Enriching the Indian scientific landscape with research communication
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India is at the cusp of a transformation. Her global aspirations are on the rise. The country wants a seat at the high table, along with other established scientific powers such as the USA, European nations, and Asian powerhouses that include China, Japan, and South Korea. India’s research output, as well as the number of patents filed and granted, has been increasing. The government is no longer wary of involving the private sector and collaborating with it to develop products and services that have a larger public purpose, as can be seen from the development of a COVID vaccine and the moves to encourage the private sector’s involvement in space exploration.

India has long been toying with the idea of increasing its research expenditure as a percentage of gross domestic product (GDP) to approximately 2 percent; however, that intent is yet to be translated into reality. This is also one of the reasons for the comparatively lower number of patents filed from India. The Economic Survey 2021-22 identifies the problem as India’s low expenditure on research and development (R&D) activities, which is a mere 0.7 percent of GDP. According to the Government of India’s Department of Science and Technology (DST), the gross expenditure on R&D has steadily increased over the years, and nearly tripled between 2007-08 and 2017-18—from approximately Rs.39,500 crores to Rs.1,13,825 crores. Despite this increase, India spent a mere 0.7 percent of its GDP on R&D in 2017-18, while the other BRICS countries spent much more—Brazil spent 1.3 percent, the Russian Federation 1.1 percent, China 2.1 percent, and South Africa 0.8 percent.

It is not merely a question of allocating more funds toward research: it is also a challenge of attracting the best brains to conduct research within the country. India lags behind many other countries, including the other BRICS nations, in the number of researchers. A DST report estimates the number of researchers in India at 255 per million population in 2017, marginally higher than the 218 in 2015 and more than double the 110 in 2000. In comparison, this number was 8,342 in Israel, 7,899 in Denmark, 7,597 in Sweden, 5,304 in Japan, and 5,003 in Germany.

It is in this context that the proposed National Research Foundation, with an allocation of Rs.50,000 crores over five years, gains significance. The aim is to strengthen the research ecosystem in the country, with a focus on identified national priority thrust areas.
The purpose of research may be to expand the knowledge base or to translate that knowledge into applications for a wider use. One cannot be at the expense of the other. The two kinds of research—basic and applied—are equally important for a thriving research ecosystem. However, the emphasis has slightly shifted to whether research can be monetized, according to Mr. Ajit Rangnekar, Director-General, Research and Innovation Circle of Hyderabad (RICH), India. In the past, a scientist was judged on their ability to publish their research in the best peer-reviewed journals. Thus, every scientist ensured that their papers stood the best chance of being published. Publication also ensured that the funding cycle did not dry up. However, according to Rangnekar, this emphasis has changed, in the last four to five years, to asking whether the research has resulted in innovation, real-world application, and monetization.

The need to communicate about research that is being undertaken is not just an Indian phenomenon but a global issue. A multi-country study on research communication reports:

Leading academic institutions, governments, and funders of research across the world have spent the last few decades fretting publicly about the need for scientists and research organizations to engage more widely with the public and be open about their research. While a global literature asserts that public communication has changed from a virtue to a duty for scientists in many countries and disciplines, our knowledge about what research institutions are doing and what factors drive their ‘going public’ is very limited.
INDIAN SCIENCE AND ITS STAKEHOLDERS

FIGURE 2: STAKEHOLDERS OF SCIENCE

Governments, funding agencies, and policymakers

Academic institutions, academics, and students

Science academies

Charities, philanthropy, and humanitarian aid organizations

Media organizations and journalists (print, broadcast, and new media)

Press officers and communication officers

Science museums and centers

Public and community engagement and allied professionals

Non-professional communicators and independent sector organizations

Advocacy organizations and activists (e.g., organizations working on the environment, climate change, etc.)

Source: Author
Research communication can be a shared responsibility for an institute, different departments, or even an individual scientist or scientist in training. Different organizations tend to focus on two aspects of the research communication daisy (see Figure 3): impact and outreach. Multiple motivations may also exist.

FIGURE 3: MOTIVATIONS BEHIND RESEARCH COMMUNICATION (DAISY MAP)

Source: University of Oxford, Mathematical, Physical and Life Sciences Division
RESEARCH COMMUNICATION BY AN INSTITUTE AND AN INDIVIDUAL

One of the most important motivations for an institute to engage in research communication is to define, maintain, improve, and extend its brand values. Research communication reflects an institute’s values, vision, and mission, and highlights its role in capability building, knowledge generation, innovation, and entrepreneurship, as well as its local and national impact. Institutes are rated based on several indicators, including the number of publications, patents filed, and citations, receipt of awards and generous grants, the number of students recruited, and the number of startups and companies built. Several international ranking systems use similar criteria.

For instance, the QS World University Rankings considers approximately 1,300 universities worldwide and grades them on a set of parameters. The first Indian university in the QS World University Rankings 2022 was the Indian Institute of Technology (IIT) Bombay, at 177th position, followed by IIT Delhi at 185th position and the Indian Institute of Science (IISc) at 186th. India fared poorly relative to other Asian nations, such as China, which had 6 institutes and universities within the top 20, and Singapore, which had 2. The top 100 included 5 from Japan and 6 from South Korea.

India’s research output grew 11 percent per year between 2008 and 2018, from 48,998 publications in 2008 to 135,788 in 2018. According to the National Science Foundation of the USA, global research output, as measured by peer-reviewed articles in science and engineering journals, grew approximately 4 percent annually during this period. Regarding India’s research output, health, biological, and biomedical sciences contributed nearly a fourth of the publications (24.41 percent), followed by engineering (17.56 percent), computer and information sciences (18.41 percent), physics (10.59 percent), chemistry (8.46 percent), materials science (9.32 percent), and social sciences (1.48 percent).

FIGURE 4: INDIA’S RESEARCH OUTPUT GROWTH IN PUBLICATIONS

- Health, biological, and biomedical sciences (24.41%)
- Computer and information sciences (18.41%)
- Engineering (17.56%)
- Physics (10.59%)
- Materials science (9.32%)
- Chemistry (8.46%)
- Social sciences (1.48%)
The growth in research activity in the country can be seen not only from the increase in the number of publications, but also from the increase in the number of patents filed and granted in India. The number of patents filed in India rose from 39,400 in 2010-11 to 58,502 in 2020-21, while the number of patents granted increased from 7,509 to 28,391 during the same period. Interestingly, an increasing number of patent applications come from Indian residents rather than multinational companies. Indian residents’ share of total applications has increased from 20 percent in 2010-11 to 40 percent in 2020-21.

**FIGURE 5: INCREASE IN THE NUMBER OF PATENTS FILED AND GRANTED IN INDIA**

<table>
<thead>
<tr>
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<th>2010-11</th>
<th>2020-21</th>
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<tr>
<td>Patents filed</td>
<td>39,400</td>
<td>58,502</td>
</tr>
<tr>
<td>Patents granted</td>
<td>7,509</td>
<td>28,391</td>
</tr>
<tr>
<td>Indian residents’ share of total applications</td>
<td>20%</td>
<td>40%</td>
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Publication output is not the only factor in these rankings; another is research communication and media reportage of the work. Equally valuable is the effect of research communication on other metrics such as citations. Mainstream media coverage is usually accompanied by increased citation counts.

In addition to improving qualitative and quantitative indices, public communication attracts private investors and philanthropic funding. According to Mr. Abhishek Goel, CEO, Cactus Communications, apart from the facts that it is a public good and that it is needed to inspire the next generation of scientists, the main reason for communicating science and scientific research is to obtain more funding for research. The West has been quite good at attracting philanthropic funding, whereas this remains extremely limited in India. In the West, entire departments or laboratories are funded by endowments and philanthropic money for a long time. Goel asks why the same cannot happen in India, especially in the new-age private universities that have emerged. Such funding would help attract the best of domestic and global minds, working to solve India’s and the world’s problems from India.

With private investors showing interest in advancing
their companies and legacies through investment in research and education, institutes need to make themselves and their achievements visible. Prompted by government bodies to raise their own funding, institutes can make these activities more relevant than ever.

Foreign universities have robust research communication initiatives\(^\text{13}\). In the USA, privately funded universities spend more on outreach activities, whereas publicly funded European universities tend to project their societal responsibility. Indian institutions are currently publicly funded but have been encouraged to invite more philanthropic funding and private partnerships. The adoption of different approaches that are aligned to institutional aspirations requires strategy and thoughtfully designed communication policies.

Research communication not only attracts funders but also increases opportunities for participation in multi-institutional collaborations and multi-continent projects. Digital communication makes it easier\(^\text{14}\) to access, communicate, and foster fruitful collaborations with international partners. Furthermore, these international collaborations can result in publication in journals with a higher impact factor.
Research, as pointed out by Mr. Varun Aggarwal, Co-founder, Foundation for Advancing Science and Technology (FAST) India, cannot be done in silos. He argues that the outcome of research is a public good that will not manifest itself automatically. Why is it a public good? Because when it is applied, it benefits all, bringing both social and economic benefits. A most recent example is the manufacture of India’s indigenous COVID vaccine, Covaxin\(^1\), by Bharat Biotech Ltd. in collaboration with the Indian Council of Medical Research (ICMR).

In an article for *The India Forum\(^2\)*, Dr. Vikram Patel, Pershing Square Professor of Global Health, Harvard Medical School, observes:

> The rapid design, evaluation and production of diagnostic tests and vaccines, and their subsequent widespread deployment across the country in response to the pandemic is an example of what can be achieved when government institutions, civil society institutions and industry collaborate with generous funding to advance the entire spectrum of science, from discovery to its translation to impact the population. This multi-disciplinary and inter-sectoral approach to research should become the norm.

Indian institutes hope to attract scientists returning from abroad as well as foreign nationals as faculty and students. The allure of Indian institutes for the returning scientist is that of serving national pride, being back home, and increased chances of obtaining funding. Some Indian institutes or a few departments therein have a tremendous reputation because of their ability to conduct cutting-edge research with limited available resources on socially relevant issues. These institutes have clearly defined and known policies for international faculty and students. The ability to attract and retain a few international faculty and students\(^3\) results in higher numbers of incoming foreign nationals\(^4\) in subsequent academic years.

This has not always been easy. An attempt was made in the early 2000s to attract Indians working on research abroad back to the country, says Dr. Gagandeep Kang, Professor, The Wellcome Trust Research Laboratory, Division of Gastrointestinal Sciences, Christian Medical College, Vellore. This met with limited success mainly because the package offered was nowhere near being lucrative, and the move failed.

Institutional prestige and visibility can also influence future hiring opportunities and compensation for students. In addition, students from such institutes establish a dense alumni network that benefits both the institutes and past and current student bodies. The IIT alumni network has in the past and in recent times relied on hiring from their alma mater\(^5\) for new talent, particularly in the startup sector.

It is easy to conflate public communication with science communication. The two, however, do share some goals, including increased public trust in science. This results in continued funding and high interest in prospective students. According to Prof. Krishnan Balasubramanian, Institute Professor, Department of Mechanical Engineering, IIT Madras, communicating research plays an important role in building an institute’s brand. People will be interested in appropriately packaged research. The IITs, he believes, carry a heavy responsibility toward society at large; thus, they understand the work that is being done and inspire the next generation of students. He recalls when he was Dean of Industrial Consultancy & Sponsored Research at IIT Madras, he personally ensured that an outside agency was hired to communicate the research work that was being done at the institute. Initially, there
was pushback from his colleagues; however, he would personally convince them of the need to talk about their research and how it would help the institute and society. The sceptics were won over, and gradually the communication process was institutionalized.

Additionally, institutions can participate in nation building by consulting with policymakers on issues related to genetic technology, artificial intelligence, superconductor use, nuclear power, gene editing, fertility science, and other problems of direct societal relevance. Effective research communication can have a vital advocacy role, as relevant and timely publication of research findings can influence policymakers and governments into making positive interventions.

Apart from institutional public communication, an individual scientist can participate in science as well as public communication. While press releases and invited talks are facilitated by an institute, a scientist has agency to use digital media routes that may or may not be facilitated by an institute. A website with updated blogs, active social media presence, informal science talks with the public, and building relationships with traditional media are all possible avenues a scientist can explore and exploit. By engaging in these activities, a scientist may attract interns, graduate students, and post-doctoral fellows while simultaneously creating excitement about the field of study and its impact on science and society.

For scientists, particularly those who work in the health sector, it is important to build a relationship with the public to recruit subjects for their studies. Literacy level, sociocultural characteristics, and awareness about clinical research strongly affect patients’ and caregivers’ decisions to participate in clinical trials. Without active communication, patients may be reluctant to participate owing to the perceived risk of harm, side effects of research, and feelings of exploitation.

Scientists who are fairly active on social media report higher numbers of invitations to seminars, talks, invitations to write review articles, requests for internships, etc. Additionally, social media has become an informal ecosystem for connecting with grant reviewers and scientific societies.

Furthermore, some scientists have shared how social media interactions have led to fruitful collaborations and publications with people they met online. This, in turn, leads to increased funding possibilities and award nominations. Even in the Indian ecosystem, a handful
of scientists are active on various platforms. Twitter and LinkedIn are favored over other platforms, while both platforms provide an opportunity for researchers to directly engage with different stakeholders with bite-sized content that links to the original articles for those interested.

With the various direct and indirect benefits of engaging with the public, there is limited motivation for individual scientists to participate in public communication. Would incentives help?

International examples show that scientists can indeed be excellent writers, authors, and effective communicators. Some in India feel that scientists should be incentivized to popularize their research to the general public, according to Prof. V. Ramgopal Rao, Former Director, IIT Delhi. Scientists see their work primarily as conducting research or guiding their students, while public communication is not a top priority for them. However, there are others, such as Prof. K. Vijay Raghavan, Former Principal Scientific Adviser to the Government of India, who question the need to offer incentives for anything and everything. “We have not told anybody clearly that this (communicating their work) is part of their job. That this is something desirable, this is something that is appreciated. Any activity of humans which is not encouraged and rewarded will disappear,” says Prof. Ashutosh Sharma, Institute Chair and Professor, IIT Kanpur and former Secretary, Department of Science and Technology, Government of India. Outside India, bodies such as the National Institutes of Health (NIH) and National Science Foundation (USA), Wellcome Trust, the Global Fund, UK Research and Innovation (UKRI), and National Institute of Health Research (NIHR), UK, etc. require the integration of public and community engagement and knowledge translation activities in funding applications to ensure that the delivery of research is responsible, and that its outputs are accessible and result in societal impact. Similar structures, if adopted by the Indian funding agencies, will lead to a shift in Indian scientists’ attitudes toward and adoption of public communication practices.
Traditionally, most institutes invest their resources in press releases. However, with an explosion in digital platforms, the possibilities for public communication have expanded.

**FIGURE 6: HOW SCIENTISTS CAN COMMUNICATE RESEARCH TO THE PUBLIC**

- Interviews for newspapers
- Interviews for radio
- Interviews for TV
- Press conferences
- Press releases
- Newsletters
- Brochures
- Popular science articles
- Popular books
- Policy briefs
- Educational material for schools and textbooks
- Documentaries
- Websites and updated blogs
- Facebook
- Twitter
- LinkedIn
- YouTube
- Instagram
- ResearchGate
- ORCID
- Google Scholar profile
- Podcasts
- Animated videos
- Citizen science projects
- Public lectures
- Public exhibitions
- Collaborations with local museums
- Science cafes/public debates
- Workshops with private organizations
- Talks at schools and colleges

Source: Author
PRACTICING RESEARCH COMMUNICATIONS

A few institutes and universities have the resources and appropriate structures for a communications office that works with in-house scientists and agencies beyond the institute. A recent FAST study notes that only a few institutes have dedicated staff working on public as well as science communication. The same personnel or team is often involved in both activities, leading to confusion in the goals of this office. The strategic precision required to engage with the right stakeholders at the right time is lacking. With limited bandwidth of available personnel, some scientists rely on freelancers or outside agencies. This is particularly true if the output requires multimedia production. The institutional communication offices have personnel with writing, social media, and, rarely, multimedia skills.

Different institutes adopt different methods to communicate their work. For instance, IIT Madras has hired an external agency to communicate its research work once it has reached an important milestone. Similarly, IIT Delhi uses its own structures to issue press releases to the media. IISc, Bengaluru, has an Office of Communications that brings out two newsletters, one of which—an eight-page monthly publication—highlights the research work that is undertaken by scientists in the institute. IIT Madras launched a bimonthly magazine in May 2021 to showcase science, technology, and innovation in India and abroad.

There is a need to both build institutional capacities for public communication and train individual scientists to participate in public communication. This involves learning to interact with the media.

According to Rangnekar, the media has very little appetite for anything in depth. It does, however, report even the most spectacular research claims, provided it involves “big news.” The trick, therefore, is for each scientist and institute to create newsworthy snippets to share with the media. The government, through the Niti Aayog or the Principle Scientific Advisor, can agree with a few newspapers to have a weekly page where interesting developments can be collated and published. In both cases, however, the real problem is the enormous...
gap between what a scientist considers exciting and what the newspaper deems newsworthy. Science is interested in new knowledge; the media is interested in exciting applications of that knowledge. Scientists and institutions must learn this game. Research papers are of interest only to other researchers. The idea, therefore, is to identify the exciting parts of a research paper that will be of interest to the lay public and educate them about it. Otherwise, research communication will not happen, while research will remain in the rarefied atmosphere in which it now happens to be.

The government, realizing the importance of communicating research work in science and technology and popularizing it among the common public, launched a program—Augmenting Writing Skills for Articulating Research (AWSAR)—through the Department of Science and Technology’s National Council for Science & Technology Communication Division. Run as a competition, this program encourages PhD scholars and post-doctoral fellows in science and technology to write at least one popular science article during their fellowship.

Quite a few science magazines and journals propagate research work; however, most often, the target audience is fellow scientists or science students, not the general public. Launched in 1964, *Science Reporter* is one of the oldest popular science magazines. It is a monthly magazine published in English by the National Institute of Science Communication and Policy Research, Council of Scientific and Industrial Research.

Prof. Kaushal Verma, Chair, Office of Communications, IISc, Bengaluru, agrees that research communication is an important part of what scientists do. He observes that there have been attempts to bridge the gap between academic writing and writing for the lay public; however, much more work needs to be done in this area. There are very few people with a flair for writing who can understand the final position of a research paper. The important rule here is that the communication should not compromise the integrity of the research work.
IISc has introduced a writing internship program for students through which students are identified and trained on structure and thought. These students then help in the communication. IISc has two in-house newsletters, one of which, *Kernel*, is a monthly eight-page newsletter. *Kernel* focuses on the research that is conducted at the institute, which is where the student interns work.

All these cases still heavily emphasize interaction with traditional media, with a preference for writing as the medium of choice. As listed above, the digital media platforms allow for more kinds of interactions. There is a need to build capacity, capability, and training modules, and to promote the digital communication infrastructure.

Prof. Ramgopal Rao points out that since institutes such as the IITs are publicly funded, they have an obligation to publicize their work. Why are scientists reluctant to engage with the general public and talk about their work? Rao says that he can talk to the public about his work and communicate the gist of what he is doing in 5-10 minutes. However, if he were to engage with them for a longer period of time, his talk might become too technical for them. He can explain his work broadly but cannot go into the details. This may be the case with most scientists, too. Hence, institutions have a duty to identify good communicators among their researchers and scientists and motivate these people to engage with the wider world. They must be incentivized to go beyond merely conducting research and publishing their findings. He also points out that research to only publish papers is not going to change anything significantly in the long run, unless we generate that knowledge and use that knowledge to create wealth later. Sections of our academic institutions need to be doing that knowledge-to-wealth translation, and that is broadly missing in our institutions.

Over the years, workshops have been conducted to train scientists in communication skills. The DBT/Wellcome Trust India Alliance, in particular, has conducted workshops for scientists on how to talk to or write for a non-scientific audience. These workshops have helped scientists appreciate the value of engaging with such audiences. According to an India Alliance study that covered 243 India Alliance grantees, “[i]n recent times, the Indian research ecosystem has seen an upward trend in scientists showing interest in communicating their science to non-scientific audiences; however, the number of science communications or public engagement projects undertaken formally by scientists remain[s] low in the country.” The study concluded that this was due to competing demands on time, absence of formal training in engaging with the public, and insufficient specialist staff at the institutes to help in public engagement. The study’s respondents requested assistance in learning how to organize a public engagement activity and engage with school children, young people, and policymakers.

Prof. B. Ravindran, Head, Robert Bosch Centre for Data Science and AI and Professor, Department of Computer Science and Engineering, IIT Madras, says that he frequently talks to lay people, including school children, about his center’s work. He also writes magazine articles explaining issues such as data analytics, artificial intelligence, and machine learning in easy-to-understand language. He accepts that it is difficult to institutionalize something like this. A colleague has recorded videos in Marathi on artificial intelligence, while another has prepared videos in Tamil on machine learning. There are people who do this kind of work in regional languages, which is far more difficult than communicating scientific research in English but is bound to have a greater influence. This is particularly relevant in engaging with local non-government organizations and activist groups that work at grassroot levels on issues pertaining to health, sanitation, climate change, etc.

For instance, in Goa, a public mobilization was seen in response to some proposals that affected the biodiversity of a specific region. What catapulted this movement was scientific information and scientists’ talking to the public about the present and past status of forests and wildlife, and the effect on trade and human livelihood. Such an informed group of citizens could then convince the authorities and argue for the preservation of the biodiversity hotspot in question.
Let us consider two examples of how public communication benefits science and scientists.

In one, a formalized network of scientific institutes, entrepreneurs, and funders hired an agency to drive their public presence and engagement. Through strategically devised social media interventions, the network could reach and enroll more people in their key programs. Through the identification of media friendly content and building of appropriate channels for communication, they could also attract more mentions in traditional media.

Another leading technological institute in the country works with strategic communication partners to increase the visibility of new innovations among potential industrial partners. A targeted newsletter yielded several hot leads for the scientists and the institute to pursue to commercialize their indigenously developed technologies.

These examples underscore the relevance of strategic public communication in advancing the stake of science and technology in society.
The science conducted in Indian institutes may be a little behind in generating revenue against every rupee invested. However, it has tremendous value in enhancing national pride, building problem solving capacity, training the younger generation of scientists, and occasional commercialization. It deserves continued and increased funding from both the private and public sectors.

Building a portfolio of quality work in terms of publications, patents, and other outputs is insufficient to create a global presence and attract the attention of private and philanthropic partners. Increased potential for attracting private monetary investment is a strong incentive for Indian research institutes to invest time and resources in public communication.

Public communication is a responsibility that can be assumed by an institute or a scientist, with strategic insights into how to communicate with the right stakeholders. The increase in the number of digital platforms allows scientific communities to engage with different public groups. This leads to considerable opportunities to gain trust, attention, and funding. Healthy competition for the spotlight and private funding might usher in a new era in scientific progress and innovation itself.
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