AKHIL BHARTIYA SHIKSHA SAMAGAM

THEMATIC SESSION

Research and Development (R&D)

JULY 2023

GOVERNMENT OF INDIA

BACKGROUND:

Research and Development (R&D) has a critical pivotal role to facilitate the growth and development of any country and rightly so, India is emerging as a favorite destination for startups, tech-innovations, automobiles, pharmaceuticals and other R&D based manufacturing activities. To become such a knowledge-based economy, the higher education sector in the country is being re-energized to cultivate the research culture, develop scientific temper and foster innovative practices among all stakeholders.

Government has taken numerous efforts to enhance the Research & Development (R&D) expenditure and create adequate opportunities for the researchers and also taken various steps to increase opportunities for research students pursuing Ph.D. and Post-Doctoral research. The number of scientific publications has been increased from 24,110 in 1999 to 2,78,496 in year 2022. As per the National Science Foundation (NSF)'s Science & Engineering Indicators 2022 report of the United States, India's position globally in scientific publications, has improved from 7th position in 2010 to 3rd position in 2020.India also occupies 3rd rank in terms of the number of PhDs awarded in Science and Engineering (S&E) as per S&E Indicators, 2022, NSF. The total number of publications has also increased from 661,912 from (2012-2016) to 1,012,624 in (2017-2021). Scholarly output has been increased from 60,555 papers in 2010 to 1,49,213 papers in 2020.

Further, National Education Policy (NEP), 2020 also envisaged establishment of National Research Foundation (NRF) to seed, grow and promote Research and Development (R&D) and foster a culture of research and innovation throughout India's universities, colleges, research institutions, and R&D laboratories. Accordingly, the Union Cabinet has approved the introduction of the National Research Foundation (NRF) Bill, 2023 in the Parliament to establish NRF, an apex body to provide high-level strategic direction of scientific research in the country at a total estimated cost of Rs. 50,000 crore during five years (2023-28).

NEP 2020 also envisions the development of active research communities across disciplines, as well as restructuring higher education institutions as multidisciplinary and research-intensive universities through institutional restructuring and resource optimization. NEP 2020 also supports the

nurturance of research and innovation through the setting up of incubation centers, greater industry-academia linkages and institutional collaborations. The government has also prioritized the establishment of R&D cells in HEIs in collaboration with industry to carry out research and development activities in various areas. In addition to this, the government is taking a variety of measures such as policy support, institutional restructuring, funding support for upskilling, establishment of research parks, incubation centers, tinkering labs, etc. Resultantly, India's ranking in Global Innovation Index has also improved from 81st position in 2015 to 40th in 2022.

As per the latest available R&D statistics, the national spending on Research and Development (R&D) measured in terms of Gross Expenditure on Research and Development (GERD) has increased over the years and more than doubled from Rs. 60,196.75 crore in 2010-11 to Rs.127,380.96 crore in 2020-21, which is 0.64% of its GDP. However, there is an ample scope for the country to increase its expenditure on R&D to further boost this sector and become pioneer across the world.

The Vision is to develop India as global Education hub by providing incentives to publish high-quality, globally cited research through universities in collaboration with robust industry-academia partnerships. The short-term roadmap to achieve these visions by 2030 is by strengthening the research fabric in universities by Identifying international institutes for academic and research collaboration, and encourage publication of internationally collaborated research through monetary incentives and scholarships. By 2047 the roadmap is to establish research as a central tenet of India's education ecosystem, publish high-quality, globally cited research papers catalysing innovation across sectors such as technology and medicine, and forge robust industry-academia partnerships. By that time National Research Foundation will turn into a global facility, build a robust research repository, undertake pioneering research informing national policy, adopt patent commercialization, and act as a hub for global research.

In the above background, a thematic session was organized on Research & Development during the *Akhil Bhartiya Shiksha Samagam 2023* and the 3rd anniversary of the NEP 2020 on 30th July, 2023.

INTRODUCTION:

The thematic session on *Research & Development* was chaired by Prof. Ajay Kumar Sood, Principal Scientific Advisor to the Government of India. Other panelists of the session are mentioned below. Hon'ble Union Minister for Education and Skill Development & Entrepreneurship, Shri Dharmendra Pradhan and Hon'ble Minister of State for Education, Dr. Subhas Sarkar graced the session with their presence. Secretary/ Higher Education and Secretary/ Ministry of Skill Development & Entrepreneurship were also present during this session. The session was attended by eminent academicians across the country and led to critical discussion and deliberations in the field of R&D in India.

	Name	Designation
Panelists for the session	Prof. Sudhir Kumar Jain	Vice Chancellor, Banaras Hindu University
	Dr. K. K. Pant	Director, IIT Roorkee
	Shri Sudarshan Jain	Secretary General, Indian Pharmaceutical Alliance, Mumbai
	Prof. Kumar N. Sivarajan	CTO, Tejas Networks
	Prof.Raghunathan Rengaswamy	Dean (GE), IIT Madras

The esteemed Chair and the panelist were requested to talk about the various important topics during the session and the session was conducted in following manner:

10.00 AM- 10.05 AM	Brief Introduction
10.05 AM- 10.15 AM	Opening remarks by the Chair
10.15 AM- 10.25 AM	Background & Expected Outcomes by Dr. K. K. Pant
10.25 AM- 10.35 AM	Roadmap for Institutions by Prof. Raghunathan Rengaswamy
10.35 AM- 10.45 AM	Industry Academia Connect by Sh. Sudarshan Jain
10.45 AM- 10.55 AM	Industry Academia Connect by Prof. Kumar N. Sivarajan

10.55 AM- 11.05 AM	Best Practices & Way Ahead by Prof. Sudhir Kumar Jain
11.05 AM- 11.20 AM	Q & A Session with the participants
11.20 AM- 11.30 AM	Concluding remarks by the Chair,

KEY DISCUSSIONS:

Name	Discussion points
Prof. Ajay Kumar Sood, Principal Scientific Advisor to GoI and Chair of the session **Opening remarks and setting the context**	● The research potential of the country and its current positioning in the world in areas of scientific innovation and pointed to the potential of the demographic dividend of the country in giving thrust to R&D initiatives in the country was prescribed by PSA. ● Importance of entrepreneurship spirit and startup culture to materialize the aspirations of India in becoming a knowledge-based economic superpower was emphasized. ● Some critical issues in the R & D ecosystem of the country were also highlighted by the Chair, such as limited number of deep-tech startups, concentration of research facilities in only a few eminent research institutes, etc. ● PSA underlined the problem of utilization of R&D facilities and the issue of a very large portion of researchers being out of the research ecosystem. ● Some measures were also suggested by prof. Sood for massification and revitalization of R&D in Indian HEIs such as: 　○ Capacity development in tier-2 and tier-3 institutions. 　○ Incentivizing professorship to world class researchers and professors in state

	universities and colleges to end the hierarchization among institutions. ○ Consortium approach where researchers across all the institutions will come together to deliver the research and development initiatives. Further, the need for application-based basic research at high level, e.g., on modern cutting-edge technologies such as AI and quantum computing was also emphasized by the Chair.
Dr. K.K. Pant Director, IIT Roorkee **(Topic: Background and expected outcomes)**	● Dr. Pant highlighted the need for interdisciplinary research and industry collaboration in Indian HEIs. ● He also underlined the critical issues in R&D in Indian HEIs such as lack of research culture, lack of infrastructural support, lack of awareness about intellectual property and outdated curriculum and pedagogy. ● He illustrated the faculty entrepreneurship programs of IIT Roorkee as a model for faculty capacity development in the R & D sector. ● Prof. Pant emphasized on the importance of Indian Knowledge Systems in the R & D sector and the need for a criterion for scientific validation in such initiatives. **Suggested Measures** ● Dr. Pant suggested multidisciplinary and interdisciplinary research as a modern-day requirement of the R & D sector to solve complex problems along with the need for ensuring gender equity by encouraging more women in STEM. ● He also emphasized collaboration among HEIs to align R&D with sustainable development goals with emphasis on research areas such as disaster management, sustainable energy such as green

	hydrogen, reducing carbon footprint etc. Dr. Pant laid a greater emphasis on industry - academia linkages for resource and knowledge sharing, forming diverse research culture, digitization of research and taking a lead in deep- tech initiatives.
Prof. Raghunathan Rengaswamy, Dean, GE, IIT Madras **(Topic: Roadmap for Instituions)**	• Prof. Raghunathan emphasized on the need of research capacity upgradation, aligning R&D with the country's priorities, interdisciplinarity in research and international collaboration. • He presented the case of IIT-Madras where 70 research initiatives are carried out in 15 Centers of Excellence that work in interdisciplinary areas and aspire to be among the top world class institutions. • He also stressed upon a multi-institutional network for global collaboration on research and development, e.g., IIT-Madras as a part of the Global Heritage Network and its joint doctoral programs, international interdisciplinary master's program. • Prof. Raghunathan emphasized on centralized infrastructural facilities for resource pooling and sharing along with a healthy balance between incremental and blue-sky research and recommended a global outlook for Indian Higher Education Institutions. Finally, he pointed to the need for a change in the mindset of the research community in terms of considering bold research problems.
Shri Sudarshan Jain, Secretary General, Indian Pharmaceutical Alliance	• Shri Jain initiated the discussion with the success story of the Indian pharmaceutical industry- the Indian Pharma sector has developed itself to supply medicine to 200 countries with 35-40% share in generic medicines. • He emphasized on the geo-political dimension in

(Topic: Industry Academia connect)	the pharmaceutical sector that India specific ailments don't attract the attention of the global pharma community. He highlighted the need for self-reliance in medicinal equipment for India specific ailments such as NDM, oral cancer etc.
	● Shri Jain proposed five important recommendations for empowerment of R&D in the pharma sector namely: 1) Simplified and streamlined regulatory framework 2) Infrastructural support 3) Robust funding mechanism 4) strong linkage between industry and academia 5) Inter-institutional collaboration
	● He also highlighted the need for course-curriculum upgradation, teacher training, tech-transfer offices for IP management, commercialization, marketing and evaluation in the specific context of HEIs which impart medical and pharma education.
	● Shri Jain proclaimed the vision of the Indian pharmaceutical industry to become number one in volume and among top three in R&D in the pharmaceutical sector by 2047.
Prof. Kumar N Sivarajan CTO, Tejas Network **(Topic: Industry Academia connect)**	● Prof. Sivarajan highlighted the lag of India with other developed economies in cutting-edge technology sectors such as telecommunications; lack of collaboration between academia and industry being one of the reasons.
	● He emphasized on the role of experienced scientists and top minds of the country in projects of national interest.
	● Prof. Sivarajan expressed the need to catch up with other countries in cutting- edge technologies and deep-tech startups such as artificial intelligence, quantum computing etc.

	• He suggested an important way out for Indian startups to survive in such a competitive market: product management by working on need-based and customer-oriented startups instead of working on supply side ideas. • Deep-tech startups, modern and futuristic technologies were at the epicenter of his discussion. He underlined the requirement of active leadership of eminent research institutions of the country such as IISc and IITs in achieving such endeavors. • Prof. Sivarajan reiterated the synergy between academia and industry for taking a lead in scientific innovation.
Prof. Sudhir Kumar Jain, BHU, VC **(Topic: Best practices and way forward)**	• Prof. Jain emphasized on the purpose of a university; while teaching and research both are essential for a university, there should be a clear demarcated vision for research focused institutions and teaching universities. • He propounded that academics and researchers should engage in research for impact rather than doing research merely for credentials. • He proposed three important factors for research; talent, resource and governance. Universities should focus on quality of research rather than quantity. He further explained how external fund generation, talent retention, etc. are crucial for quality research. • On governance related issues, he highlighted the need for consistency over time and space in university governance, efficient intellectual property management and ease of transaction of academic administration for development of a sound research culture in the university ecosystem.

	He established the criticality of research culture and university governance in research output of universities.

OUTCOMES & WAY FORWARD:

- R&D needs to be taken at a higher scale, e.g., enhanced collaboration of centers of excellence with various Indian institutions.
- Centralized facilities to be developed for national level resource pooling and sharing, e.g., i- STEM. Also, resources required to maintain such facilities and equips to be available across the country.
- Promoting deep-tech startups by ensuring access to technology and sustainable funding.
- Emphasis to be made on many other verticals in R& D such as culture, governance, ethics, etc.
- Interdisciplinary research and industry collaboration in higher education institutes is a crucial step towards quality research work.
- Need to step up our efforts in R&D, e.g., supplementing NRF with other initiatives too.
- Alignment of R&D with national aspirations and SDGs.
- Women participation in STEM is vital for advancement of research and the nation in general.

In a nutshell, the panel discussion on Research and Development theme emphasized on interdisciplinary, collaborative, inclusive and diversified research ecosystemin Indian higher education institutions to drive the growth and development of the country.

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Data Source: Main Science and Technology Indicators (MSTI), India-R&D Statistics, 2022-23 and Elsevier Report on 4th G20 education working group meeting.