

Career challenges for young independent researchers in India

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The scientific enterprise in India has grown dramatically in the past few decades, with research emerging as a viable and important career option for students of science. The country thus has a large population of young scientists in the early stages of establishing their independent research careers. While this demographic is arguably the most important group that will determine the future of scientific research in India, their status and concerns are poorly understood. The Indian National Young Academy of Sciences conducted a national survey to better understand and present the challenges faced by them. Through a structured questionnaire, we sought the views of researchers below 45 years of age. Here, we summarize the responses from 854 participants across multiple early career stages. We highlight key challenges faced by these scientists in establishing an independent research career, and suggest steps to address them.

Keywords: Academia, career opportunities, challenges, scientific enterprise, STEM, young researchers.

ACCORDING to a recent Pew survey, most Indians agree that it is important for the country to be a world leader in scientific achievements, and that Government investment in scientific research is worthwhile^{1,2}. Early career scientists comprise a major fraction of the scientific workforce³, and are critical contributors in shaping the scientific, technological and societal development of a country⁴. Facilitating their work and encouraging them is thus crucial not only for their career progress, but also for building a

strong scientific community focused on high-quality research. Ensuring the success of young scientists has become especially important with society's increasing reliance on science and technology to address our biggest problems, including the COVID-19 pandemic, food security, access to life-saving technologies, climate change and sustainable development⁴. Young researchers who are about to be or have recently become independent have a key role in shaping the country's response to these problems. However, they are perhaps most vulnerable to concomitant changes in science funding, education policies, job opportunities and support systems for young parents in India^{5,6}. How are these sweeping changes affecting young scientists? For instance, interdisciplinary research may be essential to solve many pressing problems. Do our young scientists have adequate opportunities to collaborate across disciplines? Recent reports indicate that the research culture in India can be improved by reducing hierarchical governance systems and encouraging risk-taking and curiosity⁷; for instance, by increasing the representation of young scientists in decision-making bodies^{8,9}. However, we neither have comprehensive analyses of the status of this group of researchers, nor clarity on how to address them.

Indian National Young Academy of Sciences (INYAS), New Delhi is an established young academy of the country under the ambit of the Indian National Science Academy (INSA), New Delhi, and actively contributes to science promotion, communication, policy formulation and international cooperation with other national young science

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academics. We undertook a national survey to understand the problems faced by young scientists. In this paper, we summarize and synthesize the results of the survey, and make concrete recommendations to mitigate the challenges that have emerged. Our aim was to focus on scientists who have recently transitioned to independent research positions, since this demographic will be the major driver of India's scientific trajectory in the next few decades. We conducted a nationwide survey during September and October 2020, targeted at young researchers below the age of 45 years. We distributed an online questionnaire through social media (Facebook, Twitter, LinkedIn), e-mails to heads of institutions covering the IITs, NITs, IISERs, NISERs, State Universities, Central Universities, R&D laboratories (CSIR, DRDO, ICAR, etc.), and circulation via INYAS members to their parent institutions as well as their respective academic networks. The survey questionnaire included the following sections (Annexure-I): job opportunities; securing funding and establishing an independent research career; conducting interdisciplinary research; workplace concerns; promotion and career advancement; hiring and mentoring junior colleagues, and handling family responsibilities and career breaks.

Demographics of survey respondents

We received a total of 854 responses, of which 68.1% were from males and 31.6% from females. At present, it is unclear whether this is a fair representation of the overall scientific workforce within the target age class. Among respondents, the dominant age group was 30–40 years (about 58%), while 27.2% of the respondents were below 30 years of age and 14.9% were above 40 years. About 52.7% were in permanent/regular positions, 24% in contractual, 21.5% unemployed and less than 2% were self-employed. Overall, the demographic data indicate substantial representation from our focus group of recently or about-to-be independent researchers. Around half the respondents were from centrally funded organizations, universities and CSIR laboratories; approximately 17% were from IITs, NITs, IISERs and NISERs; another 17% were affiliated with state-funded institutions and universities, and the remaining 16% were from industry and private organizations. Hence the survey covered scientists from across the spectrum of research organizations in the country.

Career preferences and job opportunities

Limited job opportunities for highly educated graduates is a major concern in India, and the employability of graduates has been questioned by many^{10,11}. Hence we asked respondents about their career preferences and opportunities in their preferred career paths.

Approximately 52% of the respondents mentioned that their preferred job would involve only research. Overall,

~13% said they would prefer only teaching, while ~31% said they prefer both research and teaching. Other preferences, noted by very few respondents (<1% each), included entrepreneurship, policy, industry, science communication, social work and intellectual property management. Interestingly, 48% of male respondents and 60% of female respondents preferred a research-only career. A larger fraction of men preferred positions that involved both research and teaching (36% for men versus 21% for women), while women were more interested in positions that focused either on research or teaching alone (16% for women versus 11% for men) (Supplementary Table 1). Notably, regardless of their career preference, most respondents reported an intermediate level of satisfaction with their current job (Figure 1 a), indicating room for improvement. Most (60%) respondents agreed that there are insufficient research positions available for those with their experience at their career stage (Figure 2 a). Similarly, 53% of the respondents mentioned that job opportunities

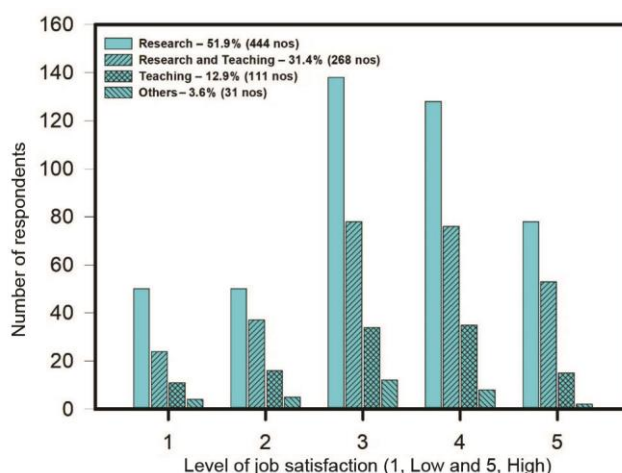


Figure 1. Level of job satisfaction of survey respondents.

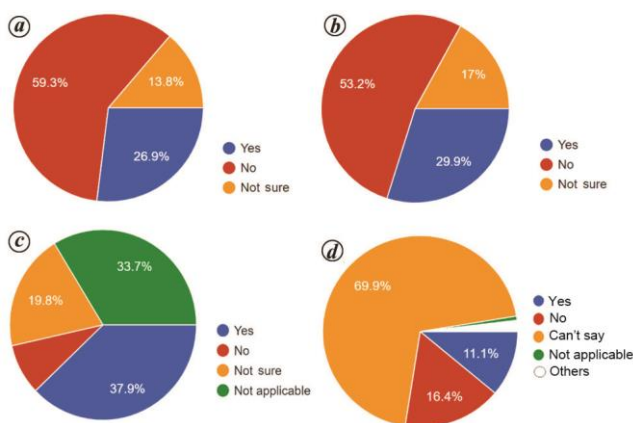


Figure 2. a, Are there enough research positions available at your current career stage? b, Are there sufficient positions available outside academia in your field of expertise? c, Did you lose job opportunities due to the need to work in the same city as your spouse? d, Does your institution encourage hiring couples?

were also limited outside academia (Figure 2 *b*). Thus, most young investigators felt that job opportunities were generally limited. Increasing job opportunities would perhaps allow people to move into a preferred position more easily, potentially increasing overall job satisfaction.

We asked the respondents whether they thought that a long training period hampered their ability to acquire a permanent job. About 47% mentioned that this was not the case, while ~30% agreed. Although most of them mentioned that they gained valuable experience during their training, many flagged age limits placed on permanent jobs as an important concern. Some respondents also voiced concerns about various forms of corruption (e.g. bribing and hiring based solely on political/management recommendations), as well as regional and caste biases and nepotism. Another concern was that Ph.D. and post-doctoral training is perceived to be too specialized for many industry or academic positions, making highly-trained candidates less competitive for such jobs. Finally, respondents pointed out that beyond 5 or 6 years, Ph.D. training without substantially different work experience had diminishing returns. For instance, a person with an M.Sc. degree and teaching experience is sometimes considered more suitable for recruitment in academic positions, compared to a person with a Ph.D. but no teaching experience.

Apart from career preferences and available positions, family and personal considerations can also have a significant impact on job choices. We asked survey respondents about the specific case of dual-career couples, since spouses would generally prefer jobs in the same city. About 38% mentioned that this significantly constrained their job opportunities (Figure 2 *c*). When asked whether their institution encouraged hiring couples, about 70% were unsure; 11% said 'yes' and 16.4% said 'no' (Figure 2 *d*). Thus, although about one-third of young scientists struggle to find ideal jobs for themselves as well as their spouse, few research institutions offer to mitigate such issues via spousal hiring. A policy of facilitating the hiring of couples in the same city if not in the same institution, through cooperation across organizations, can address this important 'two-body' problem.

Acquiring funding for independent research

One of the primary necessities for young scientists, especially those involved in experimental research, is adequate funding for setting up laboratory facilities at the start of their research career. Such funding is usually acquired through various project grants from Central and State Governments, industry, and seed grants from the home institution. This section highlights the problems in acquiring these funds.

Seed funding is not only important to begin a research career; it is also essential to obtain subsequent funding,

because applications for larger grants are unlikely to succeed without sufficient preliminary results. An alarming observation is that at the beginning of their career, less than half of the young scientists (~44%) received seed grants from their parent institution; of these, half (22.6%) received less than Rs 5 lakhs (Figure 3 *a* and *b*). Only ~7% of young scientists received a generous seed grant of over Rs 15 lakhs. As predicted by the weak seed funding support, 43% of the young scientists also did not execute externally funded projects, either as a principal investigator (PI) or as a Co-PI in the five years preceding the survey. These results, highlighting meagre funding for a substantial fraction of young independent scientists, are concerning.

Overall, there are significant challenges in both acquiring funding and executing funded projects. About two-thirds of the respondents noted the following major problems:

- Inordinate delays of up to 2–3 years at all stages, from proposal review to sanction to fund disbursement, with little or no communication from funding agencies.
- Lack of transparency in the review system. For instance, proposals are typically rejected without providing any referee comments, so they cannot be revised and improved for resubmission. The opacity of the process also leads to a strong perception of favouritism in project funding.
- Major cuts in sanctioned funds without clear reasons.
- Sometimes parent institutions discourage project submission, or create so many administrative hurdles that it becomes challenging to write and submit a grant. In some cases, senior colleagues (e.g. head of the Institution or department) discourage young scientists from independently submitting projects to funding agencies, asking to be designated as the project PI themselves.
- Lack of credit-sharing in a team project.
- Long administrative procedures for industrial projects.

The poor funding support for young scientists may reflect several lacunae: meagre funding opportunities or programmes, lack of training opportunities to learn how to write good grant applications, or the unwillingness of research institutions or industry to invest in research and development. All of these are serious and systemic hurdles

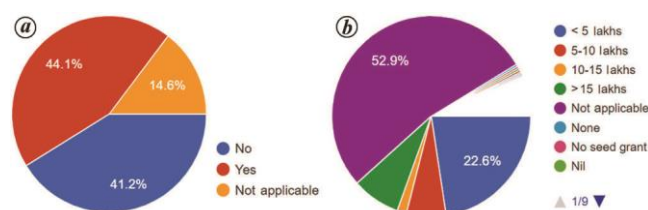


Figure 3. *a*, Did you receive a seed grant from your parent organization? *b*, What was the amount of seed grant received?

that prevent young investigators from establishing themselves as independent scientists. The underlying causes must be analysed carefully so that they can be addressed.

Pursuing interdisciplinary research

By linking and integrating diverse knowledge, frameworks and skills, interdisciplinary research can lead to the generation of new knowledge and innovation^{12–15}. Most young scientists in our survey (95%) concurred with the relevance of interdisciplinary research, with many already pursuing such collaborations (Figure 4). However, 67.6% of the respondents mentioned that they found it difficult to identify collaborators to work on such projects. About half the survey respondents mentioned that the lack of a common platform to find colleagues across disciplines was an issue. About a third also highlighted the lack of appropriate infrastructure that would be necessary to pursue such research, though most seemed satisfied on this account. Nonetheless, most (~77%) respondents mentioned that they received adequate support and encouragement from their institution in initiating interdisciplinary research. Overall, although there do not appear to be significant barriers to interdisciplinary work, developing a common web platform and centralized infrastructure for researchers across the country may further facilitate interdisciplinary research.

Challenges at the workplace: finding space, a voice and managing expectations

Office and laboratory spaces are essential for conducting academic and research activities, and are thus basic facilities that should be provided to independent scientists by their parent institutions. Surprisingly, only 66% young researchers reported having access to office space as they began their independent research career, and only ~52% had access to laboratory space. Another important aspect

of leading a research group is access to administrative support. Young faculty can get overloaded with administrative responsibilities such as involvement in the Internal Quality Assurance Cell (IQAC), organizing seminars or workshops and resource management, potentially compromising their academic and research output. Indeed, only about 60% of our survey respondents were satisfied with the administrative support provided by their institution (Figure 5 a).

The flip side of being asked to serve on administrative committees is a chance to weigh in on important decisions. A considerable fraction (~26.5%) of respondents agreed that their institution encouraged the representation of young faculty in decision-making forums like the management council, research councils, project advisory committees, board of studies, faculty-hiring committees, policy-making committees, internal grant evaluation committees and financial committees (Figure 5 b). Many participants also mentioned that their ideas were well received and they were encouraged to participate in industry interactions and sign Memorandum of Understandings (MoUs) with potential stakeholders.

Overall, 37.6% participants mentioned that senior faculty pushed their own opinions in decision-making forums and that some of the resulting policies were insensitive to the challenges faced by young faculty. Thus, although the voices of young faculty are heard, they are not always considered seriously while making final decisions. On the other hand, some institutions – especially those built during the past 10–15 years – have involved junior faculty at major decision-making positions such as Associate Dean, and encouraged faculty to develop new courses relevant to the current times. For example, in some of the newly established IITs, 33-yr-old faculty members have served as heads of their departments. These positive trends need to spread beyond institutions such as the IITs, IISERs and IISc, and become commonplace across research institutions in the country. Ultimately, institutions need to balance the duties assigned to young faculty so that they get more experience and a chance to participate in decision-making, but are not overloaded so that their core focus on research and/or teaching can be maintained.

Finally, we asked the survey participants about their teaching responsibilities. In academic institutions, it is a good sign that almost 78% early career researchers are

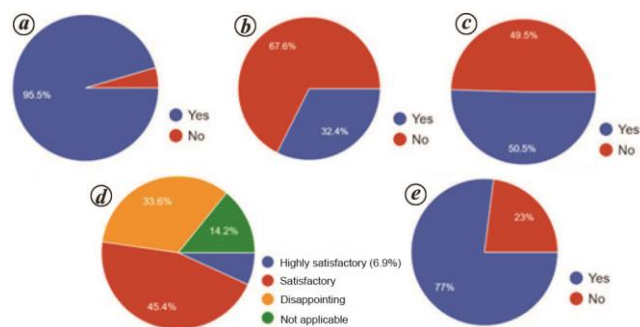


Figure 4. a. Are you currently involved in interdisciplinary research? b. Is it difficult to find collaborators? c. Do you think problems in interdisciplinary research arise due to poor communication between collaborators? d. Do you have adequate infrastructure for interdisciplinary research? e. Does your institution support interdisciplinary research?

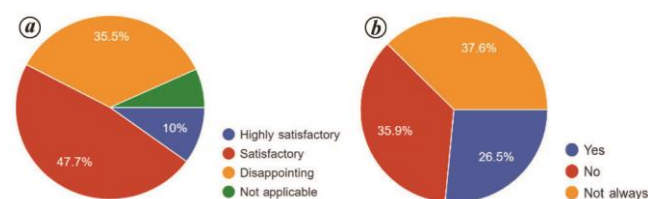


Figure 5. a. Are you satisfied with the current level of institutional support you receive? b. Are young faculty well represented in decision-making forums in your institution?

able to teach courses in their specialization. However, 12% are still asked to teach other subjects (Figure 6 *a*). While this can be viewed as an opportunity to learn new subjects, it also reduces research time and does not make efficient use of their expertise. It is heartening to note that 80% eligible young scientists are satisfied with their teaching load. While 47% of the respondents mentioned that their teaching load was in accordance with the guidelines set by the government, 13% said that their work load was not according to the norms (Figure 6 *b*). Nearly 20% of the respondents mentioned that they were hired as contract/ad hoc faculty and given a much higher teaching load than expected. Contract faculty reported feeling powerless to negotiate reasonable teaching loads, since their contract can be terminated without due process; and they are not given benefits such as specified pay and maternity leave. Hence, while most investigators in regular positions appeared satisfied with their teaching load, more attention is needed to ensure fair working terms for contract faculty, who are often overloaded.

Issues regarding promotion and career advancement

Timely assessment and promotion of young researchers is important for their careers. In our survey, when asked if promotion happened on time in their organization, only about 32% respondents said 'yes' (Figure 7 *a*). We asked the respondents to describe the criteria used for promotion, and found that in most cases (58%) research is given maximum weightage along with other factors. In about 34% of these cases, both research and teaching were heavily weighted. Other important criteria for promotion included the ability to attract funding, service to the institution (e.g. organizing workshops, mentoring), and service to the academic community (e.g. serving as a reviewer or editor). Interestingly, about 10% of the respondents were in favour of considering research exclusively for promotion decisions, whereas only 2% supported teaching as the sole criterion for promotion.

Next, we asked eligible respondents about the criteria that are currently used to assess research output. These criteria generally seem to be clear (less than 1% participants were not sure about the criteria for research assess-

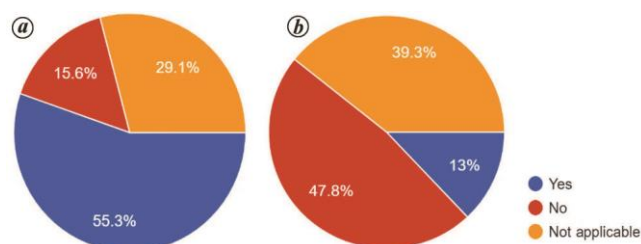


Figure 6. *a*, Are you able to teach the subject of your specialization? *b*, Is your teaching load in accordance with the rules?

ment during promotion). Nearly half of them indicated that the number of publications (54%), quality of publications (47%), and the number of projects (grants) led by the investigator (50%) are primary metrics used for assessment. Additional criteria for research assessment included impact factor of the publication (40%), patents (39%) and technology transfer (33%). In addition, a few respondents indicated that teaching hours, experience, institutional engagement, good relationship with the department head, reservation policies and the number of students graduated were also used as criteria for promotion.

Finally, we asked respondents for suggestions to improve promotion assessment. Overall, about 35% of the respondents were satisfied with the existing criteria of promotion; however, 28% were not satisfied (Figure 7 *c*). Most respondents (55%) agreed that the number of citations should be normalized by the number of publications (i.e. using indices such as the *h*-index) (Figure 7 *b*). Other suggestions included greater transparency in the evaluation process, allowing candidates to directly present their work to the promotion committee, broader assessment beyond the annual performance report (e.g. taking into account the administrative responsibilities undertaken by the candidate), and considering the quality instead of quantity of publications. In teaching institutions, including student feedback would also be useful. These responses highlight several ways in which current promotion practices can be improved.

Hiring and mentoring doctoral and postdoctoral fellows

A critical aspect of heading an independent research group is to guide students and other trainees. Among the respondents, about one-third were not eligible to guide students (i.e. they were at a postdoctoral stage or otherwise not in a position to serve as a guide (Figure 8 *a*)). However, among eligible respondents, less than half were currently supervising Ph.D. students or postdoctoral fellows, which is surprisingly low. Up to the Associate Professor position, UGC guidelines allow faculty to supervise 4–6 Ph.D. students beyond which there are no limits imposed. For postdoctoral fellows, there are no limits placed on faculty at any stage; however, young faculty typically have fewer postdoctoral fellows working with them.

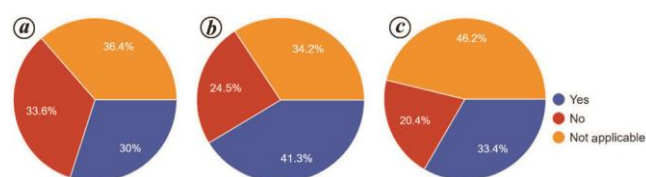


Figure 7. *a*, Does promotion happen on time in your institution? *b*, Should research paper citations be normalized? *c*, Are you satisfied with the current criteria used for promotion?

The low rate of supervision of students by young faculty arises partly because only ~41% of eligible early career researchers are allowed to guide Ph.D. students independently; and these are largely from IITs, IISERs and top-ranked central universities (43.8%) and CSIR laboratories (32.3%) (Figure 8 *b*). It is a cause for concern that about 37% of eligible researchers are either attached to senior faculty or are not allowed to supervise Ph.D. students. In addition, lack of institution-level fellowships to provide student stipends is a major reason why young faculty (who often do not have independent project grants, as discussed earlier) are unable to recruit students. Only ~27% of students are supported by institute fellowships; most are either funded by national fellowships or project grants. Finally, among the eligible respondents, 20% indicated that they were unable to attract good students and postdoctoral fellows due to the lack of institutional policies and guidelines regarding student hiring, the remote location and poor infrastructure of their institution, or because junior faculty were not allowed to participate in student interviews (Figure 8 *c*).

Mentoring and supervising students is important to develop as an independent researcher and to conduct innovative research. The survey results suggest that this development is currently severely curtailed and needs to be addressed at various levels.

Handling family responsibilities and career breaks

It is inevitable that family and work responsibilities go hand in hand, and most young scientists juggle multiple roles between work and home. We asked survey respondents about their experience while managing these various roles, and the degree of institutional support that they received. The survey revealed that about 17% of the respondents had a career break for family reasons (Figure 9 *a*). Among these, 99% were women, with the reasons being marriage, change in their husband's job, lack of family support, caring for family members (own or spouse's), family planning, maternity and post-maternity childcare. Most women respondents who had a career break mentioned that they struggled to balance their work and family life, to the point that they had to quit their job. It is noteworthy that almost none of the male respondents reported taking a career break for family reasons, high-

lighting the fact that the burden of sacrificing career goals for the family falls almost entirely on women researchers^{16,17}.

About half of those who had a career break and returned to work faced significant difficulties while doing so (Figure 9 *b*). Among all women with a career break, many had a long break lasting 1–5 years. Due to this gap, many lost touch with their scientific and academic networks and lost the confidence to compete for new positions. To make up for these losses, many reported working harder, without any relief in existing family responsibilities. Many respondents who rejoined work after their break appreciated the Department of Science and Technology (DST) scheme for women with career breaks¹⁸. However, very few respondents availed this scheme (less than 2%). Thus, despite existing programmes to facilitate return to research after a break¹⁶, difficulties still persist.

Parental (maternity/paternity) leave is another major factor that is critical for young investigators. While most eligible respondents did not face any problem obtaining leave, several of them reported that their institution did not follow Government guidelines (Figure 9 *c*). For instance, in some cases they were not offered paid leave, as mandated by the Government. In some cases, they were forced to quit their job. Generally, contractual and ad hoc faculty are deprived of paternity leave benefits. While 77% of the respondents agreed that childcare leave should also be extended to fathers (Figure 9 *d*), some male respondents indicated that their workload was so high that they did not feel it was appropriate to avail paternity leave. Surprisingly, about 6.3% of respondents felt that childcare is solely the responsibility of mothers. This attitude must be countered through policy-level changes. For instance, in Scandinavian countries paternity leave is mandatory, allowing significant help and support to women after childbirth. Childcare leave includes leave for taking care of the health and education of children up to 18 years of age. From the responses, it can be clearly observed that extending childcare leave for men is necessary. This small policy change will enable all scientists

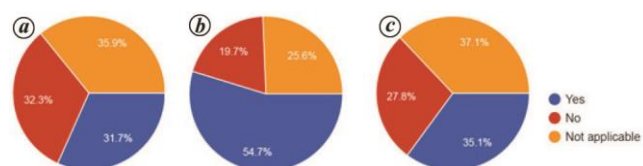


Figure 8. *a*, Are you able to guide doctoral/postdoctoral fellows? *b*, Are you able to independently guide Ph.D. students? *c*, Are you able to recruit high-quality students and post-doctoral fellows?

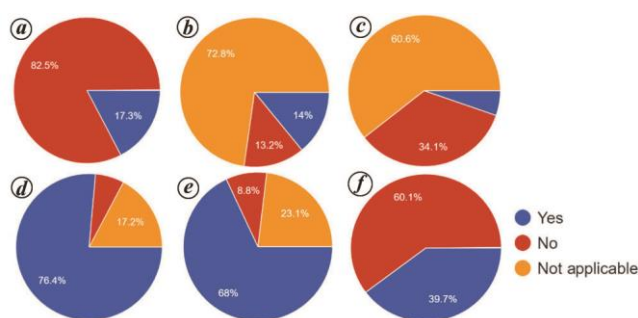


Figure 9. *a*, Did you take a career break due to family reasons? *b*, Was it easy to return to work after a career break? *c*, Is it difficult to obtain parental leave? *d*, Do you agree that paternity leave is important? *e*, Would flexibility in working hours help female scientists? *f*, Is a day care facility for children available in your institution?

Box 1. The biggest challenges for independent young researchers in India

1. Limited employment opportunities for young scientists.
2. Opaque and unevenly implemented hiring and promotion. There is a strong perception that these processes are unfair, and that they focus too much on pedigree instead of merit and on publication quantity instead of quality.
3. Age limits on permanent positions end up penalizing scientists for career breaks, family responsibilities or longer training.
4. Lack of seed funding and limited research funding opportunities for contractual staff.
5. Poor functioning of funding agencies with frequent delays in the release of funds and lack of transparency during grant review.
6. Poorly structured performance review systems that do not incentivize teamwork, participation in scientific social responsibilities and administrative contributions.
7. Poorly implemented Government guidelines on teaching load (especially for contract faculty), making young faculty vulnerable to exploitation.
8. Inadequate institutional support or policies to enable young scientists to effectively navigate both family and job responsibilities.

Box 2. Key recommendations

1. Improve access to and information about diverse job opportunities. Better exposure to diverse jobs must begin from early career stages (Ph.D. and postdoctoral training), and the number of research and teaching positions must be increased.
2. Streamline hiring and promotion; increase transparency and empathy. Institutions must provide clear guidelines and expectations for hiring and promotion, increase transparency and strive to make the process more just for those who are being evaluated.
3. Break the entrenched hierarchy. Many of the problems faced by young independent investigators stem from a deep-seated hierarchical structure that does not trust junior faculty. We suggest that hierarchies should be flattened, allowing young scientists to begin participating and engaging in decision-making at early stages, without relying on favours or mercies from senior colleagues or administrators.
4. Increase accountability in funding. Funding bodies must be held responsible for conducting rigorous proposal reviews, providing constructive feedback and distributing funds on schedule.
5. Provide adequate structural support. Expecting young scientists to perform high-quality research without sufficient support is unjust. Institutions must ensure support in the form of (a) adequate seed funding, (b) laboratory and office space, and (c) encouragement, training and mentoring to conduct and fund independent research.
6. Retain and support women scientists. Specific measures are necessary to support young women scientists, including (a) increased funding to facilitate their return to work after a career break, (b) improving participation of men in childcare, e.g. by enhancing and enforcing paternity and childcare leave, (c) increasing access to flexible working hours for young parents (including men), (d) enforcing rules regarding institutional daycare facilities, and (e) and formulating clear policies for spousal hiring to support dual-career couples.

who are parents to participate in childcare while pursuing their careers, minimizing the heavy burden that currently falls primarily on women scientists¹⁹. Additionally, about 68% of the participants mentioned that increased flexibility in working hours can dramatically improve the retention of women in science by allowing them to find the most effective work–life balance for their specific situation (Figure 9e). On the other hand, 9% of the participants mentioned that flexibility in work hours is not sufficient, and other aspects need to change concomitantly to improve the situation.

Another major concern for every working parent is childcare. Daycare facilities in educational institutions

have been mandatory since 2017, under the Maternity Amendment Act that requires establishments employing at least 50 employees to have a crèche facility²⁰. However, ~60% of the respondents reported that their institution did not have the requisite daycare facility (Figure 9f). Among those who had access to such a facility, about 50% mentioned that it was not satisfactory, with poor facilities, poor management, or because the facility was located too far from their workplace. Some respondents also reported that the daycare facility was restricted to a specific class of employees, e.g. permanent scientists. It goes without saying that if children are well-cared for, parents can focus better on their work. Another major concern for parents

was their children's education, which is a major issue if the institution is located far from a major city. For instance, 62.7% of the researchers mentioned that they would like to have primary education centres within their institution. Overall, it is clear that to facilitate the lives and careers of young independent scientists, institutions need to make substantial efforts to also provide adequate facilities for their children.

Alleviating the challenges faced by young scientists

We asked survey respondents to suggest concrete ways in which the major problems they face could be alleviated. Here, we summarize these responses.

Over 60% of the respondents mentioned that a centralized recruitment agency would help address the problems regarding recruitment. Other proposed solutions included better dissemination of information on job and career opportunities outside academia. Many participants also suggested removing or revising age limits for various jobs, and stronger measures to enforce a ceiling on the tenure of a Ph.D. (allowing people to complete their training in a reasonable timeframe). Respondents also suggested improving benefits for and workloads of contract teaching faculty to make such positions competitive and attractive, and offering them the flexibility to use innovative teaching methods to design new and updated courses. Improving the benefits of such contract positions may not only serve to create important job opportunities, but also significantly expand the breadth of subject areas offered to students.

To enhance student recruitment and improve the quality of training offered to students, participants suggested that Ph.D. applications should be free of cost, and that institutions such as IITs should place more emphasis on Ph.Ds and postdoctoral fellows. They also suggested limiting the intake of Ph.D. students, and steering bright students into various career opportunities (apart from research in academia) from the beginning.

Overall, it is clear that increasing Government funding for research would be beneficial, especially when targeted at younger faculty, and at women as well as others who have had career breaks. However, increasing the amount of funding alone would not be sufficient, and a concomitant increase in the quality and transparency of proposal review is also critical. For funding proposals, an online process similar to journal submission portals with double-blind review would be helpful.

It is also important to diversify funding opportunities rather than relying solely on the Government. Currently, less than 10% of projects led by young scientists are funded by industry. Strengthening industry-academia collaborations would diversify contributions to primary research in the country. For instance, it would be useful to offer training and internship opportunities in non-academic jobs within the Ph.D. coursework, and to link such coursework to

solving specific problems, which can later help create jobs in partnership with industry/start-ups.

Finally, to support young researchers – especially women researchers – the respondents suggested extending child-care leave for fathers and introducing flexibility in working hours. Facilitating recruitment of spouses in the same city or institution may also help many women scientists avoid the difficult choice of sacrificing either their career or family life.

Conclusion

India cannot hope to become a global scientific leader while ignoring the challenges faced by its growing body of young scientists. Hence, it is imperative that we listen to their concerns and take steps to mitigate the hurdles in their path. In this paper, we have presented the results of a nationwide survey of young scientists at the beginning of their independent research careers. The survey was structured to cover a wide range of potential challenges faced by these scientists, and gathered suggestions to address the challenges. To mitigate the major problems faced by young independent scientists in India (Box 1), we make specific recommendations for policy-level changes that could be implemented at various stages (Box 2).

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