India's STI Landscape Needs Urgent Action for SDGs Success

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Introduction

Progress towards achieving the Sustainable Development Goals (SDGs) is increasingly driven by leveraging Science, Technology and Innovation (STI) at the grassroots level. Creating a sustainable world necessitates dismantling disciplinary boundaries to strengthen inter-, trans- and multidisciplinary cooperation.[1] India's approach to achieving the UN SDGs rightly emphasises advancing along a sustainable development pathway.

The vision of an *Atmanirbhar Bharat* (self-reliant India) is aligned with the broader goals of sustainable development, incorporating social scientific inclusion, economic growth, and environmental sustainability into the mandates and agendas of the Indian government. Key focus areas include self-reliance, indigenous technological developments, health security, food, energy and cyber security—all instrumental in realising STI-related SDG targets.

None of these objectives can be effectively advanced without the collaboration and active involvement of economic and social ministries, as well as state governments. The 2030 Agenda for Sustainable Development, adopted by the United Nations General Assembly, includes 17 SDGs and 169 associated targets.[1] This comprehensive action plan is centred on five key pillars: people, planet, prosperity, peace, and partnership, under the overarching commitment of "Leaving no one behind."

Countries are responsible for monitoring, reviewing, and evaluating their area-specific progress towards the SDGs and must continue these efforts until 2030. Accelerating STI for SDGs requires harnessing successful experiences to enable sustainable development transformations.[2,3] Equitable promotions of all dimensions of human development in the face of emerging global challenges is key to shaping a forward-looking development trajectory for the 21st century.

Three critical data sources inform India's path to achieving the SDGs by 2030: Sustainable Development Report 2024 (Dublin University), India's State-wise Performance on SDGs (SDG Index 2023-24, NITI Aayog), and the Report of the Technical Group on Population Projections 2011-2036 (Ministry of Health and Family Welfare).[4,5] This article explores the convergence of India's national development priorities and STI goals with the SDGs.

Overview of India's Progress in Global Sustainable Development

As we reach the halfway point in the timeline to achieve the United Nations SDGs—agreed upon by all

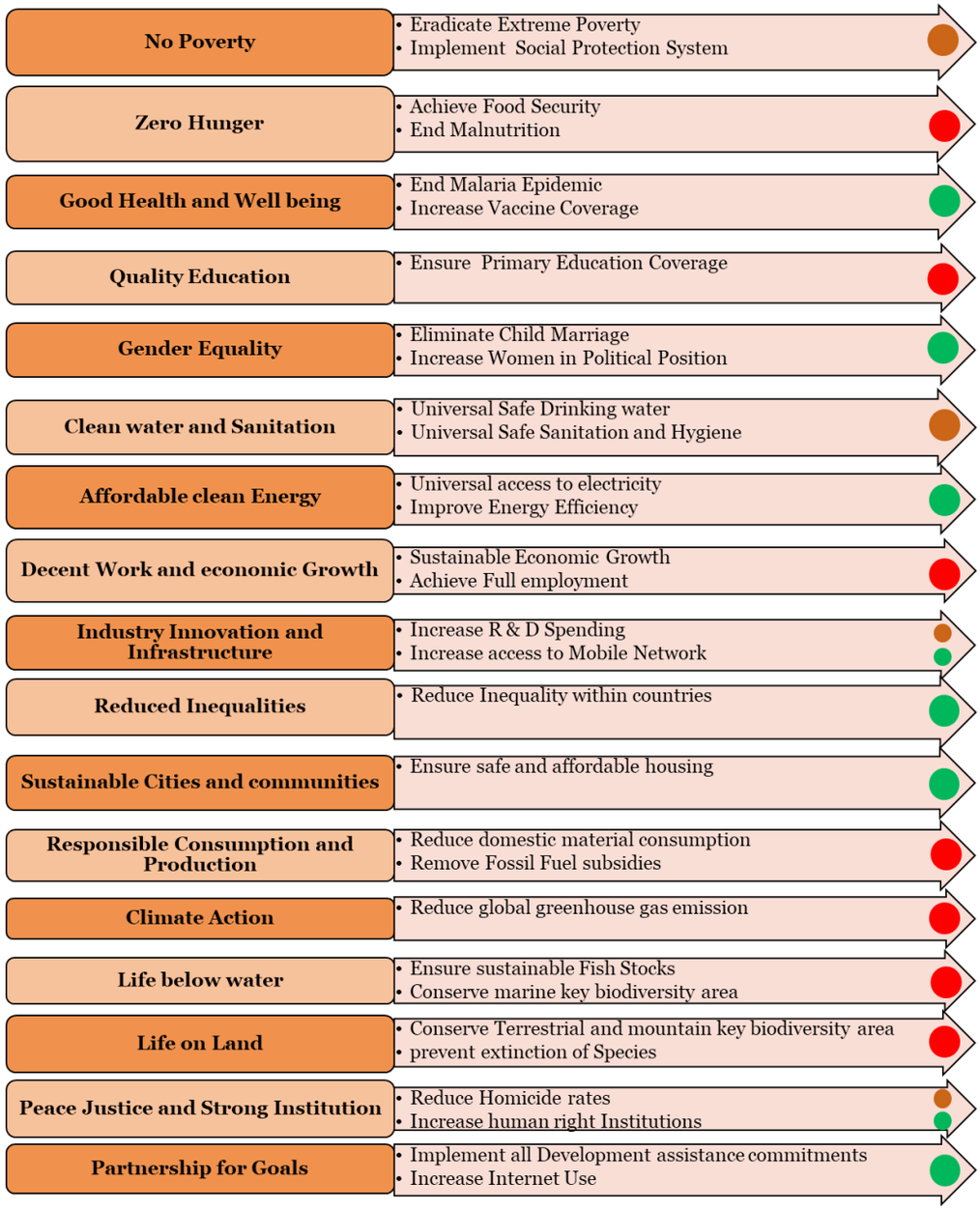


Figure 1. Snapshot of SDGs Progress (Source: Global Sustainable Development Report, 2023)

*Green: Fair progress but acceleration needed; Red: Deterioration; Brown: Limited or no Progress

countries in 2015 for completion by 2030—it is clear that significant challenges remain.[6] According to the Global Sustainable Development Report (GSDR) 2023, the World is not on track to achieve any of the 17 SDGs. The report underscores the urgency of proactive intervention, as progress will not occur automatically.

The national-level monitoring of SDG progress in India is primarily managed by NITI Aayog. The latter works closely with the Ministry of Statistics and Programme Implementation (MoSPI). Initially comprising 306 indicators, SDG framework has been revised to 295 national indicators that align with the 169 SDG targets and the Global Indicators Framework. In addition to 295 indicators, 62 priority indicators have been identified for measuring India's most essential developmental goals. However, certain key indicators, particularly those aligned with the global SDG list, are necessary for meaningful global comparisons and identifying specific gaps.[7-9] As per the STI for SDGs Roadmaps, the need for a clearer conceptual framework has been highlighted.[10,11] India's SDG framework shows gaps across several goals, including:

1. SDG 1 (No Poverty): The indicator for eradicating extreme poverty was removed in the 2023-24 government assessment.
2. SDG 6 (Clean Water and Sanitation): The measurement of the water quality indicator is missing.
3. SDG 7 (Affordable and Clean Energy): Indicators related to CO_2 emissions from fuel combustion and the share of renewable energy in total final energy consumption are not included.
4. SDG 11 (Sustainable Cities and Communities): Lacks parameters on air quality and public transport.
5. SDG 12 (Responsible Consumption and Production): No metrics for electronic waste.
6. SDG 14 (Life below Water): Of the five indicators listed, three have no targets for 2030.

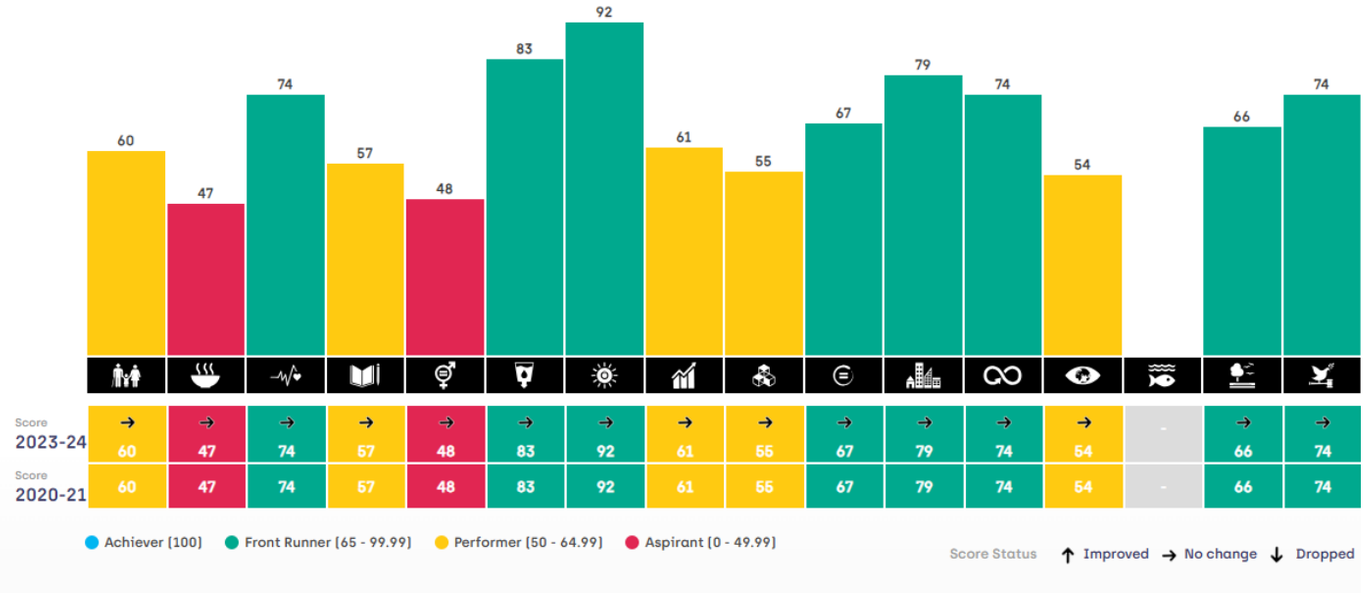


Figure 2: India's Goal-wise SDG Performance (2023-24 & 2020-21) (Adapted from the SDG India Index and Dashboard, |iTech Mission, accessed on 21 May 2025)

For effective monitoring and review, SDG indicators must be problem-oriented and tailored to national and regional dashboards. These should also integrate with Technology Readiness Levels (TRLs) to aid the progress towards Agenda 2030 and align with India's Vision @2047.

Despite some improvements, the GSDR 2023 warns that at the current pace, India is unlikely to eliminate poverty, end hunger, or provide quality education for all by 2030[11] (Figure 2; Table 1).

Table 1. Projected Impact Indicators by 2030 (GSDR 2023)	
Indicator	**Affecting Population/System**
Poverty	575 million
Hunger	600 million
Children out of school	84 million
Global temperature rise	1.5 ^{0}C
Gender equality	300 years

Given these projections, tracking progress becomes complex and urgent. There is a pressing need to formalise mandates and fully leverage the role of STI in creating inclusive and sustainable socio-economic development. Global leaders must act decisively and accelerate progress in STI for sustainable development.[12-15]

Proposed Solution and Policy Recommendations

STI has been a significant component in operationalisation, monitoring and evaluation of the SDGs. However, one of the greatest challenges facing countries today is how to accelerate the delivery of sustainable solutions across a range of pressing issues—from poverty and education to innovation, gender equity, and climate change.[16,17] Acceleration in these areas can bridge inequalities and help close the financing gap for development. This section highlights three priority areas for policy action: Accelerating R&D trajectories, identifying transformative pathways, and improving governance mechanisms for SDG implementation.

Accelerating R&D Trajectories

Innovation competitiveness and economic growth —driven by both public and private sector investment—are essential components of a knowledge-based economy and directly influence the achievement of SDG targets. The effectiveness of R&D policy and its alignment with SDG ambitions relies on how governments set priorities, allocate resources, and evaluate progress.[18]

A goal-oriented R&D policy framework is essential to allocate resources towards identified indicators. India's commitment to becoming a developed nation by 2047 underscores the need for significant shifts in its R&D ecosystem. This transitional phase demands a strong foundation of indigenous R&D capacity and innovation-driven solutions tailored to national and global development goals.[19,20]

India has made substantial progress in the innovation metrics, moving to 39th place in the Global Innovation Index within a decade. However, further progress requires bolstering foundational aspects, including improving school education, enhancing the number and quality of professionals in R&D, and increasing employment in knowledge-intensive industries.

Encouragingly, Indian government departments are increasingly acting as buyers of indigenous, technology-based products developed by deep-tech start-ups and large enterprises alike.[21] Supportive policy initiatives in favour of technological indigenisation and advanced innovation can help build industrial capabilities, strengthen human capital, and foster innovative manufacturing ecosystems.[22] These efforts will ultimately enhance India's innovation outcomes, competitiveness, and global standing.

Identification Transformative Pathways

India's aspiration to become a global technology leader hinges on identifying and advancing transformative, self-reliant development pathways. This entails reinvigorating efforts to develop and democratise critical sector technologies through indigenous innovation and diffusion strategies. Solutions rooted in the knowledge economy must be systematically leveraged to coordinate structures that enable progress across the SDGs while addressing global challenges.[21-22] A focused diversification strategy in science education, research, and innovation is critical to bridging SDG gaps and ensuring inclusive progress.

Diversity must be central to this effort—regardless of gender, geography, social status, or economic conditions. This requires recognising and strengthening the contributions of diverse stakeholders—government schemes, private initiatives, and civil society actions—in reducing inequities and fostering inclusive development.

Improving Governance for SDGs

There is an urgent need to integrate "sustainable technologies" into mainstream governance and ensure that technology development efforts address multiple SDGs synergistically. Past experience developing and deploying context-appropriate technologies that have yielded measurable grassroots socio-economic benefits must inform current STI funding and innovation policies. A culture of collaboration, particularly between STI institutions and various government tiers, must be nurtured to solve challenges faced by small enterprises, informal sector workers, and marginalised communities.[22-23] Cross-sectoral and cross-institutional coordination is crucial to implementing timely, context-sensitive, and scalable STI solutions for sustainable development.

Conclusion

Currently, at least 45 countries have defined R&D intensity goals that are closely linked to their ability to achieve the SDGs. A nation's R&D intensity is indicative of its innovation capacity and the adaptability of its technology to local development contexts. Robust support systems are needed to foster the development, deployment, and commercialisation of sustainability-oriented technologies across the STI ecosystem. Establishing centralised and regional SDG monitoring dashboards and integrating Technology Readiness Levels (TRLs) can facilitate systematic progress tracking and evidence-based policy decisions. In the post-COVID world and amid geopolitical disruption, it is imperative to assess how STI ecosystems are contribute to the SDGs. A forward-looking policy framework must be developed to reposition STI as a core pillar of 21st-century sustainable development agendas.

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