MAPPING OF S&T NEEDS OF TELANGANA STATE

Submitted to

State Science & Technology Programme (SSTP) Division
Department of Science & Technology (DST)
Government Of India

Telangana State Council of Science & Technology (TSCOST)
Environment, Forests, Science & Technology Department
Government of Telangana
Aranya Bhavan, Saifabad, Hyderabad

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TECHNOLOGY (TSCOST)
ENVIRONMENT, FORESTS, SCIENCE & TECHNOLOGY
DEPARTMENT GOVERNMENT OF TELANGANA
ARANYA BHAVAN, SAIFABAD, HYDERABAD

Marupaka Nagesh
Member Secretary

FOREWORD

It gives me immense pleasure to state that the Telangana State Council of Science & Technology (TSCOST) has successfully executed the Mapping of S&T Needs of the State (MSTN), a project sponsored by the State Science & Technology Program (SSTP) Division, Department of Science & Technology, Govt. of India.

MSTN is a **Unique and exceptionally different** program intended for identifying potential opportunities for initiating S&T interventions in major socio-economic sectors such as Environment, Energy, Rural Development, Agriculture, Education, and Health, alongside in specific areas considering the performance of the State in the UN-declared Sustainable Development Goals (SDGs).

I express my gratitude to the State Level Advisory Board (SLAB) Chairman for MSTN, Dr. Rajat Kumar Garu, IAS., Special Chief Secretary to Govt., ES&T and Irrigation & CAD Depts. & Vice Chairman, TSCOST, for his invaluable guidance, which has helped immensely in addressing various components of the Project and its execution meticulously.

Centre for Economic and Social Studies (CESS), Planning Dept., Govt., of Telangana was chosen to associate with the Project taking into consideration of its academic, research, and field-level expertise in similar projects and studies.

I am content that the CESS brought out a Report after thorough field study, analysis, and research duly taking into account the terms of reference and timelines of the Project. I sincerely thank Prof. E. Revathi, Director, CESS, and the entire team for their strenuous efforts in shaping this document.

This Report would serve as an excellent resource to TSCOST in formulating new Projects and Programs towards applying the advancements in Science, Technology & Innovation to benefit a broad cross-section of society and the environment.

I express my sincere gratitude to Sri Allola Indrakaran Reddy Garu, Hon'ble Minister for Forests, Environment, Science & Technology, Law and Endowments, Govt. of Telangana; Dr. Srivari Chandrasekhar Garu, Secretary, DST, GoI, New Delhi; Dr.Debapriya Dutta ji, Head, SEED & SSTP Divisions, DST, GoI, Dr. Rashmi Sharma, Scientist-F, Dr. Ravikanth Prajapati, Scientist-B & Officials of DST, GoI for the kind support and guidance to TSCOST at every stage.

(**MARUPAKA NAGESH**)

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CONTENTS

1. Introduction

Department of Science & Technology (DST), Government of India (GOI), played a catalytic role by facilitating the Telangana State Governments to establish and develop the State S& T Councils on S&T and provide support for their technical secretariats. Concurrently DST (GOI), in collaboration with the respective State Council, organized all India thematic meetings/workshops whose recommendations helped identify activity areas for promotion by the Telangana State S&T Council. DST also organised periodic review meetings to discuss the status of various S&T programmes and plan the future strategy. Regional Meetings organised by DST facilitated review of state S&T structures and identification of areas of mutual cooperation between States.

i.   On completion of 10 years of this programme, a Decennial Review was held to assess the strengths and weaknesses of this programme vis-à-vis DST's performance. This review indicated desire for a phase change geared towards programmatic support and strengthening linkages between State S&T Councils and Central S&T Agencies by suitably dovetailing various programmes of State S&T Councils with those of Central S&T Agencies.

ii.   It was also realised that these State S&T Councils, since their formation have now come of age to initiate a phase where resources in terms of expertise and technology promoted and generated by the Central and State S&T Agencies be pooled together to undertake joint S&T programmes.

iii. DST's support has facilitated State S&T Councils to embark upon novel initiatives resulting in a number of success stories. These include Student Project Programme (Karnataka), Clean and Fuel Efficient Technologies(Punjab), Solar passive housing technology (Himachal Pradesh), Deflouridation of drinking water(Rajasthan), Development of technology for degumming of Ramie fiber(Assam), Natural Resources Data Management Systems(NRDMS), Patent Awareness, Societal S&T programmes, S&T Human Resource Development, Entrepreneurship Development programme, Pilot scale demonstration projects, Location specific research and Technology development, Reverse Osmosis desalination project(Rajasthan and Gujarat), treatment of important poultry diseases (Nammakal, Tamilnadu),Installation of Hydrams (Himachal Pradesh), Cupola

furnace modifications(Bihar and Haryana), Cardomom drier(Sikkim), Inventory of medicinal plants(Andaman and Nicobar islands).

iv.   In tune with the DST programs/ projects, the Telangana State S&T Council has been implementing several programs/ projects targeting a wide cross section of society i.e., youth, women, child scientists, students, farmers, teachers, academicians, scientists and research scholars,

v.   TSCOST has been identifying Telangana state-specific problems & need-based programs with remedial measures/ solutions duly establishing linkages / involving the concerned line departments, National laboratories, Universities, Institutions, R&D laboratories etc.

vi.   In this connection TSCOST is focusing on R&D in Advancement in Basic / Applied Scientific Research which has social relevance and Generation / Innovation of new technologies for commercialization and studies and survey for identification of local problems with a suggestion for suitable S&T intervention for achievement of SDGs in the state.

2. Macro economy of the State

"Telangana State" as a geographical and political entity was born on June 2, 2014 as the 29th and the youngest state in Union of India. The state has an area of 1,12,077 Sq Km and has a population of 3,52,86,757. The state has an average population density of 307 per sq.km. It shares border with five neighbouring states with 10 districts. The state has two completely urbanised districts Hyderabad and its neighbouring district Ranga Reddy. The two districts with a highly globalised IT sector, several special economic zone and industrial parks drive the growth in the state.

The state consists of two geographically different areas – North Telangana and South Telangana. The North Telangana districts are relatively poor in status compared to South Telangana which is more urban and industrialized. Telangana is an agrarian economywith 55% of population dependent on rainfall for agriculture.

Telangana is one among the fastest growing States in India. The GSDP[1] is one of the most important economic indicators, as it provides information about the general economic health of the economy in terms of its size and growth. Although Telangana's

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[1] The Gross State Domestic Product (GSDP) measures the monetary value of all final goods and services produced in an economy during any given year.

economy suffered due to the turmoil caused by the COVID-19 pandemic, the State has managed to achieve an increase in the GSDP at current prices in 2020-21 as compared to the previous year, and its growth rate of GSDP in 2020-21 was higher than the national growth rate of GDP. The State GSDP has recorded a tremendous recovery in 2021-22, both at current as well as constant prices, showing enormous growth.

2.1 GSDP at Current Prices: As per the Advance Estimates (AE) released by the Ministry of Statistics and Programme Implementation, Government of India, in 2021-22, Telangana's nominal GSDP was valued at Rs.11.55 lakh crore, after achieving a growth rate of 19.1% over the previous year Rs. 9.7 lakh crore, showing strong signs of recovery from the shock of the COVID-19 pandemic.

Looking at the growth journey of the Telangana State since its formation. The nominal growth rate exceeded that of India by 1.0 percentage points (2014-15), it has increased to 3.6 percentage points by 2020-21 and declined thereafter as the Indian economy has recovered from the pandemic. When compared with pre-pandemic levels in 2019-2020, Telangana's nominal GSDP is 21.8% higher in 2021-22, whereas India's nominal GDP has only increased by 17.8% in the two years.

Telangana's economy experienced strong growth and the contribution of Telangana State to the Country's GDP has increased over time. In 2014-15, Telangana contributed around 4.1% to the national GDP, in 2021-22 it has increased to 4.9%.

2.2 GSDP at Constant (2011-12) Prices: According to the Advance Estimates (AE) for the year 2021-22, Telangana's GSDP at constant (2011-12) prices is Rs.6.9 lakh Crores for the year 2021-22, increased by 11.2%, over the previous year 2020-21, which is Rs. 6.2 lakh Crores. The State's performance was significantly better than that of India's, which experienced an increase of 8.9% in the real GDP in 2021-22. The figures for India are Rs. 105.3 lakh Crore in 2014-15 and Rs.147.7 Lakh Crore in 2021-22.

Per Capita Income (PCI): Telangana's nominal PCI (AE) had increased to Rs. 2.79 lakh in 2021-22, over the previous year Rs. 2.35 lakhs in 2020-21. Since the formation of the State Telangana State PCI is consistently higher than the average national PCI. The gap also widened in each successive year. In 2014-15, the PCI of Telangana was 1.43 times the national PCI (Telangana's PCI is Rs. 1,24,104 which is Rs. 37,457 higher than the national PCI of Rs.84,647). As of 2021- 22, the multiplier had increased to 1.86 (Telangana's PCI is Rs. 2,78,833 which is Rs. 1,28,985 higher than the national PCI of 1,49,848).

2.3 Sectoral Analysis

The GSDP of any state is measured in terms of the economic contributions made by three key sectors—Agriculture & Allied Sectors, Industries (including mining and quarrying) and Services.

Since Telangana State formation, the Services sector has been the highest contributor to Telangana's Gross State Value Added (GSVA), followed by the Industries and Agriculture and allied sectors. As per Advance Estimates of GSVA (current prices) for Telangana, in 2021-22, the agriculture sector share in GVSA has increased from 16.3% (2014-15) to 18.3% (2021-22). whereas the share industry sector in States GVSA has declined to 20.4% (2014-15) from 22.4% (2021-22). The service sector accounted for 61.3% of Telangana's State GSVA without much change since formation.

Figure 1. Tribal women farmer showcasing her biodiverse based millet farming

Telangana's Agriculture and allied sector has been on an upward growth path for the past seven years, with its current price growth rate increasing by 9.75 percentage points between 2014-15 and 2021-22. The growth rate of the sector was higher than that of India's, even during the peak of the pandemic in 2020-21. While the country's Agriculture and allied sector grew by 7.48% in 2020-21, Telangana's Agriculture and allied sector experienced a 12.24% growth at current prices during that year. This has been achieved

through a multitude of factors including new irrigation schemes such as the Kaleshwaram Lift Irrigation Project and Mission Kakatiya, and innovative Farmers Investment Support Scheme (Rythu Bandhu), farm insurance scheme (Rythu Bima), and 24x7 freepower supply to the Agriculture and allied sector.

The Industrial sector in Telangana saw a robust recovery from the pandemic in 2021-22, growing at a notable 20.23% over the previous year. Within the Industrial sector, the manufacturing sub-sector, which is critical to job creation in any economy, saw the steepest recovery in Telangana, witnessing an annual growth rate of 28.59% in 2021-22.

2.3.1 Agriculture & Allied Sectors

The agriculture sector is the backbone of the rural economy in Telangana. 4 key sub-sectors constitute the 'Agriculture & Allied Sectors'—Crops, Livestock, Forestry and Logging, and Fishing and Aquaculture. The sector is a principal source of employment for around 55% of the population in the state. Since Telangana state formation, the contribution of the 'Agriculture and Allied Sectors' to Telangana's Gross State Value Added at current prices has consistently improved from 16.3% in 2014-15 to 20.5% in 2020-21(PE). There was a 142% increase in the Gross Value Added by the sector between 2014-15 and 2020-21.

The Government of Telangana has undertaken several initiatives to boost the sector's growth, increase farmers' incomes, and improve farmers' welfare. To achieve these objectives, the Government has implemented policy initiatives such as the flagship Kaleshwaram Project and Mission Kakatiya to improve the irrigation infrastructure, the supply of 24x7 free power to farmers, investment support to farmers under the Rythu Bandhu scheme, access to inputs, markets and credit, and provisioning of life insurance to farmers under the Rythu Bima scheme.

The following section provides data on key initiatives for agriculture like rainfall soil classification, land use pattern and production of major crops, livestock, inland fisheries, and prawns in the state. The data provides an insight into the performance of the agriculture and allied sectors. The key observations and insights from the section are given below

2.3.2 Rainfall

Telangana received 1322.4 millimeters (mm) of rainfall in 2020-21(from June to May), which is 46% in excess of normal rainfall of 905.4mm. Telangana received normal rains

in the years 2017- 18, 2018-19, and 2019-20, and excess rains in the year 2020-21, which contributed to improvement in groundwater recharge. This in turn contributed positively to overall sown area and agricultural productivity of the state.

2.3.3 Soils

Soil is the basic source for the progress and development of agriculture. Telangana state is a veritable museum of soils ranging from fertile alluvial soils to very poor sandy soils. The state is blessed with productive soils without much drainage problems.

Major soil groups present in the state are i) red soils, ii) black soils, iii) alluvial soils, iv) lateritic soils, and v) problem soils including saline and saline-alkali soils and non- saline-alkali soils. Red soils are predominant in Telangana state accounting for 52 percent of the total area. Black cotton soils and alluvial soils constitute 23 per cent and 9 percent respectively. There are 22 different sub-categories within these three major soil types supporting the production of important crops such as paddy, maize, jowar, redgram, cotton, green gram, black gram, ground nut and diverse millets. The mean organic content of the Telangana soils is very low at 0.48 percent. Whereas soils are high in phosphorus and medium to high in available potassium. The soils of the state have deficiency of micronutrients such as Zinc(28%) and Boron(34%).
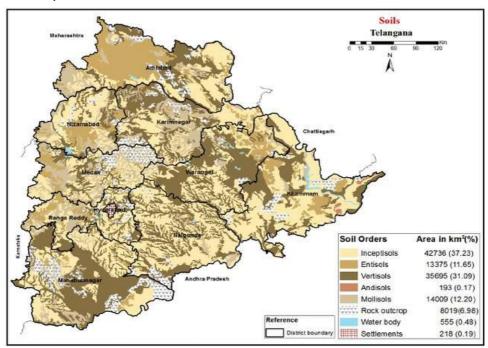

Figure 2: Soil orders of Telangana

Soil resource mapping in Telangana was conducted on 1:250000 scale by using both remote sensing and conventional methods. The soils identified were correlated and classified as per Soil Taxonomy (Soil Survey staff, 1994). Telangana soils fall into six orders namely Alfisols, Aridisols, Inceptisols, Vertisols, Entisols and Mollisols (see Fig.2). The total area of Telangana soils covered by in percentage are Inceptisols - 37.23 percent, Entisols- 11.65percent, Entisols-11.65percent, Vertisols- 31.09 percent, Aridisol- 0.17percent, Mollisols- 12.20percent,Rock out crops- 6.98 percent.

As per the pattern of land utilisation in Telangana, 49.1% of the total geographical area falls under Net Area Sown (including fish ponds) (see table 1). According to the Census of Landholdings (2015- 16), there are 59.47 lakh landholdings in Telangana covering a total area of 147.56 lakh acres. Marginal farmers (24.7 acres) hold 0.2% of total landholdings, accounting for 2.3% of the area operated (333.6 acres). Small farmers (2.48 -4.94 acres) hold 23.7% of the total landholdings, accounting for 33.1% of the area operated. Semi-medium farmers (4.95-9.88 acre) hold 9.5% of the total landholdings, accounting for 24.6% of the area operated. Medium farmers (9.89-24.7 acre) hold 2.1% of the total landholdings, accounting for 11.5% of the area operated. Large farmers (>24.7 acres) hold 0.2% of total landholdings, accounting for 2.3% of the area operated (333.6 acres).

Table 1. Land Utilisation pattern in Telangana state during 2019-20

Sl. No	Particulars	Area in acres	Percent to total Geographical area
1	Forest	66,67,005	24.1
2	Barren and Uncultivable	15,01,055	5.4
3	Land Put to Non-Agricultural Uses	20,65,780	7.5
4	Culturable Waste Land	4,01,320	1.5
5	Permanent Pastures and Other Grazing Lands	6,95,636	2.5
6	Land under Miscellaneous Tree crops and Groves not included in Net Area Sown	2,76,926	1.0
7	Current Follow Land	10,99,112	4.0
8	Other Fallow Land	13,98,111	5.1
9	Net Area Sown (including fish ponds)	1,35,89,842	49.1
10	**Total Geographical Area**	2,76,94,787	

Source: Directorate of Economics and Statistics

Among the predominant social groups in Telangana(Agricultural Census - 2015-16) Scheduled Tribes (STs) own 12% of landholdings, covering 12.4% of the area operated. Scheduled Castes (SCs) own 11.8% of landholdings covering 8.9% of the area operated. 76.2% of the landholdings belonged to the 'Others' category and covers 78.60% of the area operated.

Table 2. Area, Yield and Production of Principal Crops (2020-21)

Crop	Area (Acres)	Vanakalam Yield (Kgs/Acre)	Production (Tonnes)	Area (Acres)	Yasangi Yield (Kgs/Acre)	Production (Tonnes)
Paddy	52,51,261	1,834	96,31,057	51,71,916	2,363	1,22,20,414
Jowar	1,05,236	328	34,526	1,18,781	1,018	1,20,972
Maize	2,12,957	1,880	4,00,349	4,26,859	3,174	13,55,021
Greengram	1,52,980	168	25,713	32,227	383	12,355
Black gram	46,401	302	14,019	47,701	760	36,247
Redgram	10,56,484	314	3,31,479	2,520	2,520	700
Bengal gram	24	565	9	3,52,862	675	2,38,087
Sugar cane	53,982	35,126	18,96,172	0	0	0
Cotton	58,27,842	522	30,42,443	0	0	0
Groundnut	37,983	639	24,281	2,76,543	963	2,66,318
Soyabean	4,00,071	608	2,43,327	0	0	0
Sunflower	188	1,083	203	17,541	1,083	18,994
Bajra	1,570	376	590	23,189	376	8,719
Ragi	2,296	538	1,235	958	542	519
Safflower	18	511	9	7,513	376	2,826
Horsegram	2,677	654	1,748	1,315	654	860
Korra	883	222	194	511	222	82
Wheat	0	0	0	15,233	1,068	16,257
Castor	23,291	147	3,423	2,411	124	298

Source: Directorate of Economics and Statistics

The total production of rice in Telangana was 145.68 lakh tonnes in 2020-21. The districts of Nalgonda and Nizamabad were the highest contributors to the production of cereals accounting for 8.4% and 8.3% of the total production respectively. The total production of millets (jowar, bajra, maize, ragi, and korra) in Telangana was 19.22 lakh tonnes in 2020-21(see table2). The district of Warangal Rural and Khammam were the

highest contributors to the production of millets accounting for 15.9% and 15% of the total production respectively. The total production of pulses was 6.69 lakh tonnes in 2020-21 in Telangana. Kamareddy and Vikarabad districts were the highest contributors to the production of pulses accounting for 13.8% and 12.7% of the total state production respectively. The total production of foodgrains (cereals, millets, and pulses) in Telangana was 171.76 lakh tonnes in 2020-21. Nizamabad and Nalgonda districts were the highest contributors to the production of pulses accounting for 7.6% and 7.1% of the total state production respectively. The two major spices produced in Telangana are chillies and turmeric. The total production of chillies in 2020- 21 was 5.37 lakh tonnes. Nearly one-third of the total production came from the Khammam district (32.4%). The total production of turmeric in 2020- 21 was 2.26 lakh tonnes. Major contributors to the production of turmeric were the districts of Nizamabad (38.05%) and Jagtial (18.71%). Onion is the major vegetable produced in Telangana. The total production of onion in the state was 1.80 lakh tonnes in the year 2020-21. Jogulamba Gadwal district alone accounted for 26.96% of the total onion production. The dominant fibre crop produced in Telangana is cotton. The total production of cotton kapas in the state in the year 2020-21 was 30.4 lakh tonnes, and that of cotton lint was 57.99 lakh bales. The total production of oilseeds in Telangana, including Groundnut, Sesame, Safflower, Sunflower, Rape Mustard, Soybean, Palmoil and Castor, was 9.89 lakh tonnes in 2020-21. A significant share of oilseed production came from the Bhadradri district, which contributed 33.6% to the total production, followed by Nagarkurnool, at 14.8% of the total production.

The Government of Telangana recently launched the Oil Palm Mission to promote the cultivation of oil palm in the state. The end goal of the Mission is to improve the livelihood of farmers and to bridge the edible oil deficit in the country. The Mission provides for a Minimum Guarantee Price (MGP) of Rs. 15,000 per MT of Fresh Fruit Bunch (FFB). The total production of oil palm in 2020-21 was 4.12 lakh tonnes. Bhadradri district accounted for 80% of the production of oil palm. The total production of tobacco, which is predominantly produced in 5 districts of Telangana, was 2,731 tonnes in 2020-21. 37.5% of the total tobacco production came from Jogulamba district, followed by Jangaon district, which accounted for 21.5% of the total production.

As per the livestock census 2019, the total population of livestock in Telangana was 3.26 crore. Sheep accounted for 58.4% of the total livestock population. Goat, cattle and buffalos account for 15.1%, 13% and 12.9% of the population respectively. The production of milk in the state was 57.65 lakh tonnes, meat was 5.10 lakh tonnes, chicken was 4.10 lakh tonnes, and eggs were 1,58,470.33 lakhs in the year 2020-21.

The total production of inland fish and prawns in the year 2020-21 was 3.37 lakh tonnes and 11,734 tonnes respectively. The highest contributing districts were Nalgonda (7.5%), and Nirmal (6.7%) for inland fish, and Karimnagar (10.7%), and Nizamabad (9.5%) for prawns.

2.3.4 Horticulture

In 2020-21, area under Horticulture crops in the state is 11.57 Lakh acres with a production of 59.03 Lakh MTs. The area under Horticulture in Telangana state is contributing 5.39% of the total Agriculture area (214.48 lakh acres), whereas the sector contributes 26% in terms of value of the produce (Agriculture crops value Rs.89,058 Cr, Horticulture crops value Rs.22,774 Cr). Between 2015-16 and 2020-21, area under horticulture crops has seen a growth of 304% (from 3.8 lakh acres in 2015-16 to 11.57 lakh acres in 2020-21). Mango, Sweet orange, Acid Lime, Guava, Pomegranate, Tomato, Brinjal, Oilpalm, Cashewnut, Chillies and Turmeric are the major horticulture crops in the state. In 2020-21, total horticulture production was 59.03 LMTs, an increase of 101% compared to 2015-16.

2.3.5 Livestock sector

About 29 lakh families in Telangana State are engaged in livestock sector for their livelihood and livestock sector is emerging as one of the most potential and income generating sectors for rural and semi urban areas. Between 2012 to 2019 the livestock population in the state has increased from 26.7 million to 32.6 million with 22.09% growth between the years. Among the major states in India, Telangana is second to West Bengal in the growth of livestock population in the same period. Among livestock, Telangana ranks first place in sheep population at 19.1 million. The sheep population has seen an increase of 48.51% between 2012 to 2019. As per 2019-20 (FRE), milk and meat almost covers 76% of the total Gross Value Added in the livestock sector. With all round development in various sectors, the Telangana state is working in a focused way for the improvement of SDG scores with regards to various goals.

3. Sustainable Development Goals (SDGs)

The Agenda 2030 for Sustainable development and its 17 SDGs has been adopted by 193 countries in 2015. The SDGs build on MDGs but there are significant differences between them and also the processes leading up to their adoption. These SDGs are extensions of MDGs with sustainability parameter that is added to each MDG to be implemented in the post-2015 era along with a set of all new goals that were ignored in the MDGs (RIS, 2016).

SDGs expanded the focus of development by integrating economic, social and environmental dimensions of sustainability. Sustainable development embraces this so-

called triple bottom line approach to human wellbeing. Almost all the world's societies acknowledge that they aim for a combination of economic development, environmental sustainability and social inclusion, but the specific objectives differ globally, between and within societies (Sachs, 2012). The 17 SDGs and the 169 related targets from an overarching development framework are meant to guide the efforts of the government and non-state actors at different levels from global to local until 2030. The SDGs and their targets form a complex, integrated system with clear sectoral emphases and strong linkages among goals and targets reflecting synergies and tradeoffs among the targets. Poverty, gender equality and climate change have emerged as world's biggest challenges. All key development stakeholders have reached a consensus as to the need and urgency for adopting, implementing and monitoring the SDGs at the national, sub-national and local levels.

SDGs can be organised into three broad categories of social development, environmental sustainability and social inclusion, with the stipulation that accomplishment in any of these three categories will almost certainly be contingent on the success of all three. These in turn, depend on good governance at local, national, regional and global. More specifically, these categories are Social (SDGs 1 to 6), Economic (SDGs 7 to 11) and Environment (SDGs 12 -15) and Peace & Partnership (SDGs 16-17).

3.1   SDGs are Interconnected (synergy and trade-offs)

- SDG-2 + SDG 1: Eradicating poverty cannot be achieved without ensuring food and nutrition security for all. SDG 2 is a strong enabler for SDG 1.

- SDG 2 + SDG 3: Health and wellbeing cannot be achieved without access to sufficient quantity and quality of food. Achieving SDG 3 supports SDG 2.

- SDG 2 + SDG 5: Achieving the targets related to access to food quality nutrition for all and agricultural incomes proved key enabling condition for women empowerments and gender equality.

- SDG 2 + SDG 6: Food production is strongly dependent on and effects the quality of availability of water- trade-off

- SDG 2 + SDG 7: Agriculture, food production, and consumption strongly depend on energy services. The trade-off with clean energy

- SDG 2 + SDG 13: Agriculture is an important source of greenhouse emissions and contributes to climate action. Trade-off

- SDG 2 + SDG 15: Agriculture is a key driver impacting eco systems.

Policy makers face the challenge of implementing the SDGs simultaneously to achieve progress across social, economic, and environmental dimensions. **Science and Technology** informed analysis of interaction across SDG domains can support more coherent and effective decision making and better facilitate monitoring of progress. This will also make it possible to highlight better inequalities concerning the progress made, making it easier to identify corrective measures and avoid unintended effects.

SDG relevance has assumed greater importance in the present scenario as the world is affected by the Covid 19 global pandemic. Build back better and build back with sustainability has become the adage with a 'whole of the society' approach building partnerships with all stakeholders. They bring government, civil society and private sector together in common pursuit. In this process,**Science and Technology** play a crucial role in adopting, implementing and monitoring the SDGs for development.

3.2   SDGs in the Telangana State context

The state has been on the path of development with a major thrust on the development of infrastructure like irrigation, road and rail network and power which enabled a base for the economic and concomitantly social development. The state set its targets in irrigation, drinking water, increasing green cover through flagship programmes, leading to an overall setting for development.These development initiatives are at macro level and exclude none, but their access and impact may be restricted due to the existing socio-economic and geographic or location specific inequalities. This is necessitated by a targeted approach to focus on specific social or economic groups or specific locations. Moreover the use of Science and Technology becomes crucial for reaching the unreachable which plays a major role towards achievement of the SDGs. All stakeholders in the process of achievements of SDGs are not aware of the programmes or interventions which can be effectively communicated by technology driven methods like public digital literacy and targeted awareness programmes using ICT methods. ICT can play an important role to increase transparency, accountability and public participation all which can improve governance. Technology can be used in designing monitoring and evaluation systems like setting up dash boards, citizen feedback loops, real-time monitoring technologies like sensors and so on; facilitating the application of big data analysis for decision making; undertaking bottleneck analysis of service delivery in priority areas; design tech-enabled solutions for such problems. Specific interventions can be made in the Aspirational districts programme (ADP) or the low performing districts or among low performing social groups the Adivasis and the Particularly vulnerable tribal groups (PVTGs).Technology is also best used for monitoring and modernizing data systems at state or sub-state levels.

Table 3. SDG Performance of Telangana in 2018 and 2019 and 2020

Category	SDG	2018 Score	SDG	2019 Score	SDG	2020 score
Achiever (100)	Goal 10: Reduced inequality	100			Goal 7: Affordable and clean energy	100
Front Runner (65-99)	Goal 3: Good health and well being	73	Goal 3: Good health and well being Goal 6: Clean water and sanitation	66	Goal 1: No Poverty	68
	Goal 4: Quality education	66		84	Goal 3: Good health and well being	67
	Goal 7: Affordable and clean energy	63	Goal 7: Affordable and clean energy Goal 8: Decent work and economic growth	93	Goal 6: Clean water and sanitation Goal 8: Decent work and economic growth	96
	Goal 8: Decent work and economic growth	75		82		73
	Goal 15: Life on Land	83	Goal 10: Reduced inequality	94	Goal 10: Reduced inequality	67
	Goal 16: Peace, justice and strong institutions	66	Goal 13: Climate action	66	Goal 11: Sustainable cities and communities	76
			Goal 15: Life on Land	88	Goal 12: Responsible consumption and production	73
			Goal 16: Peace, justice and strong institutions	77	Goal 15: Life on Land	81
					Goal 16: Peace, justice and strong institutions	71
Performer (50-64)	Goal 1: No Poverty	52	Goal 1: No Poverty	52	Goal 2: Zero Hunger	50
	Goal 2: Zero Hunger	53	Goal 4: Quality Education	64	Goal 4: Quality Education	63
	Goal 6: Clean water and sanitation	55	Goal 9: Industry, innovation and infrastructure	61	Goal 9: Industry, innovation and infrastructure	59
			Goal 11: Sustainable cities and communities	62		
			Goal 12: Responsible consumption and production	58		
Aspirant (0-49)	Goal 5: Gender equality	43	Goal 2: Zero Hunger	41	Goal 2: Zero Hunger	50
	Goal 9: Industry, innovation and infrastructure	16	Goal 5: Gender equality	43	Goal 4: Quality Education	63
	Goal 11: Sustainable cities and communities	44			Goal 9: Industry, innovation and infrastructure	59
Composite score		61		67		69

Source: NITI Aayog SDG India Index Reports
Note 1: Achiever =100; Front runner=65-99; Performer=50-64; Aspirant =<50
Note 2: SDG 14 is assessed for States with sea coast

SDG India Index and Dashboard 2020-21 by NITI Aayog is the third report in succession which ranks states according to their performance. The overall score of Telangana state improved from 61 in 2018 to 67 in 2019 to 69 in 2020 (Table 3).

The state continues to be aspirant in SDG 5-gender equality and in SDG 13 - climate action. Whereas with respect to goal 4, 2 and 9 the state is a performer. Special focus is needed for improving state's performance regarding SDG 5, 4, 2, 9 and 13.

3.3 Existing schemes and projects: Contributing to improvement of performance in SDGs.

It can be seen from table 4 and table 5 that linkage between different departments of the state and the performance in SDGs through various schemes and projects.

Table 4. SDGs and Concerned Departments in Telangana

No	Goals	Departments
1	No Poverty	Panchayat Raj &Rural Development, Municipal Administration &Urban Development
2	Zero Hunger	Civil Supplies, Agriculture
3	Good health and well being	Health, Medical & Family Welfare
4	Quality Education	Education
5	Gender Equality	Women Development &Child Welfare, Scheduled Caste Development/Tribal Welfare/BC Welfare, Minorities Welfare
6	Clean water and sanitation	Panchayat Raj &Rural Development (Rural Water and Sanitation)
7	Affordable and clean energy	Energy
8	Decent work and economic growth	Labour, Employment &Training
9	Industry, Innovation & infrastructure	Industries and Commerce
10	Reduced inequality	Welfare Developments (SC/ST/BC/ Minority)
11	Sustainable Cities and Communities	Municipal Administration & Urban Development
12	Responsible Consumption and Production	Agriculture, Industries & Commerce
13	Climate Action	Environment, Forest, Science and Technology (EFS&T)
14	Life below Water	Fisheries
15	Peace, Justice and Strong Institutions	Home
16	Partnerships for the Goals	Planning, Finance (Convergence of All Departments/NGOs/Corporate sector etc.)

Table 5. Goal wise schemes for achieving the SDGs

Goal	Scheme
Goal 1: No poverty	1. Aasara Pensions, 2. Financial assistance to beedi workers, 3. Stree Nidhi Bank, 4. Economic Support to SCs, STs, BCs and minorities, 5. SC/ST Sub-plan, 6. Purchasing and assigning of 3 acre of agriculture land to SC women, 7. Housing for the poor, 8. 3% interest loans to SHG members
Goal 2: Zero hunger	1. ICDS, 2. Girl child protection, 3. Kalyana Lakshmi, 4. Shaadi Mubarak, 5. Aasara pensions for widows, 6. Economic assistance to beedi workers, 7. Stree Nidhi, 8. Land distribution, 9. Supply of 6kg rice/per person/per month
Goal 3: Good health and well-being	1. Arogya Laxmi and strengthening of AWCs, 2. New medical colleges and hospitals, 3. AYUSH, 4. Ambulance service, 5. Up gradation of district hospitals to super-speciality hospitals, 6. Up gradation of PHCs, 7. Amma vodi
Goal 4: Quality education	1. Residential schools, 2. Nutritious meals programme, 3. Welfare hostels, 4. KG to PG, 5. Coaching and skill development for formal and self-employment, 6. Coaching and scholarships for higher studies in foreign universities, 7. Conversion of welfare hostels into residential schools, 8. Education hubs, 9. Pre-matric scholarships, 10. Fee reimbursement, 11. Linking colleges with industry, 12. Special schools for minority girls
Goal 5: Gender equality	1. ICDS, 2. Girl child protection scheme, 3. Kalyana Lakshmi, 4. Shaadi Mubarak, 5. SHE teams, 6. Pension scheme for destitute/single women, 7. Economic assistance to beedi workers, 8. Stree Nidhi, 9. SERP-TRIGP, 10. Land distribution, 11. SHG bank linkage
Goal 6: Clean water and sanitation	1. Mission Bhagiratha; 2. Swachh Telangana in line with Swachh Bharat, 3. Sanitation programmes, 4. Construction of IHHLs

Goal 7: Affordable and clean energy	1. ICDS; 2. Girlchild Protection; 3. Kalyan Lakshmi / Shaadi Mubarak; 4. ASARA Pensions for widows; 5. Aarogya Lakshmi; 6. Economic Assistance to Beedi workers; 7. SERP – TRIGP; 8. Land distribution; 9. SHG bank linkage; 10. Sthree Nidhi; 11. Supply of 6 kg rice/person /month to 2.86 crore persons (1re/ kg)
Goal 8: Decent work and economic growth	1. ICDS; 2. Girlchild Protection; 3. Kalyan Lakshmi / Shaadi Mubarak; 4. ASARA Pensions for widows; 5. Aarogya Lakshmi; 6.Economic Assistance to Beedi workers; 7.SERP – TRIGP; 8.Land distribution; 9.SHG bank linkage; 10.Sthree Nidhi; 11.Supply of 6 kg rice/person /month to 2.86 crore persons (1re/ kg)
Goal 9: Industry, innovation and infrastructure	1.Financial Assistance to Handloom & Textile Promotion; 2.Industrial Infrastructure Development; 3.Incentives for Industrial Promotion; 4. NIMZ; 5. T-PRIDE; 5. T-IDEA; 6.TS-iPASS; 7. RICH; 8.T-Hub; 9. Metro Rail; 10. Industrial corridors; 11. Road network; 12.providing doubling roads from mandals to district headquarters; core roads, district roads 13. Dry Port; 14. IT Policy; 15. Creating ease of doing business
Goal 10: Reduced inequality	1.SC Sub Plan; 2.ST Sub Plan; 3.Programmes for Minority Development; 4.Programmes for BC Development; 5.Development of backward regions of the State; 6.Purchasing and assigning of 3 acres of agriculture land to the SC women; 7. T-PRIDE; 8.Prividing free education to BPL families (financial assistance to students)
Goal 11: Sustainable cities and communities	1. Construction of Double Bedroom Houses for Weaker sections; 2. Metro Rail; 3. Telangana Ku Haritha Haram; 4. Security measures (She Teams; CC cameras for cities)
Goal 12: Sustainable consumption and production	1.Solid Waste Management; 2. Agriculture, horticulture marketing; 3. Godowns and cold storages; 4. Micro irrigation

Goal 13: Climate action	1.Haritha Haram; 2. Afforestation; 3. Initiatives to promote biodiversity
Goal 14: Life below water	1.Promotion of Fish and Prawn Production 2. Dry Port as there is no coastal line 3. In-land fisheries development
Goal 15: Life on land	1. Haritha Haram (Afforestation); 2. Soil and water analysis and appropriate nutrition and cropping; 3. Mission Kakatiya; 4. Development of National Parks and Sanctuaries
Goal 16: Peace, justice and strong institutions	1.GramaNyayalayalu; 2. Schemes for modernization Police Force; 3. She Teams; 4. Right to Information Act; 5. Legal aid to weaker sections
Goal 17: Partnerships for the goals	1. TS-iPASS 2. T-IDEA, 3. Industrial Health Clinic 4. T-PRIDE; 5. T-Hub; 6. RICH

The state is in the process of streamlining its strategies for achieving the same by classifying the targets into short, medium and long term goals for three years, seven years and fifteen years respectively, as guided by NITI Aayog. Against this back drop the present study on mapping of S &T interventions has been taken up with the following objective.

3.4 Objective and Approach of the study

The objective of the study was to map the science and technology interventions for achievement of SDGs in Telangana State at state and local levels.

The study tried to map the S&T interventions with respect to all 16 SDGs. However special attention was paid with respect to SDGs 2 and 5 (persistent) and 4, 10, 13 (slippages). The National Indicator Framework (NIF) released in June 2021 has reduced the number of indicators to assess the SDGs to 295 from 302. The State Indicator Framework (SIF) is developed based on the NIF and which are customized to the State schemes and programmes also taking into account the CSS. In view of the national and state schemes prevailing the assessment of the SDGs has become more outcome based vis-à-vis scheme based. In this context S&T interventions also need to focus on outcomes that would improve the State's score to front runner or achiever in the SDGs in which it is either performer or an aspirant. In accordance with this approach the present study focused on indicators which interconnect SDGs as indicated above. Moreover it identified the focus of the S&T intervention in particular social groups or geographical locations to improve the overall performance.

3.4.1 Method of organizing the study

The study conducted a **desk review** to assess the situation of Science and Technology promotion and its link to SDGs achievement with regard to 16 SDGs. The study conducted a S**tate level Brain storming session** with relevant stake holders at CESS, Hyderabad to identify issues with respect to science and technology and their linkage to SDG achievements in terms of shortfalls of existing S&T related interventions and also need for new interventions. Regional workshops could not be conducted as planned due to 3rd wave covid restrictions in force.

Figure 3. Stakeholder consultation with Associate Director of Research, Warangal, PJTSAU

Alternately, field visits were conducted by the CESS team to the old ten districts of Telangana state to gather secondary data from CPO offices with respect to various sectors and identify the location-specific challenges and Science and Technology solutions to these problems. Depending on the need, field visits were also made by CESS to get further insights into the issues (see figure 3 & 4).

Figure 4. Interview with the Assistant Director of Agriculture, Khammam with respect to S&T needs in agriculture

4. Desk Review (On Weak/Low performing SDGs in Telangana)

Telangana state continues to be aspirant in SDG 5-Gender Equality and in SDG 13 - Climate Action. Whereas with respect to goals 4, 2 and 9 the state is a performer. Special focus is needed for improving state's performance regarding SDG 5, 4, 2, 9 and 13 and hence a detailed desk review has been conducted with reference to these SDG goals.

4.1 ICT Interventions in achieving Gender Equality –SDG 5

Performance of the indicators across the districts of Telangana

The International Telecommunications Union report (ITU, 2017) highlighted the role of information and communication technologies (ICTs) in achieving the SDGs. It has been pointed out that innovation and actions by both the government and the private sector are required to achieve this. Further, the ICT solutions require rigorous evaluation

and quality evidence (ASU, 2017). The ICT and SDGs Final Report of the Earth Institute, Columbia University, 2016 stated that there are five ways of implementing the SDG-ICT solutions - 1. upscaling of critical services in health, education, financial services, agriculture and low-carbon energy systems, 2. reduced deployment costs addressing rural and urban realities, 3. enhanced public awareness and engagement, 4. innovation, connectivity, productivity and efficiency across many sectors and 5. faster upgrading in the quality of services and jobs. This report has identified issues that the governments, industry and stakeholders should address, such as privacy and surveillance, cyber security, loss of human skills, public concern about health effects, electronic waste and carbon emissions, digital exclusion, and child protection and the internet. The report's main conclusion is that the entire public sector (including service delivery in finance, health, education, energy and transportation) needs to be equipped with a high-quality ICT infrastructure to move from a business-as-usual approach to an SDG path and to deliver on the 2030 vision.

India is among the world's leading countries in Science, Technology, and Innovation. Aadhaar, DBT and decision support mechanisms based on Geographic Information Systems are some of the recent developments in the area of Information Communication Technology applications as well as e-governance (NITI Aayog, 2021).

The penetration of Internet in Telangana has remained the lowest among southern states, and one of the lowest in the country, According to Internet and Mobile Association of India's (IAMAI) India Internet 2019 report, Internet has reached to only 31 per cent of population in Telangana and the scenario is different when it comes to Hyderabad which has 42 lakh internet users, higher than that of Pune and Ahmedabad. Further, there exist gender inequalities in internet access and digital skills across the country.

Though more progress to be made, India has achieved improvement in some of the indicators of SDG 5. Several programmes have been launched to promote gender equality such as BetiBachao and BetiPadao, Maternity Benefit programmes, Mahaila E-HAAT and Mahila Shakti Kendra etc. In addition to centrally sponsored programmes, the Government of Telangana had initiated a number of programmes aiming at integrated development of girl child and women in the state such as 1.ICDS; 2.Girl Child Protection Scheme; 3.Kalyan Lakshmi / Shaadi Mubarak; 4.ASARA Pensions for widows; 5.Aarogya Lakshmi; 6.Economic Assistance to Beedi workers; 7.SERP – TRIGP; 8.Land distribution; 9.SHG bank linkage; 10.Sthree Nidhi; 11.Safety and security of Women (SHE teams); 12. Pension Scheme for Single / Destitute Women. Bharosa (trust): An Initiative of the Hyderabad City Police & Telangana Government provides in one place a range of support services to women affected by violence (Ibid).

Despite many efforts towards gender equality, empowerment and to end all forms of discrimination against girl-child and women, the performance of the Telangana state towards this goal is not promising. In the performance of SDG 5, though the rank of the state has improved, the state has remained as *aspirant state* (low performing). Out of nine indicators considered for evaluating the performance, the state's performance is lower than that of all-India in five indicators. Wage inequalities and violence against women are the indicators which pulled back the index score (Table 6). Moreover, the state is far behind the targets fixed for all the indicators.

Table 6. Rank of Telangana among States and UTs on SDG 5 Indicators

Indicator	Rank during 2019-20	Rank during 2020-21
Sex ratio at birth	14	14
Female to male ratio of average wage/salary earnings received during the preceding calendar month among regular wage/salaried employees (rural + urban)	32	28
Rate of crimes against women per 1,00,000 women population	34	31
Percentage of ever married women who have ever experienced spousal violence	35	35
Proportion of sexual crimes against girl children to total crimes against children during the calendar year	29	—
Percentage of seats won by women in the general elections to state legislative assembly	22	23
Female labour force participation rate (LFPR)	8	6
Operational land holdings gender-wise	8	6
Overall	36	30

Note: Higher the rank lower the performance
Source: Table 5.1, NITI Aayog –SDG India Index and Dashboard-2019-20 and 2020-21

In order to improve the performance of the state it is very essential to understand the status of the indicators across the districts and sub-districts levels. NITI Aayog initiated a new programme for rapid transformation of low performing districts (Aspirational Districts) in 2018. The institutional mechanism created under Aspirational District

Programme (ADP) provides an opportunity to integrate the SDGs in implementation and monitoring framework.

Against this background, an attempt is made to list out the low performing districts in some of the indicators of SDG 5.

Target 5.1 End discrimination against all women and girls

5.1.1   Sex Ratio at Birth

According to NFHS 2019-21 report, sex ratio at birth at all-India is 929 which is behind the target fixed for the indicator at 950. The sex ratio at birth in the state is 894, which is below all-India average as well as the target. Among the 31 districts of the state, the sex ratio at birth is below the national average in 19 districts and two more districts are added when the target of 950 is included (Table 7). There is a need to scale up the initiatives such as *Mana Inti Lakshmi* to create awareness and bring attitudinal changes in the society. Further it requires the strict implementation of the provisions of the PC and PNDT Act for the improvement of the sex ratio at birth in future.

Target 5.2 End all violence against and exploitation of all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation

5.2.1 Percentage of ever married women age 15-49 years who have ever experienced physical or sexual violence committed by their husband

According to NFHS V, 2019-21, in Telangana, around 37 percent of women (15-49 years) have experienced physical or sexual violence committed by husbands. According to Crime in Telangana Report of State Crime Record Bureau, 2020 around 13 percent of total crimes constitute crimes against women. Out of total 17791crimes registered against Women during 2020, Cyberabad, Rachakonda and Hyderabad Commissionerates occupy around 44 percent of the total crimes against women. Out of the total cases, 42 percent of them belong to section 498 A IPC i.e. cruelty by husband and his relatives. This percentage exceeds 50 percent in Siddipet, Karminagar and Hyderabad Commissionerates (Table 8).

5.2.3 Proportion of sexual crimes against girl children to the total crimes against children

The cases reported under the Protection of Children from Sexual Offences Act occupied 47 percent of total crimes reported against children in 2019. The crime rate under this

Act has been continuously increasing in the state. Hyderabad, Cyberabad, Rachakonda, Bhadradri Kothgudem and Khammam districts have highest number of cases reported under this Act during 2020 (Table 9).

Target5.3 Eliminate all harmful practices, such as child, early and forced marriage andfemale genital mutilations

5.3.1 Proportion of women aged 20-24 years who were married or in a union before age

The percentage of currently married women aged 20-24 who were married before the legal age of 18 years declined to 23.5 during 2019-20 from 26 during 2015-16 and from 28 percent during 2012-13. This percentage is slightly lower in all-India than that of state at 23.3 percent during 2019-20. Out of 31 districts the percentage is below the national and state average in 17 districts (Table 10).

5.3.2 Proportion of cases reported under the Prohibition of Child Marriage Act (early marriage of children below 18 years of age) to total crime against children

The number of cases reported under the Prohibition of Child Marriage Act, 2006 in Telangana state has been increasing continuously. As per the Crime in Telangana Report 2020, 216 cases were registered under Kidnapping and Abduction of girls below 18 years age to compel them for marriage. Out of which 79 and 58 cases were reported in Cyberabad Commissionerate and Mahabubnagar district respectively.

5.5.3 Percentage of non-agricultural proprietary establishments owned by women

According to VI Economic Census 2012-13, among the total non-agricultural proprietary establishments, the percentage of women establishments constitutes only 20 percent at the state level (Table 11). However, in Adilabad district, nearly 50 percent of the units are owned by women. Majority of these belonging to tobacco units.

The literacy status of women in Telangana is poor as a major portion of the districts are under performing than the state average. In terms of literacy rate and 10 years of schooling among women in the age group 15-49 years and the percentage of female (age 6 years and above) ever attended school, 21 to 23 out of 31 districts performed below the state average. Jogulamba Gadwal, Komaram Bheem Asifabad, Jayashankar Bhupalpally, Wanaparthy, Nagarkunool, Kamareddy and Medak districts fall in the bottom ten districts in all the literacy indicators. Female literacy particularly in rural areas of these districts need serious attention (Table 12 to Table 14).

Table 7. Sex Ratio at Birth for children born during the last years2019-21

Sl.No.	District	Sex ratio at birth (Girls per 1000 Boys)
1	Warangal Rural	698
2	Nagarkurnool	771
3	Vikarabad	775
4	Adilabad	785
5	Mahabubnagar	789
6	BhadradriKothagudem	817
7	MedchalMalkajgiri	828
8	Warangal Urban	829
9	Hyderabad	844
10	Medak	848
11	JogulambaGadwal	853
12	Kamareddy	870
13	Nalgonda	883
14	Mahabubabad	885
15	JayashankarBhupalapally	903
16	Khammam	905
17	Mancherial	909
18	Peddapalli	913
19	KomaramBheemAsifabad	917
20	Karimnagar	933
21	Nizamabad	941
22	YadadriBhuvanagiri	954
23	Jagitial	955
24	Ranga Reddy	964
25	Siddipet	976
26	Suryapet	980
27	Wanaparthy	987
28	Sangareddy	1039
29	Jangoan	1089
30	RajannaSircilla	1115
31	Nirmal	1138
	Telangana	**894**
	India	**929**
	Target	**950**

Source: District Fact Sheets, NFHS V 2019-20

Table 8. Crimes against women and cases under cruelty by husband or his relatives-2020

District	Total Crime against Women (IPC+SLL)	Cruelty by Husband or his relatives IPC) (Sec. 498 A	
		Number of cases	Percentage to total
Siddipet Commissionerate	652	365	56.0
Karimnagar Commissionerate	544	289	53.1
Hyderabad Commissionerate	2390	1226	51.3
Nizamabad Commissionerate	502	250	49.8
Rajanna Siricilla	299	143	47.8
Ramagundam Commissionerate	853	400	46.9
Kamareddy	304	141	46.4
Rachakonda Commissionerate	2705	1184	43.8
Mulug	158	69	43.7
Sangareddy	273	113	41.4
Bhadradri Kothagudem	645	266	41.2
Medak	279	115	41.2
Khammam Commissionerate	699	280	40.1
Cyberabad Commissionerate	2715	1055	38.9
Nalgonda	660	250	37.9
Suryapet	604	220	36.4
Jagityal	339	122	36.0
Warangal Commissionerate	844	297	35.2
Adilabad	200	70	35.0
Wanaparthy	132	46	34.8
Nirmal	122	42	34.4
Mahabubabad	325	106	32.6
Kumaram Bheem Asifabad	200	65	32.5
Vikarabad	263	80	30.4
Jayashankar Bhupalpalli	212	60	28.3
Narayanpet	145	37	25.5
Nagarkurnool	255	65	25.5
Jogulamba Gadwal	141	30	21.3
Mahabubnagar	327	67	20.5
Railway Police Secunderabad	4	0	0.0
Total Districts	**17791**	**7453**	**41.9**

Source: Crime in Telangana, State Crime Record Bureau, Hyderabad

Table 9. District-wise number of cases registered under POCSO Act -2020

District	Protection of Children from Sexual Violence Act (Girl Child Victims only) (Total) (Col.47 to Col.52)
Hyderabad Commissionerate	314
Cyberabad Commissionerate	306
Rachakonda Commissionerate	187
Bhadradri Kothagudem	111
Khammam Commissionerate	109
Vikarabad	74
Warangal Commissionerate	72
Nalgonda	72
Ramagundam Commissionerate	66
Suryapet	63
Siddipet Commissionerate	61
Jagityal	53
Narayanpet	53
Nizamabad Commissionerate	49
Mahabubnagar	47
Mahabubabad	46
Jogulamba Gadwal	42
Adilabad	41
Nagarkurnool	40
Karimnagar Commissionerate	36
Kamareddy	36
Medak	31
Wanaparthy	27
Rajanna Siricilla	25
Jayashankar Bhupalpalli	24
Mulug	24
Sangareddy	23
Nirmal	18
Kumaram Bheem Asifabad	17
Railway Police Secunderabad	0
Total Districts	**2067**

Source: Crime in Telangana, State Crime Record Bureau, Hyderabad

Table 10. District-wise Percentage of women in 20-24 years married before 18 years 2019-20

Districts	Women in 20-24 years married before 18 years
Vikarabad	39.8
Khammam	35.0
Jogulamba Gadwal	34.6
Wanaparthy	32.6
Nagarkurnool	32.1
Medak	31.8
Kamareddy	30.8
Sangareddy	30.6
Suryapet	29.5
Ranga Reddy	29.0
Jagitial	28.4
Mahabubabad	28.3
Nalgonda	28.2
Komaram Bheem Asifabad	25.0
Jayashankar Bhupalapally	24.9
Nizamabad	23.7
Mahabubnagar	23.4
Nirmal	23.3
Warangal Rural	22.9
Warangal Urban	22.7
Yadadri Bhuvanagiri	21.6
Adilabad	21.4
Bhadradri Kothagudem	20.8
Jangoan	20.3
Siddipet	19.0
Mancherial	14.0
Peddapalli	13.6
Rajanna Sircilla	13.2
Karimnagar	11.9
Hyderabad	10.6
Medchal Malkajgiri	10.2
Telangana	**23.5**

Source: District Fact Sheets, NFHS V 2019-20

Table 11. Percentage of non-agricultural proprietary establishments owned by women-2012-13

District	% Share of women enterprises in total
Adilabad	49.5
Nizamabad	23.0
Karimnagar	12.2
Medak	29.0
Hyderabad	13.9
Rangareddy	16.7
Mahabubnagar	18.3
Nalgonda	17.4
Warangal	19.7
Khammam	16.2
Telangana	**19.5**

Source: Unit Data from Economic Census 2012-13

Table 12. District-wise Percentage of literate women (age 15-49 years) in Telangana 2019-20

District	Literate women (age 15-49 Years)
Jogulamba Gadwal	45.0
Komaram Bheem Asifabad	51.7
Wanaparthy	52.1
Nagarkurnool	57.1
Medak	57.7
Mahabubabad	58.0
Kamareddy	58.6
Nirmal	58.6
Jayashankar Bhupalapally	58.9
Vikarabad	59.3
Mahabubnagar	59.6
Warangal Rural	60.1
Jagitial	62.4
Nalgonda	62.6
Nizamabad	63.1
Suryapet	63.5
Sangareddy	63.6
Rajanna Sircilla	64.7
Adilabad	64.8

Jangoan	65.5
Khammam	66.3
Yadadri Bhuvanagiri	68.4
Bhadradri Kothagudem	68.7
Mancherial	69.5
Karimnagar	70.3
Siddipet	71.0
Ranga Reddy	72.1
Peddapalli	73.7
Warangal Urban	76.9
Medchal Malkajgiri	79.5
Hyderabad	83.6
Telangana	**66.6**

Source: District Fact Sheets, NFHS V 2019-20

Table 13. District-wise percentage of women with 10 years of schooling (age 15-49 years) in Telangana-2019-20

District	Women with 10 or more years of schooling (age 15-49 years)
Jogulamba Gadwal	27.4
Komaram Bheem Asifabad	28.7
Mahabubabad	34.7
Kamareddy	35.6
Nagarkurnool	36.0
Jayashankar Bhupalapally	36.3
Wanaparthy	37.0
Vikarabad	38.3
Medak	39.3
Warangal Rural	40.0
Yadadri Bhuvanagiri	40.0
Mahabubnagar	40.4
Khammam	40.9
Nalgonda	40.9
Nirmal	40.9
Adilabad	41.0
Sangareddy	41.5

Bhadradri Kothagudem	41.8
Nizamabad	42.4
Suryapet	42.5
Jagitial	43.5
Jangoan	44.0
Rajanna Sircilla	46.4
Peddapalli	46.6
Mancherial	48.8
Karimnagar	50.8
Siddipet	51.3
Ranga Reddy	51.4
Warangal Urban	57.2
Medchal Malkajgiri	59.3
Hyderabad	63.2
Telangana	**45.5**

Source: District Fact Sheets, NFHS V 2019-20

Table 14. District-wise percentage of women (age 6 years or above) ever attended school

District	Female (age 6 years or above) ever attended school
Jogulamba Gadwal	47.8
Wanaparthy	49.3
Kamareddy	51.1
Nagarkurnool	51.1
Warangal Rural	51.8
Medak	52.3
Jayashankar Bhupalapally	52.4
Komaram Bheem Asifabad	52.9
Vikarabad	53.1
Nirmal	53.3
Nizamabad	54.3
Mahabubnagar	54.8
Mahabubabad	55.0
Jagitial	55.9
Rajanna Sircilla	56.4
Jangoan	56.6
Suryapet	57.4

Mancherial	58.4
Adilabad	58.6
Yadadri Bhuvanagiri	59.1
Nalgonda	59.8
Sangareddy	60.2
Siddipet	60.8
Peddapalli	61.3
Khammam	61.8
Bhadradri Kothagudem	62.7
Karimnagar	63.6
Ranga Reddy	68.6
Warangal Urban	70.3
Medchal Malkajgiri	72.9
Hyderabad	80.3
Telangana	**60.9**

4.2 Climate Action -SDG 13

According to the SDG Report (2019) the Goal 13 is inter connected to SDG 11 and the state is an aspirant with respect to Goal 13. The Telangana state specific goals on climate action are as follows: 1*) Reduction of the impact of climate change on forest green cover, biodiversity and water resources; 2) Reduction of the impact of climate change on household incomes, particularly agriculture and its allied sectors; 3) Protection of vulnerable*

Table 15: Indicator wise performance in Telangana

Indicator	Parameters	Index Score
13.1	Number of human lives lost per 1 crore population due to extreme	Null
13.1	Disaster preparedness score as per Disaster Resilience Index	13.0
13.2	Percentage of renewable energy out of total installed generating capacity (Including allocated shares)	41.12
13.2	CO_2 saved from LED bulbs per 1,000 population (Tonnes)	6.07
13.2	Disability Adjusted Life Years (DALY) rate attributable to air pollution (per 1,00,000 population)	2710
Overall	-	43

Source: NITI Aayog report, 2021

population against climate induced events; 4) Reduction of the impact of climate change on human and animal health; 5) Achievement of environmental sustainability, including

mitigation measures (EPTRI, 2015). However, Table 15 reveals that the Telangana state is one among the aspirant state with overall score of 43 for 2021 year. Specifically, the percentage of energy out of total installed capacity score is 41. Moreover, CO_2 saved from LED bulbs per 1,000 population is 6 tonnes in 2021. Further, the disability adjusted life years (DALY) rate attributable to air pollution (per 1,00,000 population) in Telangana is 2710.

4.2.1 Trend of Indicators for the Targets

Telangana state has been witnessing frequent droughts over the years. The Telangana State Action Plan on Climate Change (TSAPCC) (2015) assessed the climate trends in Telangana state. According to TSAPCC (2015), climate vulnerability varies across regions and communities in Telangana. Drought plays a predominate role in assessing climate vulnerability index in Telangana[2]. The TSAPCC report reveals that the physical exposure of drought value is about 0.40 for the overall state. Mahbubnagar, Nalgonda, Karimnagar and Adilabad districts are sternly exposed to climate vulnerability in Telangana. The Providing Regional Climates for Impacts Studies (PRECIS) model projected to increase mean annual temperature up to 3^0 C in summer, Nalgonda, Karimnagar, Adilabad and Warangal districts are more would be more affected districts by 2050 and 2080 period. Moreover, the model projection shows that the rainfall varies over 2mm/day and varies across agroclimatic zones. North east rainfall shows amodest increase in the rainfall in North part of Telangana whereas slightdecrease in the south western part of Telangana in future (i.e., projected for 2050 and 2080 periods) compare to thepresent-day climate while the temperature changes appeared more coherentacross the model outputs around 4°C for different emission scenarios). The projected rainfall indicates the possible occurrence of drought situation over Mahbubnagar district by 2080. Telangana[3] is one the most per capita emitted state across states. In 2005, Telangana emitted 2-4 tons of

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[2] The Vulnerability term is often used to describe the potential (adverse) effects of climate change on ecosystems, infrastructure, economic sectors, social groups, communities and regions. According to IPCC, Vulnerability to Climate Change is refers "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, it's Sensitivity, and its Adaptive Capacity." Here it is represented by the occurrence of the climate shocks like droughts, heatwaves and floods (EPTRI, 2015).

[3] Telangana refers to the unified geographical and administrative entity of Andhra Pradesh.

CO_2 equivalent per capita and moved to above 6 tons of CO_2 equivalent per capita emissions category in 2013. Forestry survey of India (FSI) (2019) the capacity of carbon sequestration is 154842 thousand tons (73.77/ha) in 2019.

4.2.2 Strategies for improving the aspirant status by achieving the Targets and the SDG

Recent IPCC assessment report emphasised that the consequences of climate change can be mitigate or reduce by adopting appropriate adaptation and mitigation policies. As highlighted in SDG (2019) report, the climate change impacts are cross cutting many other sectors, several collective and coordinated measures need to be taken by the concern state departments regarding interventions for adaption to climate change. As reported, the state Government has formulated several measures in this direction, and various line departments have been undertaken these initiatives formulated by the GoT. As mentioned above, agriculture and its allied sectors are more sensitive to climate hazards in Telangana. Indeed, there is a need to explore the impact of improved technology interventions in the agriculture sector viz., irrigation management, advanced seed varieties, land use practices, and climate resilient cropping systems. There is an essential to explore the frontier technologies (i.e., Artificial Intelligence) interventions to understand the climate risk assessments, biodiversity conservation, disaster risk assessments, quality controls, e-waste management, disaster risk planning to improve resilience, and stakeholders network assessments. Need to explore the impact of technology interventions in urban waste management. The improvement and effective implementation of technology is not only help to achieve goal 13 but also helps to reduce the poverty and related problems of human beings.

4.3 ICT interventions in achieving Zero Hunger – SDG 2

Achieving zero hunger by 2030 will require new and existing applications of science, technology, and innovation across the food system, addressing all dimensions of food security. Investment in Innovative capabilities are critical not only for ensuring nutritious food at all times but also for harnessing agriculture and the broader food system as a driver of economic and sustainable development. STI for improving food availability could include existing technical approaches, along with new and emerging technologies (table 16). For example, techniques such as the System of Rice Intensification can lead to higher average productivity(contribution from the United Nations Educational, Scientific and Cultural Organization (UNESCO)).

Table 16. Subjects of science, technology, and innovation for food security covers under the SDG 2 – Zero Hunger.

Food security	Challenge	subjects of science, technology, and innovation
Food Availability	Biotic Stress	Tilling machines
		Spatial repellent for on-farm pests
		Improved agronomic practices (for example, push-pull mechanisms)
	Abiotic stresses	Salt-tolerant crops (for example, quinoa, potato)
		Climate-resistant crops
	Improving crop productivity (in general)	Conventional breeding
		Advanced genetic engineering
		Low-cost diagnostic toolkit for extension workers
	improving livestock agriculture (in general)	Low-cost diagnostic toolkits for livestock veterinarians
		Low-cost veterinary pharmaceuticals (ideally thermostable)
	soil	Point-of-use kits for evaluating soil nutrient content
	Need for precise integration, scheduling of inputs for increased yield	Imaging and associated analytics
		Farm management software and applications
	Farming in urban environments	indoor farming
		Vertical farming
		Aquaponics
		Low-cost greenhouses
Food access	Post-harvest loss (storage, refrigeration, transport)	Fruit preservation technologies
		Seed and grain drying, aeration and storage technology
		Low-cost refrigerated vehicles
		Low-cost solar dryers
		Vacuum or hermetic sealing

	Need for harvest and agro-processing equipment	Crop threshers (motorized and bicycle-powered)
		Agro-processing technologies (crop, meat, dairy products, fish)
Food use and	Lack of nutritious foods, especially utilization staple crops High-nutrient staple crops	Vitamin A-enriched cassava, maize, orange-fleshed sweet potato
		Iron and zinc-fortified rice, beans, wheat and pearl millet quality protein maize
	Lack of information on healthy diets	Dissemination of nutrition information (for example, health mobile applications)
Food stability	inability to predict when and how to farm	Weather-forecasting technologies Infrared sensors for detecting crop stress
		Hyperspectral imaging, based on drones and satellites
	Lack of financial mechanisms to ensure income	index-based insurance (crop and livestock)

4.4 Industry, Innovation and Infrastructure in Telangana- S&T interventions - (Sustainable Development Goal 9)

The past two years have been inexplicable for the world as a whole and India in particular. The entire focus was on saving lives and providing support to numerous affected communities given the pandemic situation. Despite this grave situation, Telangana stands out as one of the few states that have successfully managed multiple challenges presented by the pandemic.

In case of industries, the growth rate of the sector was negative (-1.7%) in 2020-21 while it rebounded and grew at a rate of nearly 20 percent (at current prices, advanced estimates) in 2021-22. The industry sector accounted for 20.3 percent of Telangana's gross state value added at current prices in the same year.

As reflected in Table 18, the contribution of the manufacturing sector to the gross state value added (GSVA) is more in Telangana as compared to the construction sector and electricity, gas and water supply and other utility services during 2011-12 to 2020-21. However the last two years of the pandemic (2019-20 and 2020-21) registered a decline in the contribution of all the three sub-sectors of secondary sector.

Table 17. Sector-wise contribution to GSVA (%) at constant (201-12) prices (2011-12 to 2020-21)

Year	Manufacturing	Electricity,Gas, Water supply and other utility services	Construction	Secondary
2011-12	18.5	2.3	6.8	27.6
2012-13	15.2	1.8	6.7	23.7
2013-14	14.3	2.4	5.9	22.6
2014-15	12.6	1.7	6.1	20.4
2015-16	15	1.7	5.7	22.4
2016-17	14.1	1.2	5.3	20.7
2017-18	14.2	1.5	5.6	21.2
2018-19	15.1	1.5	5.3	21.9
2019-20	13.7	1.7	4.8	20.2
2020-21	13.3	1.9	4.7	19.9

Table 18. Growth rate of Industry (2012-13 to 2020-21) (%) (2011-12 constant prices)

Year	Manufacturing	Electricity, Gas, Water supply and other utility services	Construction	Secondary
2012-13	-15.4	-21.1	1.6	-11.7
2013-14	-0.8	40.6	-7.7	0.4
2014-15	-7.5	-23.8	9.2	-4.9
2015-16	32.1	8.8	2.8	21.4
2016-17	1.9	-20.4	1.5	0.1
2017-18	9.3	27.9	14.3	11.7
2018-19	16.6	12.2	4.2	13
2019-20	-3.8	22.8	-4.5	-2.1
2020-21	-3.1	6.1	-2.2	-2.1

The pandemic years (2019 to 2021) registered negative growth rates for the secondary sector as a whole, manufacturing sector and construction sector (Table 18).

The Government of Telangana identifies that industrial development is vital to employment and contribute to increasing productivity in other sectors, has initiated a number of measures to guarantee continuous growth of the Industrial sector. The measures are TS-iPASS to enable the entrepreneurs to do away with the administrative

hassles, schemes for entrepreneurship like T-IDEA and T-PRIDE, and several initiatives for the MSME sector, including Industrial Health Clinics TS-Globalinker, and partnerships with private companies like SAP and Sapio Analytics. The affirmative influence of the government's investments towards consolidation of the industrial sector will start exhibiting in the coming few years, and the benefits will continue to accumulate for many years to come. In this context, it is highly essential to look into the role of Science and Technology in achieving the goals set for the industry – Sustainable Development Goal 9 – Industry, Innovation and Infrastructure in Telangana State.

Science, Technology and Innovation (STI) contributes to economic growth through increased productivity, decreasing costs, and increasing efficiency. STI caters to economic, environment and social components of the Sustainable Development Goals (SDG). For STI to be in place, the requisites are proper infrastructure, competencies and assets along with capabilities of individuals and societies to use and apply them. Innovation is the key goal of SDG 9 which implies that S&T becomes the inherent component of this goal.

4.4.1 The following components of SDG 9 require the STI so as to enable the SDG 9 to achieve the targets.

Energy

✦ Community investment and ownership of energy systems, e.g. solar farms, windmills and biomass plant in the regional level

✦ Local production and local consumption of energy with a focus on renewable energy

✦ Implementation of microgrids[4] in the industrial plants and SEZs

✦ Smart grid management[5] in industries that can use both electricity and data at once.

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[4] Within microgrids are one or more kinds of distributed energy (solar panels, wind turbines, combined heat & power, generators) that produce its power. In addition, many newer microgrids contain energy storage, typically from batteries. Some also now have electric vehicle charging stations.

[5] A smart grid is two-way flow of electricity and data with digital communications technology enabling to detect, react and pro-act to changes in usage and multiple issues. It is alsoan electricity network that uses digital and other advanced technologies to monitor and manage the transport of electricity from all generation sources to meet the varying electricity demands of end-users.

Infrastructure

✦ Development and promotion of Electric vehicle (EV) in the districts

✦ Adoption of Policies such as exempting EVs from consumption and sales taxes

✦ District level action plans for electrifying the freight transport and embracing EVs for delivery and ridesharing

✦ Develop EV battery development units link with MSMEs in each Districts

✦ Development of Logistics and Container units in identified industrial clusters of Tier II and Tier III cities

✦ Digitizing the logistics and railways- kiosk efficiency with the help of ICT

✦ Involvement of local communities for road development

✦ Constructing and checking the performances of warehouses -advanced digitised tools

✦ Development of small airports in each industrial clusters

Industry

✦ R&D activities that develop tools, equipment and machinery for industries

✦ Business incubation centres to be developed in Tier II and Tier III cities

✦ Linking premier engineering institutions with industries and develop affordable technologies for village MSMEs

Water

✦ Smart metering could be used to manage the demand

✦ Desalination or reverse osmosis technologies can be implemented

✦ Technology could enable increased leakage detection

Waste

✦ facilitate recyclable materials technologies, and apply to minimize industrial waste in the environment Novel biodegradable packaging materials

4.5 SDG 4- Quality Education

Educational development for all is crucial in the perspective of human capital, human development and human rights. It has been playing a key role in social and economic

development of countries across the world. The experiences of all developed countries in general and particularly that of East Asian countries demonstrate its impact on economic development. In the economic framework, expenditure on education is considered as an investment and observed to have both the social and private returns for such investment. Moreover, given its social returns over and above the private ones along with that of its externality effect, it is considered as **public good** hence the requirement of *public investment*. In this backdrop, the developing countries experience shows that many of them are struggle to achieving the minimum required desirable educational outcomes such as universal access that reflected through enrolment, attendance and completion, to school education: primary, middle and secondary. Inequality across sub-population groups (by gender, caste, religion, economic conditions, geography or locations) is another area of concern in access to education. Further, another emerging area of concern is that it is not only years of school education completed but beyond that it is the quality of education. In the reality of persistent regional disparities across globe and within the countries along with sub-population group inequalities across social and economic classes in educational achievements, the Development Agenda of the global community included education development as a key element of it. Global community has been urging the countries which are lagging behind to muster their effort in achieving the desirable educational outcomes, while providing them a platform with policy advocacy and technical support along with certain financial support well in certain cases. Previous Million Development Goals (MDGs) and Sustainable Development Goals (SDG) have set the agenda minimising the gaps in educational achievements.

India, although witnessed remarkable progress in its educational development during the last seven decades since independence, its achievement is still falling short of desirable outcomes. Considerable variations across states in this respect are persistent. Telangana achievements and progress is also remarkable in respect of its educational development. It had an initial disadvantage and carried the same for long, being part of educationally backward princely state of Hyderabad during pre-integration and thereafter in united Andhra Pradesh. It could overcome with sustained effort and progressed faster during the last two-and-half decades. The school attendance rates in the state are saturated wherein it is at 98 percent among the 6-14 years it is 88 per cent and among the 15-17 years. The GER in higher education for the state is 36 percent which is 10 percentage points higher than the national average. The number of schools and colleges available per lakh population in Telangana is one of the highest across states in India. More importantly the gender parity in school and higher education is realised in the state

whereas the social group inequalities are reduced to a minimum with a consistent effort of state government interventions, schemes and programmes facilitating them equal educational opportunities. Number of residential schools and colleges for girls in socially disadvantage communities is also key factor in this regard.

Despite these achievements of the state, there are still certain gaps and concerns with its educational development especially that related to quality of education. Adopting SDG-2030 agenda in general at the state level, for SDG-4 the state government would develop a perspective plan, strategies and action plan for addressing the gaps and challenges in its education development. In this regard, the state government is exploring to identify certain aspects related to science, technology and innovations (STIs) relevant in the process of attaining the SDG-4 in the Telangana states context.

4.6 Natural Resources: Forest in Telangana (Life on Land-SDG 15)

Telangana, the youngest State in the Union of India envisages comprehensive, inclusive and holistic development of its people, in the course of achieving the State's vision: 'Bangaru Telangana (Golden Telangana)'. *The vision of Telangana state with respect to SDG-15 is Conservation, Development and Sustainable management of forests and wildlife in the state to attain ecological balance and human well being and extend ecosystem services to meet the social, economic and environmental needs of the present and future generations (see table 19).*

Telangana state is in the category of front runner in India with respect to achieving the SDG goal 15 with a score of 83. However it is performing slightly less as compared to all India level whose score is 90. Government of Telangana is formulating strategies and state action plan to achieve the goal of forest and biodiversity conservation. This also includes wild life protection and natural resources conservation. Major state government initiatives taken up to address SDG goal 15 are 1.Haritha Haram (Afforestation); 2. Soil and water analysis and appropriate nutrition and cropping; 3. Mission Kakatiya; and 4. Development of National Parks and Sanctuaries.

Telangana has a total forest cover (TFC) of 26,969.54 square kilometres, accounting for 24.05% of the total geographical area of the state. Five districts—Bhadradri Kothagudem, Mulugu, Nagarkurnool, Komaram Bheem and Mancherial—together account for more than 50% of the total forest area in the state. Bhadradri Kothagudem accounts for nearly 16% of the total forest area in the state. Telangana is endowed with a rich diversity of flora and fauna with over 2,939 plant species, 365 bird species, 103 mammal species, 28 reptile species, and a large number of invertebrate species. In

Table 19. List of indicators for State Indicator Framework (SIF) for SDGs - Goal 15: Life on Land

Sl.	Goal	Target	National Indicator	State Indicator (SIF)	Data Point Position	Achievement 2019-20	Target 2022-23	Target for 2025-26	Target 2030-31	Periodicity (Monthly / Quarterly / Halfyearly, Yearly)
1	G#15: Life on Land	15.1	15.1.1. Forest area as a proportion of total land area	Forest Cover as a percentage of total geographical area	Direct Value	18.36				Biennial-FSI
2	G#15: Life on Land	15.1	15.1.2. Percentage of Tree Outside Forest (TOF) in total forest cover	Percentage of Tree Outside Forest in total Forest Cover	Direct Value	11.24				Biennial-FSI
3	G#15: Life on Land	15.2	15.2.1. Percentage change in Forest Area coverage	Percentage Change in Forest Cover	Direct Value	0.8				Biennial-FSI
4	G#15: Life on Land	15.3	15.3.1. Percentage of degraded arearestored.	Area Restored- Ha/Total Degraded Area-Ha)*100	Direct Value	27.44				Yearly
5	G#15: Life on Land	15.3	15.3.2. Increasing Tree / forest cover in degraded area	15.3.2 : Increasing Tree/ Forest cover in degraded forest/ area	Direct Value	163 (117&46)				Biennial-FSI
6	G#15: Life on Land	15.3	15.3.3. Percentage increase in net sown area	15.3.3. Percentage increase in net sown area	Direct Value	-5				Yearly
7	G#15: Life on Land	15.4	15.4.3. Conservation of local wildlife species	15.4.3.: Conservation of local wild species.	Direct Value	140	250	400	500	Yearly
8	G#15: Life on Land	15.6	15.6.1: Number of Access and Benefit sharinf Agreements signed.	15.6.1: Number of Access and Benefit sharinf Agreements signed.	Direct Value	TSBDB 43 agreements			Yearly	

contd.. table 19

Table 19. List of indicators for State Indicator Framework (SIF) for SDGs - Goal 15: Life on Land

Sl.	Goal	Target	National Indicator	State Indicator (SIF)	Data Point Position	Achievement 2019-20	Target 2022-23	Target for 2025-26	Target 2030-31	Periodicity (Monthly / Quarterly / Halfyearly, Yearly)
9	G#15: Life on Land	15.7.1	15.7.1: Percentage reduction in traded wildlife that was poached or illicitly trafficked.	15.7.1 : Number of cases registered under Wildlife Protection Act	Direct Value	121				Yearly
10	G#15: Life on Land	15.a.1	15.a.1 : Official Development assistance and public expenditure on conservation and sustainable use of bio diversity and ecosystem.	15.a.1 : Official Development assistance and public expenditure on conservation and sustainable use of bio diversity and ecosystem.	Direct Value	4572 crores				
11	G#15: Life on Land	15.c.1	15.c. 1 : Number of detection and prevention of traded wildlife that was poached or illicitly trafficked.	15.c. 1 : Number of detection and prevention of traded wildlife that was poached or illicitly trafficked.	Direct Value	121				Yearly
12	G#15: Life on Land			Number of nurseries established	Direct Value	12738	12738	12738	12738	Yearly
13	G#15: Life on Land			Number of seedlings planted	Direct Value	108700000	126700000	130000000	150000000	Yearly

2021-22, the forestry and logging sub-sector added Rs.1,944 crore that accounted for 1.77% of the Gross Value Added by the primary sector and 0.32% of the total Gross State Value Added at constant (2011-12) prices. Between 2014-15 and 2021-22, the GVA at constant (2011-12) prices by the forestry and logging grew from Rs. 1,715 crore in 2014-15 to Rs.1,944 crore in 2021-22; an absolute increase of 13.35% at a Compound Annual Growth Rate of 1.81%.

The Government set a target of planting 23,000 lakh seedlings across the state from 2015-16 to 2021-22. By January, 2022, 23,599.5 lakh seedlings had been planted—an achievement of 102.6% against the target. There are 12 protected areas in Telangana that includes 9 wildlife sanctuaries and 3 national parks covering a total of 5,692 sq.km. This also includes the Amrabad and Kawal Tiger Reserves. 29 Sewage Treatment Plants (STP) are operational in the state accounting for a total capacity of 885.5 million litres per day (MLD) and utilization of 735.8 MLD.

The 'Disability-Adjusted Life Years' (DALY) Rate attributable to air pollution (per 1 lakh population) is 2,710 in Telangana compared to the national average of 3,469, implying that per 1 lakh population, 759 fewer persons suffered from deaths and diseases on account of air pollution in Telangana than in the country as a whole. In all years from 2016-17 to 2020- 21, the Government has ensured that 100% of the Bio-Medical Waste (BMW) generated in the state is treated either through incineration or autoclaved.Telangana state has taken up many important initiatives towards achieving the SDG goal 15. These are as below.

4.6.1 Haritha Haram: This flagship programme (started on July 5th 2015) of the State envisages to increase the present 24% tree cover in the State to 33% of the total geographical area. The first objective is to rejuvenating degraded forests by a multi-pronged approach. 230 crore seedlings are proposed to be planted in the state and out of this, 130 crores seedlings are proposed to be planted outside the notified forest areas. 100 Crores within Forest areas (20.00 Crs through plantations and 80.00 Crs through rejuvenation).The second week of July every year marks a major milestone for the initiative as the planting drive is relaunched on an extensive scale in entire Telangana.Cutting-edge technological interventions like improved planting stock, GIS (geographic information system), MIS (management information system), remote sensing, tagging of each plant and DGPS (differential geographic positioning system) are being used extensively to make forest management in the State a role model for the nation.

In non-forest areas, various approaches like avenue plantation, barren hill afforestation, institutional plantations, agro-forestry, tank foreshore, canal bank, river banks and rivulets, green panchayats, Smrithi Vanams and planting in urban residential colonies, schools, parks, playgrounds are being were taken up in earlier rounds of the programme. An estimated 3,699 nurseries have been identified to raise adequate stock of plantations by various agencies, including Forest Department, District Water Management Agency, Agriculture and Horticulture and Tribal Welfare departments, for achieving the target. In addition to the existing species being planted under the haritha haram, more priority should be given to species like Peepal, Banyan, Tamarind and traditional Mango varieties.

At the State-level, two committees have been set up to monitor the progress of Haritha haram– State-level Coordination and Monitoring Committee and State-level Steering Committee, headed by the Chief Secretary. Funds for the programme are met from the State Budget and are also drawn from MGNREGA and Compensatory Afforestation Fund Management and Planning Authority (CAMPA) of the Central government. A recent nation wide report released by the Forest Survey of India makes it clear that Telangana is one of the states where greenery is growing significantly. Telangana is also at the forefront of alternative forestry and natural forest restoration schemes with the benefit of CAMPA funds.

Figure 5. Seed ball bombing by drones in the forest areas

4.6.3 Seed Bombing: In a most novel and advanced initiative for enhancement of tree cover in the state of Telangana, the geotagged "Drone Swarms" dropped one lakh "seed balls" per day making it the fastest way of sowing seeds for forest regeneration. Once it starts raining, the balls open up and seed starts germinating. Seedballs are created by local communities dependent on the forest area are being dropped by the Drones there by making seed sowing faster and more reliable in difficult terrains (see figure 5).

4.6.4 Palle prakruthi vanam: Telangana government will create Palle Prakruthi Vanams (forest-cum-park) in each of the 12,000-plus Gram Panchayats across Telangana in the coming years. It will be developed into a recreation spot for children and adults. In the prakruthi vanams, plantation of 4,000 saplings is being taken up in an area of one acre land which include a variety of fruit bearing plants**(see figure 6)**.

Figure 6. Palle Prakruthi Vanam GP: Mallannapalem; Mandal: Mudhigonda; District: Khammam

4.6.5 Miyawaki method of Afforestation: Telangana government has introduced the Japanese Miyawaki method of afforestation to grow urban forests and expand the green cover from 24% to 33%. Miyawaki is a Japanese technique introduced by **Japanese botanist Akira Miyawaki**, that helps build dense, native forests in a short time. Miyawaki method helps to create a forest in just 20 to 30 years, while through conventional methods takes anywhere between 200 to 300 years. It has revolutionized the concept of urban afforestation by turning backyards into mini-forests. This method includes planting trees, only native species, as close as possible in the same area

To achieve the target set by the Telangana state for achieving the SDG goal 15, it is essential to Align the departmental Vision (15 years) to SDGs & Bangaru Telangana and integrate department wise schemes focusing on use of science and technology. Conservation of forests and biodiversity has to be given top priority by the state. Departments must ensure a monitoring mechanism wherein the goal is monitored and the schemes helping in achieving the goal are strengthened regularly.

Convergence of departments of environment, forest and science and technology is important. Collaborations between them for knowledge, technology, capacity building, partnership with peoples.Similarly Technology intensive - mobile based, clouding, artificial intelligence has to be used. Coupled with Innovative – space for frugal innovations, experimenting.

4.7 Traditional Occupations–Opportunities of S &T interventions (SDG-8: Decent work and Economic growth).

Human progress has been based on advances in science, technology, and innovation. This was seen with the dramatic increases in growth and productivity from various technological revolutions. There is a need to adopt technological advancements in every part of our lives. It is also important to realise the need to also consider social and environmental factors when developing strategies that reflect the SDG's goals. SDG goal eight aims to Promote inclusive and sustainable economic growth, employment, and decent work for all. Sustained and inclusive economic growth can drive progress, create decent jobs for all and improve living standards.

Revamping of rural economy is critical for the livelihood of majority people in Telangana. Of the 3.5 crore population in the state, about 2.13 crore population lives in rural areas. While agriculture has been mainstay of rural folk in Telangana, non-farm activities fetch additional income apart from providing direct livelihood to many. Non–farm activities in rural economy include animal husbandry i.e., production of milk, meat,

poultry, fishing, agro-processing industries and storage etc. Sizable population also depend on traditional occupations and are engaged as black smith, bronze-smith, carpenter(**see figure** 7), goldsmith, potter, tailor, toddy tappers, stone cutters, washer man and weavers etc., for their livelihood. Few of the occupations and scope for S &T interventions is discussed in the following paras.

Figure 7. Traditional Livelihood of Carpentry

4.7.1 Vaddera

In Telangana State, the Vaddera community is one of the 130 Backward Castes which is classified under the BC–A category. The category comprises "aboriginal tribes, vimukta jatis, nomadic and semi-nomadic tribes". The community is spread across the State and the population of the Vadderas is about four lakhs, accounting for 1.1% of the State's total population. The community still predominantly pursues its traditional occupations. Based on the type of traditional work, the Vadderas can be broadly divided into two sub-groups, namely, Banda (stonework) Vaddera and Matti (earthwork) Vaddera. The former work as stone cutters, while the latter are engaged in digging and excavation for wells, tanks and foundations - including diverse construction related activities of late.

The Vadderas are among the poorest and the most vulnerable occupational communities of the State. The community is caught in a vicious circle characterized by low incomes, low educational and skill levels, lack of occupational diversity, financial incapacity to adopt technology, seasonal migration and gross under-representation in formal employment and legislative and governance institutions. As a result, the community has not been able to break into a higher socio-economic trajectory. And the hereditary construction related activities are increasingly becoming less dependable on account of unfavourable regulatory policy environment, lack of skill and technology upgradation, competition from other communities and grossly insufficient allocations and financial support from the State Government.

Traditional Occupations of Vaddera

A study done by Centre for Economic and Social Studies (CESS), in 2021, found that close to 90% of the Vaddera workforce is engaged in the traditional activities of stonework and earthwork which, on average, account for 78% of the household income(**see figure 8**). All the sample households are willing to continue the traditional occupations in the absence of alternatives. Nearly 40% of the households pursue earthwork and the rest (60%) are engaged in stonework across rural and urban areas. On average, earthwork provides 151 days of employment in a year while stonework offers 202 days. The average wage (Rs 441) of earth workers is far greater than that of stone workers (Rs 294). The Vadderas of urban areas receive higher wages than their rural counterparts in both earthwork and stonework streams.

The hereditary occupations have been adversely impacted by modern technology. All sample households were unanimous in reporting that modern technology—in the form of proclainer, JCB, compressor, crushers, blasting material, tipper, and tractors—has negatively impacted their livelihoods. Only 5% of the households are in possession of modern equipment. Therefore, the community expects the Government to extend financial support for procuring modern machinery and tools.

Three-fourths of the earthwork households reported migrant members. Usually, the seasonal migration is undertaken between November and March to locations within the State and neighbouring States. Less than a fifth (17%) of the stonework households reported seasonal or short-term out-migration. The Vaddera migrants encounter harsh living and working conditions at their destinations. The vast majority of migrant workers (70%) stay at work sites in makeshift structures and the rest stay in or close to nearby habitations. An overwhelming 93% of migrants reported hardships and constraints such as those related to WASH (Water, Sanitation and Hygiene), wages (absence of wage advances and delays in payment) and health issues.

The Vadderas eke out a precarious living through traditional activities owing to inadequate and unreliable opportunities. Migration exacerbates their vulnerability exposing them to a range of risks and deprivations. The Vadderas are unable to mechanize their operations on account of financial incapacity and lack of financial support from the State Government. The existing regulatory policy environment is unconducive to hereditary occupations. The following Act and the GOs are particularly relevant in this regard: (1) the Andhra Pradesh Water, Land and Trees Act, 2002 (the WALTA 2002); (2) the G.O. No 38 of 2015; and (3) the G.O. No 48 of 2017. Certain provisions of these policies are restrictive and hence impede the community's access to traditional livelihoods.

Figure 8. Vaddera community members seeking livelihood through stone cutting and Earth works

4.7.2 Kummari

In Telangana State, the Kummari community is one of the 130 Backward Castes which is classified under the BC–B category. The traditional and primary occupation of the community is pottery. The community is spread across the State and the population of the Kummaris is about 4 lakhs accounting for some 1.1% of the State's total population. In relative terms, the community remains socially and economically backward and politically under-represented with its unique rituals and customs. A large proportion of Kummari households still rely on the traditional activity as a primary livelihood option

in Telangana and contribute to the economy by making a wide range of pottery. But the returns from the activity have been moderate for most households. Pottery-making in the State is beset with a range of constraints, such as - scarcity of raw materials; low investments; obsolete technology; lack of product diversification; and poor marketing mechanisms due to which potters depend on intermediaries.

Traditional Occupation of Kummari: Emerging Trends and Issues

The studydone by CESS found that 92% of the Kummari households are willing to continue the traditional activity despite the headwinds associated with production and income levels **(see figure 9)**. Three-fourths of the households (75%) affirmatively stated that their children (younger generation) may have to continue the traditional activity, mainly due to the lack of alternatives.

In a majority of locations studied, clay is not available locally. They procure it from neighboring villages and even from locations that are 50-70 km away from the village. Clay is procured by paying Rs 2,000 per tractor load in rural and around Rs 7,000 per lorry load in urban areas. A majority of Kummari households reported difficulties in procuring firewood; they source it from nearby sawmills by paying some Rs 3,000 per tractor load.

Figure 9. Potter in action on potters wheel for making earthen pots

More than half(60%) of the Kummari households do not have adequate space or structures for storing their products and raw materials and a majority of the households (67%) have baking kilns on their homesteads. Close to 7% of the households, mostly in urban areas, reported that air pollution caused by bhattis (kilns) has emerged as a major issue that needs to be addressed as a priority. In some locations (such as Hyderabad and Warangal Urban) some locals even lodged complaints and filed suits against the polluting kilns.

An overwhelming 74% of the Kummari households do not have any marketing arrangements as customers themselves come to their places to buy the products. Close to 8% of the potter respondents said that they rely on their agents to market their products in other places. And nearly a tenth of them stated that they supply their products to intermediaries who in turn sell the wares at markets or in public places.

Traditional pottery is a labor-intensive family activity, but modern technology has made the entire production process relatively easy and more efficient. The technology uptake by the community has been slow as the older generation is still comfortable with the traditional equipment. The study found that potters from 42% of the households have attended training programmes conducted by Government agencies. However, 92% of the training participants conveyed that the Government did not provide them with modern machinery or financial assistance. Only, over a third (36%) of the sample households reported to be using modern equipment.

This calls for the need to provide good technological support for the communities with traditional occupations so as to improve their economic situation by improving the efficiency of their traditional skills.

4.7.3 Special Skills and Trades

Telangana Arts and Crafts

Telangana is a great place for arts and crafts with many astounding handicrafts.

Bidri Craft

The unique art of silver engraved on metal. Black, gold and silver coatings are applied on this. It involves various stages like casting, engraving, inlaying and oxidizing. The name of this art form is derived from a town called Bidar (currently part of Karnataka) of the erstwhile Hyderabad state.

Banjara Needle Craft

Banjara Needle Crafts are the traditional handmade fabrics made by Banjaras (the tribal Gypsies) in Telangana(**see figure 10**). It is a form of embroidery and mirror work on fabrics employing the needlecraft.

Figure 10. Banjara needle craft of Telangana state

Dokra Metal Craft

Dhokra or Dokra is also known as bell metal craft and is widely seen in Jainoor Mandal, Ushegaon and Chittalbori in Adilabad district. The tribal craft produces objects like figurines, tribal gods, etc. The work consists of folk motifs, peacocks, elephants, horses, measuring bowl, lamp caskets and other simple art forms and traditional designs.

Nirmal Arts

The renowned Nirmal oil paintings use natural dyes for depicting themes from the epics such as Ramayana and Mahabharata. Also, the wood paintings and other wooden articles, has great aesthetic expression(**see figure 11**). The origin of the Nirmal craft is traced back to the Kakatiya era. The motifs used for Nirmal craft are floral designs and frescoes from the regions of Ajanta and Ellora and Mughal miniatures.
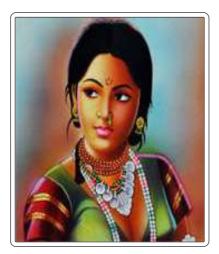
Figure 11. Beautiful Nirmal craft of Telangana

Bronze Casting

Telangana is famous world-wide for its amazing Bronze castings(**see figure 12**). While using solid casting of icons, the mould is created using several coatings of different clays on a finished wax model. This process then imparts fine curves to the cast image.

Figure 12. Bronze castings are unique to Telangana state

Preserving and protecting the skills and knowledge of traditional crafts is a growing challenge. Skill showcase, design education, creative and product development workshops can be followed up with pricing, marketing, branding, micro-finance. Creationof a digital repository of the traditional artifacts to trace the design evolution of these traditional crafts is essential.

5. Brain Storming Workshop

In collaboration with TSCOST Brainstorming session on "Mapping the Science and Technology Interventions in achieving SDGs in Telangana State "was held on 8 December, 2021 at 11 AM in the seminar hall at CESS. In addition to participation by representatives of different organizations, Sri Marupaka Nagesh garu, Member Secretary, TSCOST and his team of officials were actively involved in the brainstorming workshop.

Prof. E. Revathi, Director, CESS welcomed the participants and also gave brief account of the back drop of the brain storming workshop(**see figure 13**). She highlighted how the Sustainable Development Goals (SDGs) expanded the focus of development by integrating economic, social and environmental dimensions of sustainability. Sustainable development embraces this so-called triple bottom line approach to human wellbeing. She further stated that almost all the world's societies acknowledge that they aim for a combination of economic development, environmental sustainability and social inclusion, but the specific objectives differ globally, between and within societies. The 17 SDGs and the 169 related targets from an overarching development framework are meant to guide the efforts of the government and non-state actors at different levels from global to local until 2030. The SDGs and their targets form a complex, integrated system with clear sectoral emphasis and strong linkages among goals and targets, reflecting synergies and tradeoffs. Poverty, gender equality and climate change have emerged as the world's biggest challenges. All key development stakeholders have reached a consensus on the need and urgency for adopting, implementing and monitoring the SDGs at the national, sub-national and local levels.

Professor Revathi informed the workshop participants, that CESS has done a Sustainable Development Goals project for the Planning Department as a contribution to this Telangana State Council for Science and Technology has selected CESS for the "Mapping of Science and Technology Interventions in achieving the SDGs in Telangana State". As most of the faculty has been involved in preparing the SDG report, the same were also asked to prepare the desk review for presenting in the brainstorming session with regards to what kind of science and technology interventions can be used or made to implement sustainable development goals effectively. Accordingly, the invitation has

been sent to all the related institutions, research organisations, universities, etc., which can contribute to the Science and Technology Interventions project for SGDs.

Figure 13 Prof.Revathi, Director-CESS explains the methodology of the S & T mapping

It is evident that, in achieving the Sustainable Development Goals, there are three dimensions: important Economic, Sustainability, and Climate achieving Sustainable Development Goals. This project aims to determine why science and technology are required to achieve SGD goals and determine where the science and technology interventions are needed and with these innovations to achieve SDGs successfully. Where precisely the STI interventions are needed and what kind of interventions need to be identified by the CESS, which is also the project's outcome.

Sri Marupaka Nagesh, Member Secretary, TSCOSTspoke in detail aboutIndia's commitment to achieving the SDGs, the Government of India has launched a significant initiative to formulate Science, Technology, and Innovation (STI) roadmaps for SDGs, which the Office of Principal Scientific Adviser (PSA) is spearheading to the Government of India. In line with this initiative, all the States were directed to identify the gaps related to the implementation bottleneck for SDG and attract the Science and Technology Intervention. For the Telangana State, the Project was handled by the Telangana State Council for

Science and Technology (TSCOST), Hyderabad Centre for Economic and Social Studies (CESS) has been identified as the knowledge partner for this exercise. TSCOST has selected the CESS as the anchoring institute for the "Mapping of science and Technology interventions and achieving SDGs in Telangana State". Making the SDGs achievable at all levels (State Level, District and Mandal level) and identifying the implementation bottlenecks and figuring out the solutions for the holdups at disaggregate level (Community level). To make SDGs reach, leaving no one behind across socio-economic categories, zero regional imbalances. Sri Nagesh has highlighted how the present project intends to come up with the State's own template of STI for SDGs roadmap, including at the district level, as well as suggest the way forward for State's contribution and engagement at National Level. In this connection this brainstorming session will be pivotal, issues raised will be taken for the further consideration with respective stakeholders.

A brief presentation by Dr. Alivelu Kasturi, Associate Professor , CESS on the desk review by the CESS faculty, identifying a few possibilities of science and technology interventions in a few SDGs. She has presented on few SGDs and the areas to be focused to achieve these SDGs through S &T interventions. These include SDG – 1(Measurement of Poverty, Financial Inclusion and Social Protection Programmes), SDG 2 (Food Security and Food Availability) , SDG -3(Universalisation of Education), SDG -5(Gender Equality), SDG 9 (Energy, Infrastructure Development, Industry Establishment, Water user efficiency and Waste Management), SDG 10 (Strengthening the Statistical Data and Digital Divide), SDG 16 (Peace, Justice and Strong Institutions Science and Technology Interventions)

Dr. C. Rama Rao, CRIDA, stressed the need for formulating Sustainable Policies. He underlined the recent government policies or implications regarding Agriculture by the Telangana State Government which have raised climate change and climate pollution issues. Telangana state has the largest area of irrigation under rice which is the primary reason for climate change, through methane gas emissions. He emphasised the need for few innovations like System of Rice Intensification (SRI), wet seeding, drum seeder are the need of the hour. Few technologies can reduce the water use and fertilizer using rice production so that the rice production will be more efficient, especially in the light of expanding area in the Telangana state. According to him the policy of sheep distribution to specific communities by the Telangana Government has also raised the issue of climate change. There are also emissions from the livestock, which affect climate change. There are a few techniques where the emissions can be reduced. Also, the management and protection of the livestock needs to be monitored, Further, Telangana state stands at

second position in fertilizer use there, hence introduction of new techniques for the fertilizer use efficiency is required.

He lauded the Haritha Haram programme which is a novel initiative by the government of Telangana, which can undo the climate damage. This needs to be monitored efficiently, and the benefits should be quantified accordingly.
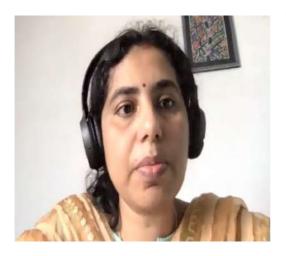
Diversification of agriculture in Telangana is the main thrust area to be focussed and based on soil quality, the agriculture pattern shall be taken up. The diversification of crops leads to increased farm income, addressing the issue of food nutrition, helps in tackling the water and fertilizer use efficiency.

Prof. B. V. Sharma, University of Hyderabad felt that regarding healthcare government of Telangana is performing well in delivering health-related issues. However, according to him, the primary concern is the healthcare of tribals, the essential issue to be addressed is the prevalence of tuberculosis among the tribals, which occurred due to a change in food culture.

The food habits of tribals have been changed due to different kinds of policies by different governments for the period now that the central issue concerning the tribals health and their food security is government should focus on paying fair prices, better prices for the non-timber products and tribal food products. The science and technology intervention primary focus can be on improving the marketing of the tribal products and also science and technology in food processing of the tribal products is also a significant area which can significantly reduce the financial stress among the tribals.

Prof Sharma, felt that we are addressing the need for Food and not Nutrition. Food is a cultural category, and Nutrition is a biological category. Biodiversity is also linked to the livelihoods of the tribals. Need science and Technology Interventions in supporting the in-situ conservation; promoting this is necessary. There is a need for the Strengthening the telemedicine and local RMPs in improving the health of tribals. We need to look into what kind of S&T are needed to strengthen the local institutions in line with the Healthcare and Agriculture practices, highlighting the local practices, making the S&T interventions tuned with these. Transfer of western technology is not the solution, but the alignment of the technology in tune with the tribal practices.

Dr. Pulomi Bhattacharya, School of Livelihoods and Development, TISShighlighted the need for technological intervention in Organising the farming community concerning post harvests and mitigating the problems arising after the harvest. Securing the Land rights for the Women Farmers, several NGOs and other institutions have already worked

towards this need. This is major in achieving SDG 5. Some kind of technological intervention can be initiated to address the issue. Technological interventions shall be introduced to reduce the drudgery, like already available techniques like seed drummer etc., which can be easily accessible for the who are not using them.

There is a need for some kind of technological innovation in tracking the early childhood in seasonal migration. Connecting the students to their respective Schools with online classes can be more helpful. Such kinds of practices can be institutionalized. Encouraging the individual to be an entrepreneur can be most effective. Some technological innovation can be placed to equip them with all the needed skills.

Dr. Uma Reddy, Agricultural Research Station, Warangal has drawn the participants attention towards themismanagement of crop residue is a primary concern, as the crop residue is brunt, it creates much pollution and damages soil quality. We are losing the organic carbon in the soil, and mutant availability is reduced. In turn, farmers will have to apply more and more fertilizer. There are a few techniques for crop residue management. This can be documented and popularized

Intense cropping of rice will lead to water stress, fertilizer stress etc., in place of paddy, there is a need to go for Irrigated dry(ID) crops. The ID technique by a few farmers can be documented and popularised. Crop diversification has to be encouraged by the state.

The cultivation of Sunhemp crop helps increase soil fertility, and the produce can be used for multiple purposes. The marketing facility for the seeds and cropping can be taken up. Taking up of Mustard crop, which attracts the honey bees, parallelly farmers can set up the beehives, which can provide the additional income for the farmers. Alternative weeding and drying can also increase the farming income and the productivity of the crops.

Prof. Mamatha, Forest college and Research Institute explains how the bio-fertilizers are being prepared using the cattle waste and in the Haritha haram, from nursery to field level, through some technological intervention.

To encourage post-harvest management techniqueMinistry of MSMEis adoptingCluster approach - where 50-60 farmers can be formed, incentives can be given to each cluster. The range of subsidies was given to the farmers' group and particular assistance from NABARD for FPO in arranging the infrastructural facility.

MSME is having a Incubation Scheme where in any institution developing the innovative technology, Rs. One crore will be provided to set up the business incubation scheme.

Under Aspire Scheme – Livelihood Business Incubation and Technology Business Incubation was the initiative introduced for the social and economic development of the Tribals and others. These are centers where the individual techniques and skill development centers.

Zero effect and Zero Defect – under the scheme, the incentives were given to the industries for renewable and sustainable energy. Technology Centres and Tool Rooms – for redesigning and upgrading the technology, consultancy services were provided and assisted in the development of designs. The cluster approach can be highlighted with regards to technology interventions. Ninety percent subsidy is given to the expected technological facility, post-harvest technology or food processing technology.

Nagesh, Save the Children spoke about the digital divide due to the online mode of classes, easy and low cost the technology for the reachability and easy access. Community radio can be reviewed to reach the children in remote areas.

The brainstorming session identified the focus areas for the S&T interventions in achieving the SDGs in Telangana State. The workshop ended with a formal vote of thanks.

6. Conclusions and Recommendations

Societal Intervention of S & T is an emerging field of action research that holds promise for the future of our country. This field builds on interactions among humans, their technologies, and the environment, and on the use of such knowledge to advance sustainability goals towards equity to address problems related to water, food, energy, livelihoods, health, habitat, mobility, and environment services. Therefore, S & T based innovative technology development and delivery programmes need to be formulated especially for the vulnerable section of society basically around sustainability science to involve and empower such disadvantaged sections of the society with new/improved skills and knowledge for livelihood security.

Therefore by using appropriate management techniques and innovative scientific tools and techniques, the resources have to be used in a more effective manner for sustainable development through collective cooperation between different stakeholders which includes government functionaries, industry, academia and the society at large. It requires building specific S & T programmes that involve the collective wisdom of all sections of society.

Telangana State plays a vital role in the Indian Economy with precious natural resources supported by robust industrial, agricultural, commercial, educational, research and developmental activities. The State possesses vast potential for development of Agriculture, Industry, Infrastructure, Environment, Health & Education through intervention of Science & Technology. New specializations like Nano Science & Technology, Spatial Technologies, Earth Sciences, New and Renewable Energy and advanced subjects need special attention of Science & Technology.

Globalisation, Knowledge penetration and Advancements in Information & Communication Technologies, Space, Energy, Bio-informatics, Intellectual Property Rights, Climate Change, Pharmaceuticals and Biotechnology have triggered new challenges for intervention of Science & Technology.

Telangana state boasts of hosting a good chunk of the country's Science & Technology Infrastructure representing almost every sphere of scientific and technological activity that the country is focusing on. A number of Govt. of India & State owned institutions have transformed the region into a knowledge hub and laid strong foundations for multi-fold growth of the economy.

Telangana State leads in Research and Development of several prime movers of the country such as Chemical, Pharmaceutical, Cellular & Molecular Biology, Information Technology, Electronics, Heavy Water, Electrical, Atomic Energy, Remote Sensing, Geophysics, Nutrition, Agriculture, Advanced Materials, Metallurgy and a host of other sectors. Besides this, the State is a strategic location for a number of Defence establishments engaged in research and development of missiles, warfare etc. much essential for the security of the country.

Over the years, due to population explosion, the State is experiencing critical problems in the areas of Agricultural Output, Drought, Natural Calamities, Global Warming, Scientific Illiteracy, Climate Change, Energy & Water, Unemployment / Underemployment. This calls for interventions of Science, Technology & Innovation in a larger dimension on a continuing basis.

To address the above issues through S&T sector, the following infrastructural facilities are required:

✦   District Offices with supporting officers and staff for replication of Technologies and Promotion of Science in the Districts

✦   Regional and District Science Centers for promotion of Scientific Literacy through experimentation, demonstration and dissemination of Science and for popularization of science.

✦   Technology Parks & Business Incubators for development of innovative solutions for societal applications/ transfer of successful technologies from lab to land and promoting S&T entrepreneurs.

Table 20. SDGs and related interventions/projects of TSCOST in Telangana state

Related SDG code	SDG related Target code	TSCOST proposed Intervention / Programs/ Projects to achieve the targets
2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture	2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	Implementing BARC technologies on improved seed varieties for increasing agricultural productivity and incomes of farmers
		Implementing BARC technologies on Radiation Processing of Food and Agricultural products
		Introduction of improved shrimp farming techniques
		Protecting traditional sciences and technologies – training and supporting artisans for value addition and non-farm employment.
		Promotion of organic farming practices such as use of vermin-compositing, bio-pesticides and bio-fertilisers and imparting training to farmers on these aspects.
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes	Implementing Popularisation of Science activities such as workshops, demonstrations, organising days of scientific importance, training programs, interaction with scientists, programs on science behind miracles and programs on superstitions etc. for development of scientific temper aiming at socio-economic development.

Contd.. Table 20. SDGs and related interventions/projects of TSCOST in Telangana state

Related SDG code	SDG related Target code	TSCOST proposed Intervention / Programs/ Projects to achieve the targets
		To create facilities to provide access to interactive science exhibits and scientific programs in order to provide them quality primary and secondary education and Programs to build the capacity in Science, Technology & Innovation at the State Level : Establishment of Science centres in all the Districts.
		Establishment of Science City in Hyderabad.
		Establishment of Innovation Hubs in Science City and Science centres
		Support programs on Science, Technology and Innovation in all the districts.
		Creation of Technology Bank : Development of an IT portal for all the technologies developed by CSIR, ICAR, ICMR, DAE, DRDO, ISRO etc. with preliminary information on the utility of these technologies and updation, maintenance of the same continuously.
7 Ensure access to affordable, reliable, sustainable and modern energy for all	7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	Implementing as many Bio-digestors as possible for converting kitchen waste into energy
		Location specific research projects on Energy for initiating need-based, resource-based projects
8 Promote sustained, inclusive and sustainable Economic growth, full and productive employment and decent work for all	8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value-added and labour-intensive sectors	Collaborating with CSIR, ICAR, BARC, DRDO, APCTT, NPC, NIMSME etc. and arranging programs on technology upgradation and promotion of Innovation for productivity improvement.
		Conducting studies on Optimum utilisation of machinery in Industries and suggesting technology upgradation measures
		Conducting studies on technology levels of existing industries and suggesting the available alternative and new technology options

Contd.. Table 20. SDGs and related interventions/projects of TSCOST in Telangana state

Related SDG code	SDG related Target code	TSCOST proposed Intervention / Programs/ Projects to achieve the targets
9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	Extending support for programs aiming at a) Establishment of Centres of Excellence in niche areas of S&T, Technology Business Incubator b) Innovation Promotion c) Increasing the number of Scientific personnel i.e. Scientists, Research Scholars etc.
11 Make cities and human settlements inclusive, safe, resilient and sustainable & 12 Ensure sustainable consumption and production Patterns	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management & 12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	Implementing BARC technologies on Municipal Sewage Sludge Radiation Treatment
		Implementing IPR technologies such as Plasma Pyrolysis for safe disposal of bio-medical waste and Plasma Nitriding to prevent corrosion on Iron, Metals and pipes etc.
		Implementing E-waste management programs in association with C-MET and STPI etc.
		Installing CO_2, CO and SO_2 trapping machines at junctions in cities
		Installing Bio-digestors for converting organic and kitchen waste to energy.
		Promotion of organic farming practices such as use of vermin-compost, bio-fertilisers and bio-pesticides etc.
		Promotion of programs aimed at reducing Plastics usage, Training on Handmade Paper making and usage etc.
		Identifying the merits and demerits of these technologies and finding suitable technologies for implementation in the State.
		Implementing the technology transfer mechanisms

As many as 25 Minor research projects have been supported during the past 8 years period for study on various processes ranging from Agriculture, Industry, Poultry, Fisheries to Organic Farming methods. These projects resulted in creation of invaluable knowledge generation for development of various connected sectors.

Based on the analysis the present study identified the following focus areas for the S&T interventions in achieving the SDGs in Telangana State

6.1 Strengthening of human resources

Promote Individual inputs towards R&D to address issues for communities in general and vulnerable sections in particular. Promote individual innovations to solve grass root problems. Involve larger number of scientists in technology adaptation and transfer programmes.

6.2 Strengthening Institutional capacities

State S&T council as tools for technology absorption and deployment. ™ Strengthening of S& T capability in rural areas. Networking of institutions based in rural areas. S&T at the Panchayati Raj Institutions.

6.3 Agriculture

Implementation of new approaches in Seed Preservation; Introduction of new crops of grains, new varieties of fruits, flowers, value addition, agro-biotechnology; New methods for improvement of soil fertility, water conservation, crop yield, reduing soil salinity etc. and New methods for protection of crop in association with Agriculture & Horticulture Departments, Agricultural Universities, Krishi Vigyan Kendras etc.

Conservation and promotion of millet based bio-diverse agricultural systems in the dryland areas of the state.

Soil Testing: Soil sample analysis using latest technology covering macro and micro nutrients.

Alternative cropping - reduces the stress on soil. Rather than continuously cropping paddy, which diminishes quality of soil. It can be regained with cropping of ID crops.

Synthetic and Organic fertilizers – Bio-fertilizers shall be prepared using cattle waste Low-cost diagnostic toolkit for extension workers - Improving the Productivity in Agriculture

Encouragement to biodiverse based millet cultivation Promotion of Organic farming on pilot basis in atleast in few villages covering all the new districts of Telangana state.

6.4 Environment Protection

Implementation of new methods based on IoT, GPS, GIS, Remote Sensing and bio-technology etc. for control of pollution of air, ground water, soil contamination etc. caused due to mining, industries, animal slaughter houses, textile mills, handloom saree making clusters and Implementation of new methods for conversion of plastics into bio-degradable material / other re-cyclable forms to reduce the effect on environment in association with TSPCB, EPTRI, Industries Department and Handlooms & Textiles department etc.

Reducing carbon footprint and adopting green environment.

Some of the areas that need immediate attention in the wake of changing climate are Sea-level rise, Soil-erosion, Extreme weather conditions including wet & dry spells, Heat wave/cold wave conditions, Forest Fires, Drinking water.

6.5 Bio-diversity Conservation

Identification of problem areas associated with Protection of Life systems (botanical, zoological including aquatic) on Land and under Water and implementation of suitable methods for conservation of the same in association with TSBDB and respective line departments.

Liquid nitrogen and low-cost alternatives for animal semen preservation

Low-cost diagnostic toolkits for livestock veterinarians

Tissue engineering for laboratory-grown animal products

Low-cost veterinary pharmaceuticals (ideally thermostable)

6.6 Forest Conservation & Development

Implementation of New methods based on IoT, GPS, GIS, Remote Sensing, bio-technology etc. for forest conservation & development and implementation of new varieties of plantations for feeding wood gasifiers, boilers and for other fuel needs in association with Forest Department.

Nee to encourage Seed bombing in a big way and also Miyawaki method of afforestation.

Need to raise nurseries of multipurpose trees that are suitable to Telangana state and which have longer life and economic value.

6.7   Water conservation

Implementation of new approaches for conservation/ safety of Drinking water, Ground water, Water in rivers, rivulets, lakes, aquifers etc. in association with Groundwater department, RWS, Panchayats, Municipalities, Municipal Corporations etc.

Cost effective technologies for Recycling and purification - potable water management.

Smart metering could be used to manage the demand

Desalination or reverse osmosis technologies can be implemented

Technology could enable increased leakage detection

Portable sensors for groundwater detection

6.8   Waste Management

Implementation of New Methods for Sewage treatment, Waste (Dry Waste, Wet Waste) to Wealth generation mechanisms, new methods for drainage cleaning systems in association with Municipal Corporations, Municipalities etc.

Facilitate recyclable materials technologies, and apply to minimize industrial waste in the environment

Novel biodegradable packaging materials

6.9   Food processing

Implementation of pilot scale plants in Food Processing, Fruit processing, Meat Processing, Fish Processing including Packaging, Marketing tie-up etc. in association with TSIIC, SERP, Rural Development Dept, Agriculture & Agricultural Marketing Dept.

Technology intervention in marketing of tribal products.

6.10   Energy Conservation, Production

Implementation of new technologies in solar, wind, hybrid power systems, micro-hydel aiming at energy conservation & production and implementation of new technologies providing scope for saving of energy in industries in association with Energy dept, NREDCAP, Industries dept. etc.

District level action plans for electrifying the freight transport and embracing EVs for delivery and ridesharing

Constructing and checking the performances of warehouses -advanced digitised tools Smart grid management in industries that can use both electricity and data at once.

Clean and Renewable energy/gadgets; Solar and wind energy; micro hydel power for decentralized generation and utilization of power involving the community.

6.11 Affordable Health care & Health security –

Adaptation and resilience; vector control services; Drugs/Pharmaceuticals. Promote capacity building among health professionals to ensure conformity with the right to health in service delivery. Green architecture – Energy-efficient building.

6.12 Data generation and Management

One of the missing links is the lack of data analytics for policymaking.

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