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Opening green windows - Technological opportunities for a low-carbon world

India is emerging as one of the world's fastest growing economy and is currently Asia's third largest economy by GDP. India had a rich heritage of manufacturing and trade practices. GoI has identified 25 emerging industrial segments and aims to grow them on par with heavy industries. These industries are seen as the next significant contributors of GDP.

Broader notions of "innovation cooperation" are needed to advance international technology efforts for sustainable development. Such a framing allows for a broader perspective on practical international technology transfer cooperation between countries. It also emphasizes the need for equitable partnerships, rather than donor–recipient relationships, and for the development of local innovation capabilities, leading to more effective marshalling of technologies to help developing countries achieve sustainable development. However, such international cooperation for generating green innovations is highly underdeveloped and does not reflect the urgent need to develop new technological solutions to the world's environmental challenges.

Department of Science & Technology (DST) works at the initial stages of value chain of the technology & innovation for cleaner and more productive and competitive production. DST supports Research & Development of technology

concept, experimental proof & Technology demonstration projects in domain of Clean Energy. The Line Ministries/ Departments vis-a vis Heavy Industries, Power, New and Renewable Energy, Promotion of Industry and Internal trade carry out the major work for policy for production and competitive production of green technologies in India. All these activities are aligned to National initiatives like Sustainable Development Goals (SDGs), Digital India, Make-in-India, Industry 4.0, SMART Society 5.0 Skill India and Start-up India.

1. **What are the challenges that governments have faced or may face in promoting green technology and innovation to contribute to national development priorities and accelerate the progress towards the SDGs**?

Green manufacturing in India has been initiated. There are several challenges in promoting green technology and innovation to contribute to national development priorities and accelerate progress towards sustainable development goals. Some of these challenges are:

Lack of Awareness: The policymakers and business leaders in India are subscribing to the importance and benefits of green technologies. Still, there is a need for greater awareness campaigns and education to increase the understanding of the value of green technologies among masses.

Financial Constraints: Green technology and innovation often require significant investments. There is a need for incentives and subsidies to promote the adoption of green technologies.

Infrastructure Challenges: India's infrastructure is still developing, and there are challenges in integrating green technologies into existing systems. There is a need for better planning and coordination to overcome these challenges.

Technological Readiness: India may not have the technological expertise required to develop and implement many green technologies. There is a need for greater collaboration and partnerships with international organizations to leverage their expertise and knowledge.

Regulatory Barriers: India's is working on the regulatory environment to make it conducive to the adoption of green technologies. These regulatory reforms will help to create a supportive policy environment that encourages innovation and investment in green technologies.

Electric Vehicle, Energy Efficient buildings, Renewable energy including Solar, Batteries etc are the some of the key industries pioneering green innovation in the country.

2. **What should governments, the private sector, organized civil society, and other stakeholders do so that developing countries can benefit from these technologies?**

The Government, Private Sector & Stakeholders must work in close coordination to raise the awareness of the technological development happening in the space of green technologies. Suitable actions are to be contemplated which could complement PPP in identification and phase wise adaptation of green technologies.

DST GoI's efforts:

DST has been at the forefront of R&D efforts that will make "Make in India" succeed. To support the scientific and technological aspects, DST ensures that infrastructure and manpower is provided for innovation and technology development. It created **SATHI** (**S**ophisticated **A**nalytical **T**echnical **H**elp **I**nstitute to support all such activities). The ultimate aim of SATHI is to create a national network of laboratories and testing facilities across India that will work on a common philosophy of "T2C2", (Technology, Testing, and Certification & Compliance). It will also help provide knowledge, adopt best practices, build technologies and create platforms for societal outreach.

DST leads the National Science & Technology Entrepreneurship Development Board (NSTEDB), which helps to promote knowledge driven and technology intensive enterprises. NSTEDB through its programs such as National Initiative for Developing and Harnessing Innovations (NIDHI) and, Technology Business Incubators (TBI) aims to establish and maintain a comprehensive and inclusive ecosystem where start-ups would be provided with support, value added services, mentorship, and funding and market access.

DST also uses the equity model to fund start-ups. Through its Technology Development Board (TDB), a statutory body provides soft loan to budding entrepreneurs at relatively low interest rates. DST along with Science and Engineering Research Board (SERB) have embarked upon a three-pronged approach to further strengthen research related to climate change and response options through intra-and extra-mural research and knowledge support systems.

In 2015, DST initiated a program called Advanced Manufacturing Technologies (AMT). The primary objective of this program is to enable the translation of "discovery research" in academic research centres into "commercially feasible technologies". AMT program focuses on futuristic technologies like non-material& surfaces, manufacturing of speciality chemicals and electronic grade materials, robotics & automation, precision manufacturing, advanced forming and near net-shaped processing etc. As of today, DST has funded 130 technology development projects and created 5 Centres of Excellences. Some of the developed technologies have already transitioned from the development phase to proto-typing on an industrial scale.

The National Mission on Interdisciplinary Cyber Physical Systems (NM-ICPS) was launched in 2018 and has a key role in developing technologies, tools,

testbeds, prototypes, algorithms, visulalization tools to augment the Ministries/Departments implementing the SDGs. The ICPS Mission facilitates and caters to these national initiatives by developing sector-specific core technologies, human sources development and develops advanced skill sets and will feed into Innovation and Start-up ecosystem of GoI. The technologies range from Data analytics, IoT, CPS testbeds, security, AI, ML, DL and Quantum technologies being pursued by 25 Hubs across the country.

The Production-Linked Incentive (PLI) Schemes have come out in few sectors for enhancing India's Manufacturing Capabilities contributing to cleaner production and competitive production.

3. How could the international community support developing countries in this regard?

The international community can play a vital role in supporting developing countries in leveraging national strategies and policies related to green technology and innovation. By providing financial and technical assistance, sharing best practices, facilitating knowledge sharing, offering capacity building, and advocating for policy coherence, the international community can help to promote sustainable development and a better future for all. The provision of technology and know-how sharing will help to increase efficiency, resilience, reliability and flexibility in manufacturing sector.