SERB-SURE scheme in India: early indicators and recommendations

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State-level institutes have an important role in strengthening the national STI ecosystem. SERB-SURE scheme was launched in 2022 to support research at state-level institutes to strengthen the national STI ecosystem. The scheme also promotes researchers with no ongoing/completed project proposals under SERB and thus is a platform to appraise the upcoming talent pool of the country. The details of proposals submitted and recommended have been gathered from the PRISM website and SERB online portal. The present article quantitatively analyses the trend of project proposal submission and approval based on parameters such as gender, state, institute type and subject area between the financial year 2022–23. Based on these early indicators, some recommendations for promoting research at state-level institutes are provided here.

Keywords: Government programme, research in India, schemes, science, SERB, SURE, technology.

RESEARCH and innovation are the primary visible tangible and intangible knowledge assets of a country contributing to a nation's prosperity thereof. Knowledge-generating pillars of a country include various stakeholders comprising colleges, universities, research labs, institutions and other academic establishments. Multiple colleges, institutes and universities in India have been established to promote scientific temperament and foster the growth of technology, industrial innovation, and entrepreneurship generation. With one of the youngest human resources, India has 1,113 universities, 43,796 colleges, and 11,296 stand-alone institutes, established and managed through the union government, state government, or private organizations[1].

The government of India (GoI) supports scientific research and development through various schemes and programmes. According to research and development (R&D) statistics, during 2020–21, the R&D contribution of Gross National Product was 0.64% (ref. 2). National Quantum Mission (NQM), Mission Innovation (MI), National Mission on Interdisciplinary Cyber-Physical System (ICPS), Funds for Improvement of S&T Infrastructure (FIST), etc. are some of the significant government initiatives to promote research, technology transfer and encouraging public–private partnerships[3,4].

India is emerging as one of the leading contributors to science and technology and is ranked 3rd in scientific publications as National Science Foundation (R&D statistics 2019–20). Most of the national universities and laboratories under the Council for Scientific and Industrial Research (CSIR), Defence Research and Development Organisation (DRDO), Indian Council for Agricultural Research (ICAR), and Department of Atomic Energy (DAE) have well-structured institutional systems and R&D funding models and are the significant R&D output producing institutes. Indian Institute of Technology (IITs) is the top contributor to national R&D (15.8% of the total)[5]. While all IITs' total patents were 540, institutes like CSIR and DRDO applied for 176 and 126 patents in 2017–18 (R&D statistics). However, various studies have highlighted the wide gap in the research activities between national institutes and state universities[6].

Banshal *et al.*[7] have evaluated the research output of 31 NITs (one in each state of the country) and have reported the impressive contribution of NITs like Trichy and Rourkela. The studies highlighted that between 2012 and 2016, NIT (Rourkela) had published the maximum number of research articles (1906). However, the gap between NITs and IITs is evident because IIT-Bombay alone has published 5979 research articles during the same period. Private universities like Manipal University, Vellore Institute of Technology, Thapar University, and BITS Pilani have published 4018, 3570, 2270 and 2254 respectively. The trend indicates the need for capacity building of state-level and private institutes for further strengthening the state-level research ecosystem.

While state-level institutes have easy access to regional centres, understanding grassroots problems, culture, socio-economic environment, and priorities can bring fresh concepts and ideas that eventually generate solutions. The accessibility to funds and resources is an imminent challenge to capacity building, training, and supporting human resources in these universities. The studies have continuously highlighted the lack of funds, research facilities, and

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thus research outcomes in the state and private universities. For instance, except for IISc-Bengaluru, and various IITs, universities from India are listed in the top 500 global universities in both ARWU and QS world ranking of universities[8,9].

In the past decade, there has been a continuous emphasis on integrating state-level universities into the overall scientific dynamics of the country. The Science and Engineering Research Board (SERB), a statutory body owned by the Government of India under the Department of Science and Technology, was established to provide financial support for scientific research and development under various schemes and programmes. SERB's State University Research Excellence (SERB-SURE) funding scheme was launched in 2022 to inculcate culture at state-level universities/private universities/colleges[10].

This paper attempts to analyse the early indicators of the progress of the SURE-SERB scheme to promote research at state-level universities. Based on quantitatively available trend analysis information of proposal submission and approval using subject, state and gender as factors. The paper explores the research question of whether the current proposal submission and approval dynamics enable the capability.

Early indicators of the impact of the scheme

In this SERB-SURE scheme, the proposals can be submitted by researchers working in institutes under state and private universities and colleges through an open call. The unique aspect of the scheme is that the project investigator (PI) should not have any ongoing/completed projects in SERB. This gives a platform to appraise and nurture the upcoming talent pool of the country for greater inclusion of regional institutes in the scientific growth of the nation. The details of proposals submitted and recommended have been gathered from the PRISM website and SERB online portal[11].

Statistics of proposals under the SURE programme in FY 2022–23

Gender-wise proposals analysis: The scheme received a welcoming response from researchers. The number of proposals received was categorized based on gender. Male candidates were found to be a more significant contributor to the number of proposals submitted. This could have resulted in more recommendations of project proposals under the male category.

As shown in Figure 1, more male researchers submitted proposals than female researchers, showing the need for popularization and awareness generation of the scheme among women candidates. The lower employment rate of women in state-level institutes might have been the contributing factor for the same. The greater participation of male candidates in project submission could have resulted in their higher rate of recommendations (80%) (Figure 2).

The analysis underscores the critical need to bolster the presence of female scientists within the Indian scientific landscape. A thorough examination of project proposal submissions across different SERB schemes reveals that it is essential for women scientists to take the helm in the field of science and technology and leverage the opportunities offered by government funding initiatives. This complex issue is characterized by the stark under-representation of women in STEM programmes, a marked decline in the number of female doctoral and postdoctoral candidates in STEM fields, and a significant shortage of women in faculty and leadership roles. Addressing these challenges requires concerted efforts from various agencies[12].

State-wise proposal analysis: The analysis of proposals submitted and recommended was performed to understand the reach of the programmes at the state level. The findings about state-wise proposal submissions are depicted in Table 1.

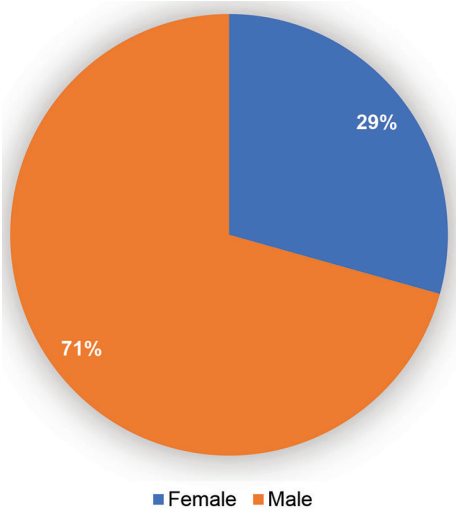

Figure 1. Gender-wise proposals submissions.

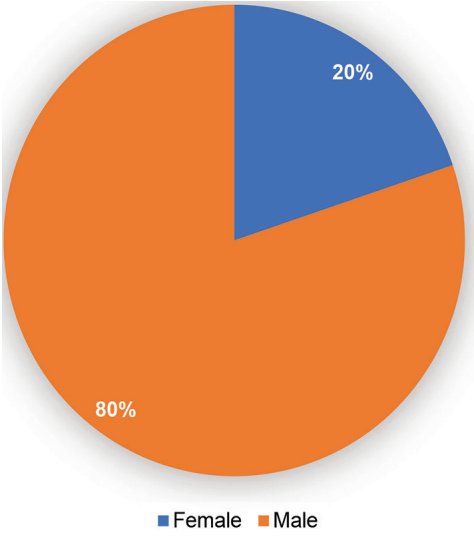

Figure 2. Gender-wise project proposals recommended.

Tamil Nadu is the leading state in terms of proposal submission in the scheme (21.06%), followed by Andhra Pradesh (9.1%), Uttar Pradesh (7.51%) and West Bengal (7.44%). Among North-eastern states, a limited number of proposals were submitted, with only Sikkim, Meghalaya, Tripura and Manipur taking the initiative. While some states with more extensive areas and populations have more institutes, there is still a need for better communication and awareness generation through local media involvement in states with lower regions, populations and remote areas. The active contribution of researchers from states like Tamil Nadu is reported by researchers, with a share of around 17% of the total national research contribution indicating research conducive ecosystem in the state. The study mentioned that in addition to a larger area, research conducive to ecosystem, state-level policies, coupled with the presence of institutes like IIT Madras, Anna University, and Vellore Institute of Technology, helped the state to submit the maximum number of publications in the past two decades[13]. The percentage of proposal approval is by the rate of submission state-wise. Several factors vary among states, including geographical area, population size and the number of researchers. These disparities also contribute to differences in proposal submission rates among states. These trends show the need for better communications and awareness generation through the involvement of local media and state science councils in the states.

Table 1. State-wise proposal submission and approval trend analysis

State/UT	Percentage submitted	Percentage approved
Tamil Nadu	21.06	12.03
Andhra Pradesh	9.10	6.24
Uttar Pradesh	7.51	6.46
West Bengal	7.44	13.36
Maharashtra	6.79	5.12
Karnataka	5.94	4.45
Telangana	5.79	4.68
Rajasthan	4.67	5.12
Punjab	4.26	4.01
Kerala	4.08	5.35
Gujarat	3.38	3.79
Odisha	3.15	3.12
Assam	2.45	2.23
Madhya Pradesh	1.98	1.56
Jammu and Kashmir	1.90	4.45
Haryana	1.72	0.22
Uttarakhand	1.52	1.34
Goa	1.48	2.23
Bihar	1.22	1.11
Jharkhand	1.20	0.67
Delhi	1.02	2.00
Himachal Pradesh	0.66	0.45
Chhattisgarh	0.61	0.89
Chandigarh	0.50	0.22
Sikkim	0.21	0
Meghalaya	0.13	0
Puducherry	0.13	0
Tripura	0.05	0
Manipur	0.04	0
Daman and Diu	0.02	0
Ladakh	0.02	0

Institute-wise trend analysis: As is evident from Figures 3 and 4, private colleges are the most active institutes taking the lead in submitting project proposals under the scheme (31%). State, private, and deemed universities have 25%, 18%, and 17% contributions respectively. The trend analysis shows the need for greater participation by publicly funded colleges, government-aided institutes, and institutes/universities under the state government, which have significantly lower participation in the submission of project proposals. Variations in work culture exist among different types of institutes, including state and private universities.

Broad-area-wise proposal analysis: The scheme allows the submission of proposals under various broad research areas, such as chemical sciences, earth and atmospheric sciences, life sciences, mathematical sciences, physical sciences, and quantitative social sciences. Figure 5 clearly shows that most project proposals were submitted in engineering and life sciences (36% and 34% respectively). Only 12% and 9% of submissions were presented in the Chemical

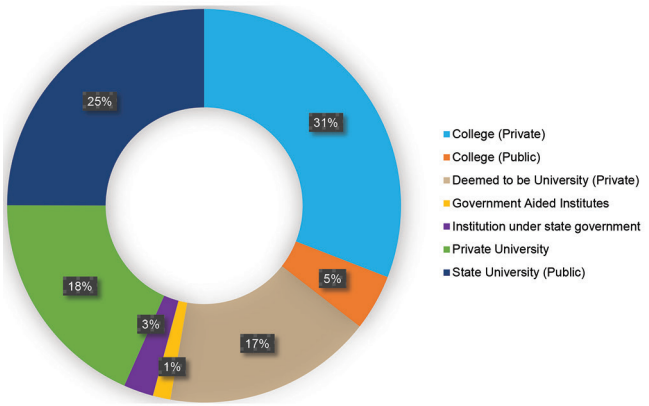

Figure 3. Institute-wise trend analysis of proposal submission.

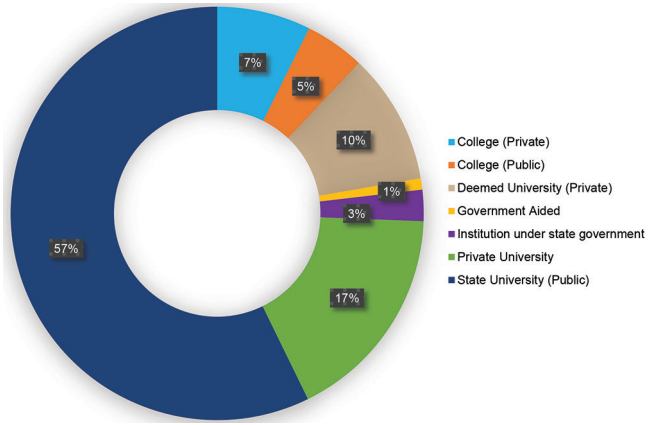

Figure 4. Institute-wise trend analysis of proposal approval.

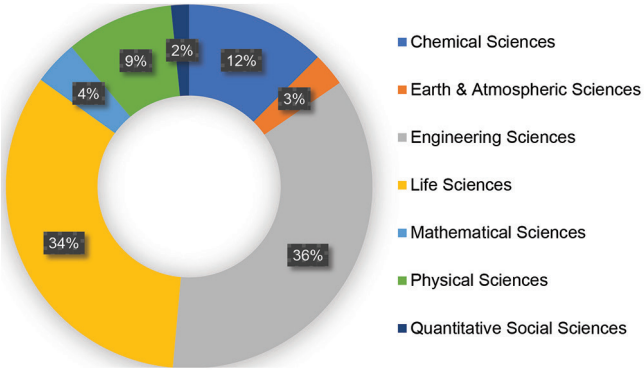

Figure 5. Analysis of proposals submissions in broad areas of research.

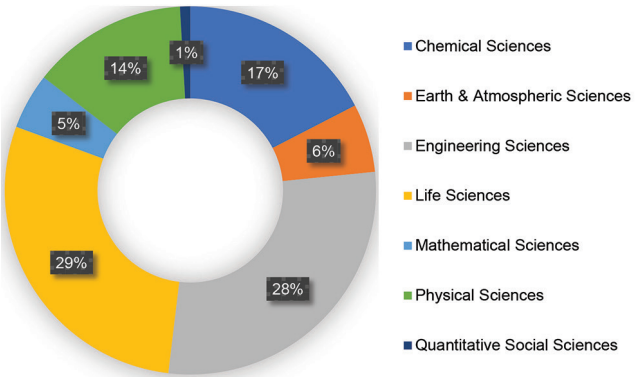

Figure 6. Analysis of proposals approved in broad areas of research.

and Physical sciences. However, only some proposals were in mathematical, quantitative sciences, and earth and atmospheric sciences domains. As evident from Figure 6, the number of proposals approved follows the same trend as proposal submissions. A broader area with greater requests also releases a more significant number of research approval rates.

Subject area-wise proposal analysis: The broad areas are further classified into sub-areas as atmospheric science, biomedical and health sciences (BHS), chemical engineering, civil engineering, computational, condensed matter physics and materials science, earth science, electrical electronics and computer engineering, and environmental engineering, etc. The proposals received and approved under these detailed analyses of different subject areas under these broad themes are presented in Table 2. Electrical electronics and computer engineering and BHS were leading in the list of approved proposals. The maximum submission of proposals under these schemes has resulted in the most outstanding approval of proposals in these subject areas. The subject area of condensed matter physics and materials science is also a popular choice in state universities and institutes. However, researchers need more significant participation in chemical engineering, civil engineering, environmental engineering, atmospheric sciences, and computation sciences (Table 2).

Discussion and way forward

States and union territories can play a significant role in developing national-level priorities, focus, and strategies to strengthen the national Science, Technology and Innovations (STI) ecosystem. States must proactively align their institutes to perform active research and contribute towards the larger goal of strengthening the R&D ecosystem. Schemes like SURE and the regional STI ecosystem be instrumental to vibrating R&D, innovation, and entrepreneurship in the state and align the national goal of 'vocal for local'.

Above findings have shown the popularity of the SURE scheme at state-level institutes. The programme has received a welcoming response from researchers all over the country. The early indicators of these submissions suggest the need to sensitize institutes to motivate, mentor and provide handholding to the female researcher to come forward and submit their research ideas for funding. The involvement of women in all streams is essential for the balanced progress and benefit of society.

Various states like Tamil Nadu and Andhra Pradesh are leading in proposal submissions. Other states, especially north-eastern and union territories like Puducherry, Daman Diu, and Lakshadweep, should explore solutions to their local problems through S&T inventions and apply for funding facilities under the SURE scheme. The present method can assist in exploring such solutions by facilitating research funds. Some states need more vital S&T bases and institutional strength, lagging in research outputs, patents, and publications. Such state institutes must connect with schemes and programmes like SERB-SURE to strengthen the state's scientific ecosystem.

The subject-wise analysis also highlights the need to motivate researchers to undertake studies in domains of subjects of societal importance. It is essential to take the initiative to improve research in social sciences, mathematical, physical, earth, and atmospheric sciences to generate solutions to reach the targets of science for society. Inter-state and intra-states institutional collaboration can help handhold the institutes with weak scientific bases and infrastructure.

India is diverse, with each state having its resources, strengths, priorities and challenges. Various regional problems exist in each state, like the availability of clean and pure drinking water, nutritional and healthy food, hunger and sanitation, fuel, and energy, etc. In addition, states can also contribute to national development in the areas of emerging technologies such as quantum technologies, synthetic biology, genetic engineering, etc. Space and satellites, disaster management, climate change, and national security are other areas where state-level institutes can contribute by leveraging local resource pools to generate solutions.

Since the scheme is targeted at supporting PIs that are first-time researchers working in state institutes, they don't need to compete with peers working in national universities. The scheme provides an excellent opportunity for such

Table 2. Analysis of proposals submitted in different sub-areas

Subject area	Percentage proposals submission	Percentage proposals approval
Electrical electronics and computer engineering	19.29	11.80
Biomedical and health sciences (BHS)	15.34	11.80
Interdisciplinary biological sciences (IBS)	12.00	9.80
Mechanical and manufacturing engineering and robotics	8.67	7.57
Condensed matter physics and materials science	7.71	8.46
Organic chemistry	5.15	10.24
Organismal and evolutionary biology (plant science)	4.09	4.90
Mathematical	3.97	4.90
Inorganic chemistry	3.68	2.90
Physical chemistry	3.58	4.23
Environmental engineering	2.74	2.23
Civil engineering	2.65	3.56
Earth science	2.25	5.12
Organismal and evolutionary biology (animal science)	2.13	2.23
Chemical engineering	2.02	2.45
Statistical and computational	1.55	0.90
Plasma high energy nuclear physics astronomy and astrophysics and nonlinear dynamics	0.95	3.12
Lasers optics atomic and molecular physics	0.84	2.00
Atmospheric science	0.7	0.89
Material mining and mineral engineering	0.7	0.89
Computational	0.48	0.45

researchers to avail funds and strengthen their research capacity.

It is hoped that a suitable oversight mechanism for generating awareness and communicating such schemes to regional institutes in remote areas of the country could assist in further improving the reach of such programmes as SERB-SURE.

1. AISHE 2021; https://aishe.gov.in/aishe/home
2. Research and Development Statistics, 2022–23; www.nstmis-dst.org
3. DST India 2023; www.dst.gov.in
4. Agarwal, M., Role of J.C. Bose Fellowship in empowering women scientists in India. *Curr. Sci.*, 2022, **123**(11), 1305–1308.
5. Kanaujia, A., Singh, P., Nandy, A. and Singh, V. K., Research contribution of major centrally funded institution systems of India. *Curr. Sci.*, 2022, **123**(9), 1082–1088.
6. Chakraborty, K., Upadhyaya, N. and Upadhyay, R. S., Explored publication pattern of the top twenty NIRF-2020 ranked Indian institutions: an evaluative study. *Libr. Philos. Pract.*, 2021, **5385**, 1–18; https://digitalcommons.unl.edu/libphilprac
7. Banshal, S. K., Singh, V. K., Base, A. and Muhuri, P. K., Comparing research performance of Indian Institutes of Technology. *Curr. Sci.*, 2019, **116**(8), 1304–1313.
8. ARWS Ranking 2022; https://www.shanghairanking.com/rankings/arwu/2022
9. QS Global Ranking 2023; https://www.topuniversities.com/university-rankings/world-university-rankings/2023
10. PRISM-SERB 2023; https://prism.serbonline.in (accessed on 20 March 2023).
11. https://www.serbonline.in/SERB/Sure (accessed on 12 March 2023).
12. Agarwal, M. and Kaur, P., Impact of selected schemes of SERB: empowering Indian women in R&D spectrum. *ACS Omega*, 2023; https://doi.org/10.1021/acsomega.3c03826.
13. Kanaujia, A., Nandy, A., Singh, P. and Singh, V. K., Mapping the research output from Indian states, *Curr. Sci.*, 2023, **124**(11), 1245–1255.

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