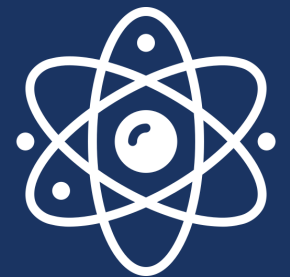


**EASE OF
DOING
SCIENCE
INDEX INDIA
2023**



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2023**



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1. Foreword

“Efforts of science can turn into great achievements only when they come out of the lab and reach the land, and their impact reaches from global to grassroots, when its ambit is from journal to jameen and when change is visible from research to real life”

**Hon’ble Prime Minister of India, Shri Narendra Modi
At the 108th Indian Science Congress¹**

India is on a cusp of achieving greater economic prosperity through its science and innovation landscape. With 40th rank at the Global Innovation Index (GII) 2022, one of the top three countries in terms of number of scientific publications and PhDs, size of higher education system as well as number of start-ups; the country is fast moving towards low-cost, high-efficiency indigenous scientific development and innovation.²

The Foundation for Advancing Science and Technology (FAST) India is on a mission to catalyse India’s journey to become a top 3 science and technology (S&T) Nation. We believe that exponential progress in our S&T capability is imperative for sustained economic and social development of the country. New S&T knowledge is the fountainhead that will propel our industry to becoming a leader rather than a follower, give us scientific tools to address our local problems and strengthen national security.

There are multiple metrics to measure our S&T output such as research papers, citations, institutions, companies in top research/innovation rankings and patent counts. Yet, to really measure if we are making S&T progress, we need to also be able to track how well the ‘S&T market’ - analogous to the business market, is set up and working. Similar to how ease of doing business is a key indicator of economic growth, we need a measure of how easy it is for scientists to create new knowledge and translate that knowledge into socio-economic goods.

¹PIB (2023), PM addresses 108th Indian Science Congress via video conferencing, available here: <https://pib.gov.in/PressReleasePage.aspx?PRID=1888228>

²Ministry of Science and Technology (2022), Year-End Review-2022: DST, available here: <https://pib.gov.in/PressReleasePage.aspx?PRID=1886841>

The Government of India has already laid down a foundation for developing an ‘Ease of Doing Science Index’ to ensure effective use of both disbursed funds (including flexibility of fund utilisation) and the researchers’ time through its Draft National Biotechnology Development Strategy 2020-25.³ In furtherance of the same, the Union Minister of Science and Technology Dr. Jitendra Singh released the new guidelines for ‘Ease of Doing Science: Towards less government, more governance’ on the Foundation Day of the Department of Biotechnology in March 2022.⁴ Along similar lines, FAST India is happy to methodically define an Ease of Doing Science (EoDS) index and present a first-of-its-kind survey report on EoDS for top research institutions in India for the first time.

FAST India’s EoDS survey attempts to ‘measure’ the efficiency of the current research environment as experienced by the science practitioners in top ranked institutions. The team has meticulously framed five areas of investigation, which span from ease of raising money, to ease of utilising the money, to ease of collaboration and commercialisation and availability of institutional resources. Other than getting ratings/measures on these parameters, the survey asks several diagnostic questions to understand why certain things are easy or hard for scientists to do. These provide a rank ordered list for government, policy makers and institutions, to focus their energy on problem areas and fix issues.

We were keen to benchmark how EoDS in India compares to foreign nations. We exploit the fact that multiple scientists in India have educational or work experience in foreign nations. We ask these scientists to rate EoDS in their previous geographical regions of work, to get a comparison with India. This helps all of us get some benchmarks on where our ecosystem must be and even have ambitions to surpass those of other countries.

This EoDS report has created a new set of data for everyone to have a fresh look at India’s S&T ecosystem. One may say that many things we find were already known – but now we have put a number to it, which we must all join forces to improve by interventions and continuous measurements. At the same time, people will find things which they did not expect and are surprising. Some of these could be low hanging areas to get quick wins. We, thus lean on all stakeholders, including the government, industry, institutions, non-profits, etc. to give this report a sincere read and use it in their policy making and programmatic interventions.

This is a first report of its kind and in its first edition. We welcome all feedback and criticism to make this better. For us, this is a conversation starter, and not the end of it. We plan to continuously measure EoDS year-on-year to track improvements and areas still lagging behind. Also, the scope of this report will be expanded in multiple ways, including, but not limited to, surveying PhD students, scientists in government labs, scientists in medical research, scientific staff, etc. Our questions and analysis shall also focus on asking deeper questions in problem areas for more objective input for stakeholders. There are also possibilities of having other nations looking at this format and accepting it. This can be a big win for India producing globally useful public goods, such as the success of Shanghai Ranking globally.

We will conclude with the expectation that EoDS can make a similar impact as other public data indices/reports such as ASER Report, National Employability Reports, EODB Reports and others.

We sign off with the expectation that EoDS will get added to the vocabulary and lexicon of policymakers, when they think of the India of our dreams. We cannot miss S&T.

Varun Aggarwal and Ashish Dhawan

³Department of Biotechnology, Government of India, Draft National Biotechnology Development Strategy 2020-25, available here <https://dbtindia.gov.in/sites/default/files/uploadfiles/Draft%20National%20Biotechnology%20Development%20Strategy%202020-25.pdf>

⁴Ease of Doing Science: Centre relaxes guidelines; makes it easier to access grants, available here: <https://newsonair.com/2022/03/03/ease-of-doing-science-centre-relaxes-guidelines-makes-it-easier-to-access-grants/>

2. Executive Summary

- ***Ease of utilising funds is rated lowest, with 58% scientists rating it below average. Ease of fundraising and commercialisation are the next two problem areas with 45-49% rating them below average.***

Overall, only 6% respondents on average rate any parameter as 'Very Good' for Indian EoDS. This is concerning since the ability to utilise funds for human resources, equipment and material etc. is a hygiene factor in comfortably doing cutting edge research. On the other hand, it is a positive signal that 52% of scientists find institutional support as good or very good. Ease of commercialisation, rated below average by 49% of the respondents, is critical to get the socio-economic benefits of research. Given the size of India's industry and startup ecosystem, there exists an opportunity to improve EoDS from both fundraising and commercialisation perspective.

- ***The composite EoDS Index value for top Indian research institutes is 57.6 on a 100 point scale, while EoDS for institutions in foreign nations by Indian scientists is rated as 80.0***

EoDS for India stands a little higher than average at 57.6. There is a gap of 22.4 points between EoDS in India as opposed to the EoDS perception of respondents for Foreign Nations. On average 77.2% scientists rate the foreign system good or very good, while only 30% do so for the Indian system. The largest gap between the Indian and foreign rating for EoDS is on the parameters ease of utilisation of funds (31 point gap) and commercialisation (22 point gap). The parameter with the lowest gap is ease of collaboration, with a 17 point gap. Given India's aspiration to be a top S&T Nation, the gaps between Indian and foreign EoDS parameters need to be bridged urgently.

- ***A large amount of scientific research is funded by government agencies.***

87% of respondents reported receiving some government funding for their research, with 62% of the respondents receiving more than half of their research funding from various government agencies. Amongst EoDS survey respondents, most common government funding agency for science research is Department of Science and Technology (DST) or Science and Engineering Research Board (SERB), a statutory body under the DST; followed by Department of Atomic Energy (DAE) and Department of Biotechnology (DBT) and Defence Research & Development Organisation (DRDO). Industry funding only counted as 7.3% of total funding obtained by the respondents. All stakeholders need to make efforts for the industry to get into long-term innovation and product developments; institutions to create trust that they can help industry and put structures to facilitate collaboration; and the government to provide incentives and programmatic support for collaboration.

- ***Early career researchers (ECRs) find utilising funds and getting institutional support much harder than experienced researchers.***

ECRs generally find doing most things related to science research harder than experienced researchers. They really struggle with utilising funds (gap of 16 points) and institutional support (gap of 25 points), as compared to experienced researchers. A plausible explanation could be that scientists better learn the processes and people dynamics with experience. Lack of training and lack of documentation of processes for ECRs could also contribute to this. We do not find much difference in experience of mid and late stage researchers, demonstrating that most of the learning of the ecosystem likely happens in the first five years of work experience. While the government has introduced interventions such as the iSTEM portal which aims to link researchers to resources, additional institutional level interventions may help in improving the experience of ECRs.⁵

- ***Ability to have international collaborators and connecting with industry stand out as problem areas.***

Being able to get international travel money, inviting, visiting or meeting foreign researchers stand out as consistently being rated low by scientists. It seems that money for international travel for scientists or their collaborators is hard to find and overregulated, wherever present. This is severely detrimental to research, as the nature of research has become more global, interdisciplinary and collaborative. One finds several highly cited papers have authors from multiple different countries. Similarly, being able to collaborate with the industry, finding grants for industry collaboration, finding support from industry, is rated among the lowest by scientists. This calls for more programs and institutional structures for making industry-academia partnership a grander success.

- ***Generally, factors associated with granting agencies were rated more difficult as compared to factors associated with academic institutes.***

Within ease of obtaining funds, the respondents were generally satisfied with the support provided by their institution for obtaining funds. However, the factors that are under the control of funding agencies, such as timeline for processing grants, availability of big money to conduct research, objectiveness of selection criteria, were rated below average. Similarly, for ease of utilisation of funds, funding for international travel as well as availability of equipment and resources were rated as lowest, while receiving grants on time and approvals for disbursement were rated close to average. Within ease of commercialisation, institutional assistance they received in identifying and applying for registration of intellectual property arising out of research was the easiest for respondents, whereas finding support to obtain funding from industry for their research was rated as the lowest ease aspect of commercialisation. This indicates that while respondents faced problems while negotiating and receiving grants from funding agencies, they believe that the general availability of institutional support at the top research institutions of India is good.

3. Recommendations

The EoDS report has multiple macro and micro insights regarding India's research ecosystem. It can serve as a guide book for policymakers and program executors, to improve the contribution of their domain to improve EoDS in India. Here, we provide some high level indicative ideas that come out of the study, however the potential interventions are much broader and deeper than those mentioned in this section.

- ***Catalyse funding beyond the government and promote research translation***

Currently, most funding for science research comes from the government in India. There are minor contributions from industry in the form of Corporate Social Responsibility (CSR) as well as international grants. Overall, in India the industry contribution to the Indian Gross Expenditure on Research and Development (GERD) is low, i.e. 37% of the GERD, while the government contributes to 63% of the GERD.⁶ This problem is connected to the lack of industry/startup-academia collaboration for translation of research. It is imperative to reboot and reinvigorate industry-academia relations to improve funding, collaboration and commercialisation of science research in India. The government also has a significant role to play to catalyse this change and has been attempting to incentivise industry-academia linkages.⁷ Such reforms need to be scaled up and promoted by stakeholders to have an impact on the science research outcomes.

- ***Make fundraising and spending money frictionless***

Governments can foster innovation in four basic ways: by funding it, by reducing its risk, by collaborating on it, and by using standards or regulations to encourage innovation.⁸ In India, the government is the largest contributor to research funding. There is a lack of transparency as well as unpredictability from the granting agencies with respect to obtaining funds that impact the overall EoDS index. Many respondents described issues relating to obtaining timely and adequate funding to be related with bureaucracy in releasing government grants for international travel and conferences. Both funding agencies as well as institutions impact the ease of utilisation of funds for researchers. There is an excessive burden on the researchers to justify their fund requirements to a precise degree. This leads to a problem of micromanagement of research funds that leads to lowering of EoDS. However, the government granting process needs to be de-bureaucratized for quick disbursements to improve ease of obtaining as well as utilisation of funds.⁹ Adoption of mechanisms such as digitisation, making processes paperless, transparency and introduction of process review and improvement are likely to improve the ease of fundraising and utilisation of funds by researchers.

- ***Attract and nurture high-quality talent***

The top Indian research institutes should adopt policies that promote hiring and retaining post-doctoral researchers and support staff. This may be achieved by a two pronged approach of making it easier for the existing staff to perform better through mentoring, streamlining of processes and introducing monetary and non-monetary incentives; as well as through new hiring for post-doctoral researchers, other academic and managerial staff. Secondly, there is a need for establishing an effective research management office/portal within academic institutions for streamlining research management, collaboration, fundraising, research outcomes as well as administrative functions.

⁶Industry and government contribution to GERD, available here Forbes, Naushad (2022), The Struggle and the Promise: Restoring India's Potential

⁷For instance, UGC Working Group report on Enabling and Enhancing University and Industry Linkages, available here: https://www.ugc.ac.in/pdfnews/7849807_University-Industry-linkages-report.pdf

⁸Ashok B. Boghani and Ronald S. Jonash, The Role of Government in Fostering Innovation, available here: https://www.adlittle.com/sites/default/files/prism/1993_q1_23-27.pdf

⁹Jayaraj (2022), The broken promise of Indian science, available here: <https://scroll.in/article/1025619/the-broken-promise-of-indian-science>

- ***Intervene to fix ecosystem issues and periodically measure.***

Indices such as the present EoDS index issued by FAST India provide an insight to the multi-layered problems that hamper the EoDS in India. All stakeholders must collaborate to work together to make interventions to improve EoDS and periodically measure improvement. While a single number has the disadvantage of hiding the important details, it does serve a useful purpose to see if there is improvement at an aggregate level or not - lest we improve one parameter at the expense of another. A periodic measurement of EoDS from practising scientists has the capacity to identify key pain areas and formulate policy measures to improve the same.

4. Introduction

“To recapture the spirit of innovation that can propel it to a global science and technology leader from net consumer to net producer of knowledge India should invest in educating its youth in science and mathematics, reform the way R&D is conducted, engage the private sector and the Indian diaspora, and take a more mission-driven approach in areas such as dark matter, genomics, energy storage, agriculture, and mathematics and cyber physical systems. Vigorous efforts to improve the “ease of doing business” need to be matched by similar ones to boost the “ease of doing science.”

The Economic Survey of India (2017-18)¹⁰

India’s economic development in its 75+ years of independence has made way for the country to aspire to be the net producer of knowledge and innovation from being a consumer. This comes with a deep understanding of the importance of developing scientific temper and its positive impact on modern, open and democratic societies such as India.¹¹ Perhaps with this understanding, a large number of higher education institutes (HEIs) in S&T were established in India soon after independence.¹² While the HEIs continue to be islands of S&T excellence within the country, the overall research ecosystem is struggling to keep up with the demands of current times. For instance, NITI Aayog had highlighted the issue of weak link between research, higher education, and the industry in India in its strategy document released in 2018.¹³

The massive talent pool available in India and its underlying culture of frugal innovation can prove to be assets in the journey to improve its capacity for innovation and consequently its economic growth.¹⁴ Improving EoDS will create an enabling environment for researchers to innovate, which can catapult India into a ‘scientific powerhouse’. India is home to the third largest scientific and technical manpower in the world.¹⁵ In academia, India has established an elite educational system producing well trained graduates from institutions of high eminence (such as the graduates from IITs, IIMs etc.), and is on its path to scale up the model of these institutions to the rest of the country. The country produces 27,84,150 S&T personnel in a year with 10,055 PhD degrees awarded in pure science subjects during 2017–18.¹⁶ It ranks eighth in the world in terms of the number of students graduating out of science and engineering streams, while being third in the world for number of PhDs (~25,000) awarded in Science and Engineering.¹⁷

The Organisation for Economic Co-operation and Development (OECD) development cooperation results framework that defines ‘results’ as the outputs, outcomes or impacts of interventions as set out in the results chain.¹⁸ These interventions called ‘inputs’ broadly include availability of adequate funding, infrastructure and resources to practise science research. The research ecosystem in India has challenges at each step of the EoDS process i.e. inputs, processes, outputs and outcomes. For instance, there are concerns over low spending on R&D in S&T as well as issues with disbursement of the funds at institutional and individual scientist level.¹⁹ General institutional delays in the procurement process due to complicated procurement

¹⁰The Economic Survey of India (2017-18), Volume 1, Chapter 8 here: https://www.domain-b.com/economy/ecosurvey2018/pdf/volume_1/20180129_chapter_08_Vol_01_2017-18.pdf

¹¹Article 51A(h) of the Constitution of India, 1950, introduced by way of its forty-second amendment in 1976, states that it shall be the duty of every citizen of India to develop scientific temper, humanism and spirit of inquiry and reform. You can access the Constitution of India here: <https://legislative.gov.in/constitution-of-india>

¹²Gopalakrishnan (1973), Higher education in post-independent India (1947-1970) : a critical evaluation in terms of selected criteria of effectiveness, available at: <https://scholarworks.montana.edu/xmlui/bitstream/handle/1/4352/31762100108149.pdf;sequence=1>

¹³Niti Aayog (2018), Strategy for New India @75, available at: https://www.niti.gov.in/sites/default/files/2019-01/Strategy_for_New_India_2.pdf.

¹⁴Katragadda and Bhardwaj (2016), Leveraging Talent Globally to Scale Indian Innovation, available at https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016-chapter12.pdf

¹⁵Ministry of External Affairs, Government of India (July, 2018) ‘India’s scientific prowess transforms lives globally’, Available at <https://indbiz.gov.in/indias-scientific-prowess-transforms-lives-globally/>

¹⁶Department of Science and Technology (2020), Research and development statistics 2019-20, available at https://dst.gov.in/sites/default/files/Research%20and%20Development%20Statistics%202019-20_0.pdf

¹⁷Ministry of External Affairs, Government of India (July, 2018) ‘India’s scientific prowess transforms lives globally’, available at <https://indbiz.gov.in/indias-scientific-prowess-transforms-lives-globally/> and Year End Review of Department of Science and Technology (December 2022), available at <https://pib.gov.in/PressReleasePage.aspx?PRID=1886528>

¹⁸OECD, Results in development cooperation (Website), available at <https://www.oecd.org/dac/results-development/what-are-results.htm>

¹⁹Please see, Lakhotia (2018), Research Fund Crunch, Real or Created, is Hitting India’s Academia on the Wrong Side, Indian National Science Academy, available at https://insa.nic.in/writereaddata/UploadedFiles/PINSA/PINSA_2018_Art69.pdf which claimed lack of government funding for research in S&T available in India, and coverage of the Indian government response to the claims here, Jayaraman and Priyadarshini (2018), Indian scientists concerned over funding crisis, The Nature, available at <https://www.nature.com/articles/nindia.2018.116>

5. Methodology and survey landscape

We wish to create an index which captures how easy it is to research in India, identifies enabling factors in the ecosystem as well as its challenges. A successful index must comprehensively capture all factors that help or prevent researchers successfully to do their job. These factors must be organised in some logical hierarchy to aid understanding and initiate possible interventions. One must be able to have some quantitative measure of these factors, which demonstrate variance and intelligibility.

We name the index Ease of Doing *Science*, whereas strictly speaking it is ease of doing *research*. We have made this decision since research uses the *scientific* process of getting to outcomes, be it research in sciences or engineering. The basis of any research is science and it needs scientific training into conducting experiments and considering what is evidence. We favour the word ‘science’ given that research is seldom understood by non-experts and ‘science’ is more accessible to the wider community of policymakers, intellectuals and industry.

There have been attempts by others to identify and document the challenges faced by researchers in India. For instance, Agashe et al (2022), undertook a national survey to understand the challenges faced by early career science researchers in India. They found that these young researchers face issues such as lack of job opportunities, unavailability and poor disbursement of research funding, problems in undertaking interdisciplinary research and having access to lab space.²⁵ Similarly, Mehta et al (2022) studied the effects of the COVID-19 pandemic on STEM research scientists who had up to 10 years of research experience.²⁶ They found that the pandemic impacted researchers’ mental health and productivity. The Office of the Principal Scientific Advisor of India had also initiated a survey titled ‘Empowering Young Scientists of India’ in October 2022, targeted at researchers younger than 45 years of age and attempting to measure the ease of doing research, career growth opportunities, opportunities for research, challenges at workplace, ecosystem for family support of young researchers / parents in research, promotion policy and capacity building.²⁷ The results of the survey are awaited at the time of writing this report.

In addition to surveys, literature also focuses on social and institutional challenges faced by researchers in India. Lack of both private and public sector funding on research and development is one of the major challenges to ease of doing science in India.²⁸ The government has been targeting increasing its contribution to the Gross domestic expenditure on R&D (GERD) as acknowledged in multiple policy documents such as the Science Technology and Innovation Policy 2013 as well as the 2020 Science Technology and Innovation Policy.^{29,30} In *Leading Science and Technology: India Next*, the author argues that the lack of financial autonomy for institutions means that they are not able to offer higher salaries to attract better teachers and researchers.³¹ Other issues in S&T research highlighted by the author include lack of collaborative, inter-disciplinary research and gaps in industry-academia linkages. In addition, there are also dual challenges of doing research as well as related administrative functions which act as barriers to ease of doing science in India.³² To our knowledge, there has been no broad-based quantitative index to measure EoDS in the ecosystem.

²⁵Career challenges for young independent researchers in India available at <https://inyas.in/wp-content/uploads/2022/02/0135.pdf>

²⁶Mehta et al (2022), Assessing the impact of COVID-19 on STEM (science, technology, engineering, mathematics) researchers in India, available at <https://wellcomeopenresearch.org/articles/7-157>

²⁷Office of Principal Scientific Advisor, <https://www.psa.gov.in/web/form/empowering-young-scientists>

²⁸Forbes, Naushad (2022), *The Struggle and the Promise: Restoring India’s potential*

²⁹Science, Technology and Innovation Policy, 2013, Department of Science and Technology, Govt, <http://dst.gov.in/sites/default/files/STI%20Policy%202013-English.pdf>

³⁰Science, Technology and Innovation Policy, 2020, Department of Science and Technology, Govt, https://dst.gov.in/sites/default/files/STIP_Doc_1.4_Dec2020.pdf

³¹DST Office Memorandum, August 2019, Available at: https://dst.gov.in/sites/default/files/OM-Scientific_Technical%20Manpower-Guidelines%20and%20emoluments.pdf; Indian Council of Medical Research (2016), Guidelines for recruitment of staff for short-term research projects, available at https://main.icmr.nic.in/sites/default/files/basic_page/Guidelines_for_recruitment.pdf

³²Awasthi (2020) How the Indian Government Can Help Improve the Ease of Doing Research available here <https://science.thewire.in/politics/government/sti-policy-2020-dst-psa-ease-of-doing-research/>

Other than referring to previous literature, FAST India reached out to researchers in S&T fields to conduct one on one interviews, to understand the various factors that influence conduct of research. Based on the results of the literature review and stakeholders' interviews, the EoDS survey questionnaire was designed to capture variable components that help in ensuring that scientific research is undertaken efficiently and effectively. These are:

- **Ease of raising funds:** This measures experience of researchers while obtaining grant funds for their research, including procedural requirements from their own universities as well as funding agencies;
- **Ease of utilisation of funds:** This captures the experience of researchers with utilisation of their research funding efficiently and in a timely manner. It takes into consideration various requirements including procurement rules around expenditure of money in academic institutions;
- **Ease of collaboration:** This component measures the ease for domestic as well as international collaborations for research;
- **Ease of commercialisation of research:** In this component, the ease with which research is commercialised through academia-industry linkages, filing patents and technology transfers are measured; and
- **Availability of institutional people and resources:** This component measures the institutional support (including students, assistants) available to researchers to perform research.

Each parameter identified above through primary and secondary research by FAST India had three sets of questions asked that enabled us to measure the EoDS. The first question asked the researchers' rating of the parameter. The second question asked for a rating of the parameters from researchers who have an experience of doing research in a foreign country in order to understand the EoDS in India as compared to a global perspective. Finally, the third set of questions contained various factors that had to be ranked on a Likert scale that enabled us to understand the reason for the overall rating of a given parameter.

A pilot of the survey questionnaire was conducted to test the survey questions. The questions were readjusted and re-positioned based on the pilot responses. New questions were also introduced based on the subjective responses received by scientists. The final survey was then posted.

We hope that this report will provide a clearer perception of the current state of Ease of Doing Science in India and provoke a wider conversation on how to generate an enabling environment for scientists in India.

For the first edition of EoDS, we focused on EoDS at top research institutions in India. The EoDS was conducted by way of an online questionnaire which was shared with identified participants electronically. In order to maintain comparability of responses, the participants were identified from within the first ten ranked institutions for research in the NIRF, 2022.³³ The institutions included IISc, 5 IITs, TIFR, VIT and AIIMS. We chose four engineering and four science departments for proper representation of different disciplines. In cases where information about selected departments was not available, close alternatives within engineering or science departments were chosen, as applicable. The sample was carefully constructed to match the real distribution on gender, years of experience, etc. Further details of the sample is available in Appendix A.

Faculty emails were collected from websites of the respective departments of the selected institutions and FAST India sent emails and reminders to participants for completing the survey. While reaching out to respondents. The survey was active for a period of 10 weeks after which data was collected and analysed.

³³Based on 2022 rankings that can be accessed here: <https://www.nirfindia.org/nirfpdfcdn/2022/flipbook/index.html#p=1>. Please see the list of institutions in Annexure A of this report.

Survey landscape

Out of 1500 potential survey respondents identified through publicly available information and contacted in October-November 2022, 140 respondents filled out the EoDS questionnaire at least partially by 15 December 2022.

Of these 140 respondents, 21 are female, 114 are male and other respondents did not want to state their gender.

The respondents were also asked to self classify on the basis of their research experience. Out of the respondents, 13% were early career researchers (with up to 5 years of research experience); 32% were mid-career researchers (between 5-12 years of research experience); and 54% were established researchers (more than 12 years of research experience).

The gender distribution in our respondents sample matches with the real distribution of researchers in the top 10 institutions.³⁴ There is no publicly available information regarding the proportion of early/mid career/established science researchers in S&T in India or distribution of science and engineering researchers within India. Therefore, the representation of these classes for researchers in the EoDS survey may or may not match with the actual distribution.

Along with the information above, the EoDS questionnaire also asked respondents if they had any experience of working or studying outside India during the course of their career. We find that 35% of the respondents had no experience in any foreign institution, while 65% had studied/worked at a foreign institution during the course of their career.

Limitations

This first edition of the EoDS Survey is focused on top research institutions in the country as ranked in the National Institutional Ranking Framework 2022 to understand the ease of doing science research at these institutions. This is a smaller subset of the universe of research conducting organisations in the country which also includes government research institutions, government-owned industries such as Public Sector Undertakings, private research institutions and other private higher educational institutions and industry among others. Future editions of this survey seek to include representatives from the wider section of research institutes in India.

This edition of the EoDS survey has classified S&T research in two broad divisions, i.e. science and engineering based on departments at the top- ranked institutions in the country. Therefore, the survey is agnostic to the type of research i.e. physical sciences, life sciences, civil engineering, etc. and instead provides a broader view of the field of scientific and engineering research itself. We have not evaluated group differences.

Further, while we have attempted to ensure accurate representation from respondents in terms of participating institutions; their field of expertise (science and engineering); gender; and stage of career of respondents, we are limited by the varying response rates of various subgroups in filling in our survey questionnaire.

³⁴Department of Science and Technology (2020), Research and development statistics 2019-20 states that the total number of women participants in R&D activity were ~16%. Report available at https://dst.gov.in/sites/default/files/Research%20and%20Development%20Statistics%202019-20_0.pdf



Part I: Ease of Doing Science – National View

This part of the report focuses on the composite EoDS Index developed by FAST India. The EoDS Index is designed to capture parameters which ensure that scientific research is undertaken efficiently and effectively in top research institutions across India. The first edition of the EoDS Index sets a baseline of what works, and identifies areas requiring improvement for a better research environment for science researchers in Indian institutions.



6. Ease of Doing Science - National View

- **What is hard and what is easy for science researchers in India?**

We have identified five parameters that comprise EoDS, namely; Ease of Obtaining Funds, Ease of Utilisation of Funds, Ease of Collaboration, Ease of Commercialisation, and Availability of Institutional Support. The Ease of Commercialisation parameter is not applicable to every type of science research. For instance, basic research typically does not have immediate commercial outputs. Keeping this distinction in mind, the EoDS questionnaire enabled respondents to rate the Ease of Commercialisation as per their research experience, while the respondents who did not have the experience of commercialisation of their research could skip this question.

The survey respondents rated these five parameters on a Likert scale of 1 to 5, with 1 being very poor, 5 being very good and 3 being Fair (Or average). These ratings help us understand which of the parameters are easier for the scientists to navigate as compared to others.

Figure 6.1 below represents the average rating for various EoDS parameters in top Indian institutions.

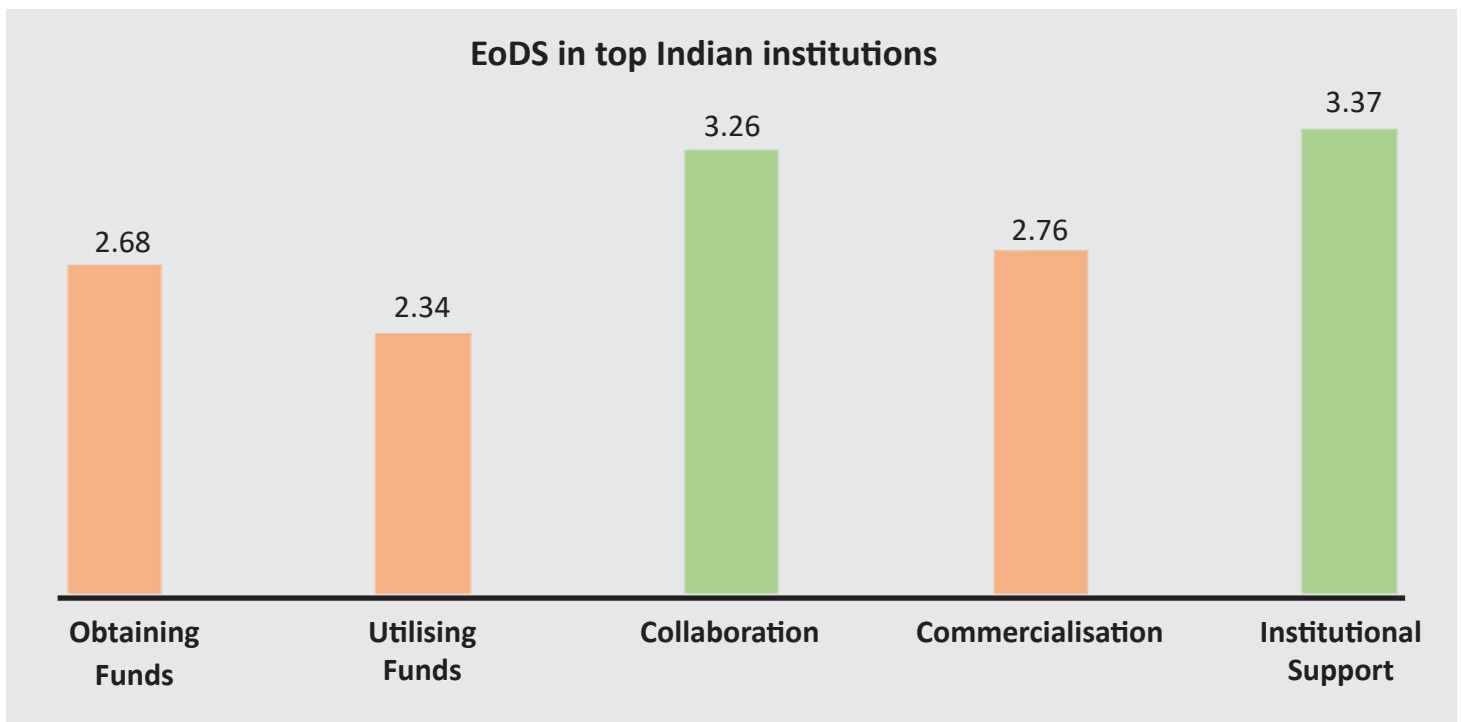


Fig 6.1: EoDS in top Indian institutions

Utilisation of grant money is rated as the toughest, while respondents seem happier with the institutional support available to them

We find that the ease of utilisation of funds is ranked the lowest at a rating of 2.34, while most respondents seem relatively comfortable with the ease of collaboration which is rated as 3.26 and institutional support available to them rated as 3.37. The ratings for ease of commercialisation and ease of obtaining funds were closer to average at 2.76 and 2.68 respectively.

In Table 6.1, we show the average ratings of the five EoDS parameters as well as their standard deviation and distribution.

	Obtaining Funds	Utilisation of Funds	Collaboration	Commercialisation	Institutional Support
Mean Rating (Out of 5)	2.68	2.34	3.26	2.76	3.37
Standard Deviation	1.05	0.96	1.03	1.21	1.07
Median response	3	2	3	3	4
Distribution of rating					
Very Poor	13%	20%	8%	20%	7%
Poor	32%	38%	9%	29%	13%
Fair	32%	31%	42%	27%	28%
Good	20%	8%	31%	19%	40%
Very Good	3%	2%	10%	5%	12%

Table 6.1: EoDS rating at top Indian Institutions: National View

We find that 58% of researchers rate ease of utilisation of funds as below average. This is very concerning since research quality is dependent on ability to utilise funds for human resources, equipment and material etc. at an institution. This is closely followed by ease of commercialisation and obtaining funds being rated below average by 49% and 45% of respondents respectively. On the other hand, it is a very positive signal that 52% of scientists find institutional support as good or very good. Overall, only 6% respondents on average (median 5%) rate any parameter as 'Very Good'. This means that even in top research institutions in India, most of the researchers do not find any of the EoDS parameters to be more than satisfactory. All stakeholders must take notice and reform the system to improve these values.

As discussed earlier, a majority of respondents felt that they are unable to utilise the funds earmarked for their research effectively. From other background research and conversations, we understand that many of the challenges in utilising funding grants emanate from tight regulations, delays and bureaucratic hurdles on procurement of equipment and consumables, as well as regulations on hiring of research staff. These regulations tend to be a mix of rules from the government's General Financial Rules (GFR), funding agencies and universities themselves, and are often ambiguous, open to varying interpretations, and at times cross purposes to each other. Some reasons for these issues were elaborated by the respondents as follows:



"First, [we need] competent administrative support!"

- Respondent A



"There are so many pointless bureaucratic hurdles everywhere, especially in using funds for reimbursement. If you forget to cross out the t, then you must either start a lengthy process from the beginning or risk failing to get reimbursed."

- Respondent B



“Don’t force us to buy scientific equipment and consumables locally made which many times wastes money and precious time”

- Respondent C

We wanted to create a composite index for EoDS which could be periodically tracked and measured. While a single number has the disadvantage of hiding the important details, it does serve a useful purpose to see if there is improvement at an aggregate level or not - lest we improve one parameter at the expense of another.

To create the index, we needed to understand the role and importance of each parameter towards science research. Therefore, in addition to the ratings above, the respondents were asked to rank the importance of five EoDS parameters in terms of their role in enabling efficient research work. We then averaged these ratings to find their respective weight to calculate the composite EoDS index. A weighted average, would weigh each parameter rating with its respective importance to the process of research, to give us a principled composite index.

Table 6.2 provides the average importance score and the ratings obtained for EoDS parameters. We find that the respondents rank ease of obtaining funds as the most important parameter and ease of commercialisation as the least important parameter. While the respondents rank ease of obtaining funds as the most important parameter, its rating was close to average, i.e. 2.68. On the other hand, availability of institutional support was ranked 2nd and was rated best of all the parameters, at 3.37. This indicates that the survey respondents found their institutions to be supportive in terms of effectiveness of institutional resources provided through availability of good quality of students, staff, equipment, infrastructure, training etc. This is in line with the NIRF institutional rankings of the surveyed institutions being one of the best in the country. Ease of utilisation of funds was ranked the 3rd most important, and had one of the worst scores of 2.34. Furthermore, ease of collaboration was ranked 4th by respondents, and had a high rating of 3.26. Ease of commercialisation of research was ranked as 5, and was rated better than ease of obtaining funds at 2.76.

Component	Average Importance Score (1 = Low importance to 5 = High importance)	Rating (Out of 5)
Ease of obtaining funds	3.73	2.68
Ease of utilisation of funds	3.17	2.34
Ease of collaboration	2.67	3.26
Ease of commercialisation of research	2.00	2.76
Availability of institutional support	3.43	3.37

Table 6.2: Importance of EoDS components

The composite EoDS Index value comes out to be 57.60 on a scale of 100. This means on average India's EoDS is rated as slightly above average, with a close to fair rating. This is a number we need to collectively seek to improve in coming years.

- **National EoDS Index and its comparison with Foreign Nations:**

To get more context of the EoDS index value for India, we wanted to compare how a similar number may look in countries outside India. We asked our respondents if they have any experience of working in any foreign institution. 35% of respondents had no experience in any foreign institution, while 65% had studied/worked at a foreign institution during the course of their career. Out of the respondents who had studied in a foreign institution, 35% had studied in the United States, 6% in Continental Europe, 4% in the United Kingdom, 1% each in Canada, and Japan.

We asked the respondents who had foreign experience to rate the five identified parameters on a Likert scale of 1-5 (very poor - very good) for their foreign research experience in the same manner as the EoDS index for India. This enabled us to understand the differences in the experience of respondents in Indian and foreign institutions.

Figure 6.2 shows the findings on the experience of scientists on Ease of Doing Science in Indian and foreign institutions. On average, while the EoDS for Indian institutions was rated as 57.6 on a 100 point scale, and EoDS for foreign institutions was rated as 80. Indian institutions should aspire to close this gap by understanding the difference in experience of researchers across various parameters within the EoDS index.

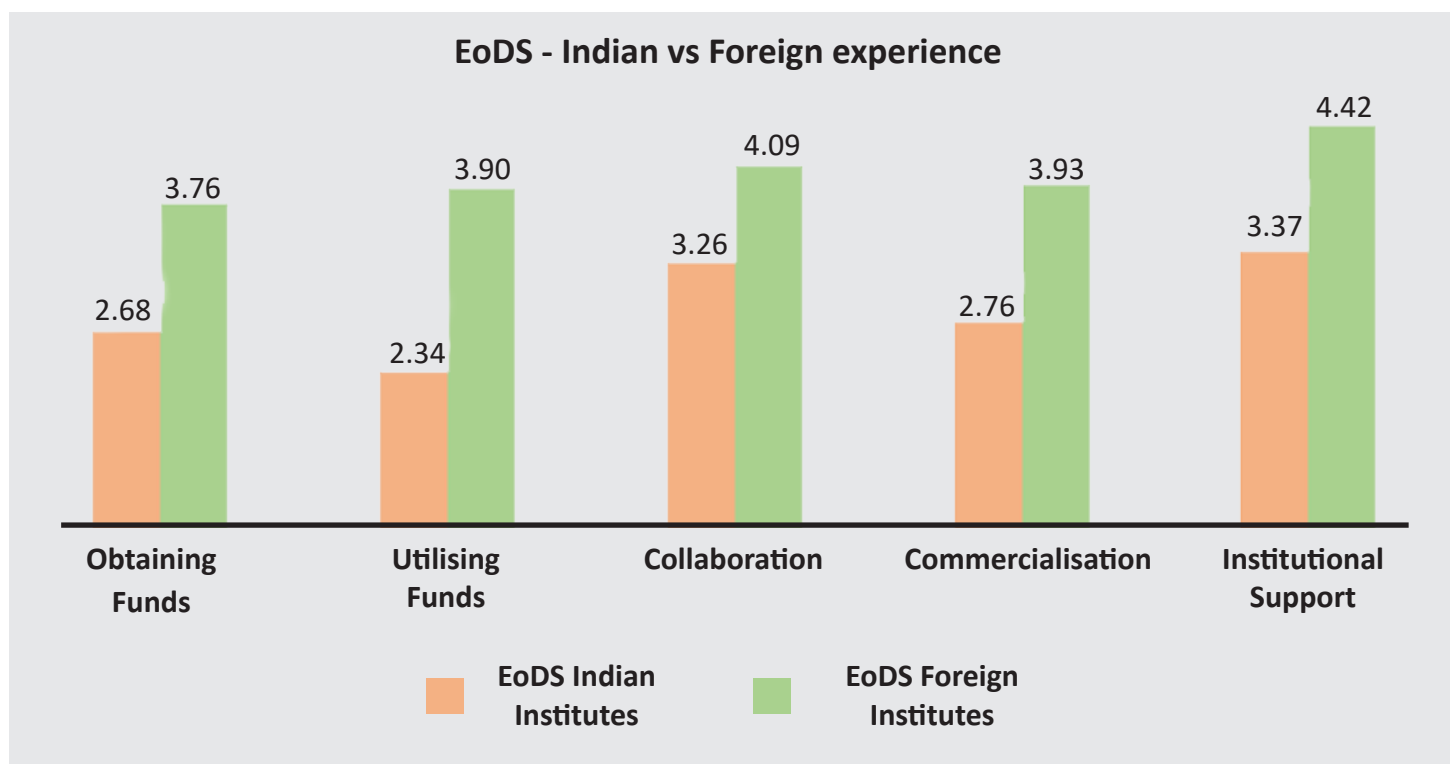


Fig 6.2: Ease of Doing Science, Indian vs Foreign experience

EoDS in India is 22.4 points below EoDS of Foreign Nations on a 100 point scale

Within the EoDS parameters rated on a 5 point scale, the biggest gap in the Indian and foreign institutions was seen in the ease of utilisation of funds wherein the Indian rating was 1.56 points below the rating for foreign institutions. This means the respondents felt that the utilisation of funds in Indian institutions was much more difficult as compared to foreign institutions. Similarly there was a 1.12 point difference between ratings of foreign institutions on ease of commercialisation as compared to Indian institutions. This shows that the respondents felt that there is a lack of support for commercialisation of research in Indian institutions surveyed for EoDS as compared to foreign institutions. On the other hand, the gap within the ease of collaboration parameter was the lowest, i.e. 0.83, while the gap for institutional support provided by foreign institutions as compared to Indian institutions was 1.05.

The comparison with foreign experience tells mostly the same story as the absolute ratings of parameters - parameters which are rated lowest for Indian EoDS are also the ones which show the most gap with foreign ratings. However, what we find is that even for the parameters rated the best in India, there is a big gap of 0.83-1.05 with foreign ratings. This clearly means while some parameters need more focus, we cannot neglect others either.

The survey respondents reported good quality institutional support and ease of collaboration at foreign institutions. In addition, all other parameters were ranked above average. Table 6.3 below shows the EoDS rating for various parameters in foreign institutions.

	Obtaining Funds	Utilisation of Funds	Collaboration	Commercialisation	Institutional Support
Rating (Out of 5)	3.76	3.90	4.09	3.88	4.42
Standard Deviation	1.11	1.40	0.86	1.12	0.96
Distribution of rating					
1	5%	16%	2%	4%	4%
2	10%	1%	5%	7%	0%
3	11%	10%	12%	23%	3%
4	56%	24%	48%	28%	36%
5	18%	49%	33%	38%	56%

Table 6.3: EoDS rating for foreign institutions

More than 83% of the respondents rated all parameters of EoDS for foreign institutions as fair or above (3 or above), with 92% of respondents rating institutional support as good or very good. On the other hand, 66% of respondents rated ease of commercialisation as good or very good. 73% of the respondents rated ease of utilisation of funds as good or very good, while 17% of the respondents rated ease of utilisation of funds at foreign institutions being very poor. Similarly, 74% of respondents rated ease of obtaining funds in foreign institutions as good or very good, while 15% of respondents rated ease of obtaining funds as very poor or poor.

Therefore, the respondents who had experience of studying/working in foreign institutions rank the EoDS at a much higher level than EoDS in the top research institutions in India. Indian policymakers, academic institutions and other

relevant stakeholders should learn and improve the EoDS based on learnings from established foreign institutes.

- **EoDS: Comparison of engineering and science institutions**

We wish to understand whether the EoDS index would differ depending on the type of institutions. In our survey sample, 54% of the respondents belonged to engineering institutions i.e. the IITs and VIT, while 46% belonged to science institutions.

Within these institutions, there were differences in experiences with respect to the EoDS parameters as shown in Figure 6.3.

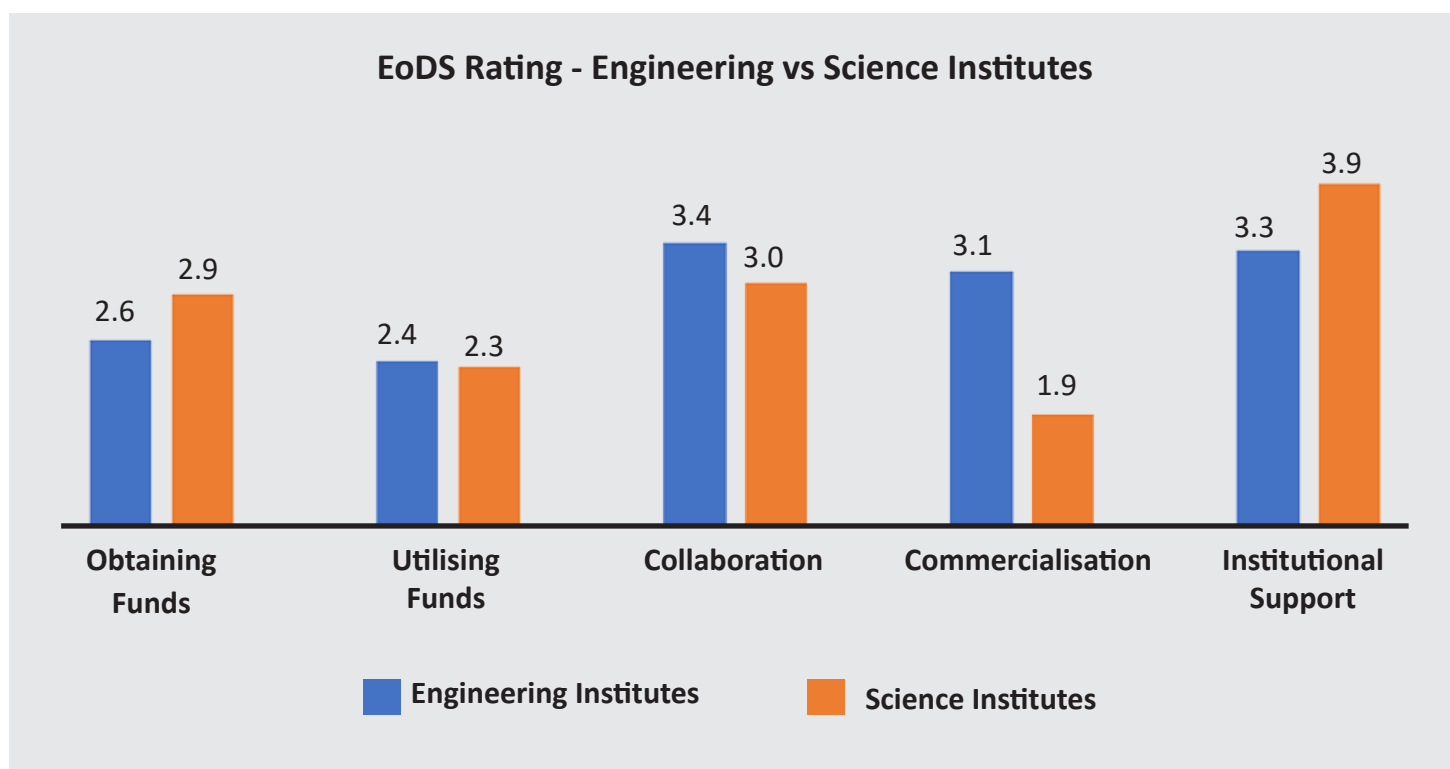


Figure 6.3: EoDS rating for researchers in Engineering Institutions (IITs and VIT) vs Science Institutions (IISc, TIFR & AIIMS)

The respondents from IITs rated their ease of commercialisation to be fair, with a rating of 3.1 but the respondents from other institutions feel that the ease of commercialisation for them was poor, rating it at 1.9. On the other hand, while both engineering and science institutions seem to provide good institutional support to their researchers, the respondents from science institutions were more satisfied with the institutional support available to them and rated their experience as very good. There was little difference in experience of respondents from IITs and other institutions for other parameters.

Table 6.4 below shows the comparison between Engineering and Science institutions ratings for EoDS. While the distribution of rating for engineering and science institutions follow a similar pattern for most ratings, for commercialisation 74% of the engineering respondents rated it fair and above, while only 32% of the science respondents rated their experience with commercialisation at fair or above.

Institutions	Obtaining Funds		Utilisation of Funds		Collaboration		Commercialisation		Institutional Support	
	Engineering	Science	Engineering	Science	Engineering	Science	Engineering	Science	Engineering	Science
Rating	2.6	2.9	2.4	2.3	3.4	3.0	3.1	1.9	3.3	3.9
Standard Deviation	1.1	0.9	1.1	0.9	1.0	1.1	1.1	0.9	1.3	1.2
Distribution of rating										
1	19%	2%	24%	16%	8%	12%	13%	42%	12%	10%
2	30%	34%	31%	44%	6%	14%	14%	26%	24%	5%
3	33%	34%	33%	30%	39%	44%	29%	29%	0%	0%
4	14%	27%	7%	9%	36%	21%	38%	3%	53%	60%
5	4%	2%	4%	0%	11%	9%	7%	0%	12%	25%

Table 6.4: EoDS rating for researchers in Engineering vs Science institutions

- **EoDS: By stage of research career**

We wanted to examine whether the EoDS Index varies according to the stage of career of the respondents. In order to identify the EoDS as per the stage of career, the respondents in the survey were asked to self classify on the basis of the following:

- (1) Researchers with 0-5 years of experience were classified as early career researchers;
- (2) Researchers with 5-12 years of experience were classified as mid-career researchers; and
- (3) Researchers with more than 12 years of experience were established researchers.

Out of the 140 respondents in the EoDS sample, 19(13.5%) were early career researchers; 45(32%) were mid-career researchers; and 76(54%) were established researchers.³⁵ Figure 6.4 below shows the EoDS ratings for various parameters by the three types of researchers.

³⁵Since we do not have publicly available data regarding the distribution of researchers in science and technology as per their stage of career, we are unable to verify if the sample below provides a reasonable representation of distribution of the researchers.

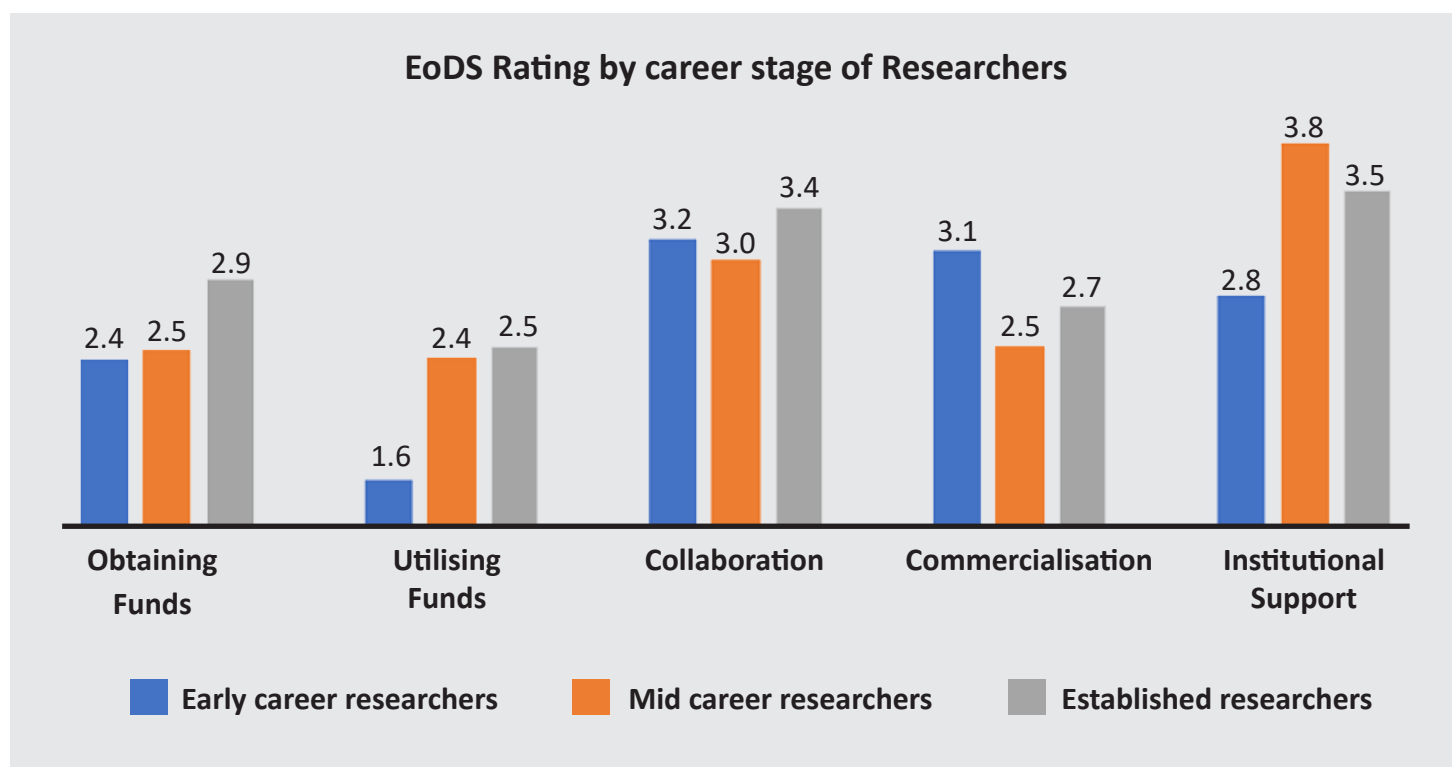


Figure 6.4: EoDS by career stage

Early career researchers struggle with obtaining and utilisation of funds, but rate ease of commercialisation and collaboration as fair, while mid-career and established researchers provide average-fair rating to most EoDS parameters.

We find that researchers with lesser experience, generally find everything harder than experienced researchers. The only exception that stands out is ease of commercialisation - this could possibly be that many commercialisation initiatives have been started recently and may have more exposure to young faculty. We find that early-stage scientists really struggle with utilising funds (gap of 0.8 points) and institutional support (1 point). A plausible explanation could be that scientists better learn the processes and people dynamics with experience. Lack of training and lack of documentation of processes for early career researchers could also contribute to this. We do not find much difference in experience of mid and late stage researchers, demonstrating that most of the learning of the ecosystem happens in the first 5 years.

Focus group discussions by FAST India as well as our survey respondents provide some insight into the problems faced by early career researchers.



“More transparent funding system and more support to young investigators in the institutes. Senior investigators anyway have better chance to get big funding.”

Respondent D



“At times even after lot of paper work and repeated presentations in front of committee second or third year money funds are not released (happened for my one DBT project, had revised progress report and submitted it number of times..still funds were not released. A PhD student working on the project has to stop and look for another problem in case funds not released and it becomes very difficult for phd student in this situation.”

– Respondent E

We recommend specific documentation and mentorship programs for young faculty in areas of utilising funds and navigating the institutional processes to bridge the gap identified in the EoDS survey.



Part II: Understanding the EoDS parameters

In addition to the overall EoDS and the rankings of parameters identified therein, the EoDS index also aimed to understand the factors that impacted various parameters as ranked by the researchers. Therefore, for each of the identified parameters, i.e. Ease of Obtaining Funds, Ease of Utilising Funds, Ease of Collaboration, Ease of Commercialisation and Availability of Institutional support, we identified 6-8 parameters which were rated on a Likert scale. The survey respondents rated these parameters on a scale of 1 to 5, 1 being very poor, 5 being very good and 3 being Fair (Or average). These factors were identified after literature review, institutional level pilot surveys as well as discussions with stakeholders. The sections below describe the factors that constitute the EoDS index parameters in detail.



7. Ease of Obtaining Funds

Ease of obtaining funds may be defined as the degree to which it is simple and efficient for researchers to secure financial support for their research projects. Ease of obtaining funds can be influenced by the availability of grants, the competitiveness of the funding process, and the level of bureaucracy and paperwork involved in applying for and receiving funding. Higher ease of obtaining funds indicates availability of adequate grants for researchers for their research subject, while low ease of obtaining funds indicates a gap in available funds and proposed research.

To understand the various factors that affect the ease of obtaining funds, the respondents were asked to rank their experience about the following on a scale of 5:

- Clear information about program/schedule
- Clarity of documents to be submitted,
- Objectivity in criteria of selection,
- Meritocracy of the process,
- Funding agency process timeline,
- University approvals for proposals (such as issuing no-objections/no-dues certificates),
- Availability of 'big money' in grants, and
- Availability of money in my area of work.

Figure 7.1 provides our findings for the factors affecting ease of obtaining funds.

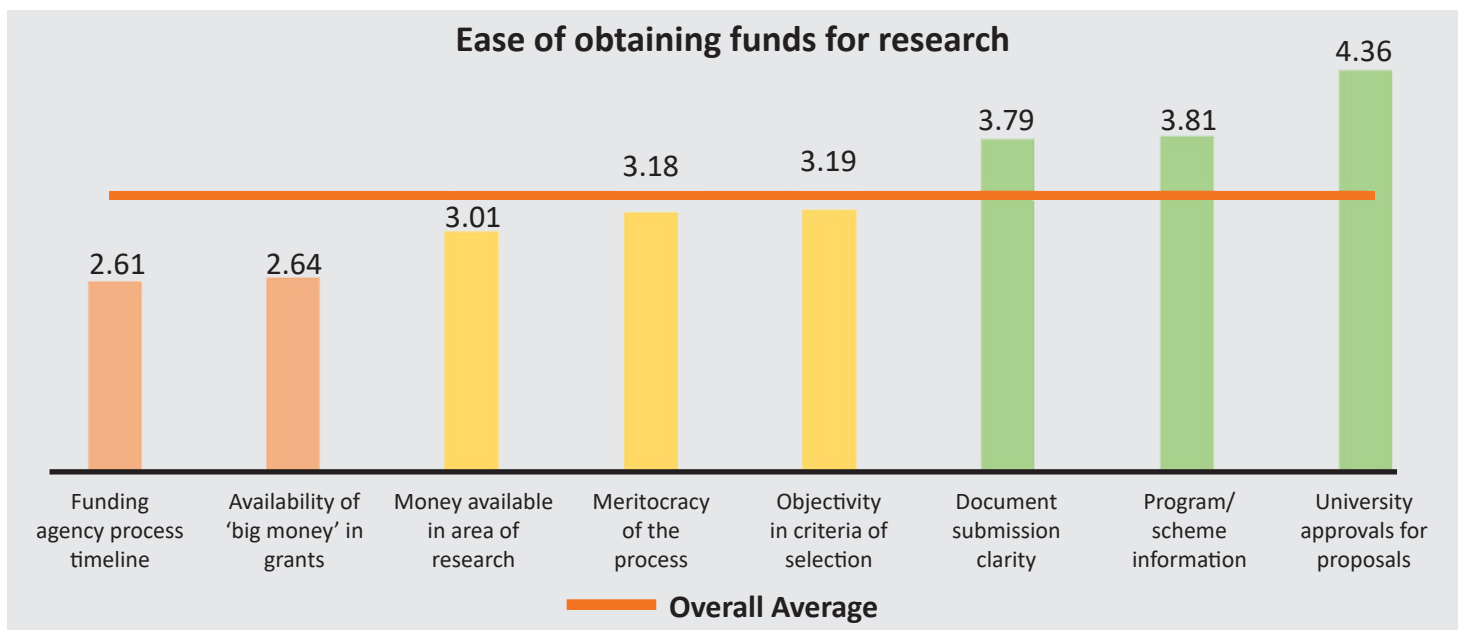


Figure 7.1: Factors influencing Ease of Obtaining Funds

We find that the average rating of various factors that make Ease of obtaining funds was 3.32 on a scale of 5. Most of the respondents felt that obtaining university approvals for proposals is the easiest part of obtaining funds which is rated as 4.36, whereas the funding agency process timeline is rated as the lowest, with an average rating of 2.61. Along with university approvals for proposals, the other factors rated above average by the respondents are availability of clear information about programs and schemes, rated as 3.81 as well as clarity in submitting documents, rated as 3.79. The respondents also felt that there is unavailability of 'big money' in grants, which is rated only slightly above average as 2.64.

The findings indicate that the respondents were generally satisfied with support provided by the university for obtaining funds. However, certain factors that are under the control of funding agencies, such as timeline for processing grants, availability of big money to conduct research, objectiveness of selection criteria, were rated below average. This indicates a lack of transparency as well as unpredictability from the granting agencies with respect to obtaining funds that impact the overall EoDS index. This lack of predictability, coupled with long timelines for decisions and disbursement of funding make it tough for researchers to be able to focus on their research. Furthermore, since the respondents felt there was a lack of big money, this is likely an indication of lack of grants for basic or fundamental research. This could be owing to the risk averse nature of granting agencies, which are typically focussed on outcomes that are related to commodification of science and shorter timelines.

Delays in fund disbursement from granting agencies for fellowships and projects and the resulting delays in salary disbursement is an area that needs immediate attention.³⁶ By anecdotal evidence, researchers appear to spend more time negotiating the nuances of diligence, compliances and approvals both with funding agencies as well as within institutions leaving less time for the science itself. Rules for capital asset acquisition, management and sustainability, allowed expenses within grants, flexibility of reappropriations within budget heads, control of salary brackets for project staff, negotiating travel approvals and expenditures etc. are all challenges that researchers face on a daily basis. Given that there are multiple granting agencies with variable rules and practices regarding financing, a researcher is required to spend considerable time to apply to different agencies for obtaining funds for their research project.



“The scientific ecosystem as the word suggests is not just about the scientists themselves. If funds that are sanctioned are not allocated timely then everything gets skewed. While scientists have to meet project-specific goals, the funding bodies should also meet timelines related to the project. Further, the funding agencies often do not recognize and relate to the ground realities of experimental research in India. In addition, the burden to just work towards productization and not focus on science is becoming increasingly predominant.”

– Respondent F

At this stage, it is perhaps important to understand the nature of funding agencies in order to be able to identify specific gaps with respect to ease of obtaining funds. We provide our findings with respect to the source of funding science research from the survey below.

(a) Source of science research funding in India:

In order to understand which type of agencies provide funding to our respondents, we asked the proportion of funds obtained by respondents from government granting agencies, respondents own institutions, industry sources, international sources, Indian philanthropic agencies, etc. Figure 7.2 shows the proportion of various types of funding obtained by EoDS survey respondents.

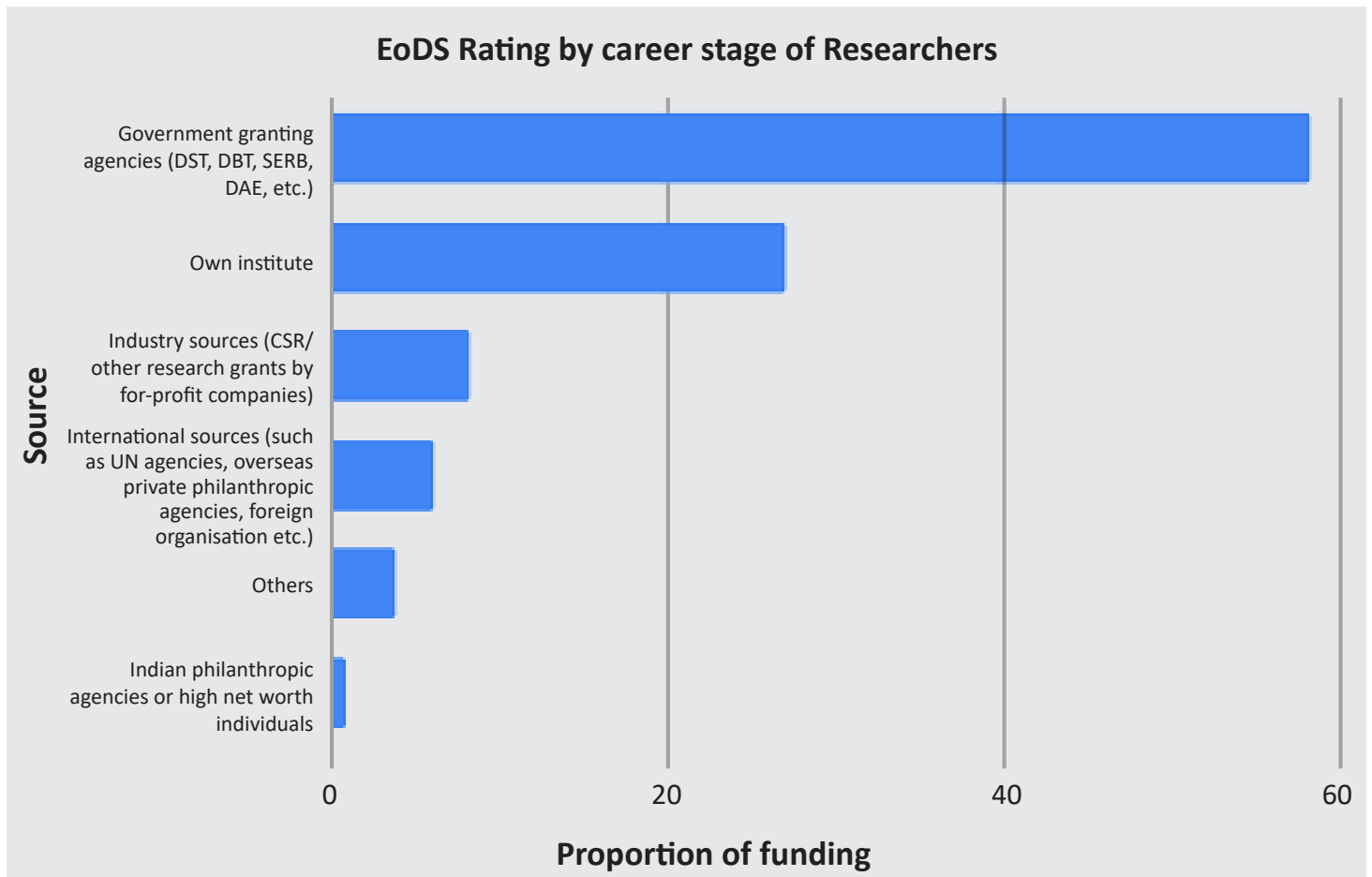


Figure 7.2: Source of funding of survey respondents

Overall, 87% of the EoDS survey respondents reported receiving some amount of government funding for their research, as opposed to 13% respondents who reported government funding not being their source for research.

62% of the respondents received more than half of their research funding from various government agencies such as Department of Science and Technology (DST), Department of Biotechnology (DBT), Science and Engineering Research Board (SERB), Department of Atomic Energy (DAE) etc. The average proportion of funding received by respondents from government funding agencies is 58.7%. Other sources of research funding include the institution of the researcher, Corporate Social Responsibility (CSR)/other grants from the industry, international bodies such as United Nation (UN) agencies, overseas private philanthropic agencies, foreign organisations etc. Indian philanthropic agencies and high net worth individuals had one of the lowest contributions in S&T funding.

(b) Government agencies involved in science funding in India:

With respect to government funding for science research in India, we wanted to understand which government agency is the top funder for our respondents. As shown in figure 7.3 below, DST or SERB, a statutory body under the DST were the top funder for 54% of respondents who received funding from government sources. Other common sources of government funding include Department of Atomic Energy (DAE) and Department of Biotechnology (DBT) each of which are the largest source of funding for 9% and 8.4% of respondents respectively. The Defence Research & Development Organisation (DRDO) was the largest source of government funding for 8.4% of respondents. Other government funding agencies of note are the Department of Space for 2.5%, and Ministry of Earth Sciences for 1% respondents respectively.



Three respondents noted that they are not funded through the government at all, one of whom cited the administrative overheads of obtaining government funding to be a hindrance to their research productivity – because of which their research lab had taken a decision not to apply for government grants.

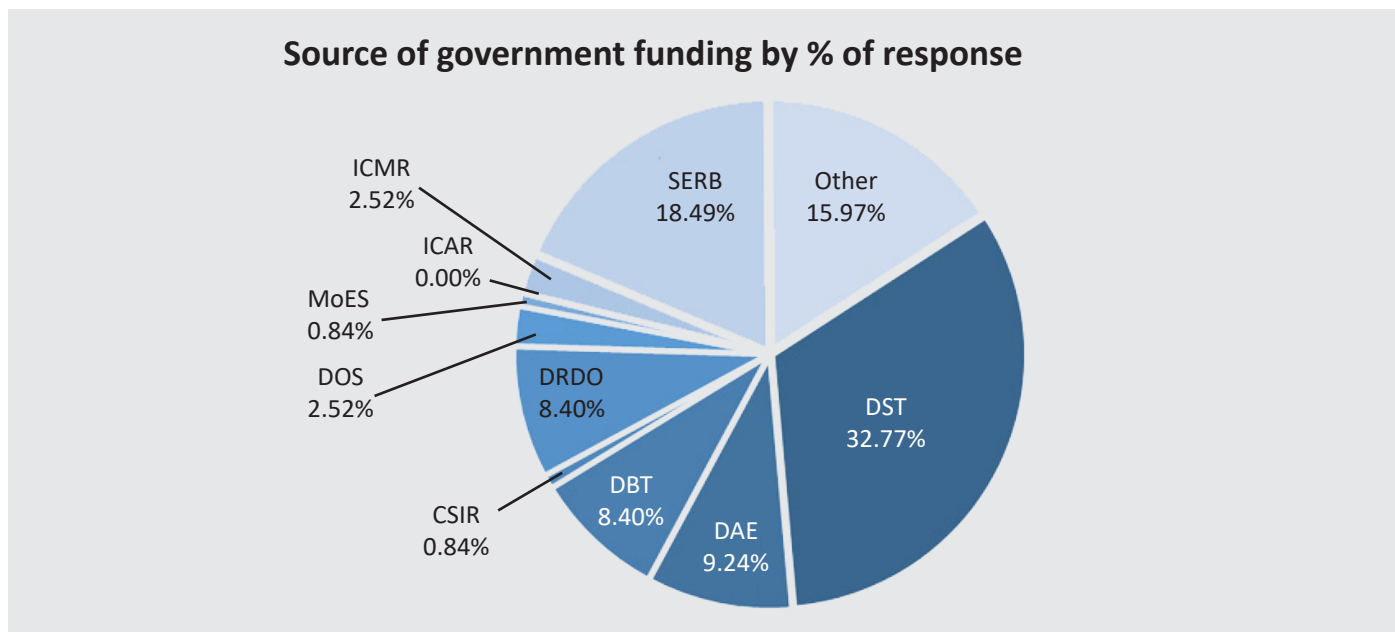


Fig 7.3: Source of government funding

8. Ease of Utilisation of Funds

Ease of utilisation of funds may be defined as the degree to which it is simple, straightforward, and efficient for researchers to use the funds that they have obtained for their research projects. Ease of utilisation of funds may be influenced by factors emanating from the granting agency. Or the institution to which the researcher belongs, or both. These factors include terms and conditions of the funding, the level of bureaucracy and paperwork involved in accessing and using the funds at the funding agency and institution level, and the flexibility of the funds to meet the changing needs of the research project. A high ease of utilisation of funds enables researchers to focus on their core research, while minimising administrative burden on them, while a low level of ease of utilisation of funds can make it difficult for researchers to use the resources effectively and efficiently.

To understand the various factors that affect the ease of utilising funds, respondents were asked to rank their experience about the following on a scale of 5:

- Receiving timely grant instalments from funding agency
- Funding agency paperwork/approvals needed for spending money
- Institutional process and support available for spending money
- Availability of required material/equipment locally in India
- Obtaining/utilising money for international travel
- Hiring students/staff for the research project
- Receiving timely stipend/salary for project staff from funding agency

Figure 8.1 provides our findings with respect to the various factors affecting ease of utilisation of funds.

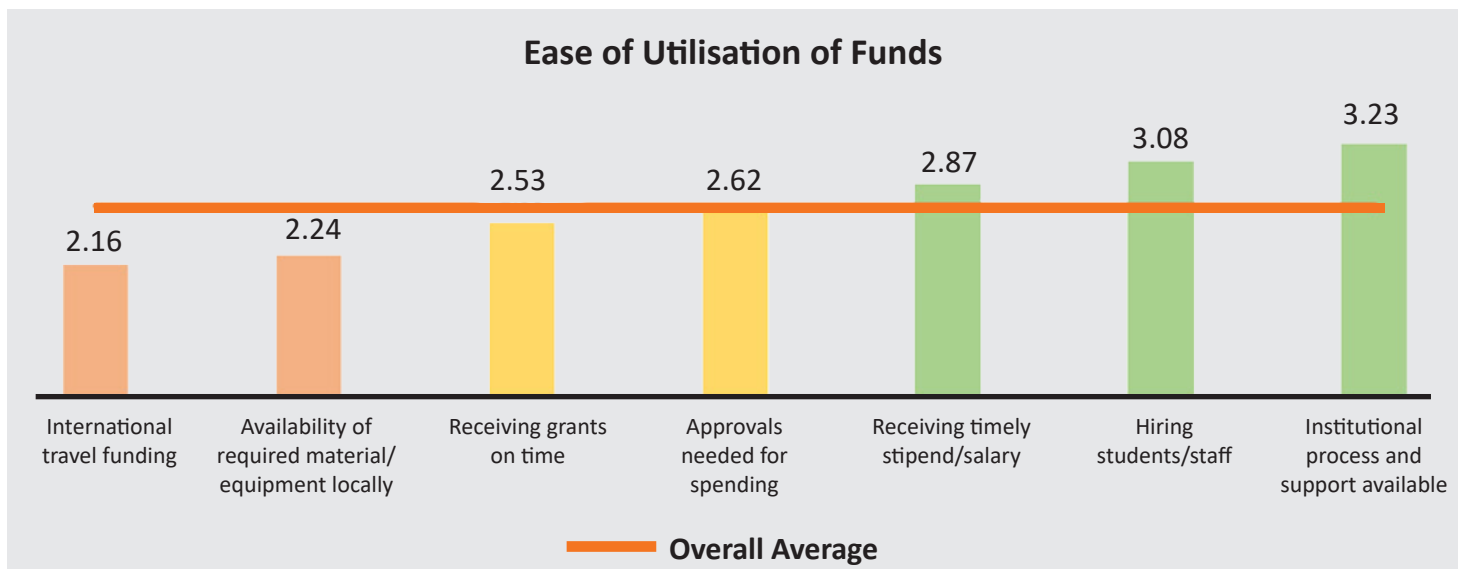


Figure 8.1: Factors influencing Ease of Utilisation of Funds

The average rating of various factors that make Ease of utilisation of funds was 2.67. We find that most of the respondents perceived that the institutional processes and support which was available to them was the easiest part of utilising funds with a rating of 3.23, whereas funding for international travel was rated as the lowest ease aspect of utilisation of funds, with an average rating of 2.16. Many respondents described issues relating to obtaining timely and adequate funding to be related with bureaucracy in releasing government grants for international travel and conferences such as the following suggestions received for improving EoDS in India as a part of our survey:



“Improve institutional and government funding and reduce bureaucracy. More government funds to institutes and ease of spending money especially for travel, conferences and computers. Remove bureaucratic red tape which stifle funding and spending. Improve ease of receiving funds.”

– Respondent G



Both the absence of ease of availability of funds and the difficulty in utilisation of funds are significant bottlenecks. The bureaucratic delays are often unpredictable, precise rules are often unclear and international travel is generally discouraged. And all these restrictions continue to hinder even for research areas like Mathematical Sciences where the infrastructure requirements are often very minimal.

– Respondent H

Along with international travel funding, availability of material and equipment locally in India was rated low as 2.24. Problems with receiving grants on time rated as 2.53 and approvals required for spending rated as 2.62 also contribute to the low overall rating of ease of utilisation of funds.

The factors identified above help in identifying gaps that need to be bridged in order to improve ease of utilisation of funds in top Indian research institutions. As seen from our analysis of the responses to the EoDS survey, both funding agencies as well as institutions in which the researchers are based impact the ease of utilisation of funds. There appears to be a trust-deficit arising from the general need to avoid mispending government funds, which translates to excessive burden on the researchers to justify their fund requirements to a precise degree. This leads to a problem of micromanagement of research funds by non-researchers such as finance officers and other administrative staff whose goals (i.e. to avoid mis-spending of funds) may be at odds with enabling science research which includes an inherent, unmeasurable risk. The respondents also noted that the procurement rules and regulations followed by institutes are inefficient, bureaucratic and cumbersome. This results in inability of researchers to utilise available funds approved by the funding agency to be used for buying equipment or materials necessary to conduct their research.

Furthermore, funds for international travel for scientists or their collaborators are either sparsely available, or are highly regulated. This seems to emanate from the perception that travel grants are frivolous expenditure and that researchers misuse such grants for non-work purposes. A shift in the mindset of both granting agencies as well as institutes would help in providing a more supportive environment for researchers in India. Because of a lack of such a supportive and enabling environment, we find an adverse impact on the quality of research generated from the country, reducing the opportunities for interdisciplinary research, global collaborations and learning. Therefore, a rebalancing of the requirements from a funding agency and university perspective is required to enable greater ease of obtaining funds in India.

Similarly, being able to collaborate with the industry, finding grants for industry collaboration, finding support from industry, is rated among the lowest by scientists. This calls for more programs and institutional structures for making industry-academia partnership a grander success.



Give more freedom in spending. Don't fence the micro-division i.e. capital and consumable. With time, new discoveries are made, project goals and requirements changes. Funding agencies need to be cognisant of that.

– Respondent I

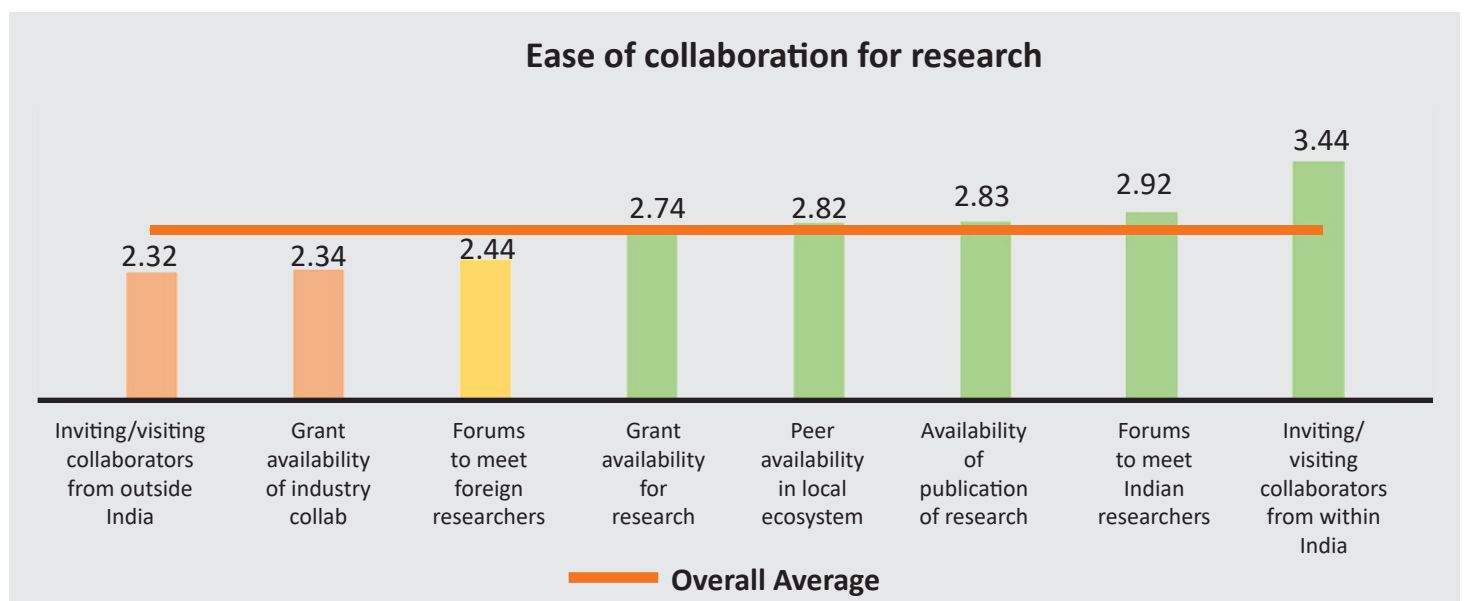
9. Ease of Collaboration

Ease of collaboration for scientific research may be defined as the degree to which it is simple, straightforward, and efficient for researchers to work together and share resources, nationally or internationally, in order to advance their research. Ease of collaboration may be influenced by availability of funding for collaboration as well as forums where researchers may interact with each other, and the overall culture and support for collaboration within a given scientific community. Collaborations have made for some of the greatest scientific advances that we have seen such as the CERN Super Collider, the Human Genome Project and others. Collaborations for knowledge sharing and infrastructure between different fields, subjects, within and across institutions and geographies are crucial for improving the quality of research.

To understand the various factors that affect the ease of collaboration, the respondents were asked to rank their experience about the following on a scale of 5:

- Inviting/visiting collaborators to your institution from within India
- Inviting/visiting collaborators to your institution from outside India
- Availability of grant programs for multi-disciplinary research
- Availability of grant programs for collaborative research with industry
- Availability of high-quality peers in local ecosystem to collaborate
- Availability of forums to meet researchers from other universities
- Availability of forums to meet researchers from outside India
- Requirements related to publication of research

Figure 9.1 provides our findings with respect to the various factors affecting ease of collaboration for research.



9.1: Factors influencing Ease of Collaboration in India

As opposed to the low rating for availability of funds for international travel and collaboration discussed in the earlier chapter, we find that most of the respondents felt that the ease of collaboration was fair and above and rated it as 2.73. Amongst the factors that impact ease of collaboration, inviting researchers from India for collaboration was rated as the easiest factor, with an average rating of 3.44, whereas inviting foreign researchers for the same was rated as the lowest ease aspect of collaboration, with an average rating of 2.32. The factors that were rated lower than the average rating included availability of grant money from industry for collaboration at 2.34 and availability of forums to interact with foreign researchers at 2.44.

The respondents of the EoDS survey ranked inviting foreign collaborators as well as availability of forums to interact with foreign researchers much below other factors determining ease of collaboration. This is linked to the mistrust by both funding agencies and institutes with respect to disbursing money for travelling in relation to research as seen in the previous section. Other factors that may impact the ability of researchers to invite foreign researchers may be the requirements related to visa, documentation and approvals from university in relation to issuing such invitations, availability of infrastructure and human resources to host events where both Indian and foreign researchers may participate, as well as general lack of grants from the funding agencies.

In addition, the issue of lack of industry funding for collaboration is in line with the lack of funding available from industry resources in general to conduct research. There are many reasons for the lack of industry-academia linkages that impact EoDS in India such as difference in goals and priorities with respect to research agendas, lack of institutional support for establishing such linkages as well as constraints with respect to time and budget.

Focusing on making collaborations easier for researchers in India is likely to have high returns in the quality of science research being conducted in top Indian institutions. As shown by Thukral and Narain (2022), international collaborations are one of the levers that may be used by institutions as well as the government to achieve better rankings of Indian institutions globally.³⁷

³⁷Thukral, Ayushee and Narain, Mudit (2022), Performance of Academic Institutes: India's Path to Rise Through the Ranks, available at <https://fast-india.org/wp-content/uploads/2022/12/6a730fbb5050424a818b20b95433ce81.pdf>

10. Ease of Commercialisation of Research

Ease of commercialisation of research may be defined as the degree to which it is simple, straightforward, and efficient for researchers to turn their research findings into commercially viable products or services. Ease of commercialisation may be influenced by the type of research being undertaken, availability of funding and resources, industry-academia linkages, the quality of research infrastructure and equipment, and the overall culture and support for commercialisation within a given scientific community. A high level of ease of commercialisation of research allows researchers to translate their work into practical applications and make a positive impact on society, while a low level of ease of commercialisation can make it difficult for researchers to turn their ideas into reality and bring their work to market. It is to be noted that not all research is amenable to commercialisation. Basic research, that deals with pursuing research in uncharted territories, does not translate immediately into commercially viable products. Therefore, researchers who perform basic research do not typically deal with this element of EoDS.

To understand the various factors that affect the Ease of Commercialisation of research, the respondents were asked to rank their experience about the following (if commercialisation is a consideration for their research) on a scale of 5:

- Incentives available for commercialising research outputs
- Institutional assistance in identifying and applying for registration of IP arising out of your research
- Availability of industry linkages (industry cell, industry meetups) in your institution
- Support to find funding from industry for your research
- Support and resources for starting your own company
- Ease of licensing your technology to industry/startups

Figure 10.1 provides our findings with respect to the various factors affecting ease of commercialisation of research.

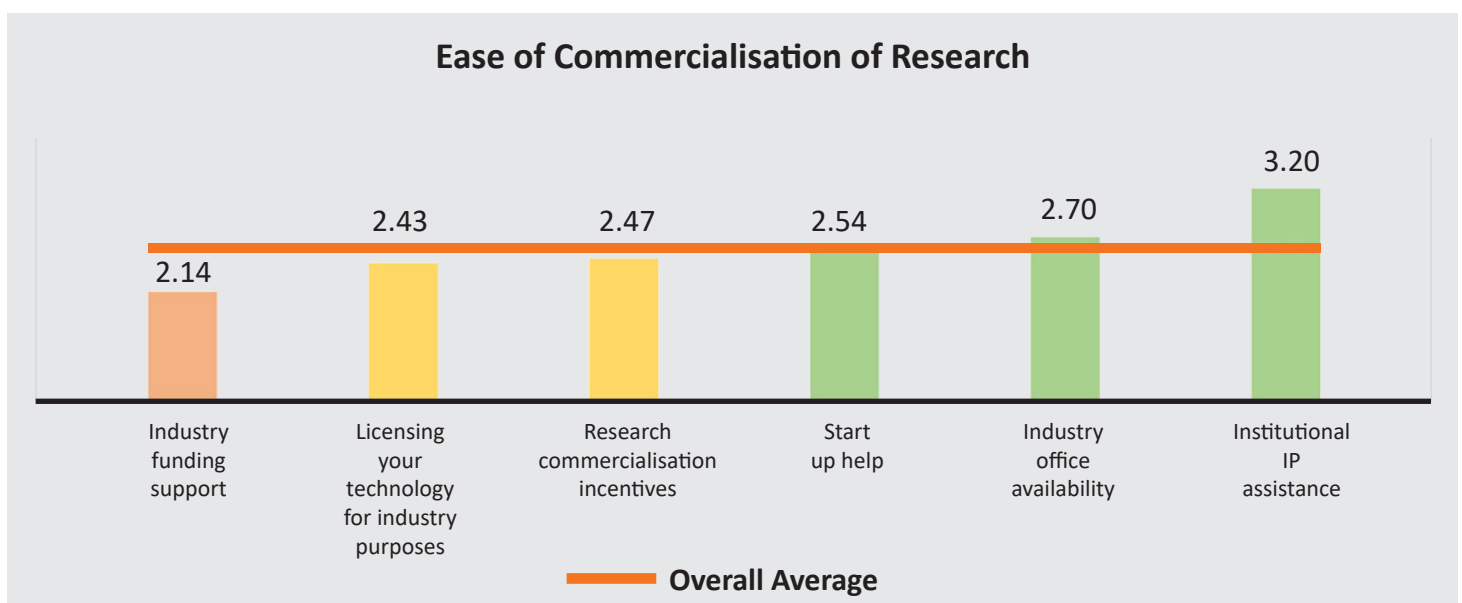


Figure 10.1: Factors influencing Ease of Commercialisation of Research

We find that the average rating of various factors that make ease of commercialisation of research is 2.58. Most respondents felt that the institutional assistance available to them in identifying and applying for registration of intellectual property arising out of research is the easiest for them with an average rating of 3.20, whereas finding support to obtaining funding from industry for their research is rated as the lowest ease aspect of commercialisation, with an average rating of 2.14. Interestingly, the respondents reported that the availability of industry linkages to be slightly above average, at 2.70 when rating the ease of commercialisation of their research. The incentives to commercialise research, licensing of technology, as well as the support available from start-ups are rated closer to average by the respondents - indicating a need for improvement in these domains.

As seen above, there is a remarkable difference between the experience of researchers within their institutions as compared to their experience with obtaining funds from the industry. While institutional assistance received in identifying and applying for registration of intellectual property arising out of research was rated the highest, finding support to obtain funding from industry or start-ups was rated less than fair. Academic institutions can play a vital role in providing support to researchers to translate their research into technology and assisting them in licensing their product to the industry. This may be achieved through industry cells at academic institutes where engagement between industry and researchers is encouraged and promoted.³⁸

The EoDS survey respondents felt that there was a lack of industry funding for their research and support and reported difficulty in licensing their technology. There may be multiple reasons for these problems such as technical and legal issues in licensing technology that creates hurdles in transforming quality research into commercially viable products, the quality of the research itself, market demand, and the ecosystem of industry/start-ups available to a researcher. We encourage further research to understand reasons for low rating of industry and licensing factors herein.

Improving ease of commercialisation of research is an important goal for India because commercialisation leads to accessibility of research products to the masses, and also helps in fostering industry-academia linkages that improve collaboration and have potential to lead to more funding opportunities for researchers. While public policy decisions, such as factoring in the intellectual property outputs of researchers and institutions in promotions and institutional rankings respectively³⁹ have led to improvement in assistance available to researchers for commercialisation of products, similar policy nudges need to be made at industry and start-up level to achieve better outcomes for the ease of commercialisation indicator in the future.

³⁸Singh, Chetandeep and Thukral, Ayushee (2023), The ingredients of a robust research ecosystem, FAST India Working Paper, available at <https://www.fast-india.org/wp-content/uploads/2023/01/The-ingredients-of-a-robust-research-ecosystem.pdf>

³⁹Methodology for University and College Teachers for calculating Academic/Research Score has inputs such as patents in the UGC Regulations on minimum qualification for appointment of teachers and other academic staff in universities and colleges and measures for the maintenance of standards in higher education, 2018, available at https://www.ugc.ac.in/pdfnews/4033931_UGC-Regulation_min_Qualification_Jul2018.pdf

11. Availability of institutional people and resources

Availability of institutional people and resources for research refers to the degree to which researchers have access to the personnel and resources they need to conduct their research. This can include things like research staff and assistants, funding and grants, research equipment and facilities, and other resources such as office space and support services. Having easy access to these resources can be critical for the success of a research project as it allows researchers to focus on their work and make progress more efficiently. Institutions that are able to provide researchers with the necessary people and resources are more likely to be able to support a vibrant and productive scientific community. On the other hand, institutions that are unable to provide adequate resources may struggle to attract and retain researchers and may have difficulty supporting high-quality research.

To understand the various factors that affect the ease of availability of institutional people and resources, the respondents were asked to rank their experience about the following on a scale of 5:

- Availability of enough good quality PhD students
- Availability of enough good quality post-doctoral researchers
- Availability of enough good quality administrative and support staff
- Availability of adequate infrastructure for research (through well-equipped labs/access to clusters etc.)
- Availability of clear incentives for performing high quality research
- Availability of adequate time for research along with other work responsibilities such as teaching and administrative work
- Availability of proper housing/office space

Figure 11.1 provides our findings with respect to the various factors impacting availability of institutional support for research.

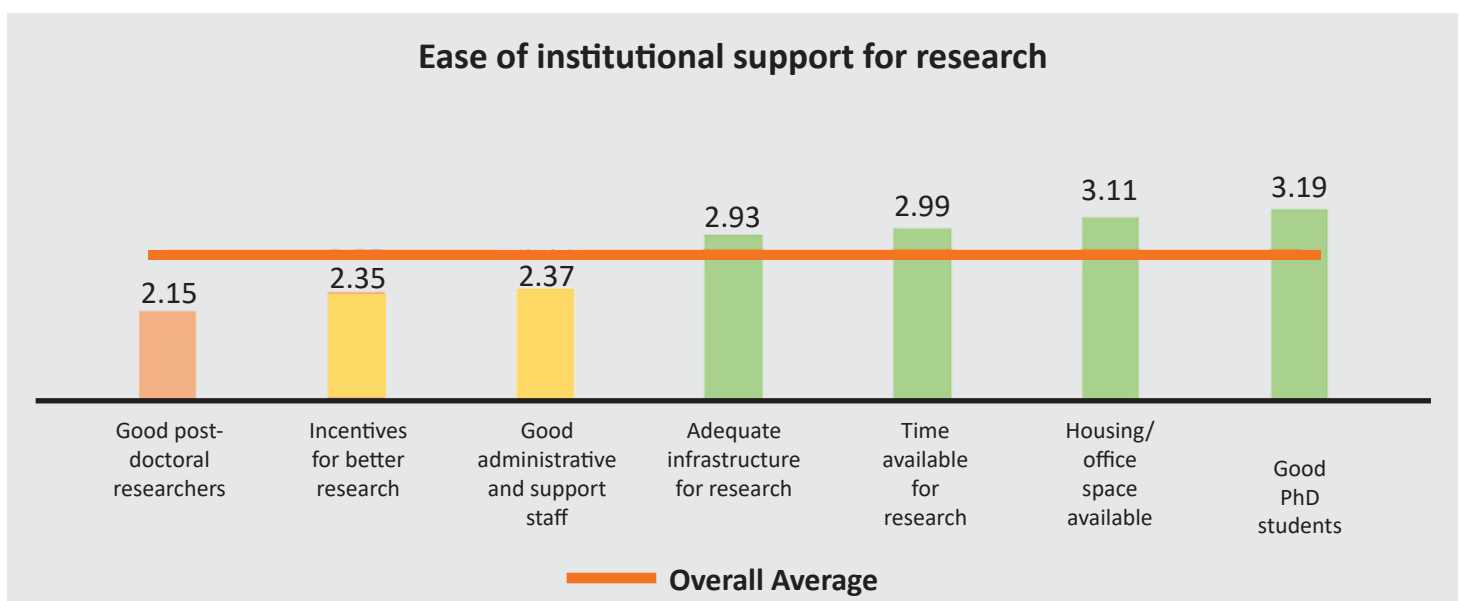


Figure 11.1: Factors influencing Ease of Institutional Support for Research

We find that most respondents felt that availability of good quality PhD students was the easiest with an average rating of 3.19, whereas availability of enough good quality post-doctoral researchers was rated as the lowest ease aspect of institutional support, with an average rating of 2.15. Unavailability of post-doctoral researchers has been highlighted as an issue by many scientists in FAST India's stakeholders consultations. There are many reasons for this issue such as lack of appropriate number of postdoc positions in top Indian research universities, underpaid post-docs, and opaque hiring processes.⁴⁰ Along with lack of availability of post doctoral researchers, the respondents also rated administrative support available to them as average at 2.37 along with a similar average rating of 2.35 to incentives available to them for conducting better research.



“Skilled manpower, technical and non-technical support staff are essential for success. Most universities are lacking that. For example in experimental research, success of PhDs depends a lot on the equipment that he or she can fabricate with the help of a mechanic in the workshop. We have to ensure that every department has a number of such highly skilled individuals. The same is true for secretarial work.”

– Respondent J

On the other hand, the respondents rated the time and infrastructure available for their research as well as housing and office space to be fair.

While the top Indian research institutions are able to provide researchers with infrastructure and resources in terms of PhD students, time for research; they need to improve the availability of post doctoral researchers, administrative staff and provide incentives for better research.

In many cases, post doctoral researchers and administrative staff are funded through project grants. In such cases, it is likely that unavailability of post doctoral researchers and support staff in Indian institutions is caused by unavailability of funds for such positions, in addition to the institutional challenges identified in the EoDS survey above. There may also be other factors (both institutional as well as granting agency level) that lead to this problem. Further research into the causes is warranted in order to understand the problem further.

In order to attract and retain their top talent, institutions should work on providing both monetary and non-monetary incentives to its resources. These include providing competitive salaries, assistance in applying for funding for research projects, supporting career growth of their talent, encouraging collaborations and promoting good science through recognition and rewards.

⁴⁰Naik and Megha (2018), The Curious Case Of The Missing Indian Postdocs available at <https://thewire.in/education/the-curious-case-of-the-missing-indian-postdocs>

12. Conclusion

The EoDS Index developed by FAST India seeks to provide an overview of the parameters that impact ease of doing science in India. We measured the experience of science researchers in top institutions in India through a survey conducted from October to December, 2022. From the survey, we find that EoDS in top Indian institutions is rated only slightly higher than the average rating by researchers in these institutions.

The EoDS survey results indicate that there is a need for stakeholders including the government, academia and the industry to come together to work towards gaps identified in this report. In order to accomplish India's goal to become a powerhouse for S&T, the major stakeholders in the ecosystem must act in an aligned, concerted and targeted manner through policies and programs directed at supporting science researchers.

We hope to conduct the EoDS survey annually, and to expand its scope in order to ensure that the index remains relevant to the needs of the nation.

Annexure A: Distribution of participants in EoDS, 2022-23

NIRF Rank	Institution
1	Indian Institute of Science (IISc)
2	Indian Institute of Technology, Delhi (IIT D)
3	Indian Institute of Technology, Bombay (IIT B)
4	Indian Institute of Technology, Madras (IIT M)
5	Indian Institute of Technology, Kharagpur (IIT Kgp)
6	Indian Institute of Technology, Kanpur (IIT K)
7	Tata Institute of Fundamental Research (TIFR)
8	Indian Institute of Technology, Roorkee (IIT R)
9	Vellore Institute of Technology (VIT)
10	All India Institute of Medical Sciences (AIIMS)

Table A-1: Top 10 research institutions in NIRF 2022 Research rankings

For the EoDS survey, wherever possible the participants from the following departments of the chosen institutes:

(a) Engineering departments

- (i) Computer engineering
- (ii) Chemical engineering
- (iii) Mechanical engineering
- (iv) Civil engineering

(b) Science departments

- (v) Physics
- (vi) Chemistry
- (vii) Maths
- (viii) Biology/biotechnology

Department	Proportion of respondents (%)
Chemistry	15.11
Chemical Engineering	5.76
Biology	10.07
Ecology	2.88
Aerospace Engineering	5.76
Physics	20.86
Computer Science	8.63
Electrical Engineering	1.44
Mechanical Engineering	2.16
Data Science	0.72
Medical Science	5.76
Bioengineering	7.19
Maths and Stats	5.76
Civil Engineering	3.60
Engineering	0.72
Interdisciplinary Sciences	2.16
Manufacturing Engineering	1.44

Table A-1: Top 10 research institutions in NIRF 2022 Research rankings

Institute details (University/lab)	Proportion of respondents (%)
IITs	52.56
IISc	26.28
TIFR	11.68
VIT	6.57
AIIMS	2.92

Table A-3: Distribution by Institutions

Type of researcher	Proportion of respondents (%)
Early career researcher (0 to 5 years of experience)	13.57
Mid career researcher (>5 to 12 years of experience)	32.14
Established researcher (>12 years of experience)	54.29

Table A-4: Distribution by stage of career

Gender	Proportion of respondents (%)
Female	15.56
Male	84.44

Table A-5: Distribution by Gender



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