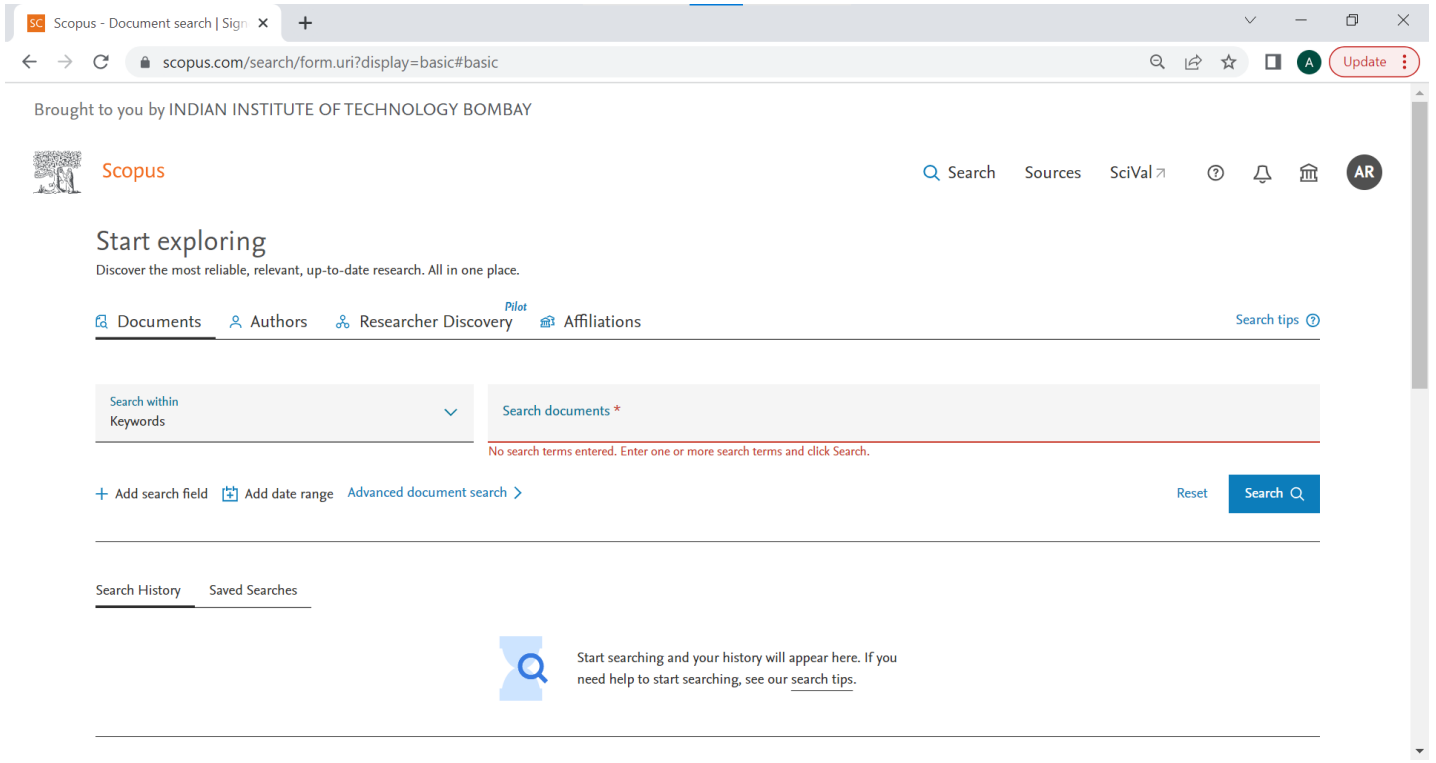


URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

The search page appears on login

- Once the system verifies the login credentials, the search page appears as shown

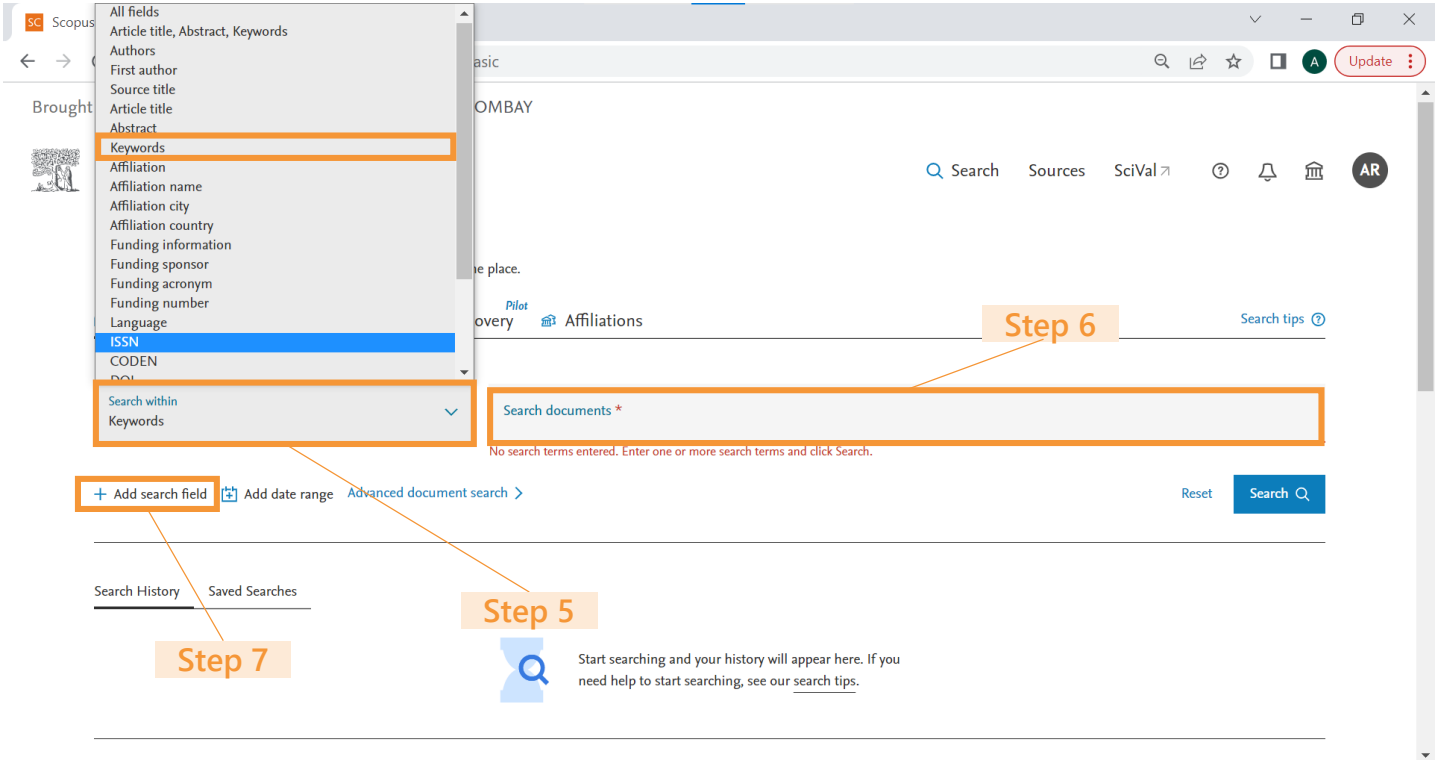


URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

Search the terms for the topic of interest from amongst the keywords indexed from the research documents

- **Step 5:** Click on “Search within” button and select “keywords” from the dropdown
- **Step 6:** Type the keywords you want to search in the “Search documents” tab
- **Step 7**: Click on the “Add search field” button to add additional keywords



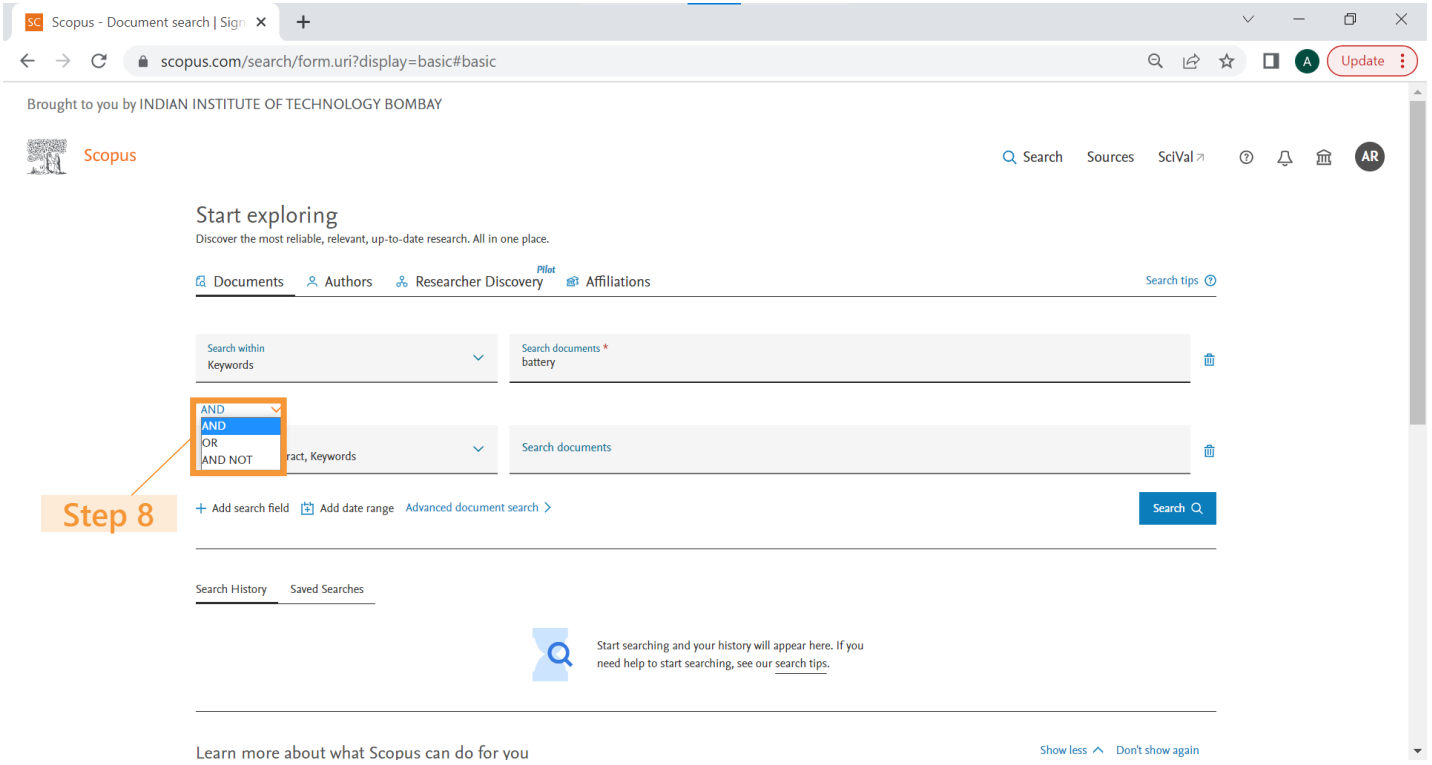
- Finding the relevant keywords for certain research topics may require a few iterations on Scopus.
  - Start with the scientific term for the research topic
  - Edit the term by adding the most repeated keywords that appear in the search results
  - Edit the term by removing few keywords that mask up the relevant results

URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

Use logical operators AND, OR, AND NOT to broaden and refine the search results as required

- **Step 8:** Click on the dropdown and change the conjunction to “OR”



Meaning of different logical operators:

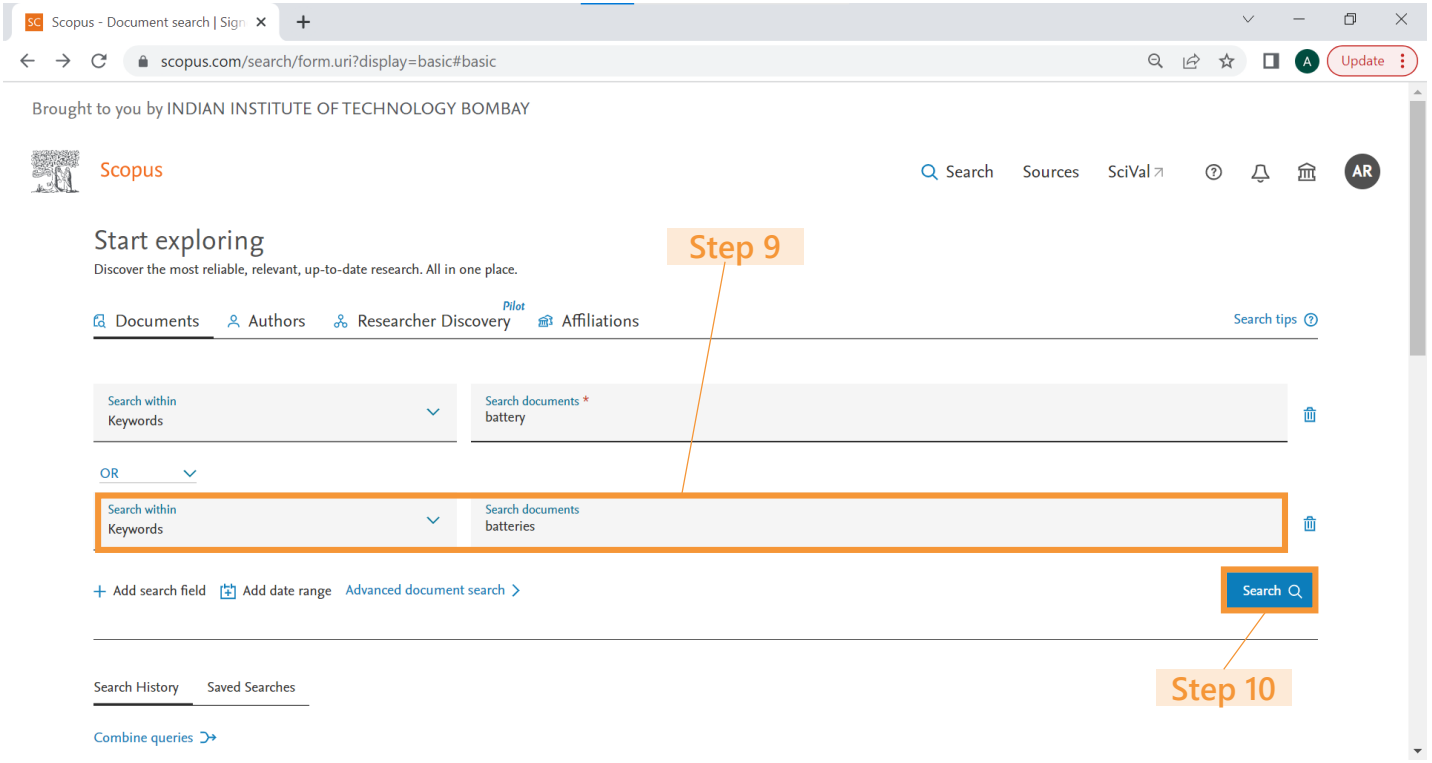
- AND operator requires all search keywords to be present in the search results
- OR operator returns results that contain any of the search keywords
- AND NOT operator is used to exclude specific terms from search results

URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

Add all the relevant search terms and click on Search to get all the associated research documents

- **Step 9:** Select keywords under the "Search within" tab and type the keyword in the "Search documents" tab
- **Step 10:** Click on the "Search" button
- Similarly add any other keyword, if applicable using the "Add search field" option

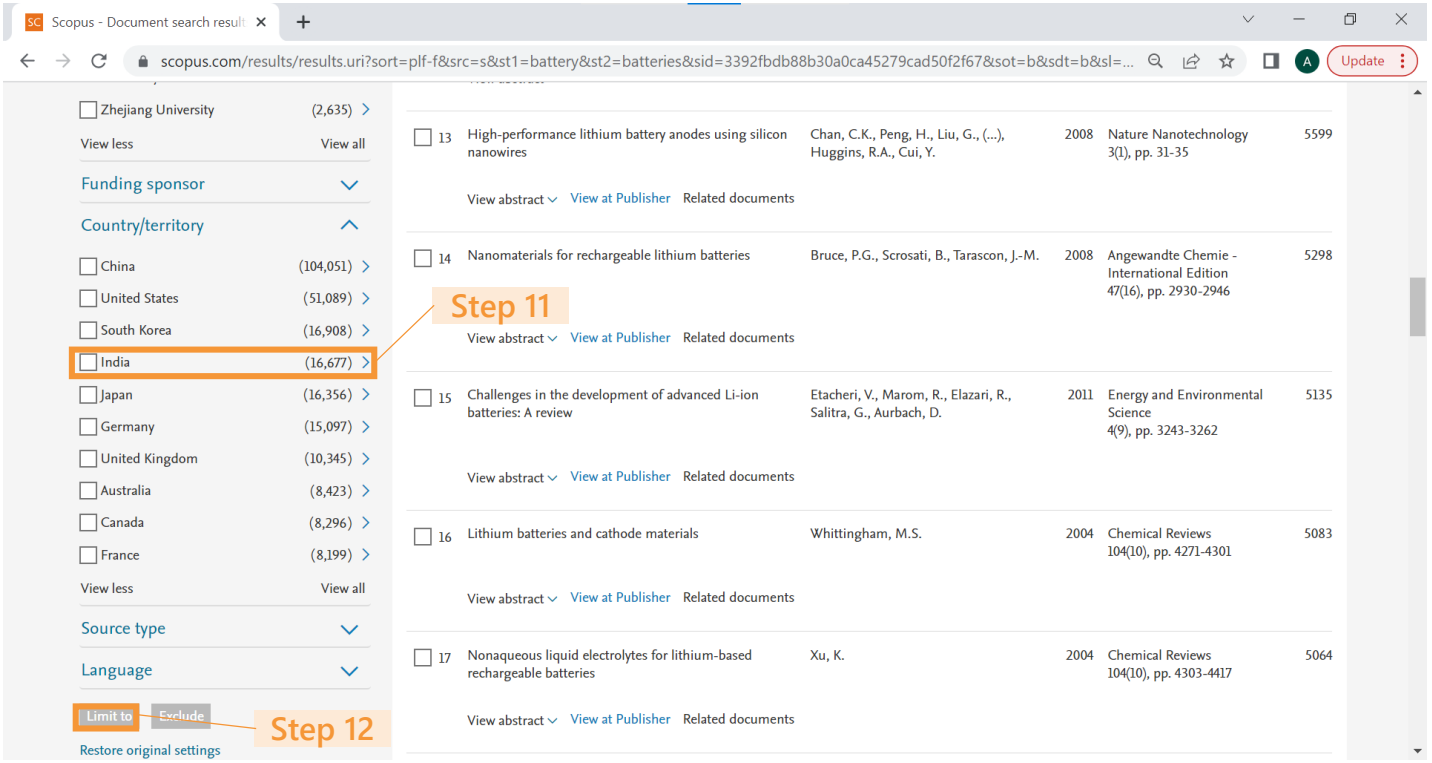


URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

Filter documents from India by checking the checkbox associated with India and clicking Limit to

- The search result yields research papers from across all countries. For India specific results, follow the below steps:
- **Step 11:** Click on the checkbox near India under the Country/territory dropdown
- **Step 12:** Click on the "Limit to" button

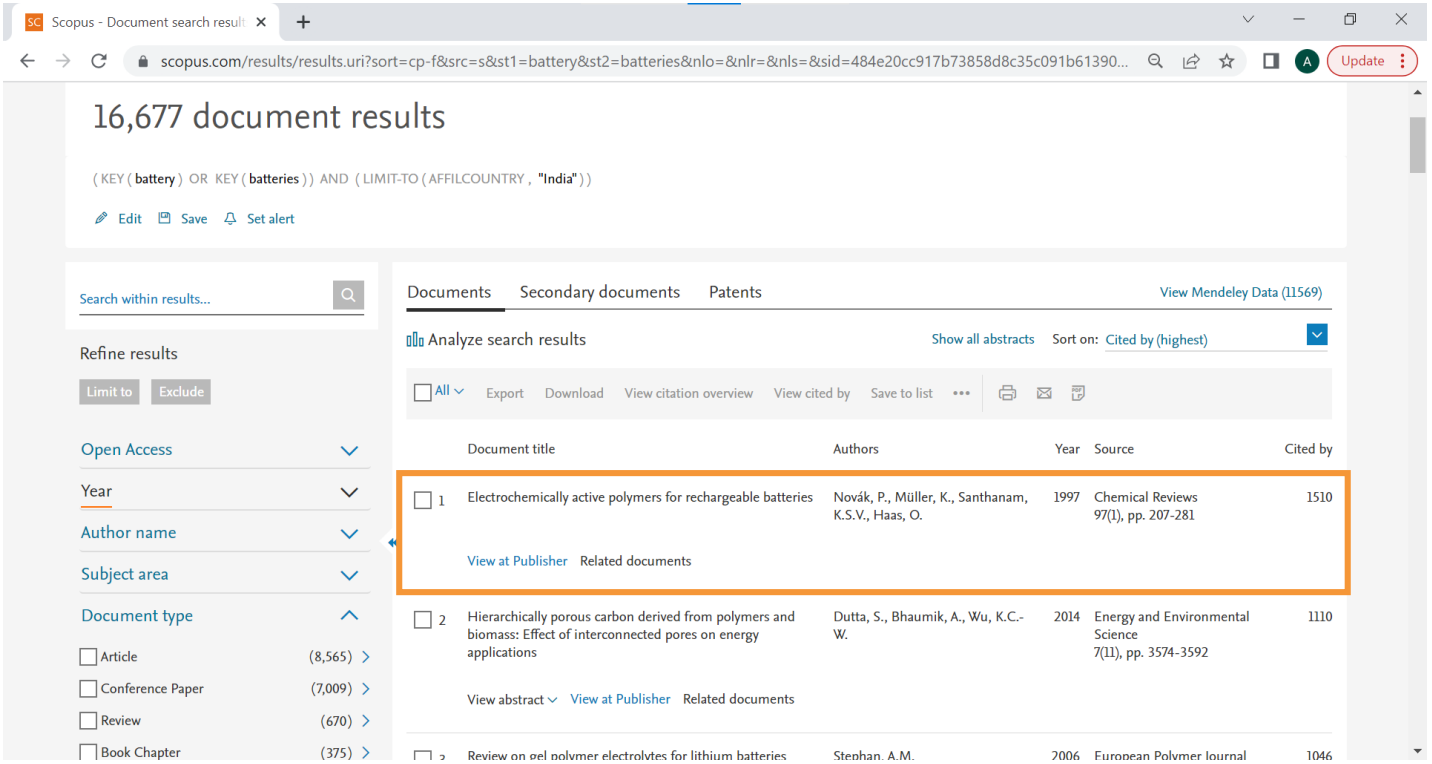


URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

The search results contain the document title, author names, year of publication, source, citations and the link to access the article

- This yields all the research documents available on Scopus from India on battery research sorted on the basis of the number of citations
- However, the list of publications can also lead to inconsistent results due to uncontrolled and different Scopus indexing of keywords



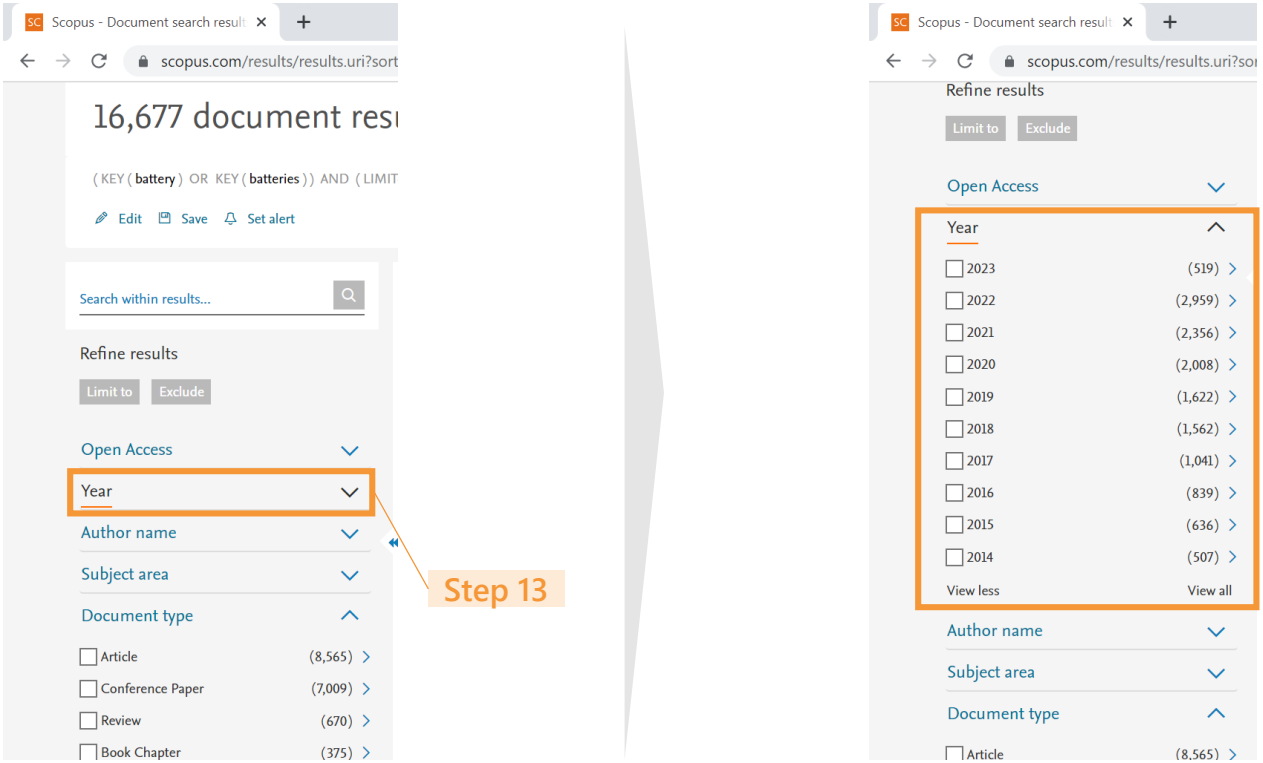
- The results contains the following information on research documents:
  - Document title
  - Author names
  - Year of publication
  - Source
  - Total citations
  - Link to access the article

URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

To obtain the number of publications per year, click on the dropdown menu located next to the "Year" field

- **Step 13:** To get the publications count by year, click on the down arrow besides Year

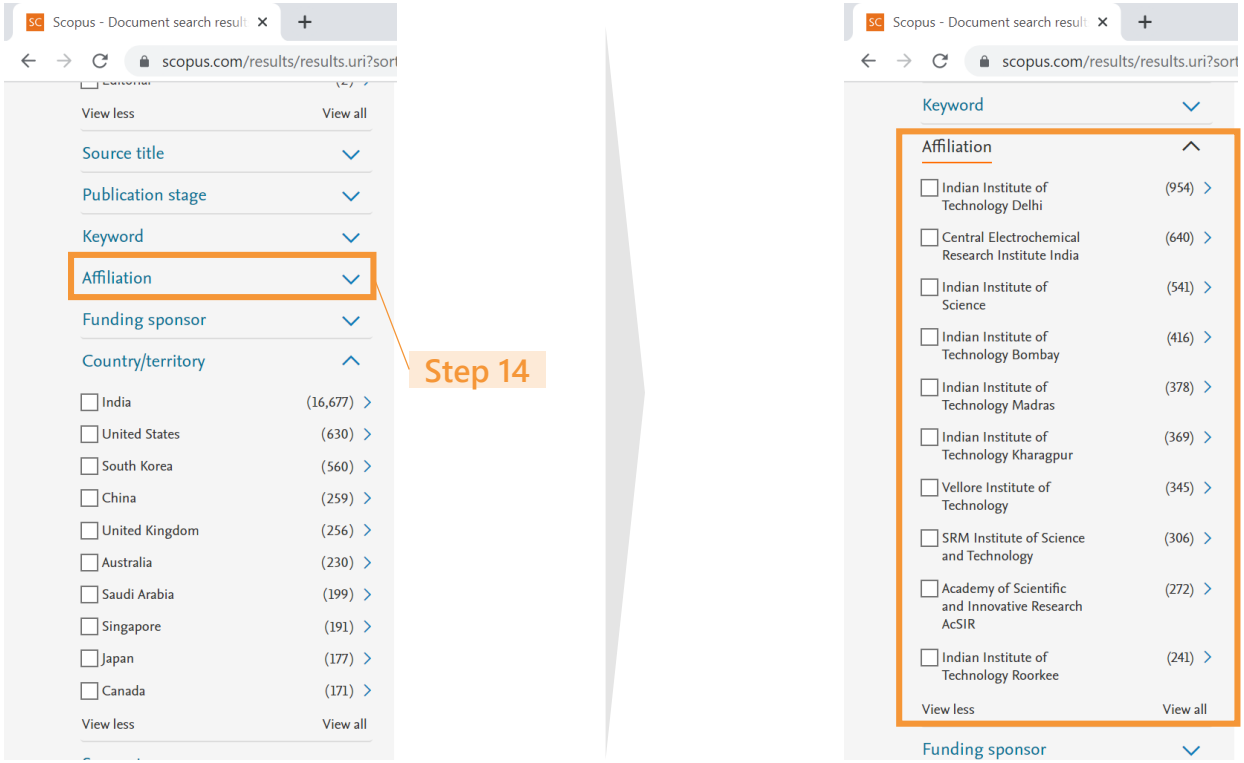


URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

To retrieve the leading research institutions for the given topic, click on the dropdown menu located next to the "Affiliation" field

- **Step 14:** To fetch the top institutions for research in the given topic, click on the down arrow besides Affiliation
- The research institutions are sorted on the basis of the number of research papers published in the given topic

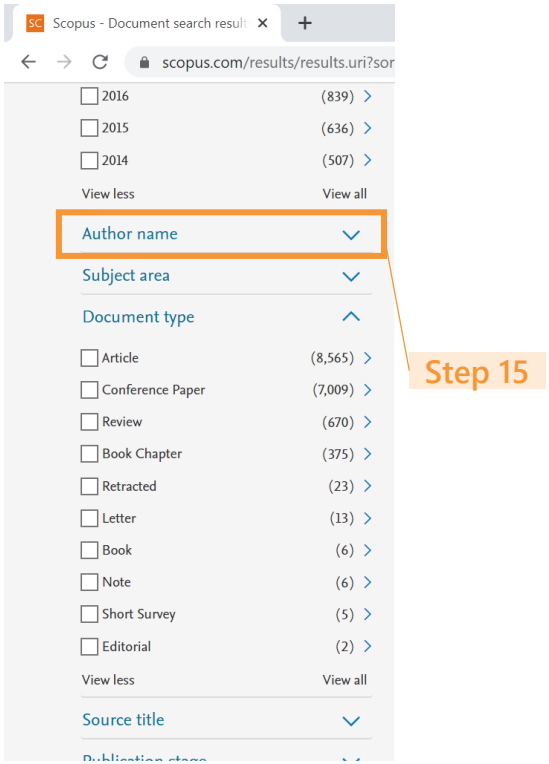


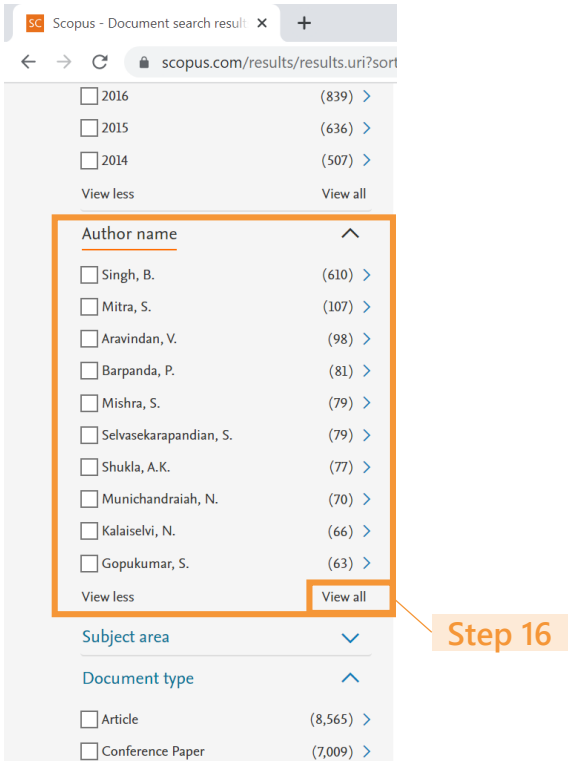
URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

To fetch the top researchers for research in the given topic, click on the down arrow located next to the “Author name” field

- **Step 15:** To fetch the top researchers for research in the given topic, click on the down arrow besides Author name
- **Step 16:** Click on the “View all” button to view the full list of researchers
- The researchers are sorted on the basis of the number of research papers published in the given topic



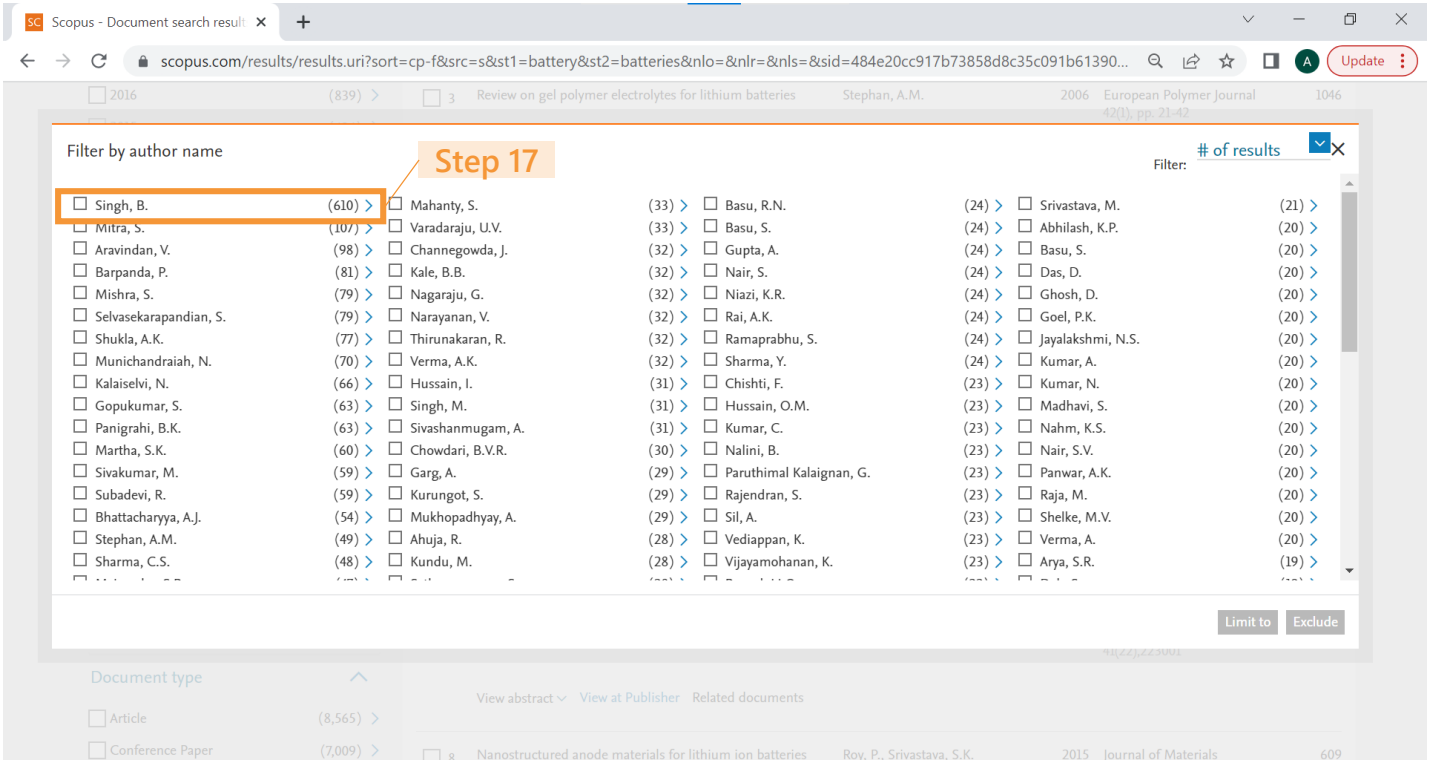


URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

To view detailed Researcher description, click on the arrow besides the author name

- **Step 17:** To view detailed Researcher description, click on the arrow (>) besides the author name

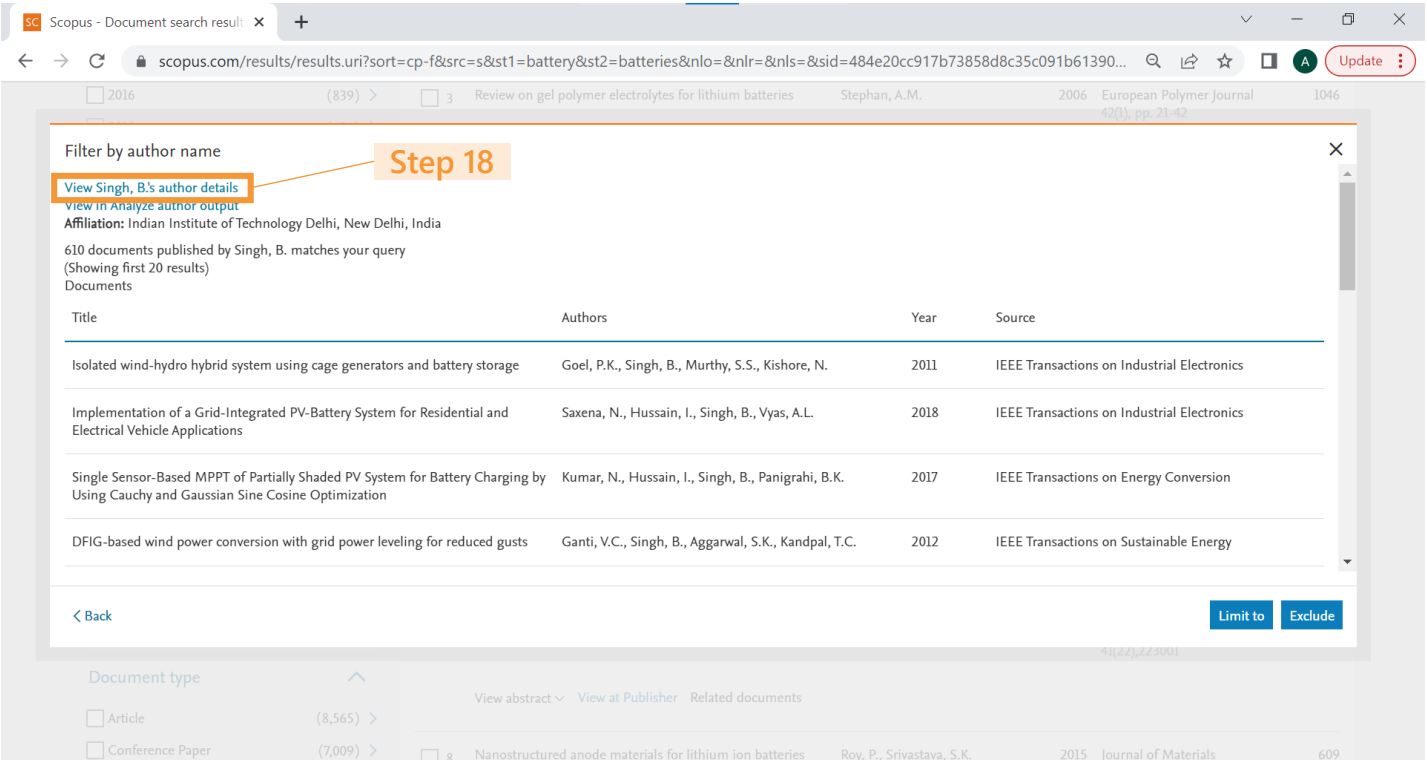


URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

Click on the “View author details” link to view the researcher profile

- **Step 18:** Click on the “View Singh, B’s author details”

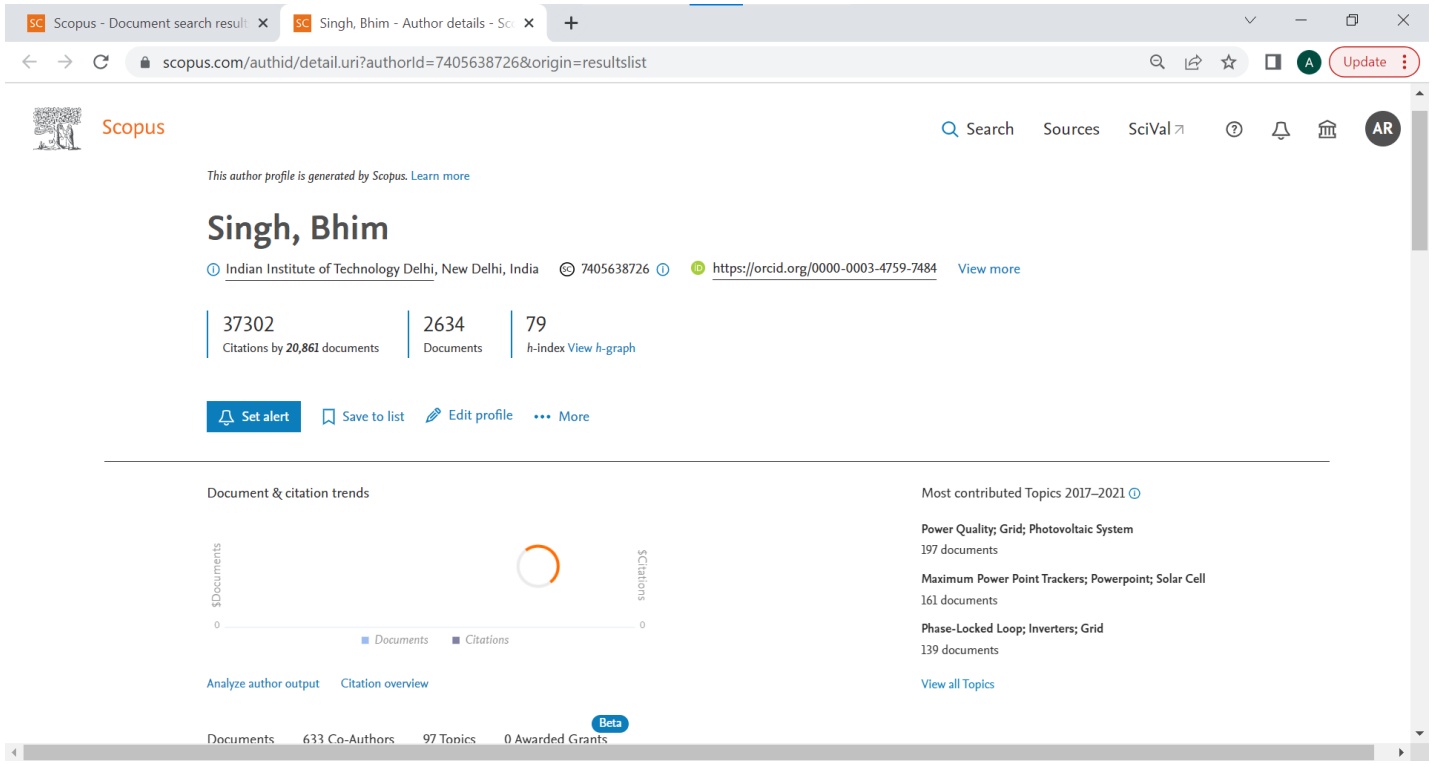


URL : https://www.scopus.com/home.uri

Domain wise case study | Guide | User Journey

The Researcher profile contains data on affiliation, ORCID ID, Citations, h index, Research topics and papers, Co-Authors and the awarded grants

- This opens the Researcher profile in a separate tab
- The Research papers published by the researcher can be checked to confirm whether the research interests of the researchers aligns with our search topic



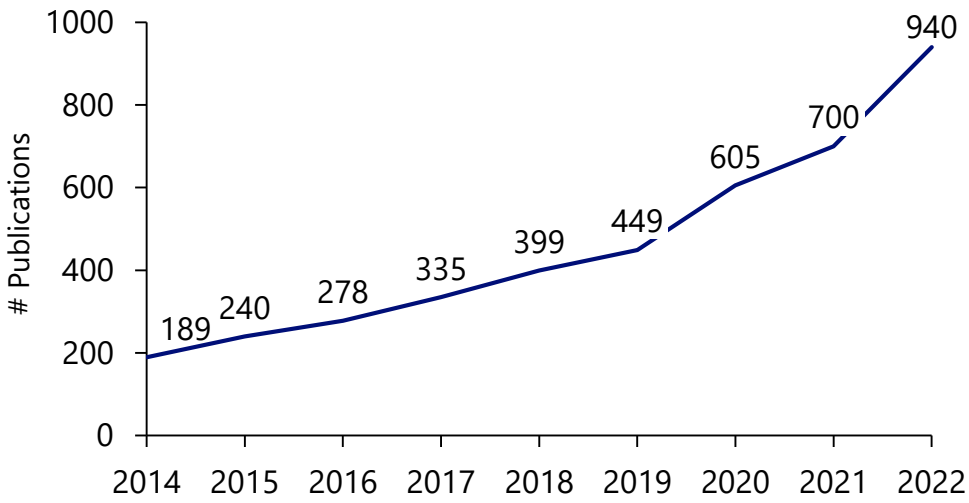
- The Researcher profile contains the following details:
  - Researcher Name
  - Affiliation
  - ORCID ID
  - Total Citations
  - h-index
  - Research topics
  - Research papers published
  - Co-Authors
  - Grants Awarded

URL : https://www.scopus.com/home.uri

Trends in publications focused on hydrogen, key institutions for Hydrogen research, etc can be obtained by searching relevant keywords in Scopus

- The keywords "hydrogen production" & "hydrogen evolution" were shortlisted after searching the topic of interest ("hydrogen") in the Scopus database and selecting all keywords related to Green energy

Key Statistics



Hydrogen is crucial to decarbonize sectors of economy that are hard to electrify. Therefore Govt. as well as private organizations are increasingly invested in Hydrogen research in line with the India's net zero goals for 2070

Key Institutions*

1. Academy of Scientific and Innovative Research (AcSIR)
2. Council of Scientific and Industrial Research, India
3. Central Electrochemical Research Institute, India
4. Indian Institute of Technology, Kharagpur
5. Indian Institute of Technology, Delhi
6. Bhabha Atomic Research Centre
7. SRM Institute of Science and Technology
8. Indian Institute of Technology Madras
9. Anna University
10. Indian Institute of Science

*Institutions with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

Researchers with research focus in hydrogen production, water splitting & fuel cells are spread across India in various Institutions

Researchers with Highest publications*

Venkata Mohan, Srinivasula Reddy
CSIR-Indian Institute of Chemical Technology
Bioenergy; Regenerative Fuel Cells, Biohydrogen Fermentation; Hydrogen Production

Pal, Ujjwal
Academy of Scientific and Innovative Research
CdS; Hydrogen Production; Photocatalyst Hydrogen Generation; Water Splitting; TiO_2

Das, Debabrata
Indian Institute of Technology, Kharagpur
Bioenergy; Regenerative Fuel Cells, Bioelectricity Biohydrogen; Fermentation; Hydrogen Production

Neppolian, Bernaurdshaw
SRM Institute of Science and Technology
CdS; Hydrogen Production; Photocatalyst Hydrogen Production; Photocatalysts; TiO_2

Shankar, Muthukonda Venkatakrishnan
Yogi Vemana University, Kadapa
CdS; Hydrogen Production; Photocatalyst Hydrogen Production; Photocatalysts; TiO_2

Kale, Bharat Bhanudas
Centre for Materials for Electronics Technology
CdS; Hydrogen Production; Photocatalyst Oxynitrides; Water Splitting; Photocatalysts

Kundu, Subrata
Central Electrochemical Research Institute
Catalyst; Cobalt Phosphide; Water Splitting

Parida, Kulamani M.
Siksha O Anusandhan
CdS; Hydrogen Production; Photocatalyst Catalyst; Cobalt Phosphide; Water Splitting

Rao, C. N.R.
Jawaharlal Nehru Centre for Advanced Scientific Research
Catalyst; Cobalt Phosphide; Water Splitting CdS; Hydrogen Production; Photocatalyst

Sathish, M.
Central Electrochemical Research Institute
CdS; Hydrogen Production; Photocatalyst Hydrogen Production; Photocatalysts; TiO_2

*Researchers with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

Key research publications of interest can be obtained on overall, researcher and university level

1. Hydrogen production by biological processes: A survey of literature
   - Das, D., Veziroğlu, T.N.
   - *International Journal of Hydrogen Energy 26(1), pp. 13-28*
   - 2001
   - 1723

2. Recent Trends and Perspectives in Electrochemical Water Splitting with an Emphasis on Sulfide, Selenide, and Phosphide Catalysts of Fe, Co, and Ni: A Review
   - Anantharaj, S., Ede, S.R., Sakthikumar, K., Karthick, K., Mishra, S., Kundu, S., T.N
   - *ACS Catalysis 6(12), pp. 8069-8097*
   - 2016
   - 1585

3. Glucose oxidase - An overview
   - Bankar, S.B., Bule, M.V., Singhal, R.S., Ananthanarayan, L.
   - *Biotechnology Advances 27(4), pp. 489-501*
   - 2009
   - 841

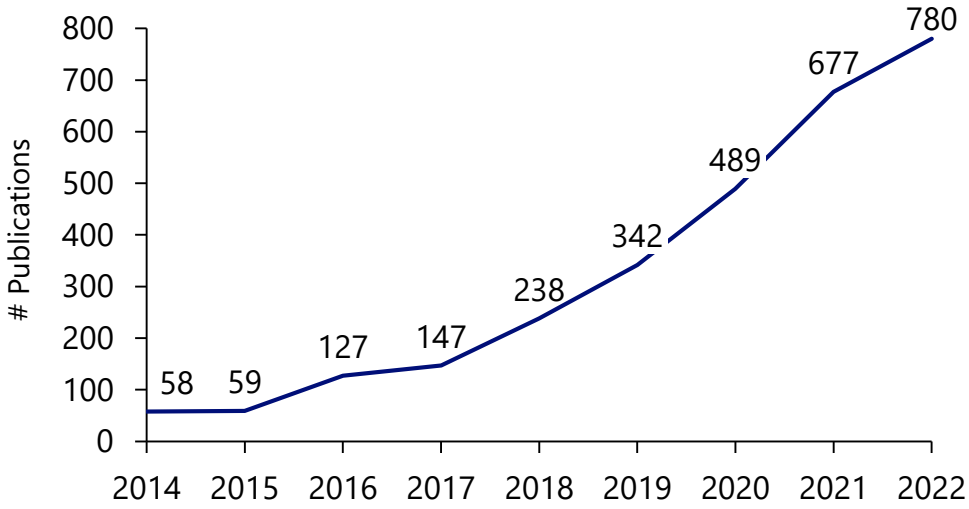
4. Precision and correctness in the evaluation of electrocatalytic water splitting: Revisiting activity parameters with a critical assessment
   - Anantharaj, S., Ede, S.R., Karthick, K., Sam Sankar S., Sangeetha K., Karthik, P.E., Kundu, S.
   - *Energy and Environmental Science 11(4), pp. 744-771*
   - 2018
   - 785

Source : Scopus

Research on drones has been gaining focus as evident from the no. of research papers published every year. IISc is the top institution for drone research in India

- The keywords "unmanned aerial vehicle", "drone", "uav" were shortlisted after searching the topic of interest ("drone") in the Scopus database and selecting all keywords related to drone

Key Statistics



India is investing in drone technology, focusing on applications in agriculture, surveillance, disaster management, & logistics.. IITs, IISc, DRDO & also private companies like Tata Advanced Systems, Mahindra Aerospace, Aero360 are pursuing drone technology

Key Institutions*

1. Indian Institute of Science
2. Indian Institute of Technology, Kanpur
3. Thapar Institute of Engineering & Technology
4. Vellore Institute of Technology
5. Indian Institute of Technology, Kharagpur
6. Anna University
7. Indian Institute of Technology, Bombay
8. Defence Research and Development Organisation, India
9. University of Petroleum and Energy Studies
10. Indian Institute of Technology, Roorkee

*Institutions with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

Key researchers in drone research are spread across IISc, IITs, IISER, BITS Pilani, TCS Research, Ramswaroop Memorial University, Nirma University, etc.

Researchers with Highest publications*

Ghose, Debasish
Indian Institute of Science
Navigation; Mobile Robots; Artificial Potential Field
Path Planning; UAV; Curvature Continuity

Kothari, Mangal
Indian Institute of Technology, Kanpur
Controller; Altitude Control; Vertical Takeoff & Landing
Ducted Fans; UAV; Transition Flight

Kumar, N.
Shri Ramswaroop Memorial University
Drone; UAVs; Base Stations

Singh, Dharmendra
Graphic Era Deemed to be University
RADARSAT; Crops; Soil Moisture
Crops; Leaf Area Index; Hyperspectral Data

Sujit, P. B.
IISER, Bhopal
Landing; Autonomous; Pose Estimation
Path Following; UAV; Fixed Wings

Ghosh, Ajoy Kanti
Indian Institute of Technology, Kanpur
Ducted Fans; UAV; Transition Flight
Soaring; Helicopter; UAV

Ratnoo, Ashwini
Indian Institute of Science
Guidance Law; Angle; Missile Control
Path Following; UAV; Fixed Wings

Das, Kaushik
TCS, Research
Controller; Altitude Control; Vertical Takeoff & Landing
Robot; Homography; Mobile Robots

Tanwar, Sudeep
Nirma University, Institute of Technology
Drone; UAVs; Base Stations

Chamola, Vinay
Birla Institute of Technology & Science, Pllani
Object Detection; Deep Learning; IOU
Drone; UAVs; Base Stations

*Researchers with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

The most cited papers on drone research focus on application of drone systems in COVID-19 & precision agriculture, algorithms for path following, etc.

1. A Comprehensive Review of the COVID-19 Pandemic and the Role of IoT, Drones, AI, Blockchain, and 5G in Managing its Impact
   - Chamola, V., Hassija, V., Gupta, V., Guizani, M.
   - *IEEE Access 8,9086010, pp. 90225-90265*
   - 2020
   - 597

2. Review on Application of Drone Systems in Precision Agriculture
   - Mogili, U.R., Deepak, B.B.V.L.
   - *Procedia Computer Science 133, pp. 502-509*
   - 2018
   - 337

3. Unmanned aerial vehicle path following: A survey and analysis of algorithms for fixed-wing unmanned aerial vehicles
   - Sujit, P.B., Saripalli, S., Sousa, J.B.
   - *IEEE Control Systems 34(1),6712082, pp. 42-59*
   - 2014
   - 327

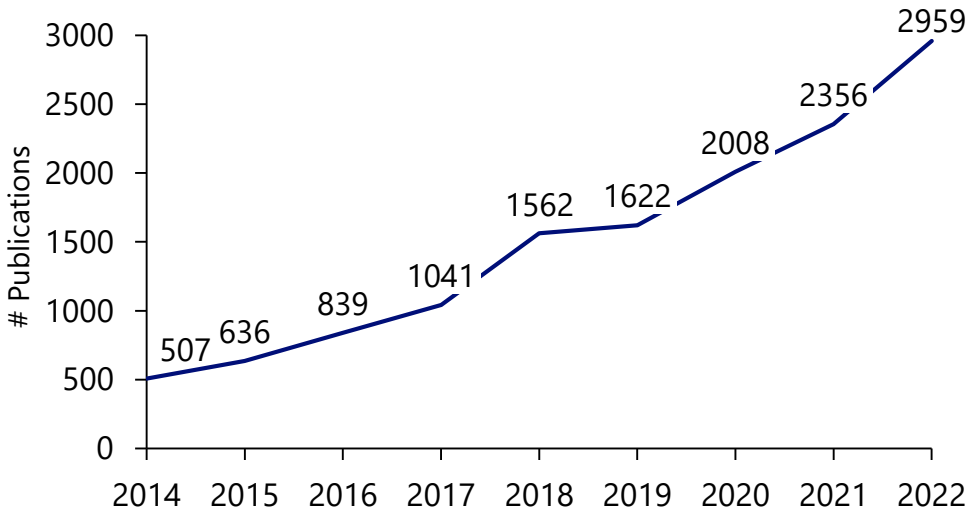
4. UAV-Assisted Heterogeneous Networks for Capacity Enhancement
   - Sharma, V., Bennis, M., Kumar, R.
   - *IEEE Communications Letters 20(6),7451189, pp. 1207-1210*
   - 2016
   - 245

Source : Scopus

Battery research has grown to ~5x of its size in 2014 with the IITs, IISc, Central Electrochemical Research Institute leading in terms of no. of papers published

- The keywords "batteries", "battery" were shortlisted after searching the topic of interest ("battery") in the Scopus database and using keywords that would fit all the top keyword results

Key Statistics



Battery research in India has been gaining momentum in recent years, as the country aims to become a global leader in renewable energy and electric mobility. Some focus areas include Li ion batteries, alternative battery chemistries, battery recycling

Key Institutions*

1. Indian Institute of Technology, Delhi
2. Central Electrochemical Research Institute
3. Indian Institute of Science
4. Indian Institute of Technology Bombay
5. Indian Institute of Technology, Madras
6. Indian Institute of Technology, Kharagpur
7. Vellore Institute of Technology
8. SRM Institute of Science and Technology
9. Academy of Scientific and Innovative Research (AcSIR)
10. Indian Institute of Technology, Roorkee

*Institutions with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

Researchers with most no. of relevant papers in battery technology are spread across IITs, IISc, Central Electrochemical Research Institute, IISER, etc.

Researchers with Highest publications*

Singh, Bhim
Indian Institute of Technology, Delhi
Power Quality; Grid; Photovoltaic System
Electric Vehicle; Vehicle-To-Grid; Charging

Shukla, Ashutosh Kumar
Indian Institute of Science
Electrode; Cobaltous Sulfide; Electrode Materials
Flow Batteries; Electrode; Vanadium

Mitra, Sagar
Indian Institute of Technology, Bombay
Sodium-ion Batteries; Electrode; Ion Storage
Lithium Sulfur Batteries; Polysulfides; Electrode

Munichandraiah, Nookala
Indian Institute of Science
Electrode; Cobaltous Sulfide; Electrode Materials
Sodium-ion Batteries; Electrode; Ion Storage

Aravindan, Vanchiappan
IISER, Tirupati
Sodium-ion Batteries; Electrode; Ion Storage
Capacitors; Electrode; Intercalation

Kalaiselvi, Nallathamby
Central Electrochemical Research Institute , India
Sodium-ion Batteries; Electrode; Ion Storage
Lithium Sulfur Batteries; Polysulfides; Electrode

Mishra, Sukumar
Indian Institute of Technology, Delhi
Power Quality; Grid; Photovoltaic System
Electric Vehicle; Vehicle-To-Grid; Charging

Gopukumar, Sukumaran
Central Electrochemical Research Institute , India
Sodium-ion Batteries; Electrode; Ion Storage
Lithium Battery; Carbon; Electrode

Selvasekarapandian, Subramanian
Matetials Research Center, Coimbatore
Lithium Perchlorates; Macrogol; Ion Currents
Nanocomposite; Barium Titanates; Dielectric Losses

Panigrahi, Bijaya Ketan
Indian Institute of Technology, Delhi
Maximum Power Point Trackers; Powerpoint; Solar Cell
Electric Vehicle; Vehicle-To-Grid; Charging

*Researchers with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

The most cited papers focus on Lithium ion battery research, innovative materials for electrolytes and electrodes, etc.

1. Electrochemically active polymers for rechargeable batteries

   Novák, P., Müller, K., Santhanam, K.S.V., Haas, O. — 1997
   Chemical Reviews 97(1), pp. 207-281 — 1510

2. Hierarchically porous carbon derived from polymers and biomass: Effect of interconnected pores on energy applications

   Dutta, S., Bhaumik, A., Wu, K.C.-W. — 2014
   Energy and Environmental Science 7(11), pp. 3574-3592 — 1110

3. Review on gel polymer electrolytes for lithium batteries

   Stephan, A.M. — 2006
   European Polymer Journal 42(1), pp. 21-420 — 1046

4. Safety mechanisms in lithium-ion batteries

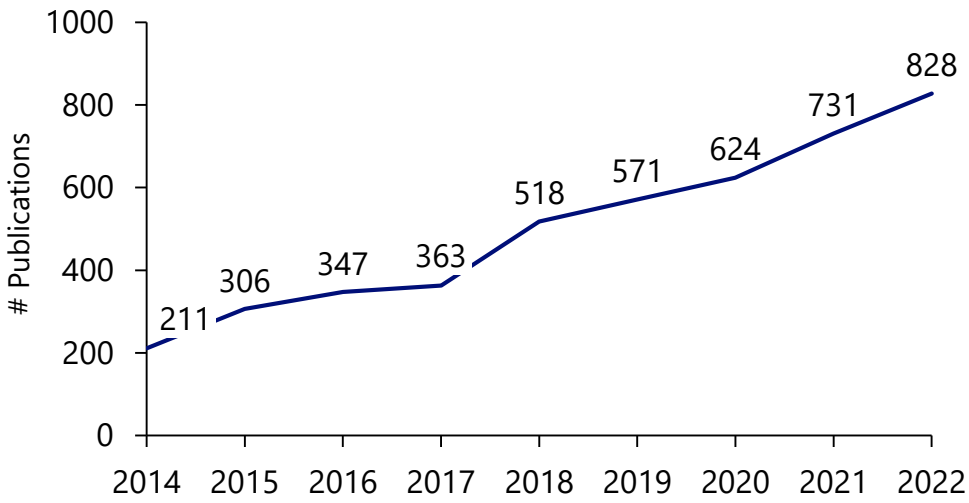
   Balakrishnan, P.G., Ramesh, R., Prem Kumar, T. — 2006
   Journal of Power Sources 155(2), pp. 401-414 — 926

Source : Scopus

Brainwave research has focused on epilepsy although other areas are also emerging. AIIMS, Jadavpur University, PGIMER, etc. are the leading institutions

- The keywords "electroencephalogram", "brainwave", "brain wave", "eeg", "electroencephalography", "brain computer interface" were shortlisted after searching topic of interest ("brainwave") in the Scopus database and selecting all top keywords related to brainwave
- The keywords "epilepsy", "seizure" was excluded from the search results to be relevant to the search topic as epilepsy and seizure was the most common research topic using the above keywords

Key Statistics



Brainwave research in India is a growing field that encompasses various aspects of neuroscience, cognitive psychology, and artificial intelligence. Recently, brainwave research in India has been extended to clinical applications, like studying effects of meditation, developing new therapies for neurological disorders

Key Institutions*

1. All India Institute of Medical Sciences, New Delhi
2. National Institute of Mental Health and Neuro Sciences
3. Jadavpur University
4. Indian Institute of Technology, Kharagpur
5. Indian Institute of Science
6. Postgraduate Institute of Medical Education & Research
7. Indian Institute of Technology Madras
8. National Institute of Technology Raipur
9. Pandit Dwarka Prasad Mishra Indian Institute of Information Technology, Design & Manufacturing Jabalpur
10. Vellore Institute of Technology

*Institutions with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

The researchers in brainwave come from various universities like Jadavpur University, IITs, IIITs, Amity University, TCS Research, BIT Mesra, etc.

Researchers with Highest publications*

Konar, Amit
Jadavpur University
Motor Imagery; BCI; Electroencephalogram
Near-Infrared Spectroscopy; Diffuse Optical Tomography; Brain Computer Interface

Sinha, Rakesh Kumarala
Birla Institute of Technology, Mesra
Motor Imagery; BCI; Electroencephalogram

Pachori, Ram Bilas
Indian Institute of Technology, Indore
Support Vector Machine; Seizures; Bonn
Motor Imagery; BCI; Electroencephalogram

Khasnobish, Anwesha
TCS Research, Kolkata
Motor Imagery; BCI; Electroencephalogram
Muscle; Neural Control; Factorization Method

Bajaj, Varun
IIIT DM, Jabalpur
Support Vector Machine; Seizures; Bonn
Support Vector Machine; Electroencephalography; BCI

Kumar, Velayudhan Mohan
SCTIMST
Positive End Expiratory Pressure; (...); Adherence
Sleep Apnea Syndromes; Sleep; (...)

Tibarewala, Dewaki Nandan
Jadavpur University
Motor Imagery; BCI; Electroencephalogram
Support Vector Machine; Seizures; Bonn

Mallick, Birendra Nath
Amity University, Noida
REM Sleep; Rapid Eye Movement State; Slow Wave Sleep

Routray, Aurobinda
Indian Institute of Technology, Kharagpur
EEG; Independent Component Analysis; Support Vector Machine; Electroencephalography; BCI

Goyal, Nishant
Central Institute of Psychiatry, Ranchi
Electroencephalogram; Imitation; Action Understanding
Electroencephalography; (...) ; Involutional Depression

Note : BCI- Brain Computer Interface; SCTIMST- Sree Chitra Tirunal Institute for Medical Sciences and Technology
Source : Scopus *Researchers with highest no. of relevant documents as per searched keyword as on Feb 2023

The top research papers on brainwave focused on diagnosing neurological disorders using EEG

1. Real-time fMRI neurofeedback: Progress and challenges

   Sulzer, J., Haller, S., Scharnowski, F., (...), Seifritz, E., Sitaram, R.
   NeuroImage 76, pp. 386-399
   2013
   307

2. Automated EEG-based screening of depression using deep convolutional neural network

   Acharya, U.R., Oh, S.L., Hagiwara, Y., (...), Adeli, H., Subha, D.P.
   Computer Methods and Programs in Biomedicine 161, pp. 103-113
   2018
   301

3. A new interpretation of nonlinear energy operator and its efficacy in spike detection

   Mukhopadhyay, S., Ray, G.C.
   IEEE Transactions on Biomedical Engineering 45(2), pp. 180-187
   1998
   296

4. A comparative study of wavelet families for EEG signal classification

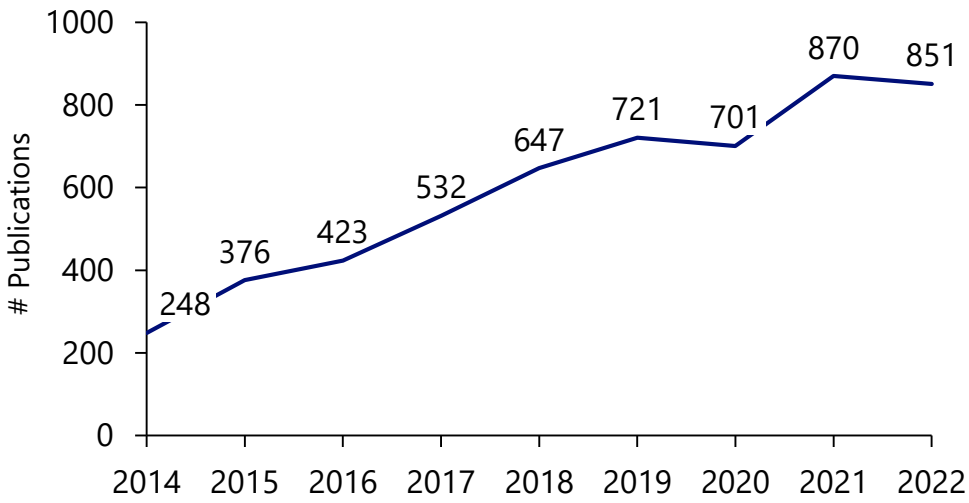
   Gandhi, T., Panigrahi, B.K., Anand, S.
   Neurocomputing 74(17), pp. 3051-3057
   2011
   241

Source : Scopus

Research on robotics is mainly limited to institutes of national importance (IITs, NITs, IISc, etc.), VIT is the only key institute in top 10

- The keyword “robotics” has been used in the Scopus database
- Due to limited work in the field, all related keywords were captured in “robotics” keyword

Key Statistics



India's robotics research community is making significant contributions to the field, and there is a growing focus on developing advanced robotic systems for a wide range of applications

Key Institutions*

1. Indian Institute of Technology, Madras
2. Indian Institute of Technology, Kanpur
3. Indian Institute of Technology, Delhi
4. International Institute of Information Technology, Hyderabad
5. Indian Institute of Science
6. Indian Institute of Technology Bombay
7. All India Institute of Medical Sciences, New Delhi
8. Indian Institute of Technology Kharagpur
9. National Institute of Technology Rourkela
10. Vellore Institute of Technology

*Institutions with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

Researchers in the field have focus in cognitive robotics, control system, mobile robotics and mechatronics among others

Researchers with Highest publications*

Krishna, K. Madhava
International Inst. of Information Tech., Hyderabad
Mobile robotics, robotic vision, outdoor robotics, multi-robotic systems and mechanism design

Biswal, B.B.
National Institute of Technology, Rourkela
Robotics, FMS, CNC, Computer Integrated Manufacturing, Rapid Product Manufacturing

Saha, S.K.
Indian Institute of Technology, Delhi
Multibody Dynamics, Robotics, Design, Mechatronics.

Behera, L.
Indian Institute of Technology, Mandi
Intelligent Systems & Control, Cognitive Robotics, Nano-robotics, Vision Based Control

Thondiyath, A.
Indian Institute of Technology, Madras
Robotics underwater robots, mobile robots & medical robots, Electro hydraulic Controls

Majumder, S.
CSIR-Central Mechanical Engineering Research Inst.
Robotics; Cognitive Robotics, Micromanipulation

Dutta, Ashish
Indian Institute of Technology, Kanpur
Robotics, Intelligent Control Systems, Microsensors and Actuators, Bio-Robotics

Bhaumik, Subhasis
Indian Inst. of Engineering Science & Tech., Shibpur
Mechatronics, robotics, mobile robotics, orthotic & prosthetic devices, smart material & micro gripper

Kala, Rahul
Indian Institute of Information Tech., Allahabad
Mission Planning for Mobile Robots, Robot Motion Planning, Intelligent Vehicles Transportation Sys.

Megalingam, Rajesh Kannan
Amrita University, Amritapuri Campus, Kollam
Design For Manufacturing, Embedded Systems, Low Power VLSI

*Researchers with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

Theme of the highly cited work in robotics is around it's use in healthcare, medical devices and automated hardware

1. Recommendations for laparoscopic liver resection: A report from second international consensus conference
   - Wakabayashi, G., Cherqui, D., Geller, D.A., (...), Barkun, J., Strasberg, S.M.
   - *Annals of Surgery, 261(4), pp. 619-629*
   - 2015
   - 886

2. Dynamic analysis of flexible manipulators, a literature review
   - Dwivedy, S.K., Eberhard, P.
   - *Mechanism and Machine Theory, 41(7), pp. 749-777*
   - 2006
   - 777

3. Artificial neural networks in hardware: A survey of two decades of progress
   - Misra, J., Saha, I.
   - *Neurocomputing, 74(1-3), pp. 239-255*
   - 2010
   - 467

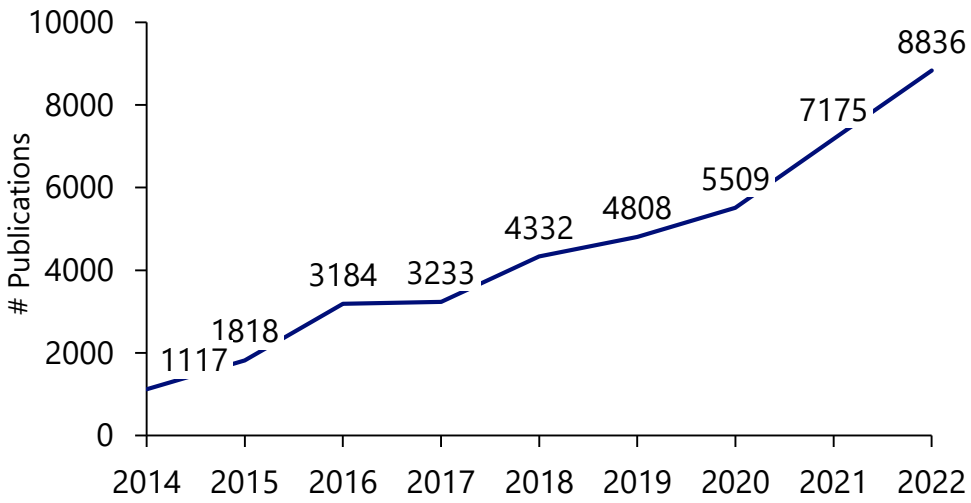
4. Extended-state-observer-based control of flexible-joint system with experimental validation
   - Talole, S.E., Kolhe, J.P., Phadke, S.B.
   - *IEEE Transactions on Industrial Electronics, 57(4),5210149, pp. 1411-1419*
   - 2010
   - 413

Source : Scopus

Research on AI and IoT has been growing fast since 2016, key research institutions include private, deemed to be and institutes of national importance

- The keywords "artificial intelligence" & "internet of things" were shortlisted after searching the topic of interest ("AI" & "IoT") in the Scopus database and selecting the related keywords

Key Statistics



AI and IoT research in India is driving innovation and growth across sectors, mainly healthcare, agriculture, manufacturing and education. It has high potential to make significant contributions to India's economy and society

Key Institutions*

1. Vellore Institute of Technology
2. Amity University
3. Anna University
4. SRM Institute of Science and Technology
5. Indian Institute of Technology, Kharagpur
6. Jadavpur University
7. Indian Institute of Technology, Delhi
8. K L Deemed to be University
9. Thapar Institute of Engineering & Technology
10. Lovely Professional University

*Institutions with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

Researchers in the field have focus in computer science, sensor network, soft computing, network security

Researchers with Highest publications*

Kumar, Neeraj
Shri Ramswaroop Memorial University, Barabanki
Computer Science Theory and Methods

Misra, Sudip
Indian Institute of Technology Kharagpur
Ad Hoc & Sensor Networks, Nano-Networks, Computer Networks, Cloud Networking.

Tanwar, Sudeep
Institute of Technology, Nirma University
Network Security, Wireless Sensor Networks , Data Communication, Blockchain Technology

Kumar Das, Ashok
International Inst. of Information Tech., Hyderabad
Cryptography, system & network security, security in smart grid, Internet of Things (IoT), Internet of Drones

Choudhury, Tanupriya
University of Petroleum and Energy Studies
Data Mining, Business Analytics, Soft Computing, Human Computer Interaction, Machine Learning

Gupta, B B
National Institute of Technology, Kurukshetra
Computer Science Artificial Intelligence

Sangaiah, Arun Kumar
Vellore Institute of Technology
Computational Intelligence, Internet of Things, Cognitive Computing

Kumari, Saru
Siksha O Anusandhan
CdS; Hydrogen Production; Photocatalyst Catalyst; Cobalt Phosphide; Water Splitting

Sood, Sandeep K.
National Institute of Technology, Kurukshetra
Network Security, Internet of Things, Sensor Networks

Gupta, D
Maharaja Agrasen Institute of Technology,
Human-Computer Interaction, Intelligent Data Analysis, Nature-Inspired Computing, ML

*Researchers with highest no. of relevant documents as per the searched keyword as on Feb 2023
Source : Scopus

Themes of highly cited papers revolve around ML, deep learning and algorithms; Research paper on IoT by Sethi, P., Sarangi, S.R. is one of the recent & highly cited,

1. Twin support vector machines for pattern classification
   - Jayadeva, Khemchandani, R., Chandra, S.
   - *IEEE Transactions on Pattern Analysis and Machine Intelligence, 29(5), pp. 905-910*
   - 2007
   - 1198

2. Internet of things: Applications and challenges in technology and standardization
   - Bandyopadhyay, D., Sen, J.
   - *Wireless Personal Communications, 58(1), pp. 49-69*
   - 2011
   - 1023

3. Internet of Things: Architectures, Protocols, and Applications
   - Sethi, P., Sarangi, S.R.
   - *Journal of Electrical and Computer Engineering, 2017,9324035*
   - 2017
   - 877

4. A survey on opinion mining and sentiment analysis: Tasks, approaches and applications
   - Ravi, K., Ravi, V.
   - *Knowledge-Based Systems, 89, pp. 14-46*
   - 2015
   - 854

Source : Scopus

Contents

Appendix | Database Introduction & Recommendation

Key terminologies

Terminology	Description
Researcher indices	• Measure contributions made by a researcher to their field of research • Includes citations, h-index, i10 index, etc.
ORCID ID	• Persistent unique digital identifier • Can be connected with professional information (affiliations, grants, publications, peer review, etc.)
Scopus ID	• Identifier used by Scopus Database • Can be linked to ORCID to import publications at both databases
Researcher ID	• Identifier introduced by Thomson Reuters Corporation • Consolidates multiple research profiles into an individual webpage
Google Scholar ID	• Unique identifier for researchers associated with Google Scholar profile
Academia ID	• Unique identifier for researchers associated with Academia (social platform for academics to share research publications)
Altmetrics	• Metrics and qualitative data complementary to traditional, citation-based metrics • Includes mentions on Wikipedia & policy documents, research blogs, media, social networks, etc.
Co author network	• Social networks reflect collaboration among researchers and are represented by nodes in network

Appendix | Database Introduction & Recommendation

Key Terminologies

Terminology	Description
Contact	• Ease of contacting a researcher via the database (availability institute details, etc.)
Publication	• Availability of researcher publications data
Patents	• Availability of researcher patent data (list, etc.)
Researcher Indices	• The number of indices captured by a database (higher the number of indices faster the updates)
Custom Search	• Customisation while searching a researcher (searching by name, expertise area, institute, etc.)
Filter by country	• Selection of researchers based on country
IDs linked	• Number of researcher IDs linked to a database
Differentiator	• Value addition unique to the database

ORCID public data file & public API can be used to access public data while member API could be used to access data restricted to trusted parties

Researcher Data available in ORCID registry

Personal Details		
Other Names	Biography	Researcher URLs
E-mail addresses	Address	Keywords
External Identifiers		

Research-related Details		
Distinction	Education	Employment
Invited Position	Membership	Qualification
Service	Funding	Peer Reviews
Works	Research Resources	

Source : ORCID

ORCID public data file & API can be used to access public data while member API can be used to access data restricted to trusted parties

1. Researchers in ORCID can choose to keep their information public, restricted to trusted parties or private
2. >80% of the data is public
3. These data can be accessed through:
    - Public Data file: contains all publicly available information and can be downloaded and accessed by anyone
    - Public API: available to all organizations and can be used to access publicly available information
    - Member API: available to member organizations. It can be used to access
        - Public data
        - Data restricted to trusted parties (subject to permissions granted by researchers)

Appendix | Database guide

Organisation Type (1/2)

Organisation Type	Description
Central University	• A university established or incorporated by a Central Act • Funds are allocated by the Ministry of Education through UGC
Central Govt. Institute/ Centrally Funded Institute	• National institutes or central institutes are institutes established and funded by the Government of India • It also includes the Institutes of National Importance
Centrally Funded Technical Institute	• Institutions providing technical education and are funded by the Central Govt. • There are 121 CFTIs in the country including 23 IITs, 20 IIMs, 31 NITs
College	• Institutes providing higher education, but not granting a degree on its own • Usually affiliated to a University to award degrees
Deemed University	• Institutions working with high standard in specific area of study, are sometimes declared as 'Deemed-to-be-university' by Central Govt. They enjoy privileges of a university; can be Govt. (central/state) or Govt. aided OR private
Deemed University-Government	• Deemed universities that are run and funded by the Govt. (Central/state)
Deemed University-Government aided	• Deemed universities that are run and , funded by private organisations, but also receive aid from the Govt.
Deemed University-Private	• Deemed universities that are run and funded by private organisations
Institute Under State Legislature Act	• An Institution established or incorporated by a State Legislature Act

Source : VIDWAN

Appendix | Database guide

Organisation Type (2/2)

Organisation Type	Description
Institutions of National Importance/ National Importance Institute	• Institutions of National Importance are university-level institutions that are established or designated by Acts of Parliament and funded by the Central Government
Inter-University Centres of UGC	• Autonomous centers setup by the UGC to provide common facilities for research, and for various services and programmes to the universities
Management Institute	• Institutes providing management education
Medical Institute	• Institutes providing medical education
Research & Development/ Research Institute	• Do not grant degree nor are affiliated to a degree granting university • Engaged in pure or applied research across areas
State Agricultural University (SAU)	• Autonomous organizations with state-wide responsibility for agricultural research, education and training or extension education. Primarily funded by state governments, but also get regular grants from the ICAR
State Private University	• Established through a central/state act • Run by a sponsoring body viz. A Society, or a Public Trust or a Company
State/ State Public University	• A university established or incorporated by a Provincial Act or by a State Act. • Run and primarily funded by state government of each of the state & union territories of India
Technical Institute	• Institutes providing technical education, cover programmes in engineering, technology, management, architecture, town planning, pharmacy, applied arts & crafts, hotel management and catering technology

Source : VIDWAN

Databases Introduction & Recommendation | Database preview: VIDWAN

Homepage: VIDWAN - Search page

Search results page

A

- Input: Researcher Expertise/ Affiliation

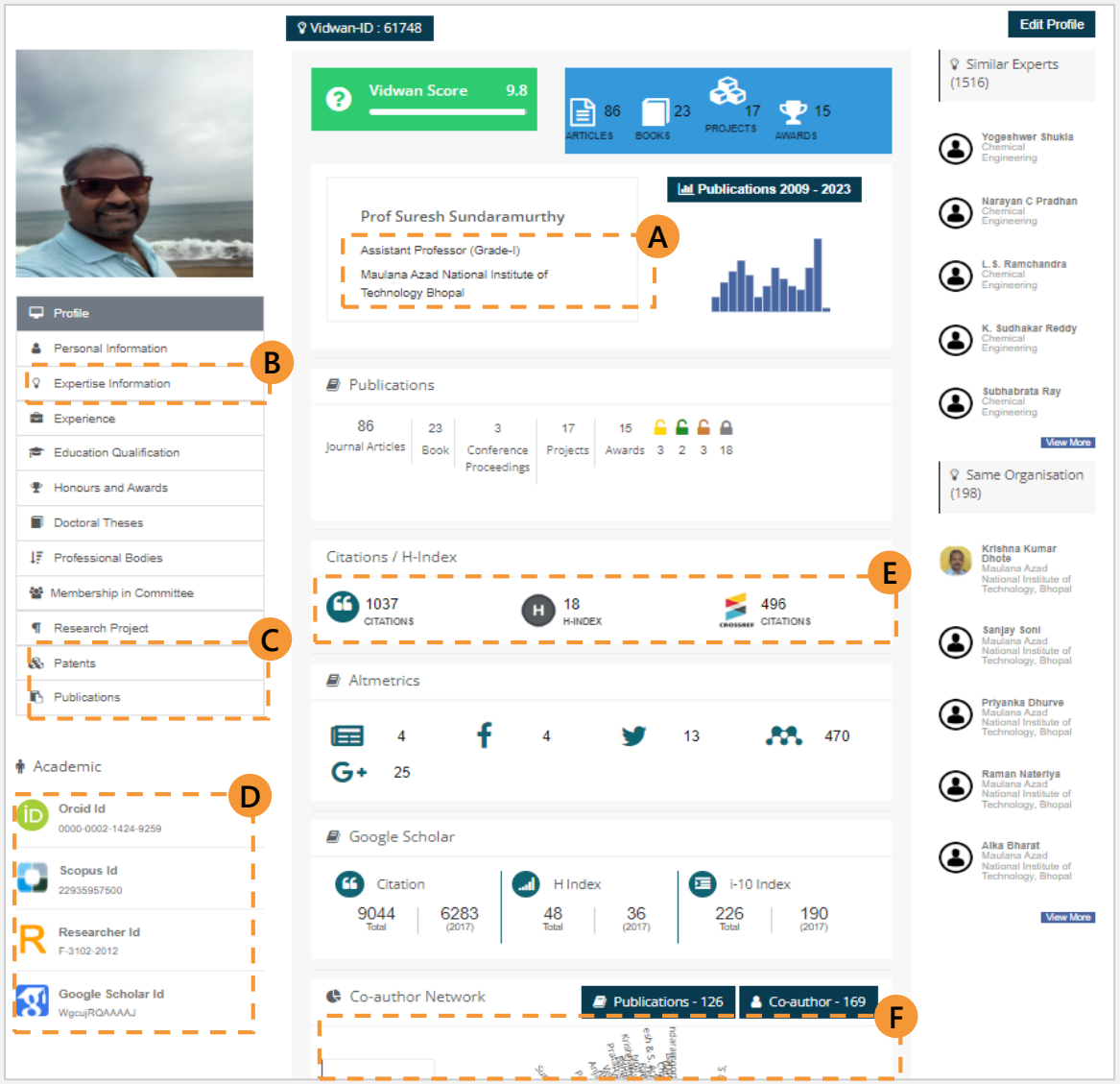
B

- Output: Researcher profiles
  - Expertise
  - Affiliation

URL: https://vidwan.inflibnet.ac.in/searchc/search

Databases Introduction & Recommendation | Database preview: VIDWAN

Homepage: VIDWAN - Researcher Profile page



Profile page

A
- Affiliation

B
- Expertise

C
- Research projects
- Patents, Publications

D
- Researcher IDs

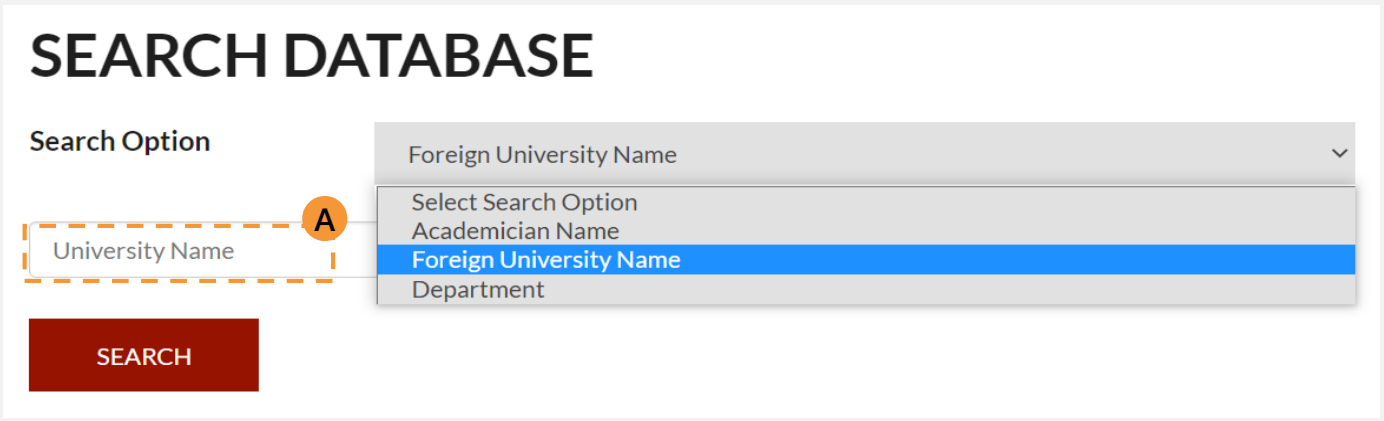
E
- Citations
- h-index, i-10 index

F
- Co-author network

URL: https://vidwan.inflibnet.ac.in/searchc/search

Databases Introduction & Recommendation | Database preview: VIDWAN

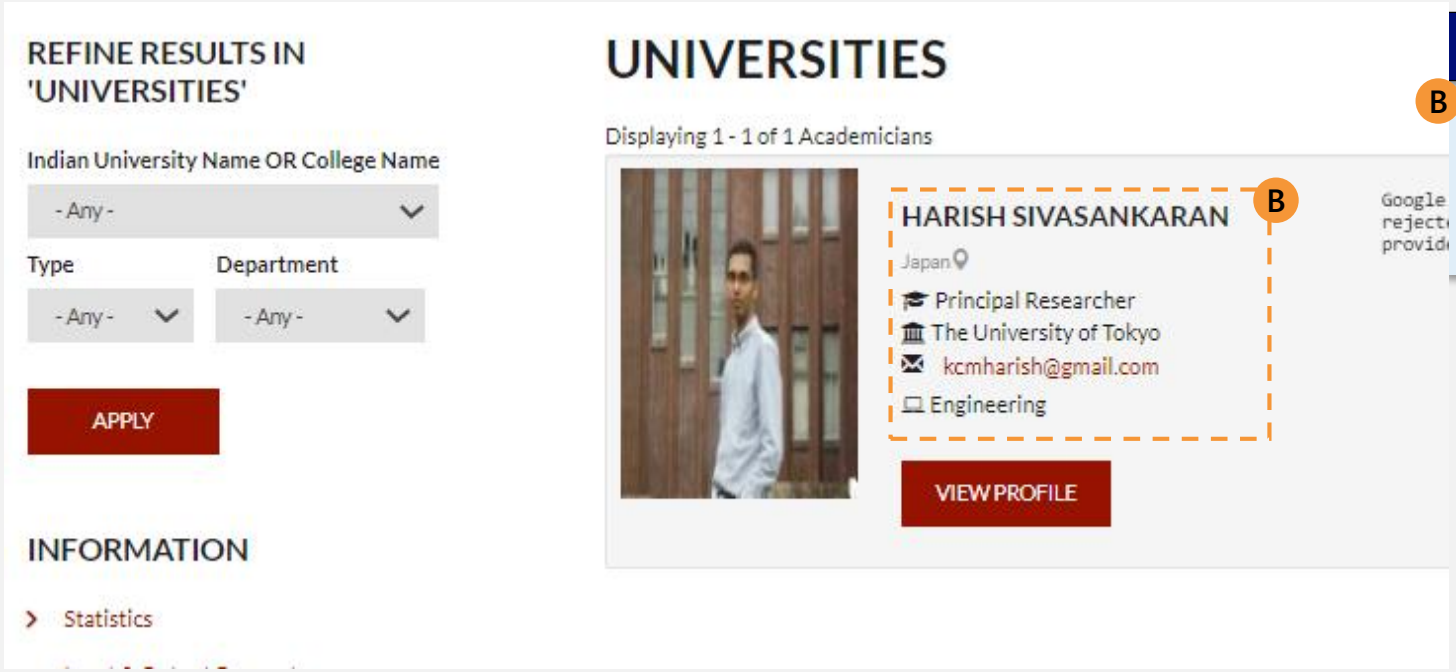
Homepage: NSTMIS - Indian Origin Academicians



Search page

A

- Input: Researcher name/ University/ Department



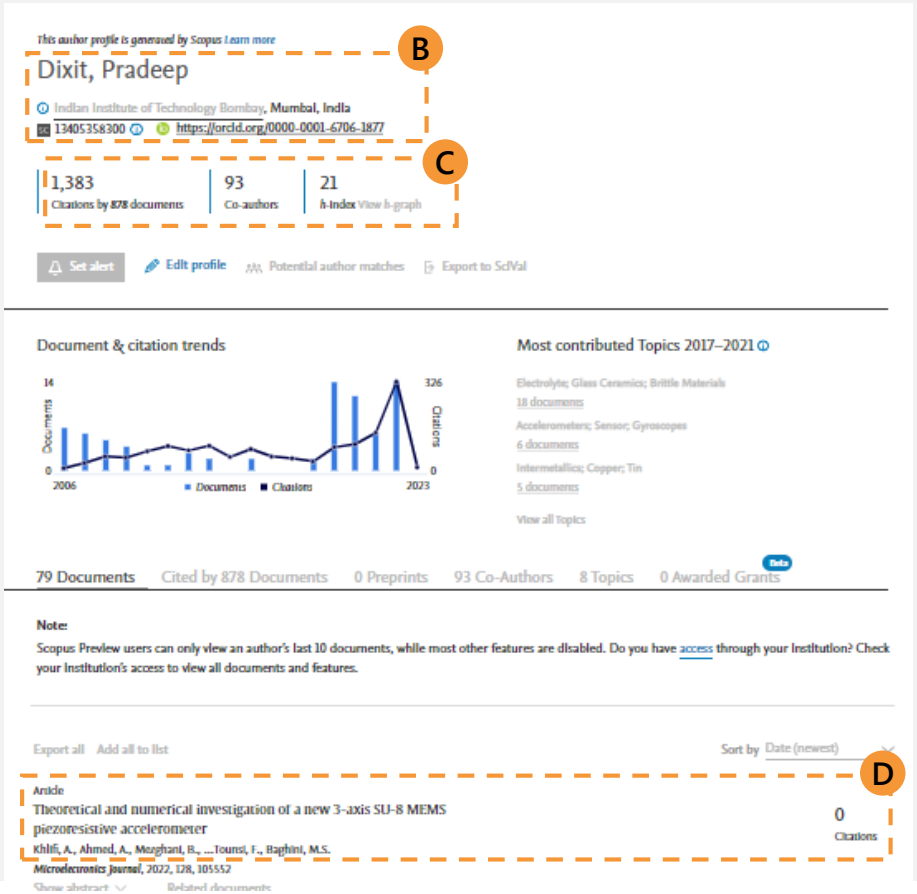
Search results page

B

- Researcher name
- Affiliation
- E-mail ID
- Expertise

URL: http://www.nstmis-dst.org/

Homepage: Scopus (without subscription login)



Search page

A
- Input: Researcher name/ Affiliation
- Output: Researcher profiles

Profile page

B
- Researcher name
- Affiliation
- Scopus ID, ORCID

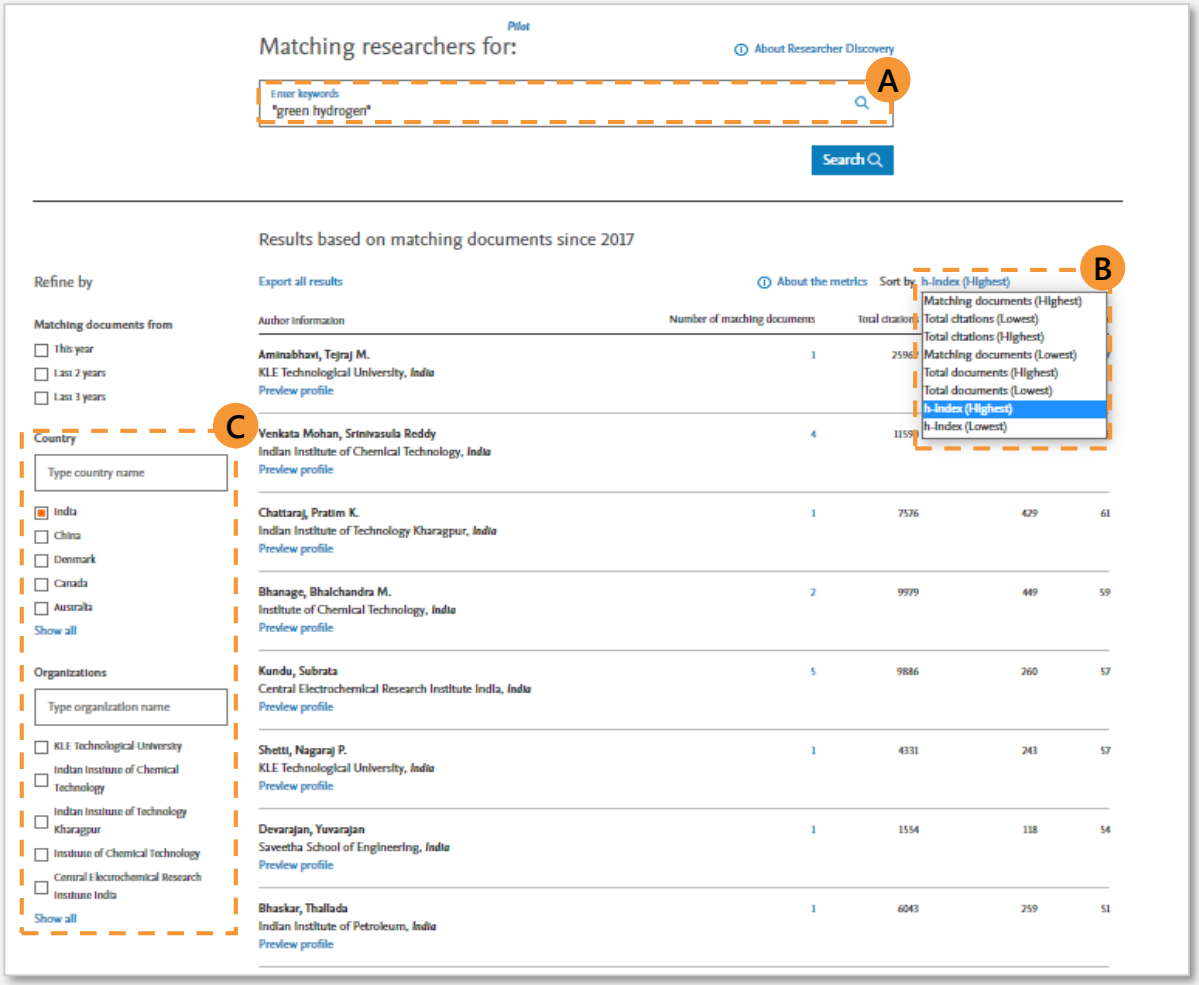
C
- Citations
- h-index

D
- Publications
- Patents

URL: Scopus Author Search

Homepage: Scopus (with subscription login)

- Scopus Researcher Discovery Pilot allows to search researchers by expertise, sort them by some metrics, & filter by country and institution

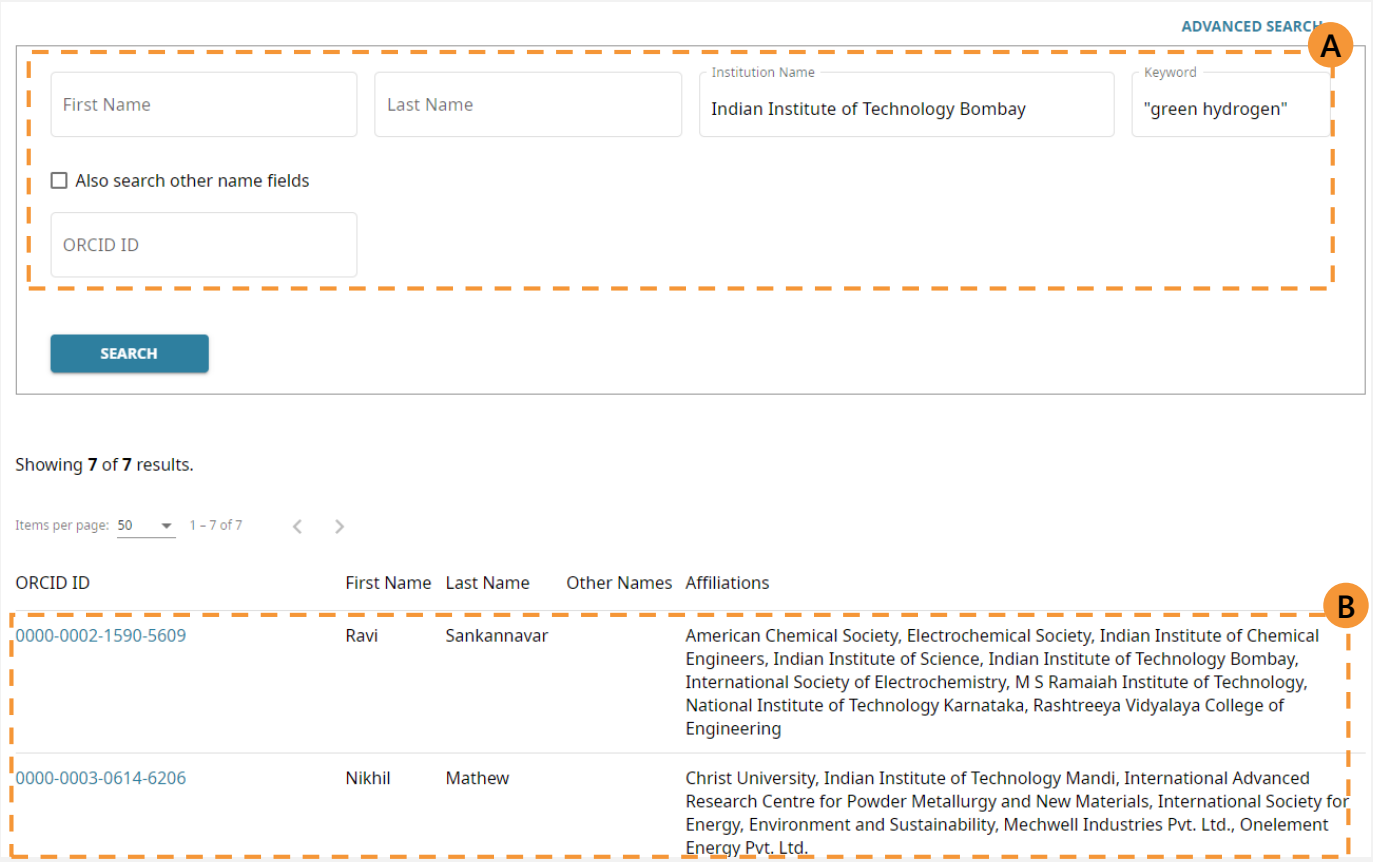


A
Search Researchers by expertise
keywords are matched against title, abstract, and journal name of articles

B
Sort Researchers by
- h-index
- Total citation
- Total documents
- Matching documents

C
Filter Researchers by
- Country
- Organization

Homepage: ORCID - Search page



Search results page

A

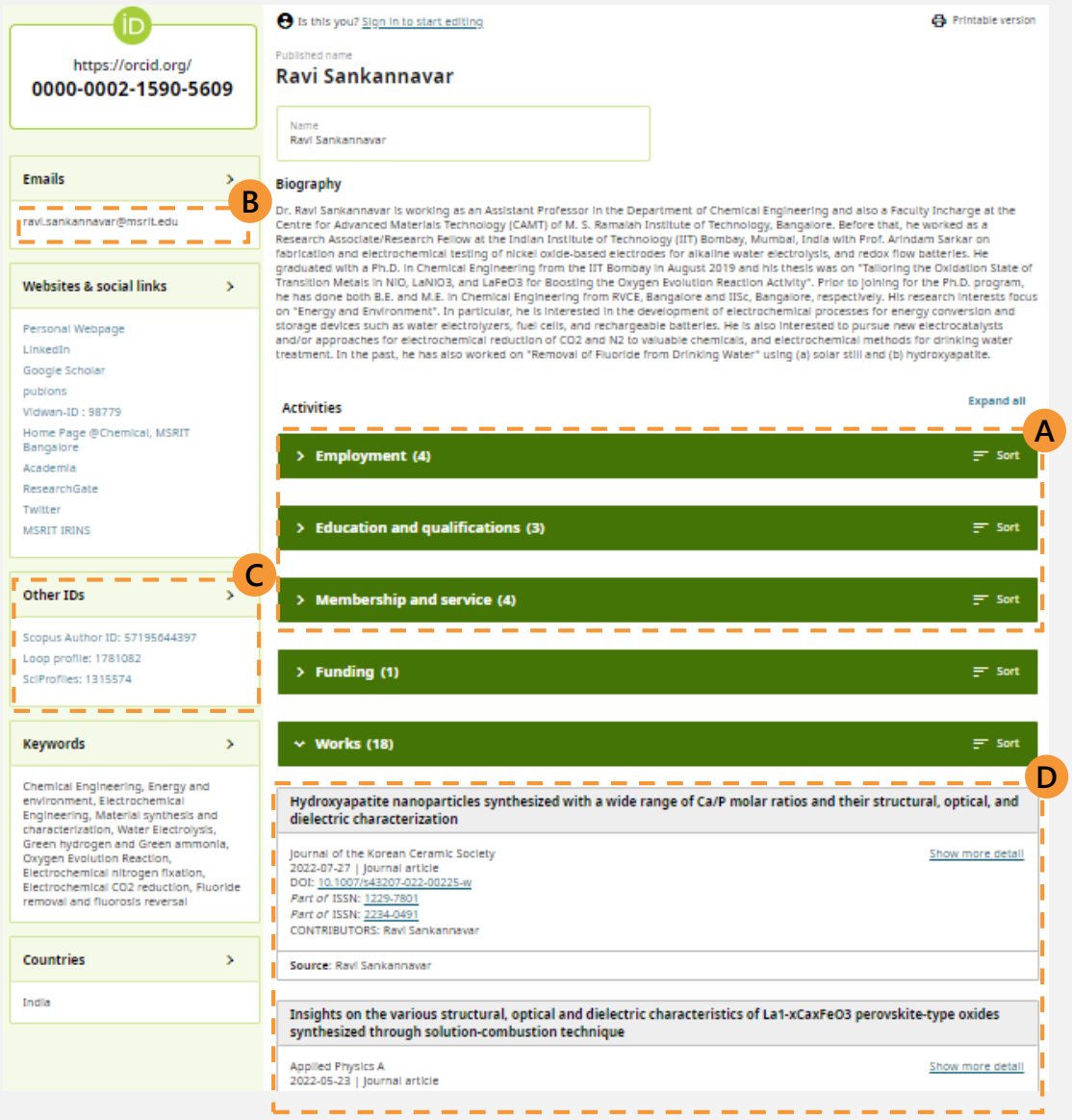
- Input: Researcher Affiliation/Expertise

B

- Output: Researcher profiles

URL: https://orcid.org/orcid-search/search

Homepage: ORCID - Researcher Profile page



Profile page

A
- Affiliation

B
- E-mail ID

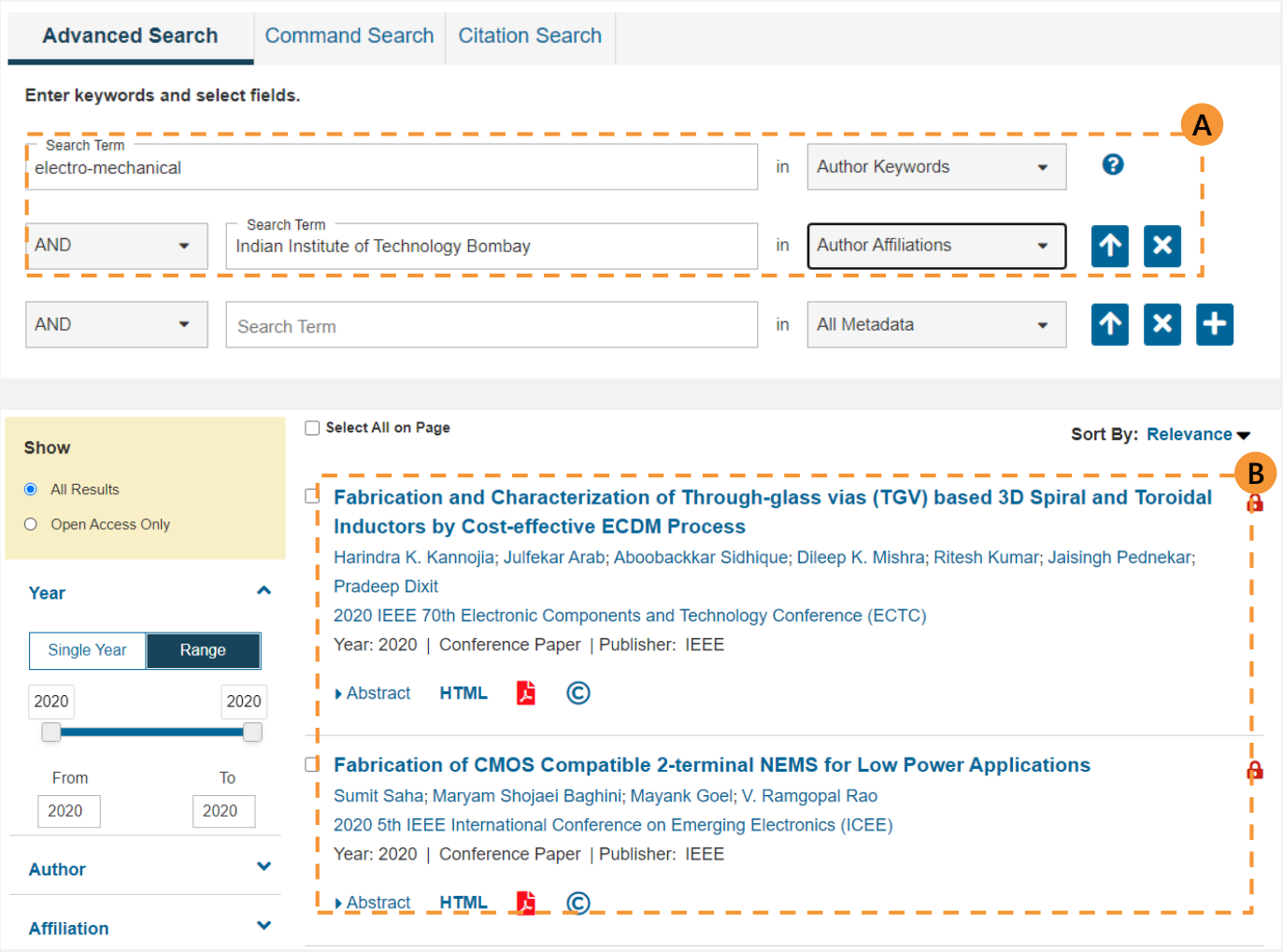
C
- Researcher IDs

D
- Publications
- Patents

URL: https://orcid.org/orcid-search/search

Databases Introduction & Recommendation | Database preview: IEEE Explore

Homepage: IEEE Explore - Search & Search Results page



Search page

A

- Input: Researcher Expertise/ Affiliation

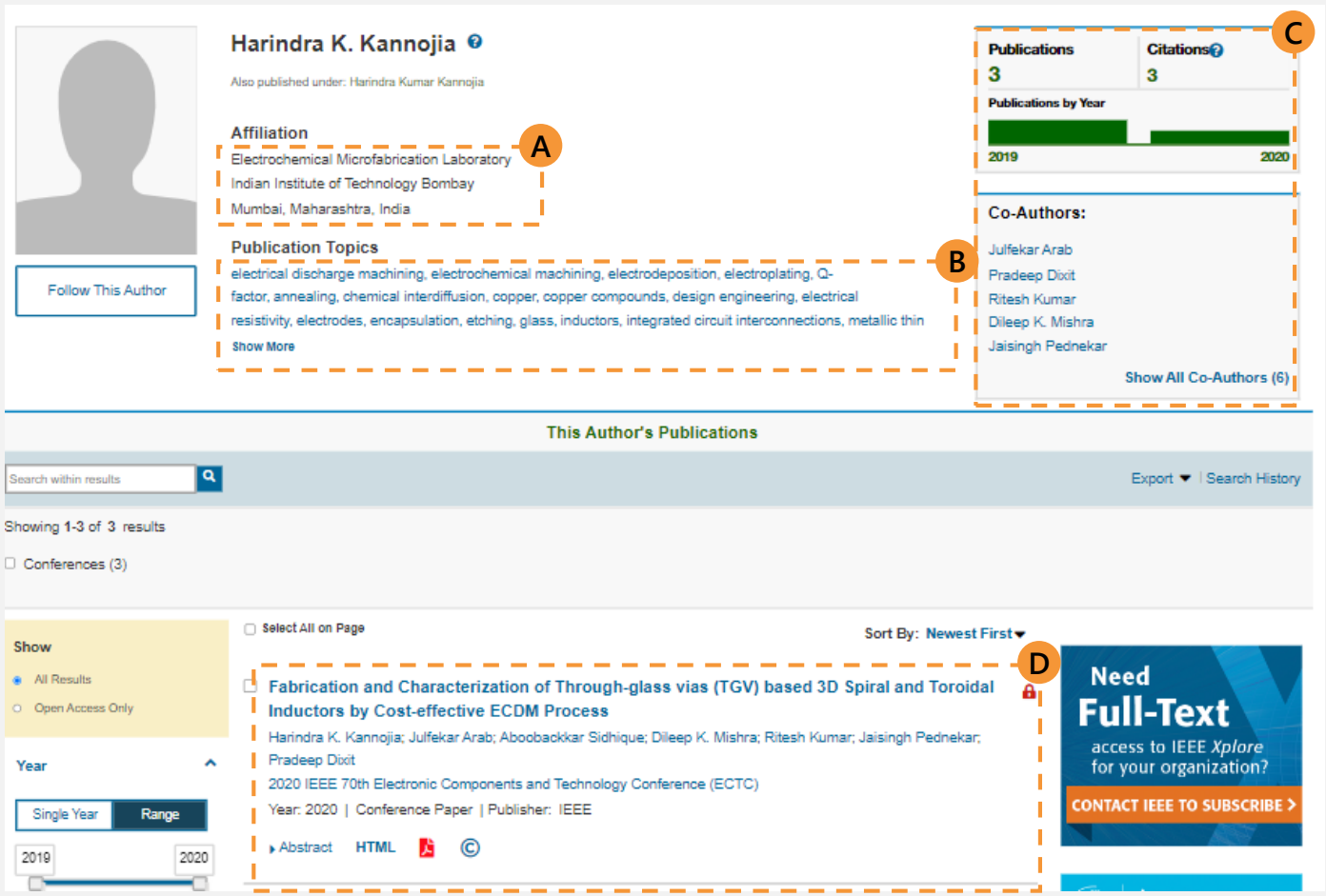
Search Result page

B

- Output: Researcher publications

URL: https://ieeexplore.ieee.org/search/advanced

Homepage: IEEE Explore - Researcher Profile page



Search page

A

- Researcher Affiliation

B

- Researcher Expertise

C

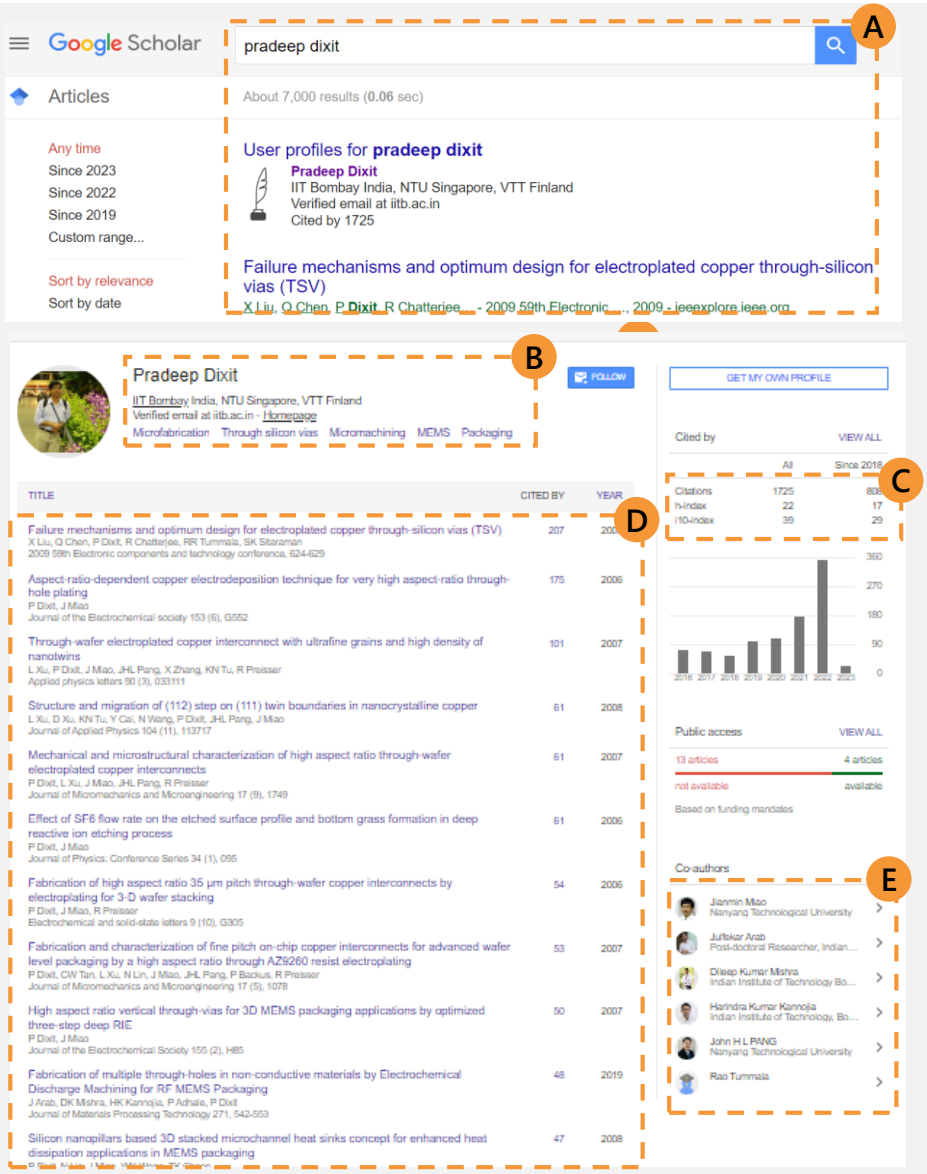
- Co Authors
- Citations

D

- Researcher Publications

URL: https://ieeexplore.ieee.org/search/advanced

Homepage: Google Scholar



Search results page

A

- Input: Researcher name
- Output: Researcher profiles and publications

Profile page

B

- Researcher name
- Affiliation
- Expertise

C

- Citations
- H index
- i-10 index

D

- Publications
- Patents

E

- Key Co-author names

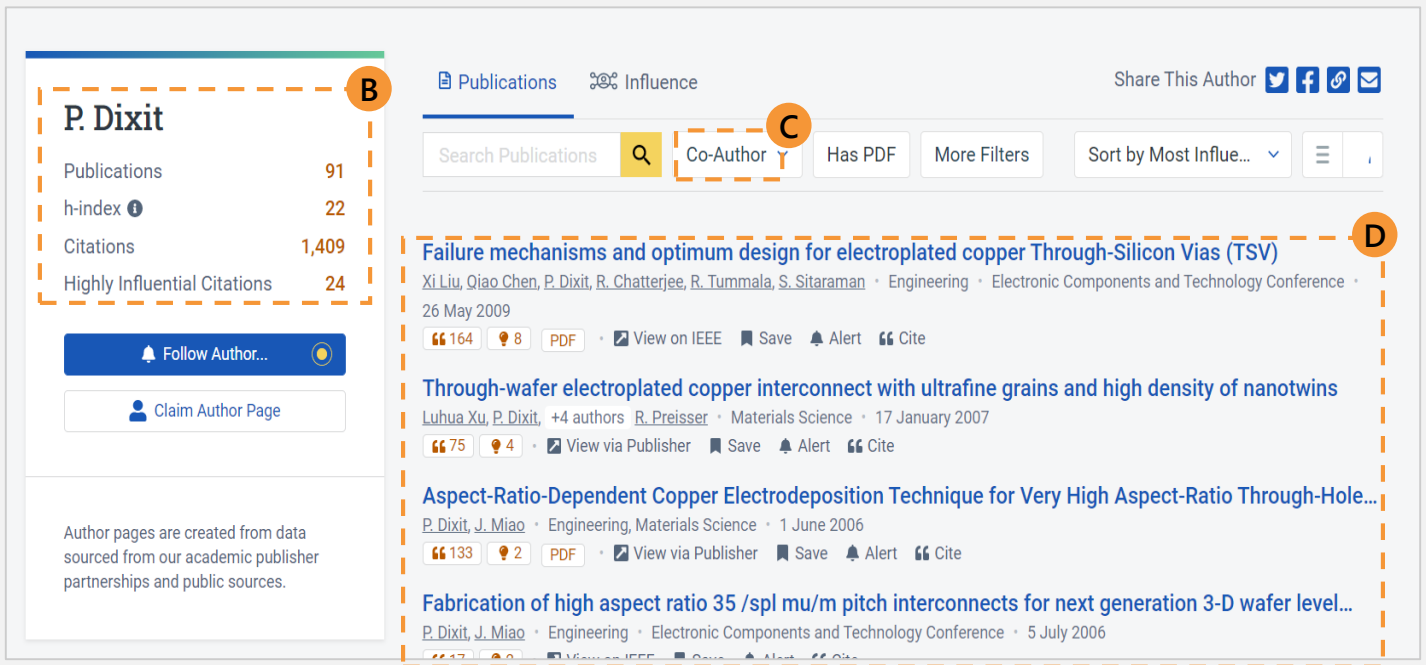
URL: https://scholar.google.com/

Databases Introduction & Recommendation | Database preview: Semantic Scholar

Homepage: Semantic Scholar

Search results page

A
- Input: Researcher name
- Output: Researcher profiles (with expertise) and publications



Profile page

B
- Researcher name
- h-index
- i-10 index

C
- Key Co-authors

D
- Publications

URL: https://www.semanticscholar.org/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