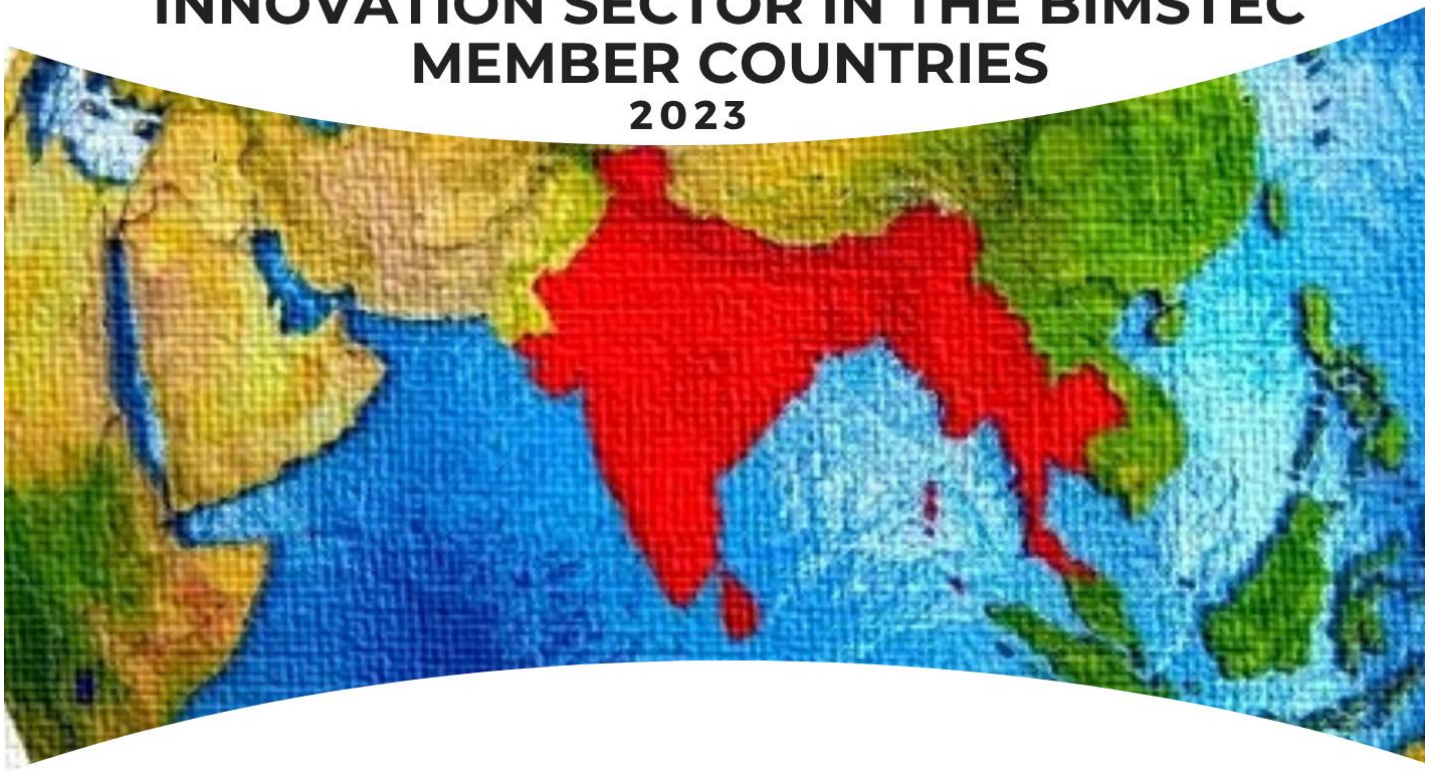
ASSESSMENT OF SCIENCE, TECHNOLOGY & INNOVATION SECTOR IN THE BIMSTEC MEMBER COUNTRIES

2023



National Science and Technology Commission of Sri Lanka

Ministry of Science and Technology

Government of Sri Lanka

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ACRONYMS

AAC - Annual Allowable Cut

ABS - Access and Benefit Sharing

ADSS - All-Dielectric Self-Supporting

AI - Artificial Intelligence

AIF - Agriculture Infrastructure Fund and Mission

ANRF - Anusandhan National Research Foundation

API - Active Pharmaceutical Ingredients

ASEAN - Association of Southeast Asian Nations

B2P - Business-to-People

BAU - Business as Usual

BCG - Bio-Circular-Green Economy Model

BCSIR - Bangladesh Council of Scientific and Industrial Research

BDC - Business Development Centre

BEZA - Bangladesh Economic Zones Authority

BHTPA - Bangladesh Hi-Tech Park Authority

BICOST - Biennial Conference on Science and Technology

BIMSTEC - Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation

BIRAC - Biotechnology Industry Research Assistance Council

BITC - Business Innovation and Technology Centre

BPO - Business Process Outsourcing

BRICS - (Intergovernmental organization comprising ten countries – Brazil, Russia, India, China, South Africa, Egypt, Ethiopia, Indonesia, Iran and the United Arab Emirates)

BST - Business Sales Tax

BWC - Biological Weapons Convention

CBU - Completely Built-Up

CEIIC - Clean Energy International Incubation Centre

CKD - Completely Knocked Down

COVID-19 - Coronavirus Disease-2019

CSI - Cottage & Small Industry

DAD - Department of Agrarian Development

DAE	- Department of Agricultural Extension
DBR	- Department of Biotechnology
DBT	- Department of Biotechnology
DCEZ	- Data Center Economic Zones
DFS	- Digital Financial Services
DHI	- Druk Holding and Investments
DITT	- Department of Information Technology and Telecom
DLAR	- The Department of Livestock and Aquaculture Research
DoMCIIP	- Department of Media, Creative Industry and Intellectual Property
DPI	- Digital Public Infrastructure
DTVET	- Department of Technical and Vocational Education and Training
EDP	- Entrepreneurship Development Policy
EE&C	- Energy Efficiency and Conservation
EEC	- Eastern Economic Corridor
EFF	- Extended Fund Facility
eGIDC	- Electronic Government Integrated Data Center
e-Gov	- Electronic Government
e-NAM	- Electronic National Agriculture Market
EPZ	- Export Promotion Zone
ESDM	- Electronic System Design and Manufacturing
EU-CBRN	- European Union - Chemical, Biological, Radiological, and Nuclear
EV	- Electric Vehicle
FDI	- Foreign Direct Investment
FTWZ	- Free Trade Warehousing Zone
FTZ	- Free Trade Zones
FY	- Financial Year
G20	- Group of 20 (Intergovernmental forum comprising 19 sovereign countries)
GAHP	- Good Animal Husbandry Practices
GAP	- Good Agricultural Practices
GAqP	- Good Aquaculture Practices
GCI	- Global Competitiveness Index
GDC	- Government Data Center
GDP	- Gross Domestic Product
GEF	- Global Environment Facility

GII - Global Innovation Index
Govnet - Government Network
GovTech - Government Technology
GSM - Global System for Mobile Communications
GST - Goods and Services Tax
HDI - Human Development Index
HESRI - Higher Education, Science, Research and Innovation
HH - Households
HRD - Human Resource Development
HSS - Hydrogen Safety Standards
ICT - Information & Communications Technology
ICTA - Information and Communication Technology Agency of Sri Lanka
IDCOL - Infrastructure Development Company Limited
IEA - International Energy Agency
IEs - Industrial Estates
IMF - International Monetary Fund
INDC - Intended Nationally Determined Contribution
INR - Indian Rupee
INSPIRE - Innovation in Science Pursuit for Inspired Research Programme
IoT - Internet of Things
IRD - Internal Revenue Department
ISP - Internet Service Provider
ISU - Implementation Support Unit
IT - Information Technology
IWMI - International Water Management Institute
JICA - Japan International Cooperation Agency
JNWSFL - Jigme Namgyel Wangchuck Super Fab Lab (JNWSFL)
LMS - Learning Management System
MIDH - Integrated Development of Horticulture
ML - Machine Learning
MOALI - Ministry of Agriculture, Livestock and Irrigation
MoH - Ministry of Health
MoICE - Ministry of Industry, Commerce, and Employment
MONERC - Ministry of Natural Resources and Environmental

MOOC - Massive Open Online Courses
MoU - Memorandum of Understanding
MPFMp - Myanmar Public Finance Management Project
MRTV - Myanmar Radio and Television
MSME - Micro, Small, and Medium Enterprises
MSO - Multi-System Operator
MSR - Myanmar Standard Rubber
MSS - Myanmar Selection System
MSW - Municipal Solid Waste
NASTEC - National Science and Technology Commission of Sri Lanka
NDCs - Nationally Determined Contributions
NDI - National Digital Identity
NEP - National Education Policy
NERDC - National Engineering and Research Development Centre of Sri Lanka
NESP - National Education Strategic Plan
NFSA - National Food Security Act
NIA - National Innovation Agency of Sri Lanka
NP - Nagoya Protocol
NRC - National Research Council of Sri Lanka
NSDA - National Skills Development Authority
NSM - National Supercomputing Mission
NSTI - National Science, Technology, and Innovation
OSSC - One Stop Service Centre
PAHAL - Pratyaksh Hanstantrit Labh
PDASL - Petroleum Development Authority of Sri Lanka
PF - PetaFLOPS
PGM - Platinum Group of Mineral
PMFME - Pradhan Mantri Formalisation of Micro Food Processing Enterprises Scheme
PM-JAY - Pradhan Mantri Jan Arogya Yojana
PM-JDY - Pradhan Mantri Jan Dhan Yojana
PMKSY - Pradhan Mantri Kisan Sampada Yojana
QR code - Quick Response code
R&D - Research and Development
RBP - Rice Bio Park

RGoB - Royal Government of Bhutan
RUSA - Rashtriya Uchchatar Shiksha Abhiyan
S&T - Science and Technology
SADMS - South Asia Drought Monitoring System
SDGs - Sustainable Development Goals
SEZs - Special Economic Zones
SKD - Semi-Knocked Down
SPR - Scientific Policy Resolution
SREDA - Sustainable and Renewable Energy Development Authority
STEAM - Science, Technology, Engineering, Arts and Mathematics
STEM - Science, Technology, Engineering, and Mathematics
STEPI - Science and Technology Policy Institute
STI - Science, Technology, and Innovation
STIP - Science Technology Innovation Policy
STISP - Science, Technology, and Innovation Strategic Plan
STP - Science and Technology Policy
TK - Traditional Knowledge
TKS - Traditional Knowledge Systems
UMIS - University Information Management System
UNCBD - United Nations Convention on Biological Diversity
UNDP - United Nations Development Programme
UNEP - United Nations Environment Program
UNIDO - United Nations Industrial Development Organization
UNSDG - United Nations Sustainable Development Group
UPI - Unified Payments Interface
USD - United States Dollar
USDA - United State Department of Agriculture
VAT - Value Added Tax
WASH - Water Supply, Sanitation and Hygiene
WIPO - World Intellectual Property Organization
WITS - World Integrated Trade Solution

FOREWORD

The National Science and Technology Commission of Sri Lanka (NASTEC) has the distinct honor of presenting this foreword to the publication prepared under the framework of the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC). At the Seventeenth BIMSTEC Ministerial Meeting, convened virtually from Colombo, Sri Lanka, in 2021, member states reached a significant decision to establish an Expert Group on Science, Technology, and Innovation (STI) Cooperation. This group was entrusted with the responsibility of formulating an Action Plan/Work Programme to strengthen collaboration in the STI sector across the BIMSTEC region.

The formation of this Expert Group represents a landmark development in the collective endeavor to strengthen and harmonize the STI landscape across the BIMSTEC region. The foremost objective of the Action Plan is to develop a vibrant culture of science, technology, and innovation among member countries, promoting the exchange of knowledge and technological expertise to support sustainable development, economic growth, and enhanced quality of life across the region. Among its key activities, the initiative includes a comprehensive assessment of the STI sectors in BIMSTEC countries. The outcome of this effort is the publication of the "Assessment of Science, Technology, and Innovation Sectors in BIMSTEC Countries," which will serve as a vital reference and will be made accessible through the BIMSTEC Secretariat website.

This publication is envisioned as a foundational resource, offering critical insights to policymakers, institutions, and other stakeholders. It will guide evidence-based decision-making, strengthen policy frameworks, and help unlock the full potential of STI in achieving shared development goals across BIMSTEC region.

The National Science and Technology Commission of Sri Lanka, as the advisory body to the Government of Sri Lanka on evidence-based policymaking within the Science and Technology (S&T) domain, takes great pride in contributing to this important regional undertaking. Sincere appreciation is extended to all member states, experts, officials, and institutions whose invaluable contributions have made this achievement possible. It is through such shared commitment and collaboration that BIMSTEC will continue to advance towards a more prosperous, resilient, and innovative future.

National Science and Technology Commission of Sri Lanka,
Ministry of Science and Technology
Sri Lanka

09 September, 2025

EXECUTIVE SUMMARY

The science, technology, and innovation (STI) sector plays a pivotal role in shaping sustainable development, economic growth, and regional integration across BIMSTEC member states. The 2023 assessments of global innovation, competitiveness, and human development highlight both the progress achieved and the disparities that remain among countries. Variations in Global Innovation Index (GII), Global Competitiveness Index (GCI), and Human Development Index (HDI) rankings, along with distinct national policy initiatives, illustrate the diverse yet evolving landscape of STI within the region.

Bangladesh ranked 106th in the GII (2024) and 116th in the GCI (2023), while its HDI reached 0.670 in 2023. The country performs relatively better in innovation outputs than inputs, reflecting a capacity for applied innovation despite gaps in education, governance, and institutional support. Bhutan is steadily advancing its STI agenda to strengthen its knowledge-based economy, diversify industrial development, and promote inclusive growth. Bhutan's HDI stood at 0.67 in 2021, ranking 127th globally, reflecting improvements in human capital alongside continued challenges in scaling innovation capacity. In India, STI ecosystem has evolved into a key driver of economic growth, social progress, and global leadership. The country ranks 39th in the GII 2024 and 37th in the GII 2022, reflecting strong performance in scientific publications, high-technology exports, and start-up activity. In Myanmar, the STI landscape is developing through national policies, strategic plans, and institutional frameworks that support socio-economic growth, with the country ranking 116th in the 2022 GII and showing slightly stronger performance in innovation outputs than inputs.

Nepal ranks 108th out of 132 economies in the GII 2023, showing a slight improvement in innovation outputs (103rd) compared to inputs (106th). Over the past four years, the country's overall GII ranking has declined from 95 in 2020 to 108 in 2023, reflecting challenges in translating innovation inputs into tangible outputs. In 2023, Sri Lanka demonstrated focused efforts to enhance its STI ecosystem and support sustainable development objectives. The country ranked 90th out of 132 economies in the GII, performing better in innovation outputs (79th) than inputs (103rd). High-tech exports reached USD 112 million, reflecting incremental growth. Thailand determines a strong and growing STI ecosystem, reflected in its ranking of 43rd out of 132 economies in the 2022 GII. The country performs slightly better in innovation outputs (44th) than inputs (48th) and ranks 5th among upper middle-income economies.

Across the region, each BIMSTEC member pursues tailored strategies to strengthen innovation, align with sustainable development objectives, and enhance competitiveness. These diverse approaches collectively contribute to regional STI advancement, providing a foundation for collaboration, knowledge sharing, and joint initiatives aimed at fostering technological progress and sustainable socio-economic development.

INTRODUCTION

The Assessment of Science, Technology, and Innovation Sectors in BIMSTEC Member Countries, 2023 stands as a momentous achievement in the ongoing journey toward regional integration and sustainable development. This publication reflects the shared vision of BIMSTEC member states to cultivate a dynamic and inclusive Science, Technology, and Innovation (STI) ecosystem—one that empowers communities, drives economic growth, and fosters resilience across the Bay of Bengal region.

With a combined population exceeding 1.7 billion, the BIMSTEC region represents immense human capital, natural resources, and economic potential. Strengthened STI cooperation among member countries not only enhances national capacities but also positions BIMSTEC as a significant player in the Asian geopolitical and economic landscape. By promoting mutual collaboration, the region is better equipped to develop resilience, stability, and inclusive growth, while contributing to broader regional and global progress.

A key activity under this initiative has been the preparation of a comprehensive assessment of the STI sectors across BIMSTEC member states. This report provides an overview of the current status of STI in each country, covering a wide range of indicators including the Human Development Index (HDI), Global Innovation Index (GII), Global Competitiveness Index (GCI), national STI policies, indigenous resources, ICT infrastructure, and related parameters. Sri Lanka has had the honor of serving as the lead country for this important undertaking in 2025. The data presented herein was obtained directly from BIMSTEC member countries. While certain data gaps remain—such as incomplete information for some countries or data not reflecting the year 2023—it is important to emphasize that all material has been presented as received, without alteration, in order to preserve the authenticity and accuracy of the report.

The outcome of this effort is the present publication, which is intended to serve as a foundational reference for policymakers, institutions, and stakeholders across the region. It is anticipated that the findings will support evidence-based decision-making, strengthen STI policy frameworks, and help unlock the transformative potential of science, technology, and innovation in advancing shared development goals.

This assessment is more than a compilation of statistics—it is a strategic resource designed to inform policy, guide investment, and inspire collaboration. By informative the strengths and challenges within each national STI framework, it lays the groundwork for targeted interventions and shared progress. As BIMSTEC continues to evolve as a regional force, this document will serve as a cornerstone for future initiatives.

BANGLADESH

Executive Summary

Bangladesh, Bhutan, India, Myanmar, Nepal, Sri Lanka and Thailand reveal significant variation in STI performance, investment, and institutional development. India and Thailand policy frameworks, higher R&D expenditure, advanced infrastructure, and global innovation rankings. In contrast, countries like Bangladesh, Nepal, and Myanmar face challenges including limited funding, weak STI governance, and a shortage of skilled human resources.

Bangladesh has steadily progressed in strengthening its Science, Technology, and Innovation (STI) sectors to drive socioeconomic development, industrial transformation, and sustainability. Despite facing challenges such as resource constraints, climate vulnerability, and limited R&D infrastructure, the Government has implemented targeted policies to foster innovation, digital transformation, and industrial diversification.

Bangladesh calls for enhanced regional STI cooperation under BIMSTEC, including a joint innovation platform, technology transfer, and increased public-private R&D partnerships to foster inclusive and sustainable growth.

Global Innovation Index- Bangladesh

Bangladesh ranks l06th out of 133 economies in the Global Innovation Index (GII) 2024, with a score of l9.1. It continues to outperform in innovation outputs relative to inputs but lags behind in key enablers such as education, research, and business sophistication.

Rankings of Bangladesh (2021–2023)

Year	GII	Innovation inputs	Innovation outputs
2023	105	117	91
2022	102	114	86
2021	116	123	101

- Bangladesh performs better in innovation outputs than inputs in2023.
- Input ranking dropped from l14 (2022) to 117 (2023), though improved from 2021.
- Output ranking fell slightly from 86 to 9l compared to 2022.

In2023:

- Ranked 34th among 37 upper middle-income economies.
- Ranked l6th among l9 economies in South and Southeast Asia and Oceania.

Global Competitiveness Index 2023 ranking – Bangladesh

Bangladesh ranks l16th in the Global Competitiveness Index 2023 with a score of 52.1, reflecting structural challenges in ICT adoption, institutions, and innovation capacity, though macroeconomic stability remains relatively stronger.

Human Development Index 2023 ranking - Bangladesh

Bangladesh's HDI value in 2023 is 0.670, placing it in the medium human development category, ranked 129 out of 189 countries. Between 2021 and2023, HDI rose from 0.661 to 0.670 (+0.91%), driven by healthcare and education improvements.

National STI Policies in Bangladesh

Bangladesh's STI policies aim to promote a knowledge-based economy aligned with Vision 2041 and the 8th Five-Year Plan. The National Science and Technology Policy (2011, under revision) emphasizes capacity building, intellectual property rights, and linkage between academia and industry need-based research, innovation, commercialization, STEM education, and collaboration across sectors.

National Nanotechnology Policy Framework

Early-stage development with focus areas in industrial applications, environmental safety and training, water purification, agriculture, drug delivery, energy. Human resource development and infrastructure is being prioritized for future nanotech applications.

National Biotechnology Policy Framework

Updated in 2012, the National Biotechnology Policy encourages public-private R&D investment across agri-biotech, medical biotech, and industrial biotech. Focus areas include saline-tolerant crops, vaccine development, and enzyme technology.

Food and Agriculture

National priorities include climate-smart agriculture, rice and fishery improvement salinity-tolerant crops, ICT-enabled extension services, smart packaging, and food safety. Institutions like BCSIR and DAE support research in post-harvest loss reduction and agricultural innovation.

Medicine and Health

Bangladesh has expanded e-health platforms, local vaccine production, and diagnostics R&D through public funding. API production and mobile health apps enhance healthcare innovation and import substitution.

Bioenergy

Bangladesh is exploring biomass and biogas technologies, especially from agricultural and municipal waste. Projects supported by IDCOL and SREDA aim at rural energy access.

Bio-based Industry

Emerging sectors include jute bioplastics, marine gelatin, and green solvents. Leather and textile industries adopt bio-finishing technologies as part of circular economy practices.

Hi-tech Exports in Bangladesh

In 2019, Bangladesh's high-technology exports were **USD 482 million**. Though fluctuating, high-tech exports are increasing, primarily driven by the ICT sector. High-technology exports accounted for **2.4%** of manufactured exports in 2023 (World Bank).

Year	Value (USD Million)	Change%
2023	515	6.8
2022	482	8.9
2021	443	4.5

High-tech exports accounted for 2.4% of total manufactured exports in 2023, led by ICT services and pharmaceuticals.

Human Capital in STI

Challenges include limited skilled researchers, weak university-industry collaboration, and underdeveloped advanced training. Government programs such as Digital Bangladesh and NSDA aim to build a future-ready STI workforce.

Special Economic Programmes Running in Bangladesh

There are 97 Economic Zones (BEZA) and 39 Hi-Tech Parks (BHTPA) under development. Tax incentives are offered until 2025, and digital infrastructure supports online service delivery and startup incubation.

National Development Policies Connected to Technology and Industry in Bangladesh

Key national strategies include the Bangladesh Delta Plan 2100, the 8th Five-Year Plan (2021-2025), and the Perspective Plan 2041-all of which emphasize ICT, innovation, and sustainable industrial growth.

Natural Raw Materials Available in Bangladesh

Bangladesh has natural gas, coal, limestone, silica sand, kaolin, gypsum, marine resources (fish, salt, algae), jute, and agricultural biomass-supporting STI applications in energy, food, and materials science.

ICT Infrastructure and Connectivity in Bangladesh

With 180+ million mobile subscribers and 130+ million internet users, Bangladesh has made strides in digital governance. National Data Centers, Smart City projects, and Startup Bangladesh Ltd. support ICT driven growth.

Best Practices of Bangladesh in STI Sector

Achievements include digital service platforms, jute genome sequencing, local COVID-19 diagnostic kit development, and integrated digital health initiatives.

Conclusion

Bangladesh is advancing in STI sectors through coordinated policies, digital investments, and institutional reforms. Continued focus on human capital, innovation ecosystems, and regional cooperation will strengthen its role as an innovation-driven economy within BIMSTEC.

BHUTAN

Global Innovation Index (GII)

To support Bhutan's inclusion in the Global Innovation Index (GII) Rankings starting in 2025, a national GII Task Force has been formally established, comprising representatives from various public and private agencies. The task force is mandated to collect and submit data on 81 indicators across seven key areas to international data partners such as UNIDO, UNESCO, WTO, World Bank, Brand Finance, and Thomson Reuters. The Department of Media, Creative Industry and Intellectual Property (DoMCIIP) under the Ministry of Industry, Commerce, and Employment (MoICE) serves as the secretariat for the task force. As of now, all task force members have successfully gathered the required data and are in the process of submitting it to the relevant international organizations to facilitate Bhutan's formal entry into the GII Rankings for 2025, under the coordination and oversight of WIPO.

Human Development Index 2022 ranking - Bhutan

Bhutan's HDI value for 2021 is 0.67 which puts the country in the medium human development category— positioning it at 127 out of 191 countries and territories. In 2020 and 2021, Bhutan's HDI value increased from 0.65 to 0.67, an increase of 0.02 percent.

Country	Year	Index	Rank
Bhutan	2021	0.67	127

National STI Policies in Bhutan (National Science Technology and Innovation (STI) Policy and Plan)

Realizing the potential for Bhutan's development, the RGoB has prioritized the development of the STI sector. The STI Initiative in Bhutan is expected to bring on new economic opportunities apart from developing an environment for new technology and knowledge transfer, market driven innovation and promotion of academic industry linkage, and R & D works. The Government Technology (GovTech) agency under the Royal Government of Bhutan takes majorlead in implementing the digital initiative across the country. Programs on STI is aimed to stimulate the digital economy through commercialization of innovative products and services in science and technology while focusing on specific areas of developing professional skills in Bhutan, and build local capacity and capability, startup hubs for global and local startups, create high value employment opportunities and tech innovation through R&D services.

Hi-tech exports in Bhutan

There is no formal data of tech exports in Bhutan however, the country has been able to attract few FDI companies that provide services to the global clients. Today, there are 25 FDI tech companies that are operating from the country. The country is putting in effort to develop the overall tech ecosystem including the growth of the local tech industry. Several initiatives are underway that will support and promote the development of Bhutanese tech products and services and make its presence in the global market.

Currently Bhutan imports high tech products from other countries to meet domestic need

High Tec Imports BHUTAN				
Year	Value in Nu.(Million)	Avg. Exchange rate	Value in USD(Million)	Change%
2023	11.62	83.19	139.59	-52.2
2022	22.97	78.60	292.29	+86.3
2021	2.99	74.48	40.12	-71.6
2020	10.35	73.39	141.03	-

List out Special Economic Zones, Tax details, adoption of digital technology details

Having identified ICT as a priority sector for the development of a knowledge-based economy, the erstwhile Department of Information Technology & Telecom of the Ministry of Information & Communications now named as the Government Technology Agency established Bhutan first ever IT Park with support from the World Bank. The IT Park was established with objective to create productive employment in the sector and increase GDP contribution from ICT sector through promotion of FDI investment, strengthening ICT industry the country and developing entrepreneurship culture and startups in the tech sector.

The operations of the IT Park started on 7th May 2012 and is operated by Thimphu TechPark. Today, it provides two major services i) facilitating FDI business in Bhutan and leasing commercial space to both domestic and foreign companies; ii) Business Innovation and Technology Centre (BITC) provides business incubation services to startups, shared technology services and data center services. The BITC has been one of the pioneers in introducing entrepreneurship culture in the country. Around 100 entrepreneurs have graduated from BITC in the past 10 years turning their idea into reality. Most of them have launched their products and services operating from the incubation center.

Thimphu TechPark launched the ‘Centre of Excellence for Information Technology’ on 21st February, 2020. Today, it serves major clients including the government agency in developing software applications and providing tech solutions using the latest technologies block chain, AI and others.

The InnoTech Department under DHI operates Jigme Namgyel Wangchuck Super Fab Lab (JNWSFL) that provides an open platform for learning and innovation inside the park. The JNWSL was officially inaugurated on October 9, 2020. At the time of its opening, it was only the third Super Fab Lab in the world, and the first kind outside the United States.

The other facility is a startup center, that was launched in 2018 to create an enabling environment for entrepreneurs to work on their business ideas. The center is operated and managed by the Department of Employment and Entrepreneurship under the Ministry of Industry, Commerce and Employment. The center provides co-working space, mentoring, training, product development, marketing and other business support.

Bhutan is gradually developing sector-specific economic zones to diversify its economy, attract investment, and foster industrial innovation. These zones go beyond IT-focused areas and include agro-processing, green industries, and light manufacturing. Key SEZs include the Motanga Industrial Park in Samdrup Jongkhar focused on manufacturing and agro-processing, Bondeyma Industrial Estate in Mongar, and the Jigmeling Industrial Park in Sarpang, which promotes eco-friendly industries with the following integration under the above-mentioned sectors:

1. **Motanga Industrial Park**

- **Location:** Samdrup Jongkhar (eastern Bhutan)
- **Sector Focus:** Medium-scale manufacturing, agro-processing
- **Features:** Strategically located near the Indian border, Motanga is Bhutan's flagship industrial estate offering serviced land plots, access to the eastern regional grid, and proximity to key transport corridors.
- **Purpose:** Intended to boost regional economic activity and reduce eastern Bhutan's dependence on subsistence agriculture by encouraging value-added manufacturing and agri-based industries.

2. **Bondeyma Industrial Estate**

- **Location:** Mongar (eastern Bhutan)
- **Sector Focus:** Agro-processing, cottage and small industries (CSI)
- **Features:** Designed to promote value-chain integration in Bhutan's agriculture sector, Bondeyma will provide agro-processing facilities, warehousing, and common infrastructure for CSI development.
- **Development Status:** Currently under infrastructure development with targeted completion in the near term.
- **Goal:** Stimulate local entrepreneurship, food processing, and rural employment generation.

3. **Jigmeling Industrial Park**

- **Location:** Sarpang (south-central Bhutan)
- **Sector Focus:** Eco-friendly industries, light manufacturing, logistics
- **Features:** Envisioned as a green industrial zone, Jigmeling is being planned with sustainable infrastructure, pollution control systems, and green technology standards.
- **Strategic Role:** As the largest planned industrial park, it will serve as a logistics and processing hub to connect Bhutan's southern border to emerging markets.

Tax details

The fiscal incentives Act of Bhutan 2021 provides direct and indirect tax and sector specific exemptions to investors.

Direct Tax Incentives: Newly established ICT businesses will enjoy a concessionary tax rate of 5 % during the qualifying period of up to 5 years.

Indirect Tax Incentives: Sales tax and customs duty on plant & machinery, construction material, ICT tools and equipment are also granted to IT service providers such as software development entities, BPO, MSO, Cable Operators and any other IT service providers.
ST and CD exemption on Research and Development equipment for Government recommended Research and Development proposal.

Under Bhutan's current Fiscal Incentives framework, IT service providers—including software development firms, BPOs, MSOs, cable operators, and other ICT-based entities—are eligible for exemptions from Business Sales Tax (BST) and Customs Duty (CD) on the import of plant and machinery, construction materials, and ICT tools and equipment. Similarly, government-approved Research and Development (R&D) proposals benefit from BST and CD exemptions on R&D-related equipment.

However, as ratified by Parliament, Bhutan will implement a new Goods and Services Tax (GST) system effective 1 January 2026, replacing the existing BST regime. Under this system, a standard GST rate of 5% will apply to most goods and services. Only five essential goods—rice, oil, salt, sanitary pads, and electronic wheelchairs—will be exempt from GST. Importantly, Customs Duty will continue to apply on goods originated from third countries.

National development policies connected to technology and industry in Bhutan

Following are the policies connected to technology and Industry;

1. Information, Communication and Media Act of Bhutan
2. Bhutan Telecommunication and Broadband Policy
3. e-Gov Policy
4. FDI Policy
5. EDP Policy

ICT infrastructure and connectivity in Bhutan

The GovTech, Royal Government of Bhutan prioritized ICT to achieve the vision of becoming an 'A technologically advanced nation, with empowered citizens and a thriving digital economy'. To this end, the government is taking a concerted effort in leveraging technologies for digital transformation of the country. One of the major achievements was in establishing the infrastructure for mobile network coverage in all the villages across the country. As of July 2021, 94% of the households in the country have access to the Internet (as per ICT baseline survey 2021 conducted by DITT). Community Centers in the gewogs were built for the digitally disadvantaged citizens to gain access to ICT infrastructure, information, and services. All the government agencies have been connected to the Government Network (Govnet) with a faster and reliable network to facilitate the delivery of public services. A total of 160 public services of various government agencies were identified and automated.

To make connectivity more affordable, accessible, and reliable, the Royal Government of Bhutan (RGOB) has extended fiber infrastructure to the sub-district level. Both OPGW (Optical Ground Wire) and ADSS (All-Dielectric Self-Supporting) fiber connections have been established, covering all 20 districts and 204/205 sub-districts. In a bid to promote service expansion into rural and underserved areas, the fiber cores are leased to internet service providers at no cost. This initiative aims to bridge the digital divide and ensure that even the most remote regions of the country have access to digital services.

Recently, GovTech also launched the National Digital Identity (NDI) that uses a decentralized self-sovereign identity framework empowering every citizen authority over their own data. With this platform, it positions Bhutan uniquely in the global arena for innovation in digital transformation. The platform also opens a plethora of innovative opportunities in the digital space for businesses leveraging the same trusted identity and privacy preserving platform.

Bhutan's first Government Data Center (GDC) was established and commissioned on March 23, 2017. After successfully establishing the required infrastructure, GDC was operationalized with 20 critical government systems. Currently, there are 400 independently developed systems and are still growing. The current infrastructure setup provides storage, compute and network resource pools, which ensures optimized investment in govt digital infrastructure.

Conclusion

Bhutan is making significant strides in enhancing its human development value and technological landscape. The Government Technology(GovTech) Agency under the Royal Government of Bhutan leads the digital transformation initiative of the country and these efforts are designed to stimulate the digital economy, develop professional skills, and support local startups, ultimately creating high-value employment opportunities and advancing Bhutan's technological landscape. These efforts not only aim to boost economic opportunities but also

strive to empower citizens and enhance overall quality of life thoughtfully leveraging technology.

The Science Technology and Innovation sector is a priority with the government's commitment to fostering the sector, alongside initiatives like the establishment of the Thimphu TechPark, Bhutan Innovation & Technology Center and investments in various digital infrastructure and development of conducive regulatory environment, highlights its ambition to build a robust STI ecosystem and ultimately cultivate a knowledge-based economy. The National Digital Strategy 2024 further highlights the vision of becoming an 'Intelligent Bhutan' prioritizing STI to become a digitally advanced nation. This strategy will drive the overall growth of the STI sector in the coming years

INDIA

Executive Summary

India’s Science, Technology, and Innovation (STI) ecosystem has undergone significant transformation in recent decades, emerging as a key enabler of the country’s economic growth, social progress, and global leadership aspirations. This assessment presents a comprehensive overview of the current landscape, key achievements, persistent challenges, and emerging opportunities across India's STI sectors.

India ranks among the top countries globally in terms of scientific publications, start-up activity, and high-technology exports. Government initiatives such as the *National Quantum Mission, National Mission on Interdisciplinary Cyber-Physical Systems, National Geospatial Mission, Atal Innovation Mission, Startup India, and Digital India* have catalyzed innovation across sectors including space, health, agriculture, energy, and digital technologies. The rise of Digital Public Infrastructure (DPI), such as Aadhaar and UPI, demonstrates India’s capability to develop scalable, inclusive, and open-source technological solutions.

India’s R&D investment, although increasing in absolute terms, remains modest as a percentage of GDP (~0.7%), and is largely driven by the public sector. Capacity building in frontier areas—such as artificial intelligence, quantum technologies, semiconductors, biotechnology, and clean energy—is underway that is supported with appropriate efforts to ensure deeper investments in research infrastructure and talent development. The recently *established Anusandhan National Research Foundation* aims to reinvigorate the research ecosystem by funding cutting-edge research and fostering linkages among academia, industry, and government.

India has taken proactive steps to internationalize its STI efforts through bilateral, multilateral, and regional collaborations including BRICS, G20, BIMSTEC, and the Global South. This assessment underscores the importance of inclusive and sustainable innovation that addresses national development goals while also contributing to global scientific advancement. Strengthening STI governance, increasing R&D investments, enhancing regional innovation capacities, and promoting open science and diversity in research are crucial to realizing India’s vision of becoming a global innovation hub.

Global Innovation Index- India

India holds 39th rank among the 132 countries assessed in the Global Innovation Index (GII) 2024. India has been on a rising trajectory, over the past several years, from a rank of 81 in 2015 to 39 in 2024. Innovation has been at the forefront of our battle against the unprecedented crisis created by the pandemic and will be pivotal in driving the country’s resilience, as enshrined call

on Atma Nirbhar Bharat. Consisting of roughly 80 indicators, grouped into innovation inputs and outputs, the GII aims to capture the multi-dimensional facets of innovation.

The following table shows the rankings of India over the past three years, noting that data availability and changes to the GII model framework influence year-on-year comparisons of the GII rankings. The statistical confidence interval for the ranking of India in the GII 2022 is between ranks - and -

Rankings of India (2020–2022)

Year	GII	Innovation inputs	Innovation outputs
2022	40	42	39
2021	46	57	45
2020	48	57	45

- India performs better in innovation outputs than innovation inputs in 2022.
- This year India ranks 40nd in innovation inputs, higher than both 2021 and 2020.
- As for innovation outputs, India ranks 39th. This position is higher than both 2021 and 2020.

In 2022:

1st India ranks 1st among the 36 lower-middle-income group economies.

1st India ranks 1st among the 10 economies in South East Asia, East Asia, and Oceania.

Global Competitiveness Index 2022 ranking – India

India's Performance in the World Competitiveness Index 2022. India jumped from the 43rd rank in 2021 to the 37th rank in 2022 on the World Competitive Index.

Covering 141 economies, the Global Competitiveness Index 4.0 measures national competitiveness- defined as the set of institutions, policies and factors that determine the level of productivity.

2022			Diff. from 2021	
Rank	**Economy**	**Score**	**Rank**	**Score**
37	India	-	42	-

Human Development Index 2022 ranking - India

India's Human Development Index (HDI) has increased significantly since 1990. However, it is still below the global average. India's HDI is ranked 132 out of 191 countries and territories in the 2021/2022 Human Development Report

India's HDI value for 2022 is 0.633 which put the country in the medium human development category positioning it at 132 out of 191 countries and territories.

Country	Year	Index	Rank
India	2022	0.633	132

National STI Policies in India

India adequately prioritizes and strategizes across the STI landscape in alignment with UNSDG goals through a balance of short-term mission mode programmes along with long term ones. There are following Policy debates happening in India to address the societal challenges.

- Intensified global and local linkages in the STI sector.

- Development of indigenous technologies in key areas such as health, agriculture, energy, environment etc. in alignment with the needs of the local communities.

- To facilitate seamless knowledge flow across the stakeholders (government including Centre and State, R&D institutions, academia, enterprises-industry, start-ups and Small and Medium Enterprises and society) of the STI ecosystem to enhance the applicability of R&D and technology development outcomes including the tangible impact of S&T on society.

- To catalyse innovation and value creation in the system with due importance given towards recognition, incentivization and promotion of Traditional Knowledge Systems (TKS) and grassroots innovations.

Thus, STI policy instrument in India is there to design and objective aims to be evidence driven, inclusive and bottom-up for the well-being of the nation and its people with socioeconomic and environmental considerations.

National Science Technology and Innovation (STI) Policy and Plan

A comprehensive involvement of different stakeholders carried out mapping the technologies globally with the aim to explore technological possibilities to attain our development goals considering new opportunities in the emerging knowledge economy era. This involves identifying new technology paradigms that might appear in the future and their game changing impact for the country.

National Nanotechnology Policy Framework

Supports the basic and applied research in Nano domain. Through two phases of the mission mode, it had created state of the art research facilities and capacity building in the country. Through its support, India is currently ranked 3rd in number of SCI publications.
Nano program has generated a draft guideline and invoked best practices for safe handling of nanomaterials in Research Laboratories and Industries.

National Biotechnology Policy Framework

***National Biotechnology Development Strategy (2020-2025)*:** Focuses on 4 major verticals as mentioned below-

i. Building capacities both human resource and infrastructure to cater to the current needs and also to the future emerging technologies.

ii. Strengthening and nurturing of a strong basic research innovation driven ecosystem across Research Institutes and Laboratories, both public and private sector, with complete engagement of Startups, Small Industry, Large Industry and also reaching out to tier 2 and tier 3 cities.

iii. The third major focus is on promoting the translation and product development commercialization ecosystem which necessarily needs to engage public and private sector and also encourage PPP models of co- development. This will require special focus on moving research leads from Laboratory towards technology development.

iv. The balance between basic and translational research needs to be maintained to ensure that we have a robust pipeline of new knowledge, which helps us to take the translational work forward.

Food and Agriculture

Indian agriculture thrives through innovation, efficiency, and expanded horizons, benefitting both farmers and the entire agribusiness sector alike by minimising losses, enhancing income, and fostering technological advancements.

- The National Food Security Act, 2013 (NFSA 2013) converts into legal entitlements for existing food security programs of the Government of India. It also includes the Midday Meal Scheme, Integrated Child Development Services scheme, and the Public Distribution System.

- The government has taken initiatives to boost the sector under schemes, such as Pradhan Mantri Kisan Sampada Yojana (PMKSY) and Pradhan Mantri Formalisation of Micro Food Processing Enterprises Scheme (PMFME) to promote cluster development and

micro-processing units, encouraging public-private collaborations, and enabling wider market access.

- Major focus for Indian Agri Value Chain is to minimize post-harvest losses, especially for perishable foods that naturally emphasises on enhancing storage and grading facilities, upgrading transportation networks, by leveraging existing schemes like Agriculture Infrastructure Fund (AIF) and Mission on Integrated Development of Horticulture (MIDH).

- Paving the way for Agri-Tech adoption, the government's initiatives, including the Digital Public Agriculture Infrastructure, Digital Agriculture Mission, and National Agriculture Market (e-NAM) Scheme, aim to enhance the adoption of Agri-tech solutions such as AI-based precision agriculture, IoT-based real-time data collection systems, and drone-based agriculture to improve farmer yield and profitability.

- For boosting the agricultural exports, Govt. of India focuses to adopt interventions like demand-driven production through regular market identification, strengthened post-harvest infrastructure with digitally enabled supply chains, adherence to global quality standards, and incentivising the promotion of agricultural exports.

Medicine and Health

The primary aim of the National Health Policy, 2017, is to inform, clarify, strengthen and prioritize the role of the Government in shaping health systems in all its dimensions- investments in health, organization of healthcare services, prevention of diseases and promotion of good health through cross sectoral actions, access to technologies, developing human resources, encouraging medical pluralism, building knowledge base, developing better financial protection strategies, strengthening regulation and health assurance.
India has initiated several reforms that could have far-reaching implications for the health sector and the broader economy. These include:

- Launching Ayushman Bharat, which encompasses the National Health Protection Scheme [Pradhan Mantri Jan Arogya Yojana (PM-JAY)], for coverage of tertiary care for vulnerable populations and Health and Wellness Centres initiative for the delivery of comprehensive and integrated primary care.

- Setting up the National Health Authority to implement the PM-JAY.

- Initiating the provision of universal sanitation coverage and making the country open defecation–free through the Swachch Bharat Mission.

- Launching Intensified Mission Indradhanush 2.0 to achieve 90 percent vaccination coverage for children under 2.

- Providing clean cooking fuel under the Pradhan Mantri Ujjwala Yojana scheme.

- Providing nutritional and social support for all National Health Protection Scheme beneficiaries with tuberculosis.

- Replacing the Medical Council of India with the National Medical Commission and setting uniform standards for medical education.

- Creating a health technology assessment body (Health Technology Assessment in India) under the Department of Health Research to evaluate all medical technologies.

Bioenergy

Implementation of bioenergy in India

- Renewables make up 22% of total energy supply in India in 2019. The renewable energy share in final energy consumption is 31%. Around 85% of renewable energy is from biomass.

- India is a large country, but also has a high population density, which is mainly concentrated in big cities. Current energy use per capita is very low; however, India is a fast-growing economy, also leading to a strong growth in energy needs.

- The traditional use of biomass for residential heating – which is the dominant type of bioenergy in India - is going down slightly (and mostly replaced by oil and gas). Modern use of biomass for power production is growing.

- Biofuels in transport so far have a very modest role, representing less than 1% of transport fuels.

- The focus is on bioethanol, which represented 3% (by energy) of gasoline consumption in 2019.

- India has important opportunities to further deploy bioenergy, particularly through the replacement of coal by solid biomass in existing assets, the replacement of traditional bioenergy by more modern (and less polluting) forms of bioenergy or the increase of transport biofuels based on domestically available agricultural residues. There are many opportunities for (renewable) energy from MSW as part of the development of waste management systems.

More details can be accessed from the web links as mentioned below:

- DBT-Bioenergy:https://dbtindia.gov.in/schemes-programmes/research-development/energyenvironment-and-bio-resource-based-applications-1
- BIRAC: https://www.birac.nic.in
- CEIIC: https://ceiic.socialalpha.org
- Clean Energy transitions: Accelerating Innovation beyond 2020: http://mission-innovationindia.net/reports/ - developed under DBT IEA joint collaboration for Mission Innovation
- Mission Innovation India Unit: http://mission-innovation-india.net
- https://www.ppac.gov.in/ for data on fossil fuels production, consumption, Import & Export
- https://www.mnre.gov.in/ for data on R&D projects.
- https://www.siamindia.com/ for data on automotive industry.
- https://mopng.gov.in/en for data on R&D projects.

Bio-based Industry

- India aims to enable Circular Bioeconomy by advancing 'High-Performance Bio-manufacturing' in the country.

- India envisions "Green Growth" in the ensuing 'AmritKaal' and this calls for a systematic framework plan for implementation of robust innovative bio-based eco-friendly solutions to further boost the ongoing economic growth.

- India envisages to bring together scientific and technological advancement towards achieving a major goal of the Department's vision of BioE3 (i.e. Biotechnology for Economy, Environment and Employment) for green, clean and prosperous India.

Hi-tech exports in India:

Experts project low to moderate growth in exports for fiscal 2023-24, given the global economic scenario. India's overall merchandise exports are likely to experience modest year-on-year growth of 2% to 4% in fiscal year 2024, reaching approximately **US$ 460 billion**. This projection follows an estimated growth of 5-7% in the current fiscal year. Exports to the US and EU27, which together account for nearly one-third of total merchandise exports, are expected to contract due to an anticipated economic slowdown and inflationary conditions in these regions.

High-technology exports (% of manufactured exports) in India was reported at 12.48 % in 2022, according to the World Bank collection of development indicators.

Country	Year	Value	Change %
India	2022	12	
	2021	10	

	2020	11	

Human Capital in STI

Human capital forms the cornerstone of India's Science, Technology, and Innovation (STI) ecosystem. India possesses a vast and diverse talent pool in science, technology, and engineering, producing over a million STEM graduates annually. However, key policy challenges persist in unlocking the full potential of this human capital to drive innovation and research excellence.

India has taken various initiatives to build Human Capacity through various programmes. Significant progress has been achieved in expanding access to technical education and research training, particularly through initiatives like the Innovation in Science Pursuit for Inspired Research (INSPIRE) program, National Research Professorships, and research fellowships under the Anusandhan National Research Foundation (ANRF). Policies such as the National Education Policy (NEP) 2020, Rashtriya Uchchatar Shiksha Abhiyan (RUSA), and various skill development missions aim to modernize STI human capital formation by promoting research integration, critical thinking, and global competitiveness.

Despite these advances, challenges persist in terms of research quality, limited doctoral output in cutting-edge fields, and uneven geographic and gender representation. Strengthening postgraduate and doctoral education, particularly in Tier 2 and Tier 3 institutions, is vital to broadening the national talent pool. There is increasing recognition of the importance of multidisciplinary education, entrepreneurship, and international mobility of researchers. The Indian youth is doing wonders in the field of Innovation and number of start-ups are increasing exponentially. India is supporting the weaker section, connecting the STEM education to economy and society, developing the people centric STI system, maintaining the gender parity and encouraging the participation of women in STI and other areas of research. Expanding such inclusive frameworks is critical to achieving equitable and sustainable STI growth.

Special economic programmes running now in India

Businesses can consider setting up or doing business with entities in India's Special Economic Zones to take advantage of favorable tax incentives, simplified customs procedures, and a conducive environment for manufacturing and trade. Special economic zones (SEZs) in India are areas that offer incentives to resident businesses. SEZs typically offer competitive infrastructure, duty free exports, tax incentives, and other measures designed to make it easier to conduct business. Accordingly, SEZs in India are a popular investment destination for many multinationals, particularly exporters.

As of 2023, India has 272 operational SEZs with a combined employment of 2.8 million people. These SEZs generated approximately US$133 billion in exports, with service exports making up around 60 percent of this total. Goods exports from Indian SEZs reached US$61 billion in FY 2022-23. Kandla SEZ in Gujarat alone accounted for US$38 billion in export value. Investments

into these SEZs grew to INR 656 billion (US$7.87 billion) as of December 2022, per data from Statista (US$1=INR83.26).

While India's SEZs are similar to those found in other parts of Asia, business leaders that are considering setting up in a SEZ should seek to understand how SEZs work in India.
The Special Economic Zone Act, 2005 amended India's SEZ policy. Many EPZs have converted to SEZs, with notable zones in Noida (Uttar Pradesh state), Falta (West Bengal state), Visakhapatnam (Andhra Pradesh state), Chennai (Tamil Nadu state), Cochin (Kerala state), Santa Cruz (Maharashtra state), Indore (Madhya Pradesh), as well as Kandla and Surat (Gujarat).

Consequently, the SEZ category encompasses various multiple zone types, such as free trade zones (FTZs), EPZs, industrial estates (IEs), free ports, free trade warehousing zones (FTWZz), and urban enterprise zones, among others. A designated duty-free enclave is considered as a territory outside the customs jurisdiction of India for authorized operations within the Special Economic Zone (SEZ). No import license is necessary, and both manufacturing and service activities are permitted. Units within the SEZ must demonstrate Positive Net Foreign Exchange over a cumulative period of five years from the start of production. Domestic sales are subject to full customs duty and adhere to the current import policy. SEZ units have the liberty to engage in subcontracting. Routine inspections of export/import cargo by customs authorities are not required. SEZ Developers/Co-Developers and Units are entitled to direct and indirect tax benefits as stipulated in the SEZs Act of 2005.
Since the Act's promulgation, the Indian government has also accepted proposals for additional, far smaller SEZs, which must be proposed by developers to the Indian Board of Approval. The SEZ Rules, 2006 lay down the complete procedure to develop a proposed SEZ or establish a unit in an SEZ.

National development policies connected to technology and industry in India

Science, technology, and innovation (STI) have emerged as key drivers of national development around the world. Since independence, four major policies have been implemented: Scientific Policy Resolution (SPR 1958), Technology Policy Statement 1983, Science and Technology Policy 2003 (STP 2003), and Science Technology Innovation Policy 2013 (STIP 2013). As India strives for faster, more sustainable, and inclusive growth, the Indian STI system, which benefits from a large demographic dividend and a large talent pool, will need to play a pivotal role in achieving these national objectives.

Natural raw materials available in India

India's major mineral resources include coal (4th largest reserves in the world), iron ore, manganese ore (7th largest reserve in the world as in 2013), lithium ore (6th largest reserve in the world as in 2023), [6] mica, bauxite (5th largest reserve in the world as in 2013), [7] chromite, natural gas, diamonds, limestone and thorium.

Here are the top 10 latest raw material examples in India:

1. **Coal**- It is a fossil fuel, used in thermal power plants to generate electricity, produce steel, power industrial processes, etc. India is the third-largest producer of coal in the world and, is also home to the fifth-largest proven reserves of coal.

2. **Iron ore**- Another raw material example that is mined in many countries worldwide, including India. Typically, a rock or mineral contains iron. And is the most important source of iron for the steel industry. It is a raw material that is processed and then used to make steel. India is the world's second-largest producer of iron ore.

3. **Steel**- India is the world's third-largest producer of steel. Steel is an alloy of iron and carbon. It is a strong and versatile material that is used in a wide variety of applications, including construction, machinery, transportation, etc.

4. **Copper**- It is a soft, malleable, and ductile metal with very high electrical conductivity. Generally, used in a wide variety of applications, including electrical wiring, plumbing, and construction.

5. **Bauxite**- It is an ore that contains aluminium. Aluminium is a lightweight metal that is used in a wide variety of applications, including construction, transportation, and packaging.

6. **Limestone**- It is a sedimentary rock that is composed of calcium carbonate. And is used in a wide variety of applications, including cement production, steelmaking, and agriculture.

7. **Sand**- It is a loose, granular material that is made up of finely divided rock and mineral particles. Typically, used in a wide variety of applications, including construction, glassmaking, and water filtration.

8. **Cement**- It is a binding agent that is used to hold together aggregates, such as sand and gravel. The most common applications of this raw material, include construction, infrastructure, and manufacturing.

9. **Petroleum**- It is a fossil fuel and is found in underground reservoirs. Typically, a versatile raw material is used in multiple products such as cars, trucks, airplanes, etc. Further, it is also used to make petrochemicals, which are, then used to make plastics, fertilisers, and other products. India is the world's fifth-largest consumer of petroleum.

10. **Natural gas**- It is a clean-burning fossil fuel. And is a good alternative to petroleum and coal. As it can be used to generate electricity, produce fertilisers, and power other industrial processes.

ICT infrastructure and connectivity in India

- 48 PetaFLOPS (PF) high performance computing facility with data centres are created across India under National Supercomputing Mission (NSM). 210 AI-PF infrastructure is also established under NSM, India.

- The Digital India Program, launched in 2015, marked a pivotal moment in India's journey towards digitalisation and included initiatives such as Digi Locker, PM-JDY (Pradhan Mantri Jan Dhan Yojana), PAHAL (Pratyaksh Hanstantrit Labh), and the development of smart cities.

- National Policy on Electronics, launched in 2019, establishes a strategic framework for India's Electronic System Design and Manufacturing (ESDM) sector. The policy actively promotes a comprehensive startup ecosystem, particularly in emerging technology areas, including artificial intelligence, 5G, IoT, machine learning, robotics, optics, and more.

- To support the vision, the Indian government has invested several incentives for electronics manufacturing, semiconductor and display ecosystem, and allied sectors, including advanced chemistry cells, auto components, telecoms and networking, and solar modules.

- The National Broadband Mission was launched in 2019 to roll out 5G services and strengthen the existing 4G network by identifying gaps while promoting "Make in India" through investments on telecom towers, optical fibre infrastructure, and spectrum/R&D to enhance digital communication infrastructure and tap the farthest corners of the country.

- Given the paradigm shift towards digitalisation, the Government of India announced the Data Center Policy in 2020.

- The policy strives to provide trusted hosting infrastructure to meet the country's growing demand for data services while facilitating cutting-edge service delivery to citizens through these reforms: promoting research and development, using indigenous hardware, setting up Data Center Economic Zones (DCEZ), and encouraging renewable energy adoption to power data centres through collaboration with the Ministry of Power on green and sustainable energy initiatives.

Best Practices of India in STI Sector

The best practices of India in STI are to focus on indigenous Research, Development and Innovation along with support to weaker sections, gender equality, sustainable development with

global ties. India is connecting the education and research with society and economy which helps in sustainable growth of the country.

Conclusion

India stands at a pivotal moment in its Science, Technology, and Innovation (STI) journey. Strategic initiatives across sectors—ranging from digital public infrastructure and space exploration to biotechnology and renewable energy—have demonstrated India's capacity for scalable, inclusive, and frugal innovation. For India to march ahead on a sustainable development pathway to include economic development, social inclusion and environmental sustainability for achieving an "Atmanirbhar Bharat (Self-reliant India)", a greater emphasis will be given on promoting traditional knowledge system, developing indigenous technologies and encouraging grass root innovation. Significant challenges such as low R&D intensity as compared to global benchmarks, limited private sector participation, and human capital development are being appropriately addressed to align with emerging technological frontiers. The new STI Policy aims to bring about profound changes through short-term, medium-term, and long-term mission mode projects by building a nurtured ecosystem that promotes research and innovation on the part of both individuals and organizations. It aims to foster, develop, and nurture a robust system for more inclusive, evidence and stakeholder-driven STI planning, information, evaluation, and policy research in India. A future-ready STI ecosystem—rooted in excellence, openness, and equity—will be central to achieving India's vision of becoming a knowledge economy and a global innovation hub.

MYANMAR

Global Innovation Index – Myanmar

According to the latest available data from the World Intellectual Property Organization (WIPO), Myanmar's ranking in the Global Innovation Index (GII) 2023 is not publicly available, as the most recent data for Myanmar is from 2022, where Myanmar ranks 116th among the 132 economies featured. The following table shows the rankings of Myanmar over the past three years, noting that data availability and changes to the GII model framework influence year-on-year comparisons of the GII ranking. The statistical confidence interval for the ranking of Myanmar in the GII 2022 is between ranks 108 and 118.

Rankings of Myanmar (2020–2022)

Year	GII	Innovation inputs	Innovation outputs
2023	-	-	-
2022	116	122	104
2021	127	128	120

- Myanmar performs better in innovation outputs than innovation inputs in 2022.
- In 2022, Myanmar ranks 122nd in innovation inputs, higher than both 2021 and 2020.
- As for innovation outputs, Myanmar ranks 104th. This position is higher than both 2021.

In 2022:

31st Myanmar ranks 31st among the 36 lower-middle-income group economies.
17th Myanmar ranks 17th among the 17 economies in South East Asia, East Asia, and Oceania.

Global Competitiveness Index 2022 ranking – Myanmar

Data not available

Human Development Index 2023 ranking – Myanmar

According to available data, the Human Development Index (HDI) for Myanmar in 2023 has not been officially released by the United Nations Development Program (UNDP).

National STI Policies in Myanmar

Science, Technology and Innovation Strategic Plan -STISP (2022-2027) have been launched by Ministry of Science and Technology in December, 2022. The vision of STISP is for the development of the nation's socio-economic progress, it is essential to nurture human resources with scientific and technological capabilities, as well as to continuously improve scientific and technological services and innovations at the international level STISP has 7 Goals and Strategic Transformations, 39 Pillar, 93 Strategies and 293 Work plans for science, technology and innovation development.

The Ministry of Education has developed the national education strategic plan (NESP) that fully aligns and successfully achieves the reform priorities of the government. The priority activities related to STI by the Ministry of Education are as follows:

- Providing training for nurturing experts continuously in STI.
- Cooperating and communicating with domestic and foreign research department, universities, degree colleges, institutes, industries and other organizations for development of STI and for development of human resources in this field.
- Organizing STI exhibitions, competitions and talks in organization, businesses, departments, universities, degree colleges, vocational training schools which are based on STI.
- Conducting research for production of value -added products by applying chemical technology, nanotechnology and other technologies.
- Conducting basic research and applied research in STI.
- Conducting innovation research to solve technological difficulties and problems faced in domestic industry.
- Conducting necessary developmental research for extension of successful laboratory scale processes to production scale.
- Conducting research and development on occupational safety and health, food and drug.
- Convening annually and participating in domestic and foreign conferences and seminars on science, technology and innovation, exchange of intellectuals and cooperation.

National Science Technology and Innovation (STI) Policy and Plan

In Myanmar, the Science, Technology, and Innovation Law (No. 22/2018), enacted on June 25, 2018, aims to foster the development of STI. Comprehensive roadmaps and strategic plans have been established to ensure the successful implementation of the law’s objectives. The National Science, Technology, and Innovation (NSTI) roadmap (2025-2030) has been formulated. This roadmap will be implemented through well-defined strategic objectives and implementation plans across the following six key areas:

(1) Governance
(2) Research and Development

(3) Human Resource Development
(4) Innovation and Entrepreneurship Ecosystem
(5) Collaboration
(6) Fund

The NSTI development roadmap (2025-2030) is designed to serve as a comprehensive guiding framework for implementing strategic priority plans over the next six years. This roadmap aims to foster a robust STI ecosystem that not only drives economic growth but also contributes to societal well-being and environmental sustainability. Its key objectives include:

a) Strengthening the STI Ecosystem: Identify and prioritize strategic areas to enhance collaboration, innovation, and research across various sectors.
b) Supporting National Sustainable Development Goals (SDGs): Align STI initiatives with the SDGs to promote sustainable growth and effectively address social, economic, and environmental challenges.
c) Addressing Current Challenges: Develop targeted strategies to tackle existing issues across various fields, ensuring that the STI landscape adapts to meet emerging needs.

The implementation of the NSTI development roadmap and strategies will adopt a comprehensive approach, engaging government organizations, policymakers, relevant ministries, private sector entities, and international partners.

National Biotechnology Policy Framework

No law or regulation specific for biotechnology/biosafety. Some existing laws are relevant such as the Pesticide Law, Plant Pest Quarantine Law, Seed Law, Animal Health and Development Law, Science and Technology Development Law, National Food Law, Patent Law, etc.

Myanmar became a member country to the United Nations Convention on Biological Diversity (UNCBD) in February 23, 1995 and Myanmar joined the Cartagena Protocol on Biosafety, an extension of the Convention and signed in May 11, 2001. Ministry of Agriculture, Livestock and Irrigation is implementing to formulate the National Biosafety Framework under Cartagena Protocol and also taking the role of National Focal point of Cartagena Protocol as well. The main objective of the Project on Development of National Biosafety Framework for Myanmar is to develop a national biosafety framework that supports the balance for biotechnology development while guarding the national biodiversity in sustainable way as well as ensuring human health through a series of all stakeholder consultations. The framework is aimed to be relevant with other Myanmar regulatory and administrative systems and consistent with the provisions of the Protocol.

With the help of the United Nations Environment Program (UNEP) and the Global Environment Facility (GEF), the Myanmar National Biosafety Framework and Policy was started in 2004, but it was drafted and not yet approved.

At 2018, with the assistance of United State Department of Agriculture (USDA), National Biosafety Framework and National Biosafety Bill to be compatible with the contemporary situation review and revise. At current, it was developed into final draft in Myanmar. National Biotechnology Policy Framework was incorporated Biosafety Framework which was developed into final draft in Myanmar.

Myanmar supports large expanses of species-rich and globally threatened ecosystems, such as lowland tropical forests and mangroves. As a result of the variety of habitat types, there is an extraordinary amount of biological diversity in the country. Myanmar has begun to recognize the importance of genetic resources to fundamental research and to the pharmaceutical, biotechnological, and agricultural industries. Myanmar Access and Benefit sharing (ABS) Policy Framework is being drafted by Ministry of Natural Resources and Environmental Conservation (MONERC). ABS forms the basis for a policy and a regulatory environment for access and benefits sharing (ABS) of the use of genetic resources under the Nagoya Protocol (NP). The purpose of the ABS policy framework is to warrant that Myanmar's genetic resources are used under a fair, equitable, and sustainable process, that safeguards biodiversity, and works toward realizing their full economic benefit, while ensuring that the citizens of Myanmar, especially Traditional Knowledge (TK) holders and indigenous/ethnic communities where applicable, receive benefit from the use of these resources.

Since December 2014, Department of Biotechnology Research (DBR) has acted as the National Focal Point for the implementation of the Biological Weapons Convention (BWC), and has been able to send annual reports containing biological information to the Implementation Support Unit (ISU). DBR has participated in the European Union-Chemical, Biological, Radiological and Nuclear Risk Mitigation Centers of Excellence (EU-CBRN) projects for biosafety. In addition, as a cooperation with ASEAN member states, DBR is acting as a Focal Point in the Sub-Committee on Biotechnology.

Food and Agriculture

About 70 percent of Myanmar's population depends on agriculture for a livelihood, and the country's economy is based on agriculture. Ayeyarwady Region is considered the country's rice bowl. Rice stands as the primary crop in the Ayeyarwady Region. Alongside rice, the region also cultivates maize, sesame, groundnut, sunflower, beans, pulses, and jute. However, the majority of the towns in the region uses traditional farming. Therefore, the nation must possess the technologies used to manufacture agricultural products into products such as food. Technology and human resource development programs in the field of food technology, including food production technology, food preservation technology, food quality maintenance technology, and research and development of food products, require assistance. Therefore, we would like to obtain short-term and long-term food technology training programs, technology exchange programs, and technical support for the development of a curriculum in food technology that is suitable for Myanmar.

Myanmar, Ministry of Agriculture, Livestock and Irrigation is taking as a lead country for Agriculture and Food Security Sector.

At the Fifth BIMSTEC Summit held in March 2022, with the approval of the BIMSTEC Leaders, the Agriculture and Food Security sector comprises two subsectors, namely Agriculture Sub-sector, and Fisheries and Livestock Sub-sector.

At the Second BIMSTEC Ministerial Meeting on Agriculture held in November 2022, the Ministers adopted the Plan of Action on Strengthening BIMSTEC Agricultural Cooperation (2023-2027) that comprises five areas of cooperation such as i) Increasing agricultural productivity, ii) Promoting sustainable agricultural practices, iii) Enhancing Agricultural Trade and Investment, iv) Promoting agriculture research and development, and v) Improving food security and nutrition. Myanmar, Ministry of Agriculture, Livestock and Irrigation will be taking place for the regional workshops and seminars as per areas of cooperation under the Plan of Action for Agricultural Cooperation (2023-2027).

The Ministry of Health is focused on strengthening the national food safety control system within the Republic of the Union of Myanmar. As an initial step, the Ministry of Health has developed 'National Food Safety Policy', launched at 27th April, 2022, which adopts the 'farm to fork' food chain approach and which provides strategic direction and sets down the union government's overall vision for the protection consumers' health and for facilitating food trade. This policy is aligned with the principles set out in the wider ASEAN Food Safety Policy and the ASEAN Principles and Guidelines for National Food Control Systems. The principles of this policy aim to facilitate the development of a sustainable and robust food safety regulatory framework within the Republic of the Union of Myanmar and to demonstrate its commitment to its responsibilities as an active ASEAN member state. This National Food Safety Policy will be reviewed periodically and updated as required to reflect new developments which impact the safety of foods or its regulation within the Republic of the Union of Myanmar.

As food control division under the Ministry of Health, Myanmar, verification process of import/export and domestic processed food recommendation are done via https://foodesubmission.fda.gov.mm online e-submission system. Ministry of Health, Myanmar cooperate with ASEAN countries according to mutual recognition agreements. National food law was announced at 3rd march, 1997 and amended at 2013 and 2023. Labeling order for prepackaged food was announced at 20th January, 2022. Now, Ministry of Health, Myanmar is implementing nutritional labeling according to national standard.

Some Technological Universities have opened a food engineering degree course and an agricultural engineering degree course. In order to share knowledge with MSMEs that manufacture, distribute and sell food, Basic Food Safety Training programs were organized in 2023. It is expected to organize food safety training and other food technology education courses according to the township.
Research areas in agriculture and food undertaken by Department of Biotechnology Research (DBR), Ministry of Science and Technology (MOST) are as follow:

Agriculture

- Development of climate smart resilience crops.
- Assessment of agricultural soil nutrients.
- Improvement of important agronomic trait crop by gene transfer. (Pest resistance crop by agrobacterium mediated gene transfer)
- Pest / fruit fly control.
- Indoor hydroponic farming technology.
- Hairy root production of transgenic plant under invitro and mass production in bioreactor.
- Micro propagation of medicinal plants, fruits and flowers via plant tissue culture technique.
- Marker Based Genetic Variation Analysis of Myanmar Rice Varieties for Eating Quality, Salt Tolerance and Drought Tolerance.
- Assessment of Soil microbial diversity using molecular technique.
- Isolation, characterization and application of beneficial microorganisms for biofertilizer production.
- Screening of drought tolerance plant growth promoting bacteria to improve soil fertility Development of bio fungicide.

Food

- Development of probiotics from fermented food
- Development of formulated fish feed

Three Government Technical Institutes, under Department of Technical and Vocational Education and Training (DTVET), Ministry of Science and Technology are offering farm machinery technology diploma courses for local youths to promote advanced agricultural practices using agricultural machinery, produce skill labours for advanced machinery farming and increase the productivity and quality of crops on farms.

Medicine and Health

Ministry of Health (MoH), Myanmar is the main ministry for health care in Myanmar. The objectives of the ministry are as follow:

1. To enable every citizen to attain full life expectancy and enjoy longevity of life.
2. To ensure that every citizen is free from diseases.

To realize these objectives, all health activities are implemented in conformity with the following Strategies:

1. Widespread disseminations of health information and education to reach the rural areas.
2. Enhancing disease prevention activities.

3. Providing effective treatment of prevailing diseases.

Developing thirty-year long-term plan (Myanmar Health Vision 2030), MoH has been implementing to fulfill its vision with the 3 Policies (Table-1) and 14 Strategic Plans (Table-2). There are 26 Laws (Table-3) enacted by MOH to ensure that every citizen is free from diseases.

Table 1: List of Policies managed by MoH, Myanmar

Sr	Title
1	Community based Health Worker Policy (2020)
2	National Health Policy
3	National Population Policy (Draft)

Table 2: The strategic plans managed by the MoH, Myanmar

Sr	Title
1	National Strategic Plan for the elimination of Lymphatic Filariasis in Myanmar (2017-2020)
2	National Leprosy Control Strategy (2019-2023)
3	National Strategic Plan for Prevention and Control of NCDs (2017-2021)
4	Five Year Strategic Plan for Young People Health (2016-2020)
5	Myanmar National Comprehensive School Health Strategic Plan (2017-2022)
6	Myanmar National Strategic Plan on Viral Hepatitis (2016-2020)
7	National Strategic Plan for Prevention and control of Avian Influenza and Human Influenza Pandemic Preparedness and Response (2006)
8	National Strategic Plan for Preparedness and Response to Zika Virus Infection (2016)
9	Strategic Action Plan for Strengthening Health Information 2017-2021
10	National Strategic Plan on HIV and AIDS Myanmar 2016-2020
11	Five Year Strategic Plan for Reproductive Health 2014-2018
12	National Strategy for Rural Water Supply, Sanitation and Hygiene (WASH) 2016-2030 (Final Draft)
13	National Strategic Plan for Tuberculosis 2016-2020
14	National Strategic Plan for Dengue Prevention and Control 2016-2020

Table 3: List of Laws enacted by MoH Myanmar

Sr	Title
1.	The Lunacy Act (India Act IV,1912) (English Version)
2.	The Myanmar Medical Degree Act (India Act VII, 1916) (English Version)
3.	The Poison Act (India Act XII,1919, Vol.IV) (English Version)
4.	The Geneva Convention Implementing Act (India Act XIV,1936) (English Version)
5.	Public Health Law
6.	Maternal and Child Welfare Association Law
7.	National Drug Law
8.	Prevention and Control of Communicable Diseases Law (1995)
9.	Eye Donation Law
10.	Traditional Drug Law
11.	National Food Law
12.	Traditional Medicine Council Law
13.	Blood and Blood Product Law
14.	The Control of Smoking and Consumption of Tobacco Product Law
15.	The Control of Smoking and Consumption of Tobacco Product Law (English Version)
16.	The Law Relating to Private Health Care Services
17.	Dental Law
18.	Accident and Injury Prevention Law
19.	Myanmar Medical Council Law
20.	Myanmar Medical Council Law (3-4-2020)
21.	Law Relating to the Nurse and Midwife
22.	Population Control Law
23.	Myanmar Redcross Law
24.	Body Organs Donation Law
25.	Prevention and Control of Communicable Diseases Law (1995) (English Version)
26.	Amendment of Prevention and Control of Communicable Diseases Law (2011)

Source: https://www.mohs.gov.mm/main/content/publication/Strategic%20Plans/list/1/12

Department of Biotechnology Research (DBR), Ministry of Science and Technology (MOST) has been undertaking the following activities:

- Development of pharmaceutical and cosmeceutical production using natural resources such as medicinal plants and endophytic microbes and evaluation of their biological activities
- Determination of the activities of Myanmar medicinal plants by cell and pharmaceutical related research

Bioenergy

Ministry of Energy, Myanmar is leading for the sustainable energy developments which are the mature energy statistics and finding the way to fulfill the domestic energy demand with the coordination and cooperation with related energy departments, regional and international organization. In this process, energy concerned sector has been implementing the renewable energy development such as bioenergy or biofuel as the alternative energy fuel to support the domestic fuel requirements. At the present, Ministry of Energy, Myanmar is planning to find out the policy regarding that the implementing of production and testing for the ethanol mix biofuel and biofuel production for the future fuel consumption. Myanmar energy sector requires the technical and financial assistance by the regional and international cooperation.

Bio-based Industry

A Memorandum of Understanding (MOU) to establish the Rice Bio Park –RBP (Paddy and Rural Prosperity) was signed between the two Governments of Myanmar and India in 2012. RBP aimed for the biological conservation of the entire biomass of the rice plant to increase income by producing market-driven value-added products that lead to helping smallholder rice farmers to get more on job opportunities aside from conventional rice production. RBP intends to

1. Strengthen agricultural sector and improve food security as well as income generation of small farm families.
2. Encourage producing value-added and market-driven rice and rice related products.
3. Set up a Rice Bio-Park demonstrating the various techniques in rice biomass utilization in the integrated demonstration farm.

In RBP, all steps of the rice supply chain from growing, harvesting, packing, processing, transporting, marketing, consuming and disposing waste and supportive measures are designed with a view to promoting sustainable development. The unique activities of the RBP are producing high nutritive value food to reduce malnutrition, feed for the livestock and poultry, and the transmission of Good Agricultural Practices to the farmers for enhancing rice productivity. Researchers in RBP carried out more researches about producing Azolla for rice-fish farming, biofertilizers from rice husk, and several treatments on using various kinds of earthworms for vermiculture, etc. These all activities can be applied for the integration of mixed crop-livestock and organic farming, agroforestry and water recycling and wastewater reuse.

Regarding the Bio-based Industry, Directorate of Industrial Supervision and Inspection under the Ministry of Industry is in cooperation with the Ministry of Science and Technology and Ministry of Agriculture, Livestock and Irrigation in order to get the least environmental impact from the waste products produced from the rice husk fuel gasifier Industries/ factories and to get long-term industrial benefits from them.

As the forestry sector in Myanmar, the operation of value-added products from timber and non-timber forest products is being carried out in order to contribute to the country's socio-economic development. In the sector of woodbased industry, a total of 160 saw-mills (large), 394 band-saws, 966 saw-mills and 343 T&G are running currently. The exporting of raw log has been banned since 1st April 2014, whereas only semi-finished and finished products are allowed to be exported.

According to Article 4 of the Paris Agreement, Myanmar submitted its Nationally Determined Contributions (NDCs) to the UNFCCC on August 3, 2021. Based on Myanmar's development status, the country's total emissions reduction target under its NDC (2021) is 244.52 million tCO2e (29% of the Business as Usual (BAU) emission scenario of 842.74 million tCO2e) unconditionally by 2030. Additionally, with international financial and technical support, Myanmar set up a conditional reduction target of 414.75 million tCO2e (49% of the Business as Usual (BAU) emission scenario of 842.74 million tCO2e) by 2030. The climate change mitigation goals in Myanmar's NDC report focus on the following key sectors: energy (electricity), agriculture, forestry and other land use, mitigation co-benefiting sectors, fuel efficient cook-stoves distribution, rural electrification, and energy efficiency.

Hi-Tech Export in Myanmar

According to data from the World Bank, Myanmar's high-tech exports in 2023 were recorded at approximately $190.414 million US dollars.

Special economic programs running now in Myanmar

Special economic zones running now in Myanmar are as follows-

a) Thilawa Special Economic Zone in Yangon Region,
b) Kyauk Phyu Special Economic Zone in Rakhine State, western Myanmar, and
c) Dawei Special Economic Zone in Tanintharyi Region in the Southeast of Myanmar

a) Thilawa Special Economic Zone

It is located 23 km southeast of Yangon city center along the Yangon River. The 250 sq km project developed by Myanmar-Japan consortium (comprising of Mitsubishi, Maurbeni, Sumitomo, Japan International Cooperation Agency (JICA)) and Myanmar public and private sector companies.

b) Kyauk Phyu Special Economic Zone

The area of Kyauk Phyu Special Economic Zone is 1,600 hectares (4,000 acres) and it is situated in Kyauk Phyu District in Rakhine State. It is a key area for both the national economic development and Rakhine State development.

In 2015, a consortium led by CITIC won the tender to develop the deep-sea port and industrial estate projects. The framework agreement aims to implement the Kyauk Phyu Deep Sea Port project, according to international practice.

c) ***Dawei Deep Sea Port and SEZ***

It is located at the southern part of the country touching the Andaman Sea and 350 km away from Bangkok. Dawei SEZ has an area of 196 square kilometers.

As Legal Frameworks for SEZs, the following laws and rules were enacted;

a) Myanmar Special Economic Zone Law & Dawei Special Economic Zone Law (27th January, 2011)
b) Myanmar Special Economic Zone Law (23rd January, 2014)
c) Myanmar Special Economic Zone Rule (27th August, 2015)

However, the **Myanmar Special Economic Zone Law** (The State Peace and Development Council Law No. 8/2011) and the Dawei Special Economic Zone Law (The State Peace and Development Council Law No. 17 /2011) were repealed by Myanmar Special Economic Zone Law of 2014.

The objectives of the Myanmar Special Economic Zone Law (2014) are to create jobs, promote living standards, provide vocational training opportunities, promote the export of goods, and attract domestic and foreign investments (Chapter II).

The law offers **SEZs tax holidays**, exemptions from customs duties and other taxes, and protection from nationalization for investors and developers. Under the SEZ law, the price of goods manufactured, services rendered, and good exported shall not be restricted.

The **SEZ law** includes incentive such as corporate income tax relief, import duty relief, long-term land leasing and expropriation protection mechanisms and low labour costs and etc.

Tax Incentives for SEZ Development are as follows:

Income tax exemption	Import tax exemption
Free Zone (For Export)	Free Zone

7 years' exemption 50% relief for next 5 years 50% for next 5 year if profit reinvested within 1 year	Exemption on import of raw materials, machinery & spare parts, construction material and motor vehicles for construction purpose Exemption on import of trading
Promotion Zone (For Local Market)	**Promotion Zone**
5 years' exemption 50% relief for next 5 years 50% for next 5 years if profit reinvested within 1 year	Duty exemption on import of machinery & spare parts, construction material and motor vehicles for construction purpose. 50% relief for next 5 years

Table 4: Tax Incentives for SEZ Development

Commercial tax/VAT exemption	**One Stop Service Centre (OSSC)**
Investor may be given exemption investor may be given exemptions during specific period only	• Ossc has set up for approval of investment, company registration, entry visa, stay permit, certificate or origin, collection of taxes, approval of employment permit, permission for factory construction and other documents. • All ossc sections use their own standard operating procedures
Dividend pay-out	**Asset protection**
• Investor may apply for income tax exemption for dividends based on profit accrued locally for which tax has been paid	• Assets profits & other rights shall be recognized and protected • It is guaranteed that investment shall not be nationalized

If the investors and developers invest in Special Economic Zone, they can enjoy exemption and relief for income tax and commercial tax in accordance with 2014 Myanmar Special Economic Zone Law.

If the investors and developers invest outside the Special Economic Zone, they can apply the relevant tax laws as follow:

- In Myanmar, domestic taxes are collected by the Internal Revenue Department (IRD) under the Ministry of Planning and Finance. IRD is collecting five kinds of taxes and duties including income tax, commercial tax, specific goods tax, stamp duty and state lottery. The tax rates are enacted annually by Union Taxation Law.

- 65 kinds of stamp duties are described in Schedule 1 under the Myanmar Stamp Act.
- The parties have to pay stamp duties in line with the Myanmar Stamp Act.
- The tax rates under the 2023 Union Taxation Law are as follows:

    - If the companies make investments in Myanmar, they shall be charged 22% of corporate income tax and 5% of commercial tax in accord with the existing tax laws.
    - Income tax rate for individual person is progressive rate from 0% to 25%.

    - Associations of persons engaged in the exploration or exploitation of oil and natural gas sector in Myanmar shall be subject to 25% income tax on the total net income without deducting the allowances under Section 6 of Income Tax Law.

    - Other than the exempted goods and services mentioned in the Union Taxation Law 2023, the commercial tax shall be charged at 5% on the sale proceeds if the goods are produced and sold within the country, or on the landed value if the goods are imported, or on the sale proceeds for carrying out importing goods and reselling them in the country, and trading, or on the charges for servicing.

    - 8% of commercial tax shall be charged on the export of electrical energy and 5% on the crude oil. On the sale proceeds of export all commodities other than electricity and crude oil, the commercial tax shall be charged at 0%.

    - In case, when the specific goods are being imported into Myanmar or manufactured in Myanmar, Specific goods tax shall be imposed in consistent with the defined rates under Section 11 of Union Taxation Law, 2023.

    - Specific goods tax shall not be charged on the export of specific goods other than logs and different types of timber. (Log and different types of timber – SGT 10%)

National development policies connected to technology and industry in Myanmar

The current vision of the Ministry of Agriculture, Livestock and Irrigation (MOALI) is an inclusive, competitive, sustainable agricultural system in which food and nutrition are secured, that contributes to the socio-economic well-being of farmers and rural people and to the further development of the national economy.

The MOALI set up the seven policies that aim for the development of the agriculture sector in Myanmar;

a) Land Use and Management Policy
b) Water Use and Management Policy
c) Agricultural Mechanization and Input Sector Policy
d) Research, Development and Extension Policy
e) Marketing, Value-added Processing and Export Policy
f) Governance, Institutional and Human Resource Development Policy
g) Environmental Conservation and Climate Change Resilience

In addition, Good Agricultural Practices (GAP), Good Animal Husbandry Practices (GAHP) and Good Aquaculture Practices (GAqP) protocols and guidelines in order to achieve food safety in Myanmar and to meet in the standard of international and global market. The MOALI conducted innovative and academic research activities for agricultural development in line with Myanmar Sustainable Development Plan and Policy. Moreover, the Ministry has carried out breeding research for regionally adaptable varieties, climate resilience seed production and new technology. The Farmer Channel began transmission on October 15, 2013 as free- to-air channel. Production of agricultural related edutainment programs aim to improve farmer knowledge and their livelihood. Farmer Channel is a joint program between Myanmar Radio and Television (MRTV) and MOALI to broadcast 6 hours looping in every day. MRTV helps as a network provider and MOALI servers as a content provider. The Department of Livestock and Aquaculture Research (DLAR) was established under the MOALI with vision of an inclusive, competitive, food and completes the socio-economic well-being of farmers and rural people as well as fostering national economic growth through an understanding and application of innovative livestock and aquaculture research. The Ministry opened a call center on March 1, 2017 with the aim of providing agricultural information and advices to farmers and people and facilitating the technical decision by addressing promptly of daily challenges and assisting agricultural technology along the agricultural value chain.

Industrial Development Policies formulated by Ministry of Industry

Industrial Policy (2016)

The Ministry of Industry formulated the Industrial Policy and it was enacted by approval of The President Office in February, 2016 with the vision; **to establish a new modern industrial nation** for the development of industrial sector.

According to the Industrial Policy the following industries which will be carried out in priority under policy are;

a) Labour Intensive Industries (Short-Term)
b) Primary Commodity Industries (Short-Term)
c) Basic Manufacturing Industries without advanced technology (Short-Term)
d) Medium Technical-based Industries: (Medium-Term)
e) Advanced Technical-based Industries: (Long –Term)
f) Infrastructure Industries: (Long –Term)

Myanmar Industrial Development Strategy (2017)

The Ministry of Industry promulgated an Industrial Policy in 2016 and followed-up the Myanmar Industrial Development Strategy 2017 with the assistance of UNIDO. In the Myanmar Industrial Development Strategy, the Strategies has been designed for the implementation of the Short-Term Priority Industries as below;

a) Textile & Garment Industry
b) Food Processing & Packaging Industry
c) Plastic Processing Industry
d) Construction Materials Industry
e) Labor Intensive CMP Industry
f) Machine, Tools & Parts Industry
g) Chemical Industry
h) Tire & Rubber Industry
i) Pulp, Paper & Paper Products Industry

Among them, the following three main priority industries were selected in connection with the policies of the State;

a) Textile & Garment Industry
b) Food Processing & Packaging Industry
c) Machinery Industry

Small and Medium Enterprise Development Policy (2015)

The Ministry of Industry formulated the Small and Medium Enterprise Development Policy and it was enacted in 2015. The vision of this policy is as follow;

"Creation of regionally innovative and competitive SMEs across all sectors that enhance income generation and contribute to the social-economic development Mission."

Regarding to this policy, "to set up to industrialized country by placing and emphasis on small and medium enterprises based on agriculture, to develop the performance and productivity of SMEs and to become the backbone of the country's economy" and "to enable the emergence of more SMEs and the transformation from cottage industry to SMEs and from SMEs to large scale industries" are the objectives. Moreover, priority businesses are selected as the short-term and long-term plan to successfully achieve the aim of the policy.

National Energy Efficiency & Conservation Policy, Strategy and Roadmap for Myanmar (2016)

In Myanmar, the National Energy Efficiency and Conservation (EE&C) policy, strategy and roadmap has been formulated in 2016. The scope of the National EE&C policy covers four sectors: industry, commercial & public building, residential buildings and other (street lightings and uses). The main target is to reduce energy consumption reduction 20% by 2030 based on year 2012 energy consumption data. The main aim is to fulfill the national targets of energy intensity reduction and reduce carbon emissions in Myanmar. The results can support the national energy security as well.

Automotive Policy (2019)

The Ministry of Industry formulated the Automatic Policy and it was enacted in March, 2019 with the vision; to increase the usage of vehicles with affordable prices in each and every sector and to be higher Unit in Operation-UIO. According to the policy, in the road map of the development of vehicle industries mainly includes (a) Vehicle Sales (b) Vehicle Production and (c) Parts Production.

National Textile Policy (2022)

The Ministry of Industry formulated the National Textile Policy and it was enacted in June, 2022 with the vision; to become the competitive and sustainable textile Industry of the Union which

contributes to continuous economic growth, to the further development of decent work and well-being of communities, to safeguard the cultural heritage and to protect environmental resources.

EV Policy (2023)

In Myanmar, the electric vehicles and related industries development policy was published in February 2023. The vision of this policy is to reach the usage of electric vehicles to 14% in 2025; 32% in 2030; 67% in 2040 and 100% by 2050 of the total number of registered vehicles per year". This policy will implement 18 basic principles in three periods: short term (from 2022 to 2025); medium term (from 2026 to 2030) and long term (from 2031 to 2050).

Regarding the policy, in the short term, import and sale as the CBU will be encouraged and also assembly and production as the SKD / CKD. In the medium term, SKD will be prioritized, and CKD will be prioritized in the long term.

Laws and bylaws formulated by Ministry of Industry

The Ministry of Industry has drafted and enforced the laws and bylaws regarding the industrial sector are as follows;

a) The Private Industrial Enterprise Law – 1990
b) Prevention of Hazard from Chemical and Related Substances Law – 2013
c) Boiler Law – 2015
d) Small and Medium Enterprises Development Law - 2015
e) Small and Medium Enterprises Development by law – 2016
f) Prevention of Hazard from Chemical and Related Substances Rules -2016
g) Industrial Zone Law (2020)

Furthermore, the Ministry of Industry has been formulating the following law and by law;

a) Industrial Zone by Law
b) Energy Efficiency and Conservation Law

Green Economy Policy Framework (Draft)

Ministry of Natural Resources and Environmental Conservation, Myanmar is formulating Green Economy Policy Framework. The green economy policy framework (2021- 2030) is a guiding document to enable decision-makers at union, state and regional level to identify investments that should be promoted to support a Green Economy in Myanmar and delivers multiple benefits to people, environment and the economy and to pursue Government of Myanmar’s commitment to the achievement of Sustainable Development Goals. The vision is to enhance the investments in a low-carbon, green economy development trajectory that prioritizes the efficient use of

natural resources. The major guiding principles are sustainability, efficiency, inclusivity and resiliency. Green economy approach would stimulate new and more environmental-friendly sectors with circular business models, mitigate the negative impacts of production and consumption, and provide the country with sustainable financing, resulting in more resilient and socially inclusive growth. Green technology is especially important in mitigating the human's adverse activity on the environment and in promoting sustainable development.

Intended Nationally Determined Contribution (INDC)

To ensure Myanmar continues to develop and maintain conditions to secure the wellbeing and safety of its people, Myanmar has adopted a strategic vision to transform Myanmar into a climate-resilient, low-carbon society that is sustainable, prosperous and inclusive, for the wellbeing of present and future generations. Myanmar submitted its INDC in August 2015 and endorsed the Paris Agreement in 2017. Based on the INDC, work has progressed in the forestry, electricity, and rural renewable energy sectors. Adaptation was identified as a priority and work has progressed across a range of sectors. In the coming years, the means of implementation, through international financial support, technology transfer, and capacity building, will allow Myanmar to scale-up enhanced adaptation and mitigation actions.

Natural Raw Materials Available in Myanmar

Natural Raw Material Available for the Ministry of Industry's products

Table 5: Natural Raw Material Available for the Ministry of Industry's products

No.	Material	Industry	Remark
1	Lime Stone	Steel, Steel Billet Production	
2	Sand	Steel, Steel Billet Production	
3	Rubber Smoked Sheet	Tyre and Rubber Production	
4	Fiber GA	Refractory cement board Production	
5	R6D Salvage Fiber R6D	Refractory cement board Production	
6	(MSR -10/20) Myanmar Standard Rubber (MSR -10/20)	Tyre Production	
7	Calcium Carbonate	Tyre Production	
8	Ball Clay	High voltage Insulator/Ceramic Production	
9	China Clay	High voltage Insulator/Ceramic Production	
10	Limestone	Glass / Cement Production	
11	Laterite	Cement Production	
12	Gypsum	Cement Production	
13	Marble Block	Marble Production	
14	Feldspar	Glass / High voltage Insulator Production	
15	Quartz	Ceramic Production	

16	Dolomite	Glass Production	
17	River Stone	Table wares and sanitary ware	
18	Cement	Refractory cement board Production	
19	coal	Cement Production	
20	Clay	Cement Production	
21	Quartz	High Voltage Insulator Production	
22	Silica Sand	Glass Production	
23	Sand	Glass Production	
24	Magnesium Chloride (Feldspar)	Glass Production	
25	Cullet	Glass Production	
26	Local Seed Cotton	Textile and Textile Production	
27	Local Cotton	Textile and Textile Production	
28	Avocado Oil	Pharmaceutical production	
29	Castor Oil	Pharmaceutical production	
30	Sugar	Pharmaceutical production	
31	Maltose	Pharmaceutical production	
32	95% Alcohol	Pharmaceutical production	

Forest Sector

Myanmar has diverse ecosystems and biodiversity, and belongs to a rich entity of natural resources. The priority of the country's natural resource management is to emphasize on ensuring sustainable utilization and management.

In Myanmar, in line with the Sustainable Forest Management, the country's forests have been managed following the Annual Allowable Cut (AAC) under the Myanmar Selection System (MSS) in order to ensure the sustainability and perpetual utilization of forest resources.

The allowable productivity for timber production is 13,689 stocks per year for teak wood with 6'6" gird limit, and 605,651 stocks per year for hard wood with 6'-7' gird limit. The productive capacity is anticipated based on the annual increment, and the production is allowed only within its capacity.

Mining Sector

Myanmar is endowed with extensive varieties of mineral resources of metallic and non- metallic, industrial raw materials, precious stones and fuel minerals. According to the Geological Survey and exploration activities, more than 60 minerals commodities and more than 2000 mineral occurrences were recorded.

There are very rich on Jade, Ruby, Sapphire, Limestone; rich on Copper, Lead, Zinc, Tin, Tungsten, Iron, Gold, Coal, Baryte; fairly rich on Antimony, Silver, Nickel, Gypsum and poor on Chromite, Manganese, PGM (Platinum Group of Mineral) Minerals, Radioactive Minerals,

Diamond, Fertilizer Minerals, Fluorite, Bauxite, Mercury, Kaolin, Feldspar, Uranium, Quartz, Bentonite, Mica, Rare Earth Elements-REE, etc.

ICT infrastructure and Connectivity in Myanmar

Myanmar's e-government development has become more visible in recent years through increased internet connectivity, rising smartphone penetration, and new electronic functions. Currently, Government initiatives are focused on achieving the policy goals of digital government, as well as the expansion of modern digital infrastructure, digital services, and digital innovation, in order to foster the emergence of a digital ecosystem in Myanmar. Since the focal ministry of Myanmar, the Ministry of Transport and Communications is endeavoring to enhance ICT infrastructure and e-government initiatives, facilitate online transactions, and create a trust and confidence environment in the use of digital services.

Currently, Myanmar e-Governance Master Plan 2030 has been formulated and adopted with the vision of effective and efficient implementation of digital government in order to achieve genuine, inclusive and transformative economic development of Myanmar. This Master Plan consists of **"Guiding Principles", "Strategic Framework", "Roadmap" and "Action Plans" that are set to be executed by 2030.** Aim to develop the digital first delivery of government services and to enhance data transactions between government agencies, business communities and public, the e-Government Data centers were established by the Ministry of Transport and Communications. These data centers provide e-Government common application, server co-location service, government cloud service and center operation support facilities.

In addition, the e-Government Integrated Data Center (eGIDC) Establishment Project has been undergoing, which will become the first national-level data center in Myanmar.

To become a modernized and effective tax administration system based on technology, and to align with evolving digital technology, the IRD has been implementing the convenient tax payment system. According to the Myanmar Public Finance Management Project (MPFMp), Primary Data Center and Disaster Recovery Data center were established with world bank Loans and grants, and became operational from 1 August 2018. For the purpose of improving the tax administration system aligning with evolving information technology and, high compliance, the IRD has been implementing with respect to e-Services and technology-based tax administration system as follow:

a) e-Fillinge
b) Registration
c) e-Payment
d) e-Library

Universities under the Ministry of Science and Technology are doing researches in Big Data analysis, Internet of Things, Artificial Intelligence, ICT-based Smart Infrastructure, Software Defined Networking and other current technology trends. Syllabus and curriculum are also being

updated in accordance with the changing technologies. Universities are also working together with the Regional Governments to develop e-government system including ICT infrastructure, applications and other online services. Universities are also giving advice for the development of smart and safe cities around the country. Universities are also developing ICT-based teaching learning and management platform such as Learning Management System (LMS) and University Information Management System (UMIS). Some of the universities are also doing collaboration and cooperation with other institutions and universities not only in the ASEAN and Asia-Pacific Region but also around the world

NEPAL

Global Innovation Index – Nepal

Nepal ranks 108th among the 132 economies featured in the GII 2023. The following table shows the rankings of Nepal over the past three years, noting that data availability and changes to the GII model framework influence year-on-year comparisons of the GII rankings. The statistical confidence interval for the ranking of Nepal in the GII 2023 is between ranks 103 and 108

Rankings of Sri Lanka 2020 – 2023

Year	GII	Innovation inputs	Innovation outputs
2023	108	106	103
2022	111	106	111
2021	111	99	116
2020	95	89	106

- Nepal performs better in innovation inputs than innovation outputs in 2023.
- This year Nepal ranks 106th in innovation inputs.
- As for innovation outputs, Nepal ranks 103th.

Human Development Index 2023 ranking - Nepal

Nepal's HDI value for 2023/24 is 0.601 which put the country in the medium human development category positioning it at 146 out of 193 countries and territories. From the lens of gender, Nepal stands at 116th position in global Gender Inequality Index. Between 1990 and 2023, Nepal's HDI value increased from 0.399 to 0.601.

Country	Year	Index	Rank
Nepal	2023/24	0.601	146

National STI Policies in Nepal

Ministry of Education, Science and Technology is the ministry who looks upon the overall STI landscape of Nepal. The major policies on STI are mentioned below:

National Science Technology and Innovation (STI) Policy 2019

The objectives aim to boost national production and productivity by leveraging science, technology, and innovation, while also fostering knowledge-based entrepreneurship, sustainable resource management, and the development of skilled scientists and technical experts through

modernization and research-oriented education. The Policy has identified the priority sectors for utilization of STI, which are: I) Growth of the industrial production and productivity, II) Commercialization of agriculture and utilization of land; III) Sustainable infrastructure development (housing, water supply, tourism and green energy); IV) Sustainable utilization of biological and precious mineral resources; V) Environment, climate change and disaster risk reduction; and VI) Good governance and delivery of service, cyber and national security.

National Biotechnology Policy 2006

The objectives of the National Biotechnology Policy, 2006 of Nepal are to address food security challenges by enhancing food grain and nutritious food production, particularly for the growing population, while prioritizing areas where biotechnology can benefit Nepal. Additionally, the policy aims to promote research and development in biotechnology to improve forestry, agriculture, and food sectors in a globally competitive and environmentally sustainable manner, foster managerial skills, attract competent researchers, encourage entrepreneurship, mitigate environmental degradation, and facilitate the translation of research outcomes into practical applications for rural and national economic development.

Food and Agriculture

There are specific and generalist policies in Food and Agriculture. A few of those policies are mentioned below:

- National Agriculture Policy
- Agro business policy
- Rangeland policy
- Livestock Policy 2068
- National Seed Vision 2013 – 2025
- Agriculture Mechanization Promotion Policy 2071
- National Coffee Policy 2064
- National Fertilizer Policy, 2058
- National Agro-forestry Policy
- National Food-safety Policy 2076
- National Animal Health Policy, 2078

Medicine and Health

There are specific and generalist policies in Medicine and Health. A few of those policies are mentioned below:

- Oral Health Policy 2070
- Nutrition Policy and Strategy
- National Drug Policy
- National Drug Transfusion Policy
- National Safe Abortion Policy

- National Mental Health Policy
- National Medicine Policy
- National Health Policy

Biomass Energy Strategy 2017

There is Biomass Energy Strategy 2017, The objectives of Nepal's biomass energy policy include: generating energy from agricultural and forest residues as well as organic wastes to enhance energy supply and security; promoting entrepreneurship in biomass energy to bolster employment and income generation; and reducing reliance on imported energy by efficiently producing and utilizing biomass resources.

Hi-tech exports -Nepal

High-technology exports (current US$) in Nepal was reported at 3330281 USD in 2022, according to the World Bank open data sources.

High-technology exports (% of manufactured exports) in Nepal was reported at 1% in 2022, according to the World Bank collection of development indicators.

Country	Year	Value	Change %
Nepal	2022	330281	- 93 %
	2021	6433383	- 48%
	2020	9513473	

Special economic programmes running now in Nepal

As per 15th periodic plan, Government of Nepal has announced program of One Province One Special Economic Zone (SEZ), under which there are 7 SEZ locations identified, Bhairahawa, Simara, Panchkhal, Biratnagar, Jumla, Dhagadi and Gorkha. Two sites are already in operation as per SEZ Act 2014.

The investors in SEZ are granted permission and administered in all respect of export and import under strictly simplified ~One Window Policy ~ or one stop service. They have liberal tax regime with exemption to varying degrees in income tax, excise duty, VAT and others taxes and duties. They have facilities of repatriation of investment, immigration, banking, export-import facility, foreign worker's employment etc. All relevant services such as custom, banking, insurance, police, fire, medical etc. are at the door. SEZs are governed by liberal production oriented labor law with hire and fire policy forbidding union and strikes. Instead, the labors have wages much higher than outside SEZs, fixed working period and liberal extra benefits and allowances.

National development policies connected to technology and industry in Nepal

- Industrial Policy 2067

- National Intellectual Property Policy 2073
- Electricity Development Policy 2058
- Telecommunication Policy 2060
- Information and Communications Technology Policy, 2072
- Green Hydrogen Policy, 2080

Natural raw materials available in Nepal

The major raw materials related to minerals used in industrial and construction works in Nepal are: Limestone (most abundant), Coal, Talc, Clay red, Granite and marble (identified, but not extensively explored), Semi-precious and precious stones (tourmaline, aquamarine, ruby and sapphire), The Department of Mines and Geology is engaged in the exploration and evaluation of mineral resources in Nepal. Other main natural resources include mainly the water resources for hydropower.

ICT infrastructure and Connectivity in Nepal

Ministry of Communication and Information Technology have the authority for spectrum management, regulating broadcasters (radio and Television), telecom operators, Press and media and films. It has departments like Department and Information and Broadcasting, Department of Information Technology, Nepal Telecommunication Authority, Department of Information Technology to facilitate the ministry in this regard. Government of Nepal have launched Digital Nepal Framework 2019 with eight important sectors and 80 digital initiatives.

Some ICT data are presented below:

1. 73.15 % of HH have ordinary mobile phones followed by 72.94 % of HH with smart mobile phones, Television penetration 49.37% and internet facility penetration of 37.72% (National Census 2021)

2. ICT industries contribution to GDP 3.71%

3. ISP Licensed: 131, No. of ISP in operation 63 (major 10), Basic Telephone service provider: 1, GSM Cellular mobile service provider: 2

SRI LANKA

Executive Summary

In 2023, Sri Lanka's Science, Technology, and Innovation (STI) landscape reflects a nation actively working to strengthen its innovation ecosystem and align it with Sustainable Development Goals (SDGs). Despite ongoing economic challenges, Sri Lanka has pursued a series of strategic reforms, sectoral policies, and innovation-focused initiatives, reinforcing its commitment to technological progress and regional collaboration under the BIMSTEC framework.

Sri Lanka ranked 90th out of 132 economies in the Global Innovation Index (GII) 2023, showing stronger performance in innovation outputs. The country is 13th among lower middle-income economies and 6th in Central and Southern Asia. While these rankings highlight areas for improvement in innovation investment and capacity-building, they also reflect a solid foundation for growth.

Furthermore, in 2023, Sri Lanka made notable progress in advancing its STI ecosystem through a series of policy reforms and sector-specific initiatives. In this regard the National Science and Technology Commission played a pivotal role in proposing four sets of policy recommendations as technical outputs of the 9th Biennial Conference on Science and Technology in 2023. These recommendations focused on climate change, agriculture, renewable energy, and the optimization of natural resource utilization including minerals and nutraceuticals, aiming to leverage economic benefits through contributions to STI. Within the landscape of strengthening the policies, the country also developed STI Action Plans for the agriculture sector, revisited the existing National Biotechnology Policy, and introduced a new National Mineral Policy. Furthermore, work was underway to formulate a national Indigenous Medical Policy, with each initiative aimed at enhancing innovation and sustainability within key economic sectors.

Sri Lanka also took major strides in technological advancement and economic development. The launch of the National Hydrogen Roadmap and Hydrogen Safety Standards (HSS 2023) signified a strong commitment to a clean energy future. Digital transformation efforts were led by the National Digital Economy Strategy 2030, which seeks to establish the country as a regional hub for digital innovation. In agriculture, the institutionalization of the GeoGoviya Smart Farming Platform enabled over 1.4 million farmers to make data-informed decisions and adapt to climate challenges. These developments were complemented by improved export performance, with high-tech exports reaching USD 112 million in 2023, and were supported by investment-oriented initiatives such as the Colombo Port City Special Economic Zone and broader economic reforms under the IMF program.

The country is also able to initiate numerous best practices in STI governance, including open policy forums, data-driven institutional assessments, STEAM education promotion, open science

initiatives, and the development of digital and innovation infrastructure for Micro, Small, and Medium Enterprises (MSMEs).

Overall, Sri Lanka's STI sector in 2023 showcases deliberate and forward-looking efforts to build a resilient, knowledge-based economy. By addressing gaps in innovation inputs and effectively leveraging policy instruments, the country is well-positioned to enhance its global competitiveness and contribute meaningfully to regional STI collaboration under BIMSTEC.

Global Innovation Index – Sri Lanka

Sri Lanka ranks 90th among the 132 economies featured in the GII 2023. The Global Innovation Index (GII) ranks world economies according to their innovation capabilities. Consisting of roughly 80 indicators, grouped into innovation inputs and outputs, the GII aims to capture the multi-dimensional facets of innovation.

The following table shows the rankings of Sri Lanka over the past three years, noting that data availability and changes to the GII model framework influence year-on-year comparisons of the GII rankings. The statistical confidence interval for the ranking of Sri Lanka in the GII 2023 is between ranks 85 and 98.

Rankings of Sri Lanka 2021 – 2023

Year	GII	Innovation inputs	Innovation outputs
2023	90	103	79
2022	85	102	68
2021	95	103	85

- Sri Lanka performs better in innovation outputs than innovation inputs in 2023.
- This year Sri Lanka ranks 103rd in innovation inputs, lower than last year and similar compared to 2021.
- As for innovation outputs, Sri Lanka ranks 79th. This position is lower than last year and higher than compared to 2021.

In 2023:

- Sri Lanka ranks 13th among the 37 lower middle-income group economies.
- Sri Lanka ranks 6th among the 10 economies in Central and Southern Asia.

Human Development Index 2022* rankings – Sri Lanka

**[The most recent data for such an index is available for 2022, and as of the time of posting, there is no HDI estimate for Sri Lanka in 2023]*.

Sri Lanka's HDI value for 2022 is 0.78 - which put the country in the high human development category - positioning it at 78th rank out of 185 countries and territories. In comparison, the world average is 0.727 points, based on data from 185 countries. Historically, the average for Sri Lanka from 1980 to 2022 is 0.713 points. The minimum value, 0.569 points, was reached in 1980 while the maximum of 0.782 points was recorded in 2020

Country	Year	Index	Rank
Sri Lanka	2022	0.78	78

National STI Policies in Sri Lanka

In 2023, Sri Lanka's Science, Technology, and Innovation (STI) landscape was characterized by ongoing efforts to build upon existing frameworks, develop new strategic initiatives in specific high-tech areas, and receive policy recommendations, rather than the adoption of a singular, new overarching National STI Policy.

The primary body responsible for STI policy formulation and advice to the government is the National Science and Technology Commission (NASTEC). As of 2023, the formally adopted National Science and Technology Policy of Sri Lanka was from 2008, with a draft for a new Science, Technology and Innovation Policy having been prepared in 2018.

A significant milestone in 2023 was the 9th Biennial Conference on Science and Technology (BICOST IX), which produced a set of policy recommendations submitted to the government. These were presented through four technical reports focused on the following thematic areas: Climate Change, Agriculture, and Food Security; Nutraceuticals and Lead Medicinal Compounds from Sri Lankan Bio-resources; Value Addition to Natural Resources and Minerals of Sri Lanka; and Renewable Energy, Energy Storage, and Green Hydrogen.

Sri Lanka's 9th Biennial Conference on Science and Technology (BICOST IX)—2023 Technical Outputs

The 9th BICOST was convened by the National Science and Technology Commission of Sri Lanka (NASTEC) on March 23rd and 24th, 2023, under the patronage of the Hon. Minister of Education. The objective of the forum is to provide a platform to discuss science, technology, and innovation (STI) that would pave the way to making available the STI policy recommendations to the government as per the S&T Development Act 1994/11. The theme of the 2023 Conference was 'Science, Technology, and Innovation for Sustainable Development in the Era of Climate Change".

Over the course of a series of three-month pre-conference activities, followed by a two-day main conference, more than 250 scientists from academia, industry, the bureaucracy, and representatives of public and private sector institutions worked on the following sub-technical thematic areas and came up with a set of policy recommendations through a series of technical reports:

1. Climate change, agriculture, and food security
2. Nutraceuticals and lead medicinal compounds derived from Sri Lankan bio resources
3. Value addition to natural resources and minerals
4. Renewable energy, energy storage, and green hydrogen

Science, Technology and Innovation Action Plan for Agriculture Sector Fruits and Vegetable Crops in Sri Lanka 2021-2025

The National Science and Technology Commission (NASTEC), with collaborative policy consultation with the Science and Technology Policy Institute of South Korea (STEPI) and local consultants, developed STI policy instruments in the agriculture sector, with a particular emphasis on improving productivity, process, and entrepreneurship development. The draft plan was submitted to the Ministry of Agriculture to consider implementation.

Strengthening the Biotechnology Sector

Recognizing the immense potential of Sri Lanka in the field of biotechnology, the National Science Foundation (NSF) identified it as a national priority area to support the country's socio-economic development.

Accordingly, the NSF appointed an expert committee to review the existing National Biotechnology Policy, taking into account recent global and local advancements in the field. The committee worked diligently and developed a comprehensive set of recommendations aimed at advancing the biotechnology sector in Sri Lanka.

A stakeholder consultation was conducted to refine these recommendations, and the inputs received played a fundamental role in shaping the final outcome. Upon incorporating the feedback from stakeholders, the revised policy recommendations were submitted to the National Science and Technology Commission (NASTEC), which had been a collaborative partner in this initiative from the outset. As the national authority for science and technology policy formulation, NASTEC was entrusted with guiding the adoption and implementation of the updated biotechnology policy.

National Mineral Policy

The National Mineral Policy (2023) of Sri Lanka establishes a strategic framework for the sustainable and responsible management of the nation's mineral resources. Recognizing minerals as non-renewable assets essential to economic development, the policy aims to bridge the gap

left by outdated regulatory structures such as the 1999 Mineral Policy and Mines and Minerals Act of 1992. It emphasizes value addition, environmentally sound mining, and the diversification of the mineral sector, including marine resource exploration. The policy also addresses issues such as land ownership, seabed mining, and foreign currency flows from mineral exports. Seven core goals guide the implementation, including developing a national mineral inventory, promoting R&D, and strengthening governance frameworks.

Grounded in sustainability, the policy outlines key principles including maximizing value through local processing, ensuring environmental conservation, and promoting equitable mineral rights. The implementation mechanism involves cross-sectoral coordination led by the Ministry of Environment, with accountability from sectoral regulatory authorities and stakeholder consultations. The framework deliberately excludes hydrocarbons and focuses instead on aligning with SDGs and national industrial policy. Ultimately, this policy aims to transform the mineral sector into a contributor to national growth, environmental stewardship, and technological advancement through a balanced, inclusive, and forward-looking governance model.

Strengthening the Clean Energy Sector

In 2023, Sri Lanka embarked on the National Hydrogen Roadmap as a bold step towards a greener future. This roadmap was developed by the Petroleum Development Authority of Sri Lanka (PDASL) in collaboration with a subsidiary of the Norwegian firm specializing in renewable hydrogen production in India, which is supposed to advance the hydrogen economy of the country.

A key breakthrough was the introduction of Hydrogen Safety Standards 2023 (HSS 2023), which provides a robust framework for monitoring and evaluation, along with regular updates to remain aligned with global advancements. The roadmap includes Implementation Plan 1 of HSS 2023, which allows for policy, regulatory, incentive-based, market-driven, and investment-oriented interventions to support the growth of the sector. Notably, the policy domain includes the formulation and introduction of a National Green Hydrogen Mission and Policy, along with a comprehensive set of regulations for green hydrogen development.

Furthermore, the Ninth Biennial Conference on Science and Technology ((BICOST IX-2023), a national biennial forum that provides a platform to address the pertaining socio-economic issues in the country at the interface of science and policy, has proposed a number of policy recommendations aimed at advancing green hydrogen adoption. These recommendations focus on capitalizing on the renewable energy potential of Sri Lanka, particularly through hydro, wind, and solar power, and producing green hydrogen sustainably.

Hi-tech exports in Sri Lanka

In 2023, high-technology exports for Sri Lanka was 112 million US dollars. Though Sri Lanka's high-technology exports fluctuated substantially in recent years, it tended to increase through 2011 - 2023 period ending at 112 million US dollars in 2023.

Country	Year	Value (USD)	Change %
Sri Lanka	2023	112,381,343	8.7%
	2022	103,354,129	9.6%
	2021	94,325,867	13.4%

Special economic programmes currently running in Sri Lanka

The Colombo Port City

The Colombo Port City Special Economic Zone is a strategic business hub connecting over 45 major locations from around the world, improving the ease of doing business in Sri Lanka, with a progressive legal and regulatory framework facilitating the ease of doing business. Foreign investors can enjoy business operations in a well-regulated and secure financial environment with access to attractive visa schemes, foreign employment permits, and full property ownership. With an economically ring-fenced system, investors can engage in business with confidence.

IMF Extended Fund Facility (EFF) Program

While not a zone, this is a critical overarching program guiding Sri Lanka's economic trajectory. The EFF involves comprehensive policy guidance and financial support aimed at restoring macroeconomic stability, ensuring debt sustainability, and implementing structural reforms. These reforms cover fiscal consolidation, revenue mobilization, and improvements in public financial management, creating a more conducive environment for investment and growth.

National development policies connected to technology and industry in Sri Lanka

- Trade Policy
- Industrial policies
- National Policy Framework
- Priority for National Security
- Friendly, non-aligned, Foreign policy
- An Administration free from corruption
- New Constitution that fulfils the people's wishes
- Productive Citizenry and a vibrant Human resource
- People-Centered Economic Development

- Technology-Based Society
- Development of Physical Resources
- Sustainable Environmental Management
- Disciplined, law-abiding, and values-based society
- National Policy for Construction
- National Science and Technology Policy in Sri Lanka
- National Biotechnology Policy
- National Research and Development Framework
- National Physical Planning Policy and Plan Sri Lanka 2010–2030
- Water policy development in Sri Lanka
- Sri Lanka's private investment policies (2013)
- The National Policy on Health Information
- National Health Policy
- National Environment policy
- Water Development
- National Climate Change Policy
- National Energy Policy and Strategies of Sri Lanka
- National Mineral Policy
- National Indigenous Medical Policy

Natural raw materials available in Sri Lanka

- Natural Rubber, Tea, Coconut
- Minerals - graphite, mineral sands, limestone, phosphates, and gems sand, clay
- Cosmetic Raw Material - Aloe Vera, Sandalwood, Gyrinops walla, Agar wood
- Cotton
- Spices – Cinnamon, cloves, Cumin Seed, Pepper

ICT infrastructure and connectivity in Sri Lanka

National Digital Economy Strategy 2030

The ‘National Digital Economy Strategy 2030’ of Sri Lanka is a visionary framework designed to guide the nation towards a digitally empowered future. Its primary purpose is to drive innovation, inclusivity, and sustainable growth by embedding digital transformation into all aspects of society and the economy. The policy aims to establish Sri Lanka as a hub for digital innovation and entrepreneurship, particularly within the Asia-Pacific region. By 2030, it envisions a Sri Lanka where citizens, businesses, and government institutions seamlessly engage in a robust digital ecosystem that enhances efficiency, trust, and accessibility.

The scope of the strategy encompasses the entire digital landscape of Sri Lanka, addressing infrastructure, digital skills, governance, cybersecurity, financial inclusion, and sectoral innovation. It seeks to overcome historical challenges and capitalize on emerging technologies such as artificial intelligence (AI), machine learning (ML), and the Internet of Things (IoT). By integrating these technologies into public and private sectors, the strategy not only aims to boost economic competitiveness but also to enhance social equity and environmental sustainability.

This comprehensive strategy recognizes the need for collaboration among diverse stakeholders, including government agencies, private enterprises, academia, and civil society. It emphasizes leveraging public-private partnerships, streamlining regulatory frameworks, and fostering an innovation-driven culture. The implementation of the strategy is to be monitored closely through clear performance metrics, ensuring adaptability to the dynamic global digital economy.

Core principles

Inclusivity: Ensuring all Sri Lankans benefit from digital advancements, particularly underserved communities such as rural populations, women, and marginalized groups.

Innovation: Promoting entrepreneurship and creative solutions through the adoption of advanced technologies like AI and ML.

Sustainability: Integrating environmentally conscious practices, including green technologies, to achieve climate and economic goals.

Global connectivity: Positioning Sri Lanka as a competitive global hub for digital investment and innovation.

Human-centric approach: Prioritizing citizen needs in designing digital services to foster trust and improve quality of life.

Rights-based framework: Emphasizing digital access as a fundamental human right, supported by non-discriminatory and transparent policies.

Priority areas

Infrastructure, connectivity, and access: This area focuses on ensuring universal high-speed broadband access across Sri Lanka by 2030. The government plans to simplify licensing, promote competitive markets, and encourage private investment to expand broadband infrastructure. Special attention is given to underserved areas to bridge the digital divide. The goal is to create a robust and inclusive broadband industry that underpins the digital economy.

Skills, literacy, industry, and jobs: Addressing the demand-supply gap in digital skills, this priority emphasizes developing a digitally literate workforce and fostering an entrepreneurial ecosystem. Initiatives include integrating digital skills into education, reskilling and upskilling programs, and targeted support for women-led businesses. The aim is to create a diverse, adaptable workforce capable of thriving in a digital economy.

Connected digital government: A citizen-centric approach to governance is at the heart of this area. The strategy envisions a seamless digital government where public services are accessible, efficient, and user-friendly. This involves developing a common digital public infrastructure, integrating digital IDs, enhancing cloud computing, and leveraging AI and data analytics for decision-making.

Cybersecurity, safety, and privacy: The strategy emphasizes building a secure digital ecosystem by recognizing the risks posed by cyber threats. This includes enacting robust cybersecurity legislation, strengthening data protection frameworks, and fostering awareness about online safety. The goal is to create a safe and trusted environment for individuals, businesses, and government entities.

Digital financial services (DFS): Financial inclusion is a key component, with efforts to expand the availability and adoption of secure, efficient, and affordable digital financial services. This includes improving digital payment systems, fostering interoperability among service providers, and ensuring financial literacy for all demographics. Special attention is given to integrating DFS into public services, such as welfare and transport.

Digitalization across sectors and MSMEs: The strategy prioritizes the digital transformation of key sectors, including agriculture, health, tourism, and manufacturing. Micro, small, and medium enterprises (MSMEs) are a significant focus, with targeted support to help them adopt digital technologies. This includes awareness programs, financial assistance, and sector-specific roadmaps to drive innovation and competitiveness.

The strategy focuses on six thematic areas to achieve its goals. Infrastructure development is central, ensuring universal broadband access by 2030 and fostering competitive markets. The development of digital skills across all demographics aims to create a skilled and adaptive workforce. A connected digital government will streamline public services, making them accessible and citizen-centric. Cybersecurity and data privacy frameworks will safeguard digital spaces, ensuring trust and safety. Digital financial inclusion will empower individuals and businesses, especially in underserved areas. Finally, sectoral digitalization will drive innovation and competitiveness in key industries like agriculture, health, tourism, and manufacturing.

Implementation of the strategy is to be guided by high-level ownership from the President and coordinated through a dedicated agency. Collaboration with stakeholders will be prioritized to leverage expertise and resources. A clear performance monitoring framework will ensure accountability and adaptability, positioning Sri Lanka as a leader in digital transformation in the Asia-Pacific region.

Climate Smart Agriculture

Amidst significant challenges in Sri Lankan agriculture, including the aftermath of the COVID-19 pandemic, fertilizer bans, smallholder farmer struggles, and increasing climate extremes, the Department of Agrarian Development (DAD) partnered with the International Water Management Institute (IWMI) and Unmiti Pvt. Ltd. to launch the GeoGoviya Smart Farming Platform in 2022. This initiative, later upgraded and institutionalized as the National Digital Agricultural Data Platform in 2023, aims to empower farmers through data-driven insights for enhanced productivity, resilience, and sustainability. GeoGoviya integrates advanced climate services, geospatial analytics, and smart farming technologies to provide real-time data on crucial agricultural factors, enabling farmers to make informed decisions tailored to their specific needs.

The GeoGoviya platform offers a comprehensive suite of tools, including drought monitoring and early warning systems via the South Asia Drought Monitoring System (SADMS), geospatial mapping for efficient land use, soil health assessments, and crop monitoring. Smallholder farmers, even those with limited digital literacy, benefit from user-friendly dashboards providing tailored recommendations for irrigation, pest management, and fertilizer application. Furthermore, GeoGoviya supports real-time monitoring and reporting for DAD, including a farmer and land registry with geo-tagging, QR code identifiers, and offline data sync capabilities for comprehensive field data collection.

Leveraging a substantial database of 1.82 million paddy land records and 1.42 million farmers, GeoGoviya underpins CultivateX, an IWMI product delivering customized agro-climate advisories incorporating agronomic recommendations. This integration helps farmers mitigate climate risks and adopt resilient practices. The platform has also streamlined financial assistance, preventing duplicate records and saving Sri Lanka over $1.6 million. By employing block chain-based land registries, Keyhole Markup Language databases, and screening algorithms, GeoGoviya enhances resource transparency and efficiency, providing policymakers with analytics for evidence-based agricultural strategies and paving the way for a climate-smart future.

Best practices of Sri Lanka in STI Sector

- Prioritized the Research and Development (R&D) activities to support the national fund allocation in line with the four priority areas of the 09th BICOST technical outcomes (by National Science and Technology Commission of Sri Lanka – NASTEC).

- Initiated an annual open forum to present the findings of the annual review of the performance of the Science and Technology (S&T) institutions. Ensure the implementation recommendations proposed within the identified policy thrust areas for the advancement of the S&T sector through enhancing the institutional performances; the first annual open forum was successfully conducted in 2023 (by NASTEC).

- Adopted a national annual data collection mechanism for S&T activities from the public sector entities to benchmark the input and output assessments of them with global STI performance indices (by NASTEC).

- Promoted science education through a STEAM approach at the school level (by the National Science Foundation of Sri Lanka – NSF).

- Expanded the National Digital Repository platform under open science activities (by NSF).

- Launched a National Business-to-People (B2P) platform to streamline the processes in the national innovation system (by the National Innovation Agency of Sri Lanka-NIA).

- Launched the Global Innovation Index (GII) from Sri Lankan perspectives: to encourage inventors locally to strengthen the national innovation system towards climbing the global rankings (by NIA).

- Encouraged major R&D equipment sharing among researchers and institutions to optimize resource utilization and promote a collaborative research culture through national funding mechanisms for R&D (by the National Research Council of Sri Lanka-NRC).

- Launched a Business Development Centre (BDC) focused on supporting the private-public entities to come up with national important projects through technical evaluation, feasible studies and joint proposal submission in the sector of engineering (by the National Engineering and Research Development Centre of Sri Lanka - NERDC).

- Prioritized the digital transformation of key sectors (agriculture, health, tourism, and manufacturing) and the empowerment of Micro, Small, and Medium Enterprises (MSMEs) to drive innovation and competitiveness through targeted support, including awareness programs, financial assistance, and sector-specific roadmaps (by the Information and Communication Technology Agency - ICTA).

- Launched a GeoGoviya Smart Farming Platform in 2022, subsequently upgraded and institutionalized as the National Digital Agricultural Data Platform in 2023, to empower farmers through data-driven insights for enhanced productivity, resilience, and sustainability by integrating advanced climate services, geospatial analytics, and smart farming technologies, thereby enabling informed, tailored decision-making (by Department of Agrarian Development (DAD) partnered with the International Water Management Institute (IWMI) and Unmiti Pvt. Ltd.).

Conclusion

Science, Technology, and Innovation (STI) landscape of Sri Lanka, in 2023 demonstrates a nation actively striving to enhance its innovation capabilities and address key socio-economic challenges. The country has made strides in formulating policies and action plans across various sectors, including agriculture, biotechnology, and mineral resource management. Initiatives such as the National Digital Economy Strategy 2030 and the GeoGoviya Smart Farming Platform Showcase Sri Lanka's commitment to leveraging digital technologies for economic growth and sustainable development.

Despite these advancements, challenges remain, as reflected in Sri Lanka's performance in the Global Innovation Index 2023, where it ranks 90th out of 132 economies. While the country performs better in innovation outputs than inputs, there is room for improvement in both areas. The emphasis on high-tech exports and the establishment of special economic programs like the Colombo Port City Highlight Sri Lanka's efforts to attract investment and integrate into the global economy.

Overall, STI sector of Sri Lanka in 2023 is characterized by a combination of strategic policy development, targeted initiatives, and ongoing efforts to strengthen its innovation ecosystem. The nation's focus on renewable energy, digital transformation, and value addition to natural resources signals a commitment to sustainable and technology-driven development. By addressing the gaps in innovation inputs and effectively implementing its policies, Sri Lanka can further enhance its STI capabilities and improve its global competitiveness.

THAILAND

Global Innovation Index- Thailand

Thailand ranks No. 43 among the 132 economies featured in the GII 2022. The Global Innovation Index (GII) ranks world economies according to their innovation capabilities. Consisting of roughly 81 indicators, grouped into innovation inputs and outputs, the GII aims to capture the multi-dimensional facets of innovation.

The following table shows the rankings of Thailand over the past three years, noting that data availability and changes to the GII model framework influence year-on-year comparisons of the GII rankings. The statistical confidence interval for the ranking of Thailand in the GII 2022 is between ranks 43 and 45.

Rankings of Thailand (2020–2022)

Year	GII	Innovation inputs	Innovation outputs
2022	43	48	44
2021	43	47	46
2020	44	48	44

- Thailand performs better in innovation outputs than innovation inputs in 2022.
- This year, Thailand's ranking in innovation inputs has dropped to 48th place, marking a decline from the previous year but remaining consistent with its position in 2020.
- In terms of innovation outputs, Thailand now holds the 44th position. This represents an improvement from the previous year and remains consistent with its ranking in 2020.

In 2022:

Thailand ranks 5th among the 36 upper middle-income group economies.
Thailand ranks 9th among the 17 economies in South East Asia, East Asia, and Oceania.

Global Competitiveness Index 2022 ranking – Thailand

Covering …… economies, the Global Competitiveness Index 4.0 measures national competitiveness—defined as the set of institutions, policies and factors that determine the level of productivity.

			Diff. from 2021	
Rank	**Economy**	**Score**	**Rank**	**Score**
33	Thailand		28	

Human Development Index 2022 ranking - Thailand

Thailand's HDI value for 2022 is 0.803 — which put the country in the "very high" human development category— positioning it at 66 out of 189 countries and territories. Between 2021 and 2022, Thailand's HDI value increased from 0.800 to 0.803, an increase of 0.003.

Country	Year	Index	Rank
Thailand	2022	0.803	66

National STI Policies in Thailand

National Science Technology and Innovation (STI) Policy and Plan

Higher Education, Science, Research and Innovation (HESRI) Policy and Strategy 2023-2027. Empower higher education, science, research and innovation. Transform the country for rapid and sustainable development. Enhance competitiveness with the value-creating economy and get ready for the future.

Objectives of HESRI Policy and Strategy:

- Enhance the competencies and skills of Thai people to boost competitiveness and promote sustainable development.
- Transform into a value-based, creative economy that ensures a stable local economy and self-sustainability.
- Promote sustainable development, address social and environmental challenges, and enhance resilience to a disruptive world.

Core strategies of HESRI Policy and Strategy:

- Increase economic competitiveness and sustainable self-reliance through a value-based, creative economy to be future-ready.
- Elevate social sustainability and environmental development to address challenges and adapt to the world's changing dynamics.
- Advance cutting-edge science, technology, research, and innovation to create new opportunities and prepare the country for the future.

- Develop manpower in higher education and research sectors as a foundation for sustainable and accelerated economic and social development.

National Nanotechnology Policy Framework

- Using nanotechnology to enhance the quality of life, health, medicine, and public health
- Using nanotechnology to enhance the agricultural sector and manufacturing industry
- Enhance energy security and environmental conservation through nanotechnology
- Human Resource Development (HRD) in nanotechnology
- Development of infrastructure and enabling factors

National Biotechnology Policy Framework

Promoting green innovation through biosciences as being pivotal to economic security, regional competitiveness and a healthier society. This vision is backed by a three-pronged approach. First, programs work in parallel with global, regional and national development priorities to foster a cohesive integration of biosciences into all aspects of development policy and planning. Second, the Framework emphasizes Thailand's competitiveness and self-sufficiency through biotechnology. And third, the Framework promotes private sector investment in biotechnology research and development particularly initiatives that deepen community engagement in biotechnology.

Food and Agriculture

- Help assure food security for a growing global population while also responding to the myriad of adaptation challenges posed by climate change.
- Advance market competitiveness and strengthen agricultural sustainability by increasing quality, productivity and innovation while reducing costs.
- Increase biotechnology's role in crop and livestock cultivation, especially through their inputs (e.g. fertilizer, herbicide, pesticide and feed) to raise food production efficiency and to contribute to environmentally responsible and sustainable agricultural production.
- Improve agricultural quality and productivity to increase yields in the sector's value chain through genetic improvement, quality and safety controls, nutrient labeling and product diversification and innovation.

Medicine and Health

- Promote public wellness, increase national self-reliance in healthcare and build competitiveness in markets where Thailand's biotechnology sector is poised to contribute.
- Expand the use of key technologies including: genomics, genetic modification and molecular biotechnology, production of active pharmaceutical ingredients (API), and

new industrial production techniques, all with an aim to grow the following product sectors: medical diagnostic kits, drug development, vaccines and food supplements.
- Enable industry to generate leading products for the high-end market by supporting advances in innovation and by cultivating a stronger biotechnology support infrastructure.
- Propel Thailand to become a healthcare products hub within ASEAN.

Bioenergy

- Increase energy security by using biotechnology to develop alternative energy sources which are not in conflict with food production.
- Apply key technologies including genomics, microorganism physiology, genetic modification, high throughput screening, fermentation and industrial manufacturing technologies to increase bioenergy development.
- Targeting at three specific energy sources: biogas from wastewater and solid wastes, ethanol from cellulosics and biodiesel from algae.

Bio-based Industry

- Strengthen industry's commitment to prioritize environmental protection by taking advantage of biotechnology's offerings that allow for cleaner, more efficient manufacturing processes.
- Emphasize the development of biocatalyst technologies with a focus on discovery and genetic improvement of microorganism strains to elevate fermentation technology.
- Accelerate establishment of biosafety safeguards for the use of genetically modified microorganisms in controlled conditions.
- Attract foreign investment and/or import fermentation and downstream process technologies so that local manufacturing gains a comparative advantage to cultivate bio-based industry development opportunities.
- Structure government procurement processes to support markets for bio-based products

Hi-tech exports in Thailand

In 2019, Thailand's high-tech exports amounted to approximately $40 billion USD (The Observatory of Economic Complexity) (TheGlobalEconomy.com). This figure includes various categories of high-technology products such as electronics, integrated circuits, and other advanced technological goods. The strong performance in high-tech exports reflects Thailand's significant role in the global technology supply chain, particularly in the electronics and automotive sectors.

The value of Thailand's high-tech exports constituted about 26.6% of its total manufactured exports, indicating a robust presence in the global high-tech market (Map - Lowy Institute Asia

Power Index) (World Bank Open Data). This performance was supported by significant export partners, with the United States, China, Japan, Vietnam, and Hong Kong being the top destinations for Thai high-tech goods (World Integrated Trade Solution (WITS)).

However, despite these strengths, Thailand faced challenges in maintaining its position relative to global and regional competitors. The country's export sophistication, which measures the complexity and value-added nature of its exports, had shown signs of stagnation. Thailand's overall export sophistication was about 37% lower than the global frontier and 21% lower than the Asian frontier, highlighting the need for further advancements in its export portfolio to keep pace with leading economies in the region (IMF eLibrary).

High-technology exports (% of manufactured exports) in Thailand was reported at 22% in 2022, according to the World Bank collection of development indicators.

Country	Year	Value	Change %
Thailand	2022	22	3
	2021	25	3
	2020	28	4

Special economic programmes running now in Thailand

The Eastern Economic Corridor (EEC) Development Plan under scheme of Thailand 4.0 aiming to revitalise and enhancing of the well-known Eastern Seaboard Development Program that had supported Thailand as a powerhouse for industrial production in Thailand for over 30 years.

Chachoengsao, Chonburi and Rayong Provinces have been designated for the development of the Eastern Economic Corridor (EEC), a pilot project for the economic development of Thailand's Eastern Seaboard. Over the past 30 years, these three provinces have been developed to support the fast growing industries. It was the "eras of industrial revolution". In 1987, Map Ta Phut industrial estate was established and it was the beginning of the development of Thai heavy industry, such as petrochemical, auto and electronics industries. These eras are also called Thailand 3.0. Today, Thailand is ready to move forward to the era of Thailand 4.0.

The EEC area covers over 13,000 Km2. The government has launched measures to support and accelerate the economic growth in the EEC, for instance, measures to develop public utilities, transportation systems, logistics, human resources, and investor's facilitation in the form of One-Stop Service Center.

In the future, the EEC will grow into a modern metropolitan, a hub of trade and investment, a center for regional transportation and logistics, a significant source for human resources, a tourist attraction and most importantly, the most modern Gateway to Asia.

National development policies connected to technology and industry in Thailand

- Higher Education, Science, Research and Innovation (HESRI) Policy and Strategy
- National Economic and Social Development Plan
- Bio-Circular-Green Economy Model (BCG)

Natural raw materials available in Thailand

- Agricultural Products: Thailand is a major producer of agricultural goods such as rice, rubber, sugar, and cassava. These are crucial both for domestic consumption and as export commodities.
- Minerals: The country has substantial mineral resources, including tin, tungsten, lead, zinc, and precious stones like sapphires and rubies. Thailand's mineral industry is particularly known for its production of gypsum and lignite, which are essential for construction and energy production respectively.
- Forestry Products: Thailand's forests provide timber, which is utilized in construction and furniture manufacturing. The country also produces non-timber forest products such as bamboo and rattan.
- Fisheries: Thailand has a thriving seafood industry, with extensive coastal and inland aquaculture. The country's exports include shrimp, fish, and various seafood products.

ICT infrastructure and connectivity in Thailand

Thailand Smart Cities

Thailand has defined seven key criteria for the development of smart cities, aimed at enhancing the quality of life, sustainability, and technological advancement. These criteria are:

- Smart Environment: Improving water and air quality, managing waste, and increasing green spaces to reduce CO2 emissions annually.
- Smart Mobility: Enhancing travel convenience, efficiency, and safety with eco-friendly solutions, aiming to significantly reduce road traffic fatalities.
- Smart Living: Providing services that enhance health and well-being, catering to an aging population, and improving public safety with extensive crime monitoring.
- Smart People: Increasing digital literacy and knowledge among citizens, encouraging the use of technology for economic and social benefits.
- Smart Energy: Improving energy efficiency and promoting the use of renewable energy, with a target of increasing renewable energy usage each year.
- Smart Economy: Boosting business efficiency and flexibility, with the goal of raising the average income per capita.
- Smart Governance: Developing public service systems for easy and quick access, aiming for significant public engagement in digital service platforms and public service development.

Thailand now has 35 smart cities in 25 provinces. 7 key cities involved in the smart city initiative include:

1. Bangkok
2. Phuket
3. Chiang Mai
4. Khon Kaen
5. Chon Buri
6. Rayong
7. Chachoengsao

Thailand Cyber University Project (Thai MOOC)

The Thailand Cyber University Project, known as Thai MOOC – for "Massive Open Online Courses" – is a cooperation between the Ministry of Higher Education, Science, Research, and Innovation, the Office of Information Technology and Communication Center, and numerous educational institutes to develop and manage online courses. It is a project that is driven by economics and the goal of a quality society employing digital technology.

The Massive Open Online Courses are considered a center for the national community, the center of Architectural Information Technology for an "Open System Education for Lifelong Learning" (Lifelong Learning Space) with teaching and learning modes that happen through various learning resources courses. One major purpose is to meet students' needs and to support students as they "upskill and reskill" to enhance their knowledge and skill for work, and to help develop all Thais in a new era of change.

The main objectives of the Thailand Cyber University Project include the following:

- Massive Open Online Courses management to support an unlimited number of students with information sources, learning profiles, "Credit Bank," and a credit transfer system;
- Teaching and learning standards and guideline development and educational quality assurance system for the community;
- Building cooperation with different universities to develop and improve subject materials in MOOC, and collaborating on credit transfer between institutes;
- Course development, including materials and activities, following the quality standard and Massive Open Online Courses;
- Test bank development for courses-record assessment and evaluation in the MOOC system, collecting data for research, and developing better procedures for teaching and learning.

People who are interested can register and start by choosing more than 500 online subjects from more than 120 institutes and develop skills needed in life via http://thaimooc.org.

Thailand Digital Government Development Plan

Thailand 4.0 strategy prioritizes increased sustainable technology- and knowledge-based economic drivers, as well as increasing access to benefits of economic growth for all income groups. The strategy includes diverse foci such as economic growth, human capital, and environmental protection under a 'Digital Thailand' plan. Thailand's e-Government 4.0 initiatives are part of this, and new technologies for the provision of public services are expected to support an overall digital transformation of Thai society, improve direct public and business services, and increase digital coordination across agencies. More broadly, they are also expected to improve public sector responses to key challenges in Thailand such as human trafficking, illegal fishing, low aviation standards, corruption, and insufficient public services.

The Cabinet approved the Thailand Digital Economic and Society Development Plan in April 2016. The plan is a guideline endorsing the use of technology and innovation as the main engine of Thai economy. Digital Government Development Agency (Public Organization) or DGA, as a pivotal promoter under the plan, has developed the Thailand Digital Government Development Plan. The objective of the Thailand Digital Government Development Plan is to strategically digitalize Thai government agencies, to deliver best citizen-centric services, with a high level of efficiency and transparency.

Goals of Digital Government Development Plan:

- Improving country's digital government related ranking and Indices.
- Providing government services that response to country's demands of all sectors rapidly, precisely, and paperless.
- Creating government data that easily accessed and improve government transparency and public participation.
- Developing digital government infrastructure that collect and manage integrated database, support cooperation among agencies, and efficiently provide government services.

Thailand's Tech Start-Ups

According to the survey conducted on 100 startups from across Thailand in 2020, the top sectors of the startup industry were Business Service at 26%; and PropertyTech and Innovative Technology on music, arts and culture (MARTech) at 11%. The rest are Lifestyle 10%, Deep Tech 10%, FinTech 9%, AgTech & FoodTech 6%, MedTech 5%, EdTech & GovTech 5%, TravelTech 4%, and IndustryTech 3% respectively.

3 Tech Unicorns:

- Flash Express - Delivery and logistics
- Ascend Money – E-Wallet by TrueMoney
- LINE MAN / Wongnai - On-demand services (food delivery, products, and messengers)

Pao Tang - Thailand Digital Wallet App

Pao Tang is a comprehensive digital wallet app developed by Krungthai Bank in Thailand. Launched in January 2018, it quickly gained popularity, amassing over 40 million users by late 2020. The app is designed to facilitate a wide range of financial activities, serving as a key tool in Thailand's push towards a digital economy and improved financial inclusion.

Key features of Pao Tang include:

1. Government Disbursements: The app has been instrumental in distributing government funds, such as the 3,000-baht cash handout during the COVID-19 pandemic and a 10,000-baht digital wallet initiative aimed at stimulating economic activity.
2. Investment Opportunities: Pao Tang offers low-risk investment options like the 1-Baht Bonds, which are government savings bonds accessible even to small investors. This feature has democratized investment opportunities, making them available to younger and less wealthy individuals.
3. Healthcare Services: Through its Health Wallet feature, Pao Tang provides users with access to universal healthcare services, including appointment scheduling for medical screenings, vaccinations, and free COVID-19 antigen test kits.
4. Digital Lottery: The app includes a digital lottery feature, addressing issues of overpriced lottery tickets by offering them at a fixed price, thereby enhancing accessibility and transparency.
5. Retirement Savings: Recently, the app introduced a retirement savings feature for self-employed individuals. Users can automatically save a portion of their spending into the National Savings Fund, promoting financial security in retirement.
6. Merchant Payments: Pao Tang has been widely adopted by small merchants and street vendors, facilitating cashless transactions through mobile payments and QR codes.

Overall, Pao Tang has become a pivotal tool in Thailand’s financial ecosystem, supporting both personal financial management and broader economic policies.

Conclusion

Thailand's economy faced challenges from global inflation and the lingering effects of the COVID 19 pandemic. Despite these obstacles, the government focused on recovery by supporting key sectors such as tourism, agriculture, and manufacturing. Economic growth was driven by the gradual return of international tourists, export expansion, and infrastructure investments.

In terms of science, technology, and innovation, Thailand emphasized developing its digital economy and innovation ecosystems. Key policies promoted research and development, digital transformation, and high-tech industries such as electric vehicles, biotechnology, and artificial intelligence. These efforts aimed to enhance global competitiveness and drive progress towards sustainability goals.

CONCLUSION

The BIMSTEC region demonstrates both progress and diversity in advancing STI. India demonstrates strong performance in global indices, reflecting robust institutional frameworks and high innovation outputs, while Bangladesh and Nepal show steady improvements through targeted policies and strategic initiatives. Sri Lanka and Myanmar continue to strengthen their innovation ecosystems, while Thailand maintains stable performance, reflecting its commitment to competitiveness and productivity. Bhutan, despite its smaller scale, makes consistent strides in human development and digital adoption, further enriching the regional STI landscape. What emerges is a shared recognition among member states that STI is a key driver of sustainable development, economic resilience, and regional integration. While disparities in capacity, investment, and infrastructure remain, the diversity of approaches taken by each country underscores the potential of complementary strengths. Collectively, these efforts highlight opportunities to harmonize policies, expand collaboration, and leverage regional resources to achieve common goals. The direction of STI in BIMSTEC illustrates that cooperation and tailored strategies are vital for ensuring inclusivity, sustainability, and global competitiveness. By building on individual progress and fostering greater collaboration, the BIMSTEC region can transform its varied national initiatives into a powerful collective force for growth and innovation.