

Innovation Oriented Cooperation of Centralised Research Infrastructure for South Asia

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Introduction

We live in an era where each advancement in Science and Technology is met with a challenge, be it the climate crisis, loss of biodiversity, or a virus that becomes more virulent with every new mutation it acquires. Most research endeavours in today's world need access to laboratory facilities, cutting-edge instruments and sophisticated high-end research infrastructures. Bridging the gap between aspiring researchers and the availability of resources and infrastructure is the need of the hour. South Asia is home to about 1/4th of the world's total population, among which India alone has about 62.5% of youth between 15-24 years of age¹. It becomes imperative to address this gap when we consider the magnitude of the population in the South Asian countries as a whole.

Although many governments have made considerable efforts to facilitate the sharing of research infrastructure (RI) to cater to the needs of the researchers, several challenges still prevail in terms of access to specific requirements and lack of awareness about the availability of these facilities. Optimum utilisation of publicly funded research equipment has been a concern. Several functioning instruments are either abandoned or remain unused once the projects for which these were acquired are over. The lack of skilled or trained personnel to maintain these facilities and instruments is also a persisting issue.

Establishing structures that facilitate the maintenance and sharing of RI will foster a productive research environment and get many young minds interested in science, which will, in turn, strengthen the Science, Technology and Innovation (STI) ecosystem of the nation². This policy brief highlights some essential policy interventions regarding improving access to RI among the researchers of a single country and the whole South Asian research community. It advocates for establishing a central body linked with a dedicated fund through any of the prevailing regional cooperation to manage and facilitate sharing of the RI through a mutually convenient mechanism. Promoting innovation to facilitate the reuse and sharing of existing instruments and their components is highly encouraged by bringing researchers from different STEM fields on a single platform. The policy brief also underlines a bottom-up approach toward institution-institution cooperation. It braces the institutes of eminence in the region to come to the fore and be flag bearers for sharing their infrastructure system.

Overview of the Research Infrastructure Sharing Problem

The establishment of RIs and facilities is a great boon to any country. But, the actual progress of science and the inculcation of scientific temperament in citizens would directly depend upon the efficient use of the available and existent facilities. Some of the priority problems to be addressed concerning sharing of RI in South Asian economies include:

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1. The **large base of geographically scattered scientific stakeholders** in South Asian countries poses a difficult task in the allotment and accessibility of the few available scientific infrastructures.
2. The **existence of separate portals** for submitting an expression of interest to gain access to a particular instrument available at multiple research facilities is undesirable and creates unnecessary competition among them.
3. Currently, many facilities across the South Asian economies remain unused to their full potential. The **non-usage of a particular instrument** could be associated with several problems, such as a technical issue with the machine, skilled personnel not available, only a few researchers using it or the mere difficulty of record-keeping and administration. Sometimes, the **lack of a transparent feedback system** for the facilities also obstructs efficient sharing.
4. The **absence of efficient outreach channels to create awareness** about available infrastructure and sharing platforms highlights the problem of information asymmetry within the scientific community. Significant efforts are required to address this pressing matter.
5. **Lack of a trained workforce with the necessary skills to maintain and handle scientific instruments** is another concern that requires innovative strategies and leveraging of existing knowledge among the scientific community.
6. In general, after the project's completion or the superannuation of the faculty, the instruments attached to them are either dumped in the storerooms or sold as scraps. There is a **need to harness the potential of these sophisticated scraps that can potentially lead to many innovations**. An expert team can outline the life cycle of such instruments and ensure their optimal utilisation as a whole and each of their functional components.

Research Facilities Sharing Scenario across the World

Most shared RIs are funded, managed and operated at national levels and provide services primarily to local research communities. There have been constant demands for optimising the operation of these national RIs. It is in the context of South Asian nations, where the research budgets are limited, and governments and funding agencies face the challenge of supporting increasingly large and complex RI portfolios. While the developed countries have pondered on this matter long ago and formed consortiums, any such mechanism for regional cooperation has been lacking among the South Asian countries to date.

A few examples of worldwide national and regional cooperation for RI facilities are:

Europe:

- **The European Commission** ensures the RIs are open and accessible to all researchers in Europe and beyond, users being individual teams from academia, research institute and the business sector.
- **European Strategy Forum on Research Infrastructures (ESFRI)**: The ESFRI develop a strategic roadmap identifying investment priorities in European Research Infrastructures for the next 10-20 years.
- **European Research Infrastructure Consortium (ERIC)**: An EU legal entity that facilitates the establishment and operation of RI.
- **Promoting African European Research Infrastructure Partnerships (PAERIP)**: This EU-funded project aims to build new partnerships between Europe and Africa to share RIs.
- **Berlin University Alliance (BUA)**: The three major Berlin universities – Freie Universität Berlin, Humboldt-Universität zu Berlin, Technische Universität Berlin – and Charité – Universitätsmedizin Berlin are represented in this consortium. Effective sharing and efficient use of resources in the areas of research infrastructure and internationalisation is one of the objectives of the BUA.

United States of America:

The Department of Health and Human Services of the USA introduced a Shared Instrumentation Grant (SIG) program to make available to institutions high-priced research instruments that can only be justified on a shared-use basis. For example, the S10 (Biomedical Research Support Shared Instrumentation

Grants) is awarded to domestic public and private institutions of higher education and non-profit domestic institutions such as hospitals, health professional schools and research organisations. Every instrument awarded by this S10 grant is used on a shared basis by thousands of investigators in hundreds of institutions nationwide, thus promoting cost-effectiveness and a collaborative multidisciplinary environment.

Singapore:

Singapore National Research Foundation (NRF) introduced the National Research Infrastructure (NRI) framework in April 2015 to guide the development of selected research facilities to be operated as a national resource, open to all researchers in Singapore.

India:

India is leading two initiatives, the Sophisticated Analytical and Technical Help Institute ([SATHI](#)) and the Indian Science, Technology and Engineering facilities Map ([I-STEM](#)). SATHI aims to establish new instrumentation facility centres across the country for researchers from institutes that lack such sophisticated instrumentation. I-STEM, on the other hand, enlists the existing facilities and provides a transparent and equitable booking mechanism to the end-users. Therefore, I-STEM helps in efficiently utilising the existing infrastructure, while SATHI focuses on filling the gaps by creating new facilities.



Pakistan:

The International Centre for Chemical and Biological Sciences (ICCBS) at the University of Karachi is the national centre of excellence where samples for analysis are submitted by researchers from all over the country, with results provided to the researcher within 24 hours and billed to the University Grant Commission of Pakistan.



I-STEM
Linking Researchers and Resources
Launched by the Honourable
Prime Minister of India

Indian Science, Technology and Engineering facilities Map (I-STEM)

I-STEM: Strengthen the Indigenous Development of Scientific Instruments

After establishing a National web portal through which R&D equipment in institutions across the country can be located and accessed in a transparent way, I-STEM is entering a New Phase with the following objectives -

- ▶ Working towards a more comprehensive listing of R&D facilities. Availability, and their active use
- ▶ Providing partial assistance to Tier 2 and Tier 3 institutions for the maintenance of facilities shared through I-STEM through Comprehensive AMC program
- ▶ Partial assistance to Users from Tier 2 and Tier 3 institutions who use facilities through I-STEM
- ▶ Promoting the indigenous development - especially by startups - of scientific equipment and value-added technical supplies, including software, used for R&D; enabling such development via the (national) Digital Catalogue of indigenously developed technologies and products maintained by the I-STEM portal
- ▶ Establishing regional centres for providing technical training and skill development, in part by restoring/stripping R&D equipment written off by I-STEM institutions; thus developing a stream of talent and gainful employment through maintaining and upgrading R&D facilities
- ▶ Providing access through the web to R&D software platforms to Academic Users to promote R&D and more effective instruction/learning, especially in smaller institutions.

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graph TD
    A((Indigenous Equipment Development)) --> B((Skill Development Program))
    B --> C((User friendly R&D facilities access across the country))
    C --> D((Partial funding to Institution, Researchers and Start-ups))
    D --> E((Software Services through I-STEM))
    E --> A
    
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Proposed Solutions and Recommendations

Establishing a Central Body among the South Asian Countries for Sharing of Research Infrastructures to Strengthen Regional Cooperation

Nearly all South Asian nations lack enough resources to establish world-class RIs. In this regard, a central body and a dedicated fund may be constituted either as a part of any existing cooperation mechanisms such as SAARC or through a new cooperation mechanism to facilitate the sharing of RI facilities. The central body having representatives from the member countries may focus on the seamless linkages between the national RI facilities through a unified information system. It would boost the region's research and innovation ecosystem and develop a healthy, affordable, and sustainable STI ecosystem.

Sharing of Research Infrastructure

Instrumentation shared award schemes should be initiated with the awardee institutes to provide appropriate support for associated infrastructure, such as space to house the instrument, technical personnel and post-award service contracts for instrument maintenance and operation. Funding bodies should try to maintain uniform distribution of high-end equipment to different regions of the country. Central instrument facilities of the premier institutes/ universities should also be made accessible to all.

Premier institutes need to work in parallel with the SATHI centres to fill the gaps in the availability of RI for the smaller research institutes and universities/colleges. It should be initiated in every city/cluster (as feasible), thus creating a nodal system. Booking of the facilities (SATHI centres, I-STEM and RI facilities) should be made available through a single web portal which should be available to researchers from across the borders, based on signed MoUs and other agreements for the same. Scientific Research Infrastructure Sharing Maintenance and Networks (SRIMAN) guidelines by the Department of Science and Technology, India, aim to encourage the sharing and efficient utilisation of RI across the country.

Repairing and Reusing the Instrumental Waste

Clear policies are needed to repair, refurbish and reuse the high-cost sophisticated equipment in the maintenance contracts. Dedicated facilities with skilled instrumentation engineers under the governance of an independent statutory body are to be established across the region to take care of the repairing/ refurbishing activity for the non-functional equipment. A multipartite approach may be adopted wherein immediately upon the condemnation of an instrument, its details should be enlisted on the common portal. The instrument, then, should be transferred to the authorised facilities for exploring its repair within a stipulated time.

If irreparable, free distribution of such instruments and their constitutive spares could facilitate ease of repair and maintenance of various instruments lying unused across the country. The instruments thus generated through acquiring various constitutive spares after testing could then be made available for sale at a reduced cost (to colleges, universities and start-ups) on the website. These facilities could also accommodate the visitation charges of students/ researchers across varying engineering courses to tour the facility and include a provision (a summer programme) for access to these facilities to the students to encourage a better understanding of these instruments. Thus, laying the foundations of a 'make in the country' programme.

Addressing Lack of Awareness

The lack of awareness of the various programs and portals for sharing RI needs to be tackled through a dedicated outreach plan. It shall help with regular updates being disseminated to relevant stakeholders and raising awareness about such provisions by the governments. Through the SRIMAN program, the Indian government aims to incentivise the institutions by rating them for the extent of participation in the initiative, which would encourage them to raise awareness themselves.

Conclusion

As resource-limited countries, India and its South Asian neighbours require a framework that facilitates the availability, accessibility and sharing of state-of-the-art infrastructure with the users more efficiently. It

will enable the financially-skewed academic institutions, universities, R&D labs, start-ups, etc., to leverage the cutting-edge instrumentation that would promote high-end research and innovation for the betterment of society. The post-pandemic era has left most South Asian nations economically weaker and resource-constrained than ever before. It, therefore, calls for sharing the RI more than ever. It would require a robust and sustainable infrastructure of sharing resources and resource mobilisation, accessibility, and cost-effective and frugal innovations.

This brief proposes investment in shared RI facilities and their maintenance (repair and reuse of instruments) along with human resource training for operation and maintenance and instrumentation databases. It also advocates innovation, for example, reusing working spares from non-functional equipment, making refurbished ones and proposing buy back at a lower cost. Creating awareness amongst various stakeholders of the shared RI to increase the visibility of the facilities is another suggestion. An

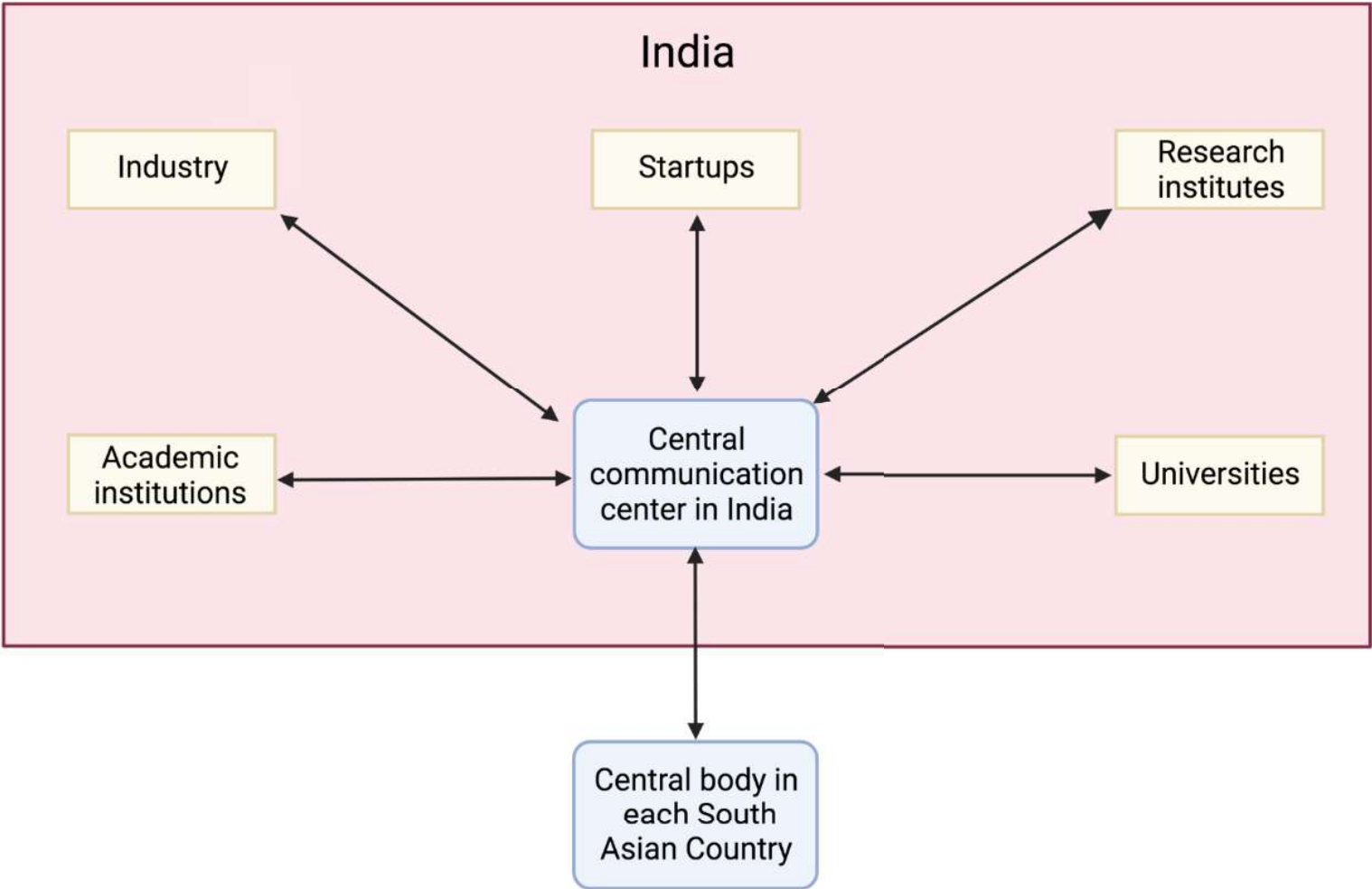


Figure 1. Structure of the Proposed Research Infrastructure Sharing Framework

updated national portal or other online tools by integrating more functions, such as maintaining a central repository/consortium housing a list of instruments, flag maintenance-related issues, sharing resources and a booking platform, is also recommended. A one-user account per department/ laboratory is proposed on the platform to avoid duplication of the booking processes.

There is also a need to establish a central body/ forum overseeing the functioning of the RI facilities across the country in coordination with the Central and State institutions. Cultivating a sustainable shared resource platform will help nations to prepare for future public health emergencies more efficiently without posing tremendous pressure on a country's health care system. As a way forward, if the model proves to be successful at a national level, it should be recommended to other South Asian countries through the regional alliance to agree on cooperation across borders to share the National RI facilities. It will encourage and facilitate sharing of RI at a great cross-country level and cater to the needs of partner countries, while fostering friendly scientific and international relations among the South Asian economies.

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