MINISTRY OF SCIENCE & TECHNOLOGY
MINISTRY OF EARTH AND SCIENCES
GOVERNMENT OF INDIA

विज्ञान एवं प्रौद्योगिकी विभाग
DEPARTMENT OF
SCIENCE & TECHNOLOGY

Techनींव@75

अपना देश, अपना विज्ञान

TESTIMONY OF SCIENCE & TECHNOLOGY EMPOWERMENT OF THE COMMUNITY

REPORT

REFLECTING THE STI ABSORPTION CAPACITY OF THE COMMUNITY

Catalysed & Supported by
Science for Equity, Empowerment & Development (SEED) Division
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Developed and Published by:

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Catalysed and Supported by:
Science for Equity Empowerment and Development (SEED) Division
Department of Science and Technology, Government of India

REPORT
Techनीव@75: Testimony of Science and Technology Empowerment of Community

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(An autonomous organisation of the Department of Science & Technology, Govt. of India)

A. Dhanalakshmi
Director

2nd February 2024

FOREWORD

In commemorating the Techनींव@75 programme, we delve into the profound impact of Science, Technology, and Innovation (STI) interventions in empowering diverse communities across tribal, rural, and urban landscapes. This initiative meticulously examines the foundational role of STI in society, quantifying its pervasive influence on various communities and social structures throughout India's 75 years of independence. The programme not only assesses the current state of STI integration but also explores the aspirations and expectations of these communities. Moreover, it actively seeks feedback to determine the necessary steps for scalability and sustainability of these interventions.

I am delighted to introduce the comprehensive report documenting the remarkable journey of the Techneev@75 programme: "Testimony of Science and Technology Empowerment of Communities for Livelihood Improvement." This programme stands as a testament to the transformative impact of Science and Technology (S&T) on the livelihoods of diverse communities.

This report unveils an indigenous framework and presents seven practical models for delivering technology and innovation at the community level, transforming them into Science and Technology (S&T)-enabled entities. The inclusion of a meticulous bottom-up approach, coupled with a scalable assessment scale, facilitates a nuanced understanding of communities' needs.

It is my sincere belief that this output of the programme will serve as a cornerstone in developing tailored S&T knowledge-enabled livelihood systems and its enhancements for local-level development. By aligning with the aspirations of Atma Nirbhar Bharat, this endeavour aims to contribute significantly to realizing the dreams of a self-reliant and empowered nation.

(A. Dhanalakshmi)

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GOVERNMENT OF INDIA
Ministry of Science and Technology
Department of Science and Technology
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24th November 2023

FOREWORD

The Nation commemorated "Azadi Ka Amrit Mahotsav", marking 75 years of Independence on August 15, 2022. To mark this occasion, it was only fitting to celebrate India's scientific and technological prowess and accomplishments and its outstanding contribution in Nation building during 75 years of its journey. On this momentous occasion, Ministry of Science and Technology [Department of Science and Technology (DST), Department of Biotechnology (DBT), Council of Scientific and Industrial Research (CSIR)] and Ministry of Earth Sciences (MoES) organised "Techनींव@75" programme to highlight the impact of science, technology, and innovation in fostering social equity and inclusion.

Since Independence, Science and technology have been widely adopted as vital tools for bolstering the nation's economic and social development. Over the years, India has made substantial advancements in numerous spheres of S&T. However, in order to highlight how such scientific and technological advancement have benefitted various targeted communities by opening up new livelihood opportunities and developing their technological absorption capacity, Techनींव@75was an unique attempt .

Techनींव@75 programme highlighted the impact of STI intervention in empowering communities, whether tribal, rural, or urban, displayed the STI capacity at the fundamental level of society and quantified the extent to which STI has permeated in various communities and social structures during 75 years of Independent India's journey. It also gauged the aspirations and expectations of the communities, in addition to mulling upon prospects and getting their feedback on what needs to be done further to make these interventions scalable and sustainable.

The report includes an indigenous framework and seven practical models of technology/innovation delivery system at community level to make them S&T-enabled and a scale to assess the communities in the more prudent bottom-up approach, along with the recommendations at micro, meso , macro, and meta levels. I hope this report will help in developing tailor-made S&T knowledge enabled welfare programs for local level development and help in achieving the dreams of Atma Nirbhar Bharat (Self-sufficient India).

(Dr. Debapriya Dutta)

INTRODUCTION

Science and Technology (S&T) play a crucial role in advancing both communities and individuals, particularly in key areas such as education, healthcare, livelihoods, sanitation, and access to clean water. Assessing development through these parameters provides a holistic view and helps guide S&T interventions towards sustainable solutions. For S&T and innovation to be truly valuable, they must serve as the foundation for improving livelihoods, raising living standards, ensuring health and hygiene, promoting education and awareness, and striving for equity and inclusion

When considering livelihoods within the realm of S&T, the emphasis should be on reinforcing and validating traditional knowledge systems, ensuring their preservation and effective utilization for employment and livelihood generation. Enhancing existing traditional livelihoods through S&T, rather than introducing alternative options, validates the role of S&T. However, in cases where traditional livelihoods are absent or irretrievably lost, S&T should facilitate the creation of new livelihood systems.

It is imperative to re-evaluate the livelihood landscape with traditional livelihoods at its core. Scientific institutions, organizations, researchers, and policymakers should actively engage with grassroots communities, not to impose unfamiliar S&T innovations, but to collaborate and enhance existing livelihoods in ways that resonate with local populations. This approach ensures maximum community participation.

The focus should be on strengthening existing livelihoods, no matter how modest, through S&T interventions. R&D must connect with on-the-ground realities and integrate seamlessly with traditional knowledge and practices.

The "Techनीव@75"programme, organized by the Department of Science and Technology in collaboration with DBT, CSIR, and MoES, aimed to showcase the profound impact of Science, Technology, and Innovation (STI) on community aspirations and socio-economic development was implemented by Vigyan Prasar, as one of the knowledge partners. This initiative sought to highlight how STI interventions have propelled communities towards realizing their aspirations and fostering economic growth. Additionally, the programme aimed to identify systemic gaps within the Science & Technology delivery system that hinder the improvement of quality of life and livelihoods within communities. By pinpointing these gaps, we can develop targeted strategies to address them

and enhance the effectiveness of STI interventions. Furthermore, the programme endeavoured to establish pathways for strengthening community-level preparedness, credibility, and resilience through the integration of STI. By leveraging the power of innovation and scientific advancement, we aim to empower communities to overcome challenges and thrive in an ever-changing world.

The programme was designed to unite three categories of community impact presenters and community members—Knowledge Organisations, Principal Investigators (PIs), Change Makers, Experts & Scientists and beneficiaries from the Community—on a single platform for sharing their experiences. It was structured around three main sessions. In Session I, titled "Technical Impact Presentation," the focus was on societal feedback through the sharing of beneficiary experiences and the convergence of community change leaders and change makers. Session II, termed "Technical Impact Compilation," involved the compilation of 75 impactful stories showcasing India's progress towards Atma Nirbhar Bharat, along with a collage-making competition promoting the theme "Vocal for Local with STI interventions." Finally, Session III, dubbed "Technical Impact Vision," featured round table discussions on the role of STI in enhancing community preparedness and resilience, along with messages from ministries and departments supporting STI-led growth for holistic development.

The programme aimed to delve into and evaluate the impact of STI on evolving aspirations of the Indian populace, alongside assessing the influence of developed infrastructure, technological access, employment opportunities, skill development, capacity building, and networking among stakeholders. Each session was conducted to identify and rectify systemic gaps hindering S&T delivery, CBO participation in STI development, and the community's capacity for knowledge absorption. Throughout the event, motivational and innovative stories spanning various sectors such as agriculture, energy, water, sanitation, health, education, and housing was highlighted. Ministries such as the Ministry of Panchayati Raj, Ministry of Rural Development, Office of PSA, Vigyan Prasar, UNDP, Wildlife Institute of India, and Tata Trust collaborated with the Ministry of Science & Technology to showcase relevant efforts and introduce a roadmap for leveraging STI for sustainable life and livelihoods, social enterprises, and community resilience

Expected outcomes included the creation of a compendium showcasing STI achievements over the past 75 years, featuring 75 impactful stories selected during Techनीव@75, as well as a collection of 75 collages reflecting self-reliance within the Indian community. It sought to raise awareness among local governments, field-based voluntary organizations, community leaders, and startups about the bottom-up approach and the promotion of outputs and outcomes from government initiatives. At the end of the programme, an analysis was done to establish a framework and proposed seven models for enhancing Indian community preparedness, credibility, and resilience, while facilitating interactions between beneficiaries and change makers with various stakeholders.

The study demonstrated how leveraging the livelihoods framework can empower the underprivileged and marginalized communities, enabling them to assert their social and economic rights through grassroots STI interventions. Concurrently, it offered a pathway for funding agencies and apex bodies to formulate policies and programmes centered around livelihood development. The

framework delves into sustainability challenges and underscores the imperative for social and economic transformation to materialize these goals.

The evaluation of technology absorption capacity within communities, conducted through the Techनीव@75programme, served as a pivotal step in addressing pertinent issues and formulating strategies for advancing a science and technology-enabled sustainable livelihood approach. The study put forward a series of recommendations, elaborated upon in the Report.

The proposed framework, outlined in the Report, commences with the identification and assessment of local knowledge systems, while also incorporating strategic management of value co-creation and potential innovation in accordance with socio-economic, ecological, and environmental factors. To fortify the local innovation system, value co-creation must be facilitated by science and technology, knowledge exchange, and social dimensions. The study emphasized the importance of ensuring that technology aligns with available natural, human, and financial resources, while also corresponding to the cultural practices of users and communities. Furthermore, the wise adoption of technology is crucial for engaging users and communities, as well as enablers such as social change makers and knowledge organizations, in order to continuously stimulate resource integration, knowledge updating, and renewal throughout the entire process.

Vigyan Prasar an autonomous organization of Department of Science & Technology played a significant role towards implementing the programme. Vigyan Prasar developed a dedicated and interactive multi-way digital platform for the exchange of ideas and thoughts between community groups and scientific institutions, scientists & experts; brought scientific community/Institutions/ experts to the doorsteps of communities who have certain elements of STI interventions that has reached to them either from the top or are their own local innovations. VP documented suggestions for the upliftment of the local innovation system and their roles in establishing sustainable livelihood systems, by exploring them through various Science Ministries and STI Academia. VP also facilitated the process of STI empowerment of communities through interventions at grassroot level and at institution level while bridging the gaps, enticing people to adopt scientific ways and means, and coming up with local innovations that make life easy for them. In the process, it facilitated cross- bridge collaborations and inter-linkages among various scientific organisations and communities.

Dr Kinkini Dasgupta Misra
Scientist – F, Vigyan Prasar

Acknowledgment

We would like to extend our sincere appreciation to all individuals and organizations whose contributions have made the Techनींव@75 programme a success.

First and foremost, we are grateful to the community members as participants whose active involvement and enthusiasm have been the driving force behind the programme's accomplishments. Your dedication to learning and innovation has been truly inspiring. Various community groups from far-flung rural and peri-urban regions of 27 States and 4 Union Territories shared their experiences on the Techनींव@75 platform.We would like to express our heartfelt gratitude to our esteemed Speakers, Experts, Mentors, Principal Investigators (PIs) of Knowledge Organizations for generously sharing their expertise, insights, and experiences with the participants. Your valuable contributions have enriched the programme and provided invaluable guidance to aspiring technologists.

Through this Programme, we got introduced to the Societal Change makers/Change-leaders who actually were the bridge between the communities and Knowledge Organsiations in implementing the appropriate STI intervention to the society resulting in the generation of livelihood opportunities and improvement in quality of life. They shared their experiences and recommendations to help identify and address systemic gaps and to determine the community's capacity for absorbing technology and knowledge. We extend our thanks to them for their commitment to excellence and their contributions.

Our special thanks to the science film makers, who travelled to the remote areas and captured the inspiring stories of the communities in video films.

We sincerely acknowledge the support and collaboration of our knowledge partners DBT, CSIR and MoES, besides the lead role played by DST and other stakeholders whose contributions have enabled us to deliver a high-quality and impactful programme. Your generosity and commitment to fostering technological innovation are deeply appreciated.

We express our deep gratitude to Dr. Debapriya Dutta, Former Advisor & Head of SEED Division at the Department of Science and Technology (DST), whose visionary conceptualization of this programme and his invaluable guidance throughout its implementation have been instrumental in its success. Dr. Dutta's expertise, insight, and commitment to fostering innovation have greatly enriched the programme and provided a solid foundation for its development and aligning it with the Livelihood Systems. His mentorship has inspired us to strive for excellence and has been a driving force behind the programme's achievements.

We thank Dr Debapriya Dutta and Dr Anuradha Phugat, Scientist C-, SEED-DST for giving us the opportunity to work and contribute to the programme of assessing the impact of science & technology on the society in last 75 years of India's independence.

We are truly fortunate to have Director, Vigyan Prasar Ms A Dhanalakshmi's guidance and relentless support, which have been indispensable in making this programme a resounding success.

Finally, we would like to thank all project staff of Techneev@75, and VP officials for their efforts in planning, coordinating, and executing various aspects of the programme and contributed their expertise to make the Techनींव@75 programme a reality. Your commitment to excellence and attention to detail has been instrumental in ensuring the smooth operation and success of Techनींव@75 programme.

Vigyan Prasar

CHAPTER

1

BACKGROUND

Science and Technology (S&T) are widely acknowledged as a crucial tool for promoting and bolstering the nation's economic and social development. Over the years, India has made substantial advancements in numerous spheres of S&T and prides itself on having a robust network of S&T organisations, skilled labour, and an innovative and robust knowledge base. The Indian government has long acknowledged that advancements in S&T are essential for improving industrial and agricultural production, improving the quality of goods and services, and raising the levels of income and the wellbeing of society. The highest echelons of the government have consistently provided support for S&T initiatives.

India has given the S&T sector a special emphasis because it recognises that in today's knowledge-based inter-connected world, nations that can incorporate and employ the remarkable strides in S&T for national development have a comparative advantage. Strengthening the knowledge base is crucial in the age of globalisation and rapidly dwindling natural resources. This has been done by creating innovative technologies that will meet the nation's needs and add value to indigenous resources and biodiversity, as well as protect and preserve the rich traditional knowledge. Utilizing all technologies – traditional, conventional, and modern

S&T intervention transforming the way of life of the Birhor Tribal community, West Bengal

– would significantly advance national growth. Technologies geared toward improving human welfare, such as those that offer innovative and economical solutions for disaster preparedness, mitigation of impacts of natural hazards, health services, population management, preservation and integrated management of land, water, and energy resources, have been accorded the top priority.

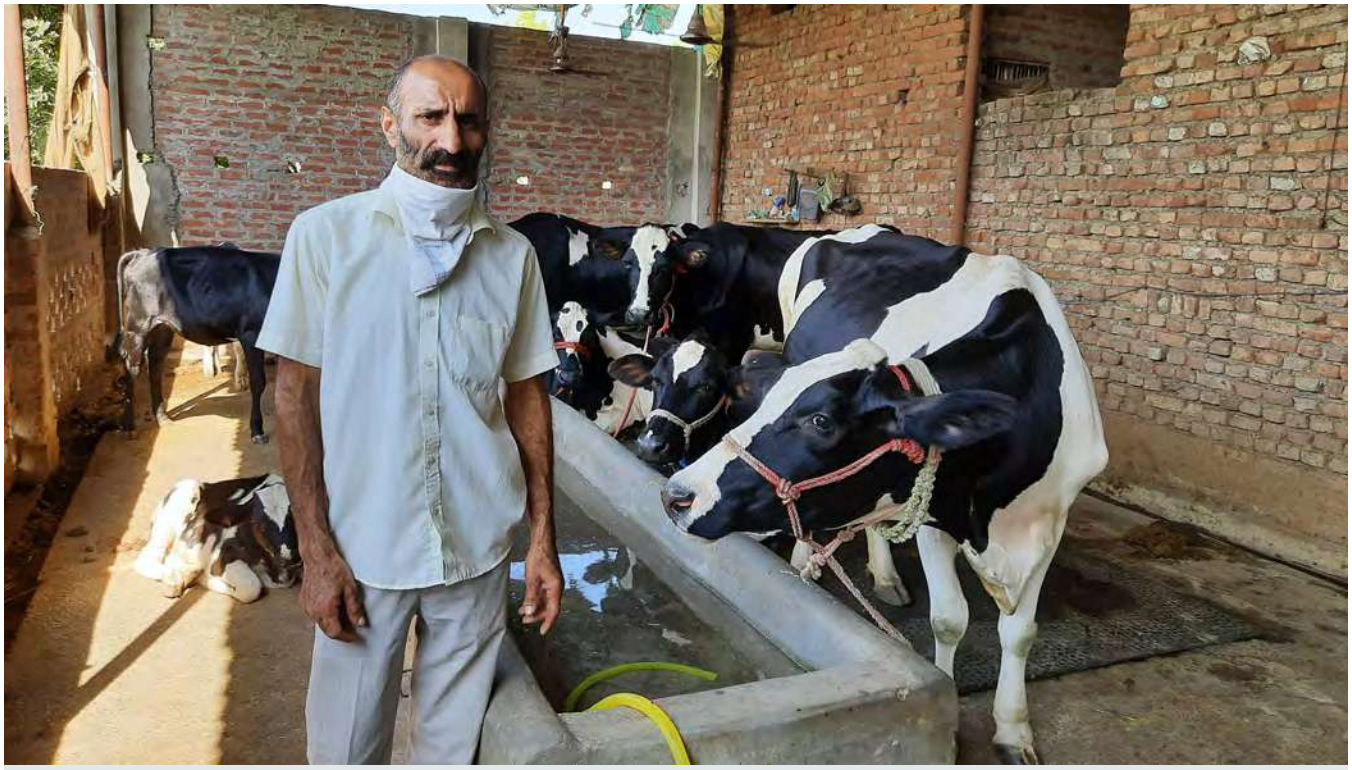
It took me four years to convert and transform the lives of Birhor community to cultivate with modern agricultural practices and provide sustenance and generate income.

- Biswanath Dasgupta, Changemaker

1.1 INTRODUCTION

The nation commemorated the Azadi Ka Amrit Mahotsav, marking 75 years of Independence on August 15, 2022. To mark this occasion, it was only fitting that we acknowledge, appraise, and showcase India's scientific prowess and accomplishments as well as its outstanding S&T development during the course of its seventy years of independence. On this momentous occasion, the Ministry of Science and Technology [Department of Science and Technology (DST), Department of Biotechnology (DBT), Council of Scientific and Industrial Research (CSIR)] and Ministry of Earth Sciences (MoES) organised - Techनींव@75 to highlight the impact of science, technology, and innovation in fostering social equity, inclusion, and aspiration.

The programme was overseen by the Science for Equity, Empowerment, and Development (SEED) Division of DST, which has extensive experience of aspiring field-based organisations working to advance the creation, delivery, and dissemination of science and technology in order to support socio-economic development. It was conducted by Vigyan Prasar and hosted by the India Science, Technology, and Innovation (ISTI) Portal. The purpose of the initiative was to illustrate the community's ability to engage in Science, Technology, and Innovation (STI). It demonstrated how STI interventions strengthen communities and emphasised the part STI has played in easing people's daily lives at the grassroots level. Techनींव@75 shared the perspectives and experiences of empowered communities regarding the contribution of science and technology in bringing change in their quality of life, resulting in a strong sustainable societal foundation (नींव). It focussed the spotlight on the nurtured communities in rural, peri-urban, and urban areas across the country that have witnessed significant growth in their infrastructure, indigenous knowledge, resource use, quality of life, and livelihood due to ease of access and adoption of STI.



Science helps Jammu Cattle Owners in Dairy Farming

1.2 PURPOSE

S&T capabilities are essential for the social and economic advancement of the nation. S&T advancements can benefit rural communities by opening up new livelihood opportunities and diversifying their sources of revenue. The way people live and work can be drastically improved by new technologies. S&T can also raise the standard of living for rural residents and make it easier for them to access services.

The milk from my dairy is sold at a price of Rs 100 per kg and my monthly income is around Rs. 35,000-40,000. The training and support system provided by SKUST is a blessing for the dairy industry in the Jammu region.

- Dinkar Kaushal, an entrepreneur, and a change maker

The necessity of harnessing science and technology for transforming rural India has long been acknowledged. As a result, the Government of India launched a number of programmes to use science and technology to promote community prosperity and the overall growth of rural areas. The Techनींव@75 programme attempts to highlight the impact of STI intervention in empowering communities, whether they are tribal, rural, urban. The programme aims to display the STI capacity at the fundamental level of society and quantify the extent to which STI has permeated various communities and social structures over the course of 75 years of India's independence. It also gauges the aspirations and expectations of the communities, in addition to mulling upon future prospects and what needs to be done to make these interventions scalable and

sustainable. The programme also placed a strong emphasis on identifying grass-roots innovations, enhancing them, increasing their effectiveness, and disseminating them to a large population to ensure that the impact of such innovations is reflected in better livelihood prospects. Technologies that decreased laborious tasks, saved time and energy, and increased production efficiency were identified,

With the training, the local people are no longer required to dive into deep waters to get seaweed. They now also follow 'seeding,' 'no-fertilizer' and 'knee-depth water harvesting' methods.

- Dr M Ganesan, Senior Principal Scientist at CSIR-CSMCRI

Seaweed cultivation empowering fishing community to become micro-entrepreneurs.

adapted, and promoted, inspiring the community's members to pursue entrepreneurship and launch businesses.

1.3 GENESIS

India is a country of more than 1.4 billion people. It has millions of problems and a billion minds to solve them. Over time, during the development of India Science Technology & Innovation (ISTI) Portal, a need was felt to institutionalise the idea of Collective Intelligence (CI). It is a type of wisdom building that grows out of a group. The basic principle lies in the concept that when people work together, they form a type of intelligence that simply cannot exist on the individual level. The group intelligence emerges from several individuals' collaboration, collective efforts, and competition and appears in consensus-decision-making.

The unprecedented outbreak of COVID-19 in 2020 affected the world, and so India, and powerfully impacted the livelihoods, health, nutrition and socioeconomic condition of the communities globally. India saw reverse migration to villages and towns from metro cities during lockdowns. To harness this opportunity, to tap the available grassroot resources, to take science to the society and from land to lab, ISTI Portal implemented the concept of collective intelligence, on a pilot basis, through a new initiative named as "Science-Society- Setu for AtmaNirbhar Bharat (S34ANB)" in collaboration with Science for Equity Empowerment and Development (SEED) Division, Department of Science and Technology, Government of India. The initiative provided an online platform for establishing collaborations and dialogues between ecosystem partners, like S&T based Voluntary Organizations, Knowledge Organizations (KOs), Social Start-ups, Grassroot Innovators and Communities for STI based appropriate solutions.

A total number of 7 Ministries, 3 International Organisations and 123 speakers from 90 Institutions across the country have shared their knowledge and experiences and deliberated on opportunities for technical interventions and possible collaborations. Around 22000 targeted audiences were reached directly by using various digital media platforms through ISTI Portal. The initiative helped fructify several cross-bridge collaborations, identify new partners (in individuals, institutions, resource groups, user groups, etc.), and identify numerous ideas & emerging technologies for systemic intervention, like strengthening social capital.

Coastal communities build thier lives with Seaweed

Moreover, the initiative (and the idea of collective intelligence) received a more comprehensive acceptance as Ministries, International Organisations, Knowledge Organisations and Science Communities came forward to take this concept of collective intelligence in consensus decision making process for the welfare of the society-in-general.

1.4 OBJECTIVES

- Identifying the systemic gaps that impede the effective delivery and application of STI interventions to the communities.
- Encapsulating the potential of the communities to absorb and implement STI and highlighting the ways that STI interventions have affected the socio-economic growth and aspirations of the communities.
- Building pathways for strengthening preparedness, credibility & resilience at community level through STI interventions.
- Promoting scientific temper among community members and motivating them to develop locally relevant solutions and inventions that are both inexpensive and reproducible.
- Bridging the communication gap between communities and scientific institutions so that both might benefit from one another.
- Analysing the gap areas and strengths in great detail and developing a comprehensive model to explain STI empowerment.
- Identifying ways to eliminate bottlenecks in the S&T delivery chain.

CHAPTER

2

STAKEHOLDERS

The programme included active stakeholders' participation who played an active role in identifying systemic gaps, identifying the technological needs, the solution providers, the knowledge organisations, the experts, funding organisations, technology implementers and solution providers, policy makers, scientists and experts. The stakeholders also included participations from private agencies, local level bodies, community groups like SHGs, FPOs, and social change makers. Some of them are as follows:

i. **Community Groups:** The groups formed within communities which are aimed at making desired improvements to a community's social health, well-being, and overall functioning. These groups occur in geographically, psychosocially, culturally, spiritually, and digitally bounded communities. The community groups that apply and amplify solution- driven and S&T-enabled activities towards addressing the solution to a need-identified issue are the prime stakeholders of the initiative.

- Various community groups from far-flung rural/ peri-urban regions of 27 States and 4 Union Territories shared their experiences on the Techनींव@75 platform.
- They provided societal input through the sharing of experiences and the presentation of impact tales from various groups.
- They assisted in the study of how STI interventions affected the development of infrastructure, opportunities for livelihood, encouragement of enterprise,

Toolmaker of Kendure Village, Pune

The entire neighbouring area is based on farming as an occupation. The local farmers faced difficulty as there was no place for the maintenance of tools used for agriculture. He wanted Aniket to stay in the village and used his skill set to create a space for himself as well as work for the benefit of the local farmers.

- Aniket's father

Reviving the traditional medicinal resources-Chirayita seeds

We did not have any knowledge of using earthworms for producing manure. Dr Singh dispelled our myths that using this manure may lead to health issues. Now we want to produce more and more seeds so that our group benefits more. We want to be dependent on vermi composting rather than any chemical fertilizers.

- Dineshwari Devi, one of the Chiryita producers from kamrunag

development of skills and capacity, and enhanced networking among different stakeholders.

ii. **Societal Change makers:** A societal change maker is someone who is taking creative action to solve a social problem. They are intentional about solving a social problem by finding the means and ways for it. The change makers – who were oriented towards implementing STI-based interventions towards finding a solution – worked as catalysts for the initiative.

- Societal Change makers/Change-leaders introduced the appropriate STI intervention to the society resulting in the generation of livelihood opportunities and improvement in quality of life.
- They shared their experiences and recommendations to help identify and address systemic gaps and to determine the community's capacity for absorbing technology and knowledge.

iii. **Scientists/Experts:** The scientists participated in the initiative were the persons having expertise in their domains, developed technologies, and/or had flair of working in science-enabled livelihood generation.

- The scientists who created the necessary technology or enhanced the readiness index level of the indigenous technologies offer information on the S&T intervention used, their benefits and drawbacks, scalability, and readiness.
- Eminent figures from the scientific and social disciplines who have a history

of working for the welfare of others, applying new technologies and innovations, and developing policies also took part in the discussion to suggest a policy framework that would boost STI at the local level.

Bringing digital India to the tribal villagers, Aurangabad

A basic computer training and desktop publishing course helped me set up Kasturi Multiservice, my own online common service centre, and internet café. The earning from the service centre cum internet café is Rs. 15000 to 20000 per month.

- Dadasaheb Gorakhnath Gaikwad, the changemaker

Skilling at grassroot level, Women SHG, Uttrakhand

- Roundtable discussion was held to lay a roadmap and identify the gap areas and bottlenecks.

iv. **Vigyan Prasar and its role:** Vigyan Prasar (VP), the national level organisation, has been relentlessly working since more than last three decades in science communication, popularisation and extension, reaching out to a range of target audiences, across the length and breadth of nation, inculcating scientific temper and promoting the use of science and technology for the common good.

The organisation played an instrumental role in implementing Techनींव@75 initiative as one of the knowledge partners and implementing institute. The programme was hosted at ISTI Portal (https://www.indiascienceandtechnology.gov.in/Techनींव@75). The Portal is providing a platform for digital repository of all the innovations and technologies developed in the Indian STI ecosystem, and facilitate the

Now, we earn Rs. 1 lakh to Rs. 1.5 lakh per annum. With the training provided by HESCO, our products have a longer shelf life and so, are more saleable. The skills and income have encouraged every woman in the village, from young to old, and nearby villages to come forward and become a part of this change.

- Nirma Negi of Khoi village

cross-bridging of knowledge sharing/exchange among various audience groups and stakeholders. It also hosts the interactions and multi-corner discussions where the experts and scientists interact with community members, and all benefit from one another.

VP played four important roles towards implementing the programme:

i. **An interactive, dedicated digital platform:** VP developed a dedicated and interactive multi-way digital platform for the exchange of ideas and thoughts; provided ISTI Portal platform as an interface between community groups and scientific institutions, scientists & experts; brought scientific community/Institutions/ experts to the doorsteps of communities who have certain elements of STI interventions that has reached to them either from the top or are their own local innovations.

ii. **Highlighted grassroot success stories:** During interactions with the community groups, VP provided a voice to them who in turn reflected how they have been empowered through STI interventions. VP also produced various knowledge products and resources and disseminated them among the people.

iii. **Identified and documented systemic gaps:** VP brought experts on board so as to mull on what should be done for documenting, replicating and scaling up the local innovations and how

'Ship of the Mountains' New tech breathes life into Himalayan Yak

communities across the states can be encouraged to come up with local solutions. In the process, they indicated the gap areas due to which our local innovation system is on the decline. These have been documented in the Systemic Gaps.

iv. **Suggested interventions both at grassroots and at policy level:** VP documented suggestions for the upliftment of the local innovation system and their roles in establishing sustainable livelihood systems, by exploring them through various Science Ministries and STI Academia. VP also facilitated the process of STI empowerment of communities through interventions at grassroot level and at institution level while bridging the gaps, enticing people to adopt scientific ways and means, and coming up with local innovations that make life easy for them. In the process, it facilitated cross- bridge collaborations and interlinkages among various scientific organisations and communities.

In 2018 we faced a severe snowfall for two months, which led to the death of many of our yaks. At that time, mineral feed blocks were brought Arunachal Pradesh and distributed among the community by the National Research Centre, which saved around 50-60 of a herder's yaks.

- Pasang, an employee of the Animal Husbandry Department in North Sikkim

CHAPTER

3

THEMATIC AREAS

The 75-hour long Techनींव@75 event took place over the span of almost a year, starting on November 15th, 2021, and ending on August 29th, 2022. The programme encompassed the intended 25 episodes (3 hours/day in 25 days) on various themes related to STI and touched upon 75 communities across the length and breadth of the nation. The sessions showcased past developments in the STI ecosystem, promoted indigenous technologies, social enterprises, and start-ups, and enabled the exchange of ideas across a large spectrum of communities in the country.

The sessions were conducted on five broad themes:

3.1 Natural Resource-Based Livelihood

Science and technological (S&T) interventions that invest in conservation and sustainable use of natural resources to boost productivity, resulting in greater income as well as enhanced quality of life for rural households. Natural resource-based livelihood opportunities were built around the conservation of land, water, and biomass, that in turn increased the productivity of agriculture, forestry, livestock, and even non-farm activities that depended on these or other natural resources such as weaving, fabric production, toy manufacturing, embroidery, etc.

3.2 Energy Access for a Prosperous Society

S&T interventions explore transformational energy transition pathways that could offer new livelihood opportunities while enriching the lives of rural people, enabling communities to flourish, and regenerating the Earth's natural life support systems. Technologies that ensure access to affordable, reliable, and modern energy sources for improving the living and working conditions of all rural people were discussed under the theme.

Exploring transformational energy transition pathways requires a multifaceted approach that integrates science and technology across various sectors, including energy generation, distribution, storage, and consumption. Technological interventions are essential drivers of transformational energy transition pathways, enabling the shift towards a low-carbon, resilient, and decentralized energy system. However, achieving widespread adoption and impact requires concerted efforts across multiple fronts, including technological innovation, policy support, market incentives, and societal engagement.

Areas Covered

- **Solar Energy:** Such as solar electrification program in Hanchukuda, Rajasthan; Solar dryers to preserve fruits, vegetables, meat, spices etc. at Roing district, Arunachal Pradesh; Micro

Garo women setting up micro enterprises using local resources, Bolmoram WTP, Meghalaya

Tribal community becomes thriving Apiculturists, Jharkhand

Apiculture provides a solution as elephants cannot harm the bees and we can earn from honey production. Our main crop is Sargujja, grown on the tar land of the village. The earnings from apiculture are 1.5 times more than farming.

- Change Maker Baliya Bedia

solar Dome, Herma, West Tripura; Mountain solar water heating system, Himachal Pradesh

- **Water Resource Management:** Low-Temperature Thermal Desalination Plants at Islands of Lakshadweep; Watermill-based grain grinders, Dokwala, Dehradun
- **Biomass Energy:** Energy efficient Jaggery Furnaces in Uttar Pradesh, Cow Dung Pot and log making machine at Correctional Home in Dharamshala, H.P; Compact Food waste Biogas Unit at Thiruvananthapuram
- **Other Energy Sectors:** Cotton Wick making machine, Gujarat; Bamboo splint making machine in Correctional Homes located at Dasna, Gurugram and Alipore, Kolkata; LED Bulb Unit for women at Chikara, Odisha

3.3 Healthy Society

In this section it was brought forward how S&T interventions that ensure the physical, mental, and social health of the rural community, showcased the experiences of the beneficiaries that improves overall well- being of rural people by strengthening health services of rural India that support the prevention, diagnosis and treatment of disease.

The programme explored various S&T interventions for promoting health and well-being in rural areas such as :

Telemedicine and Telehealth Services: Telemedicine platforms enable remote consultations between patients and healthcare providers,

overcoming geographical barriers to healthcare access. Mobile apps, video conferencing, and remote monitoring devices facilitate diagnosis, treatment, and follow-up care for rural residents.

Health Information Systems: Electronic health record (EHR) systems and health information exchanges (HIEs) streamline data management and enable seamless sharing of patient information across healthcare facilities, improving care coordination and patient outcomes.

Healthcare Delivery Innovations:

Mobile Clinics and Health Camps: Mobile medical units equipped with diagnostic tools and essential medications bring healthcare services directly to rural communities, reaching underserved populations in remote areas.

Point-of-Care Diagnostics: Portable diagnostic devices and rapid testing kits allow for on-site screening and early detection of diseases such as malaria, tuberculosis, and HIV/AIDS, facilitating timely treatment and disease management.

The training provided by NIF has changed our lives. Now women need to devote only 1-2 hours of their time daily to making compost. We sell compost to nurseries, but we want to increase our yields and foray into online marketing.

- Sunita Halder

Innovative technology transforms compost-making for Chattisgarh community

Not just as a police officer, but as a human I wanted to help them. Local produce here is of such high quality but it was all going to waste since they did not know how to make value-added products.

- Dr Pritpal Kaur, SP, Noklak district

Community Health Workers (CHWs): Training and equipping CHWs with mobile technology and decision support tools empower them to deliver basic healthcare services, health education, and preventive interventions within their communities.

Early Warning Systems: Predictive modeling and machine learning algorithms analyze environmental, climatic, and demographic factors to forecast disease outbreaks and health emergencies, enabling proactive response and mitigation measures.

Health Education and Behavior Change Interventions:

Digital Health Communication: Mobile apps, SMS alerts, and interactive multimedia platforms deliver health education messages, preventive care reminders, and behavioral interventions to promote healthy lifestyles and disease prevention.

Value-added farm products with technological innovations, Noklak Society, Nagaland

Community Engagement: Leveraging social networks and online communities fosters peer support, knowledge sharing, and collective action for health promotion initiatives, addressing local health concerns and cultural preferences.

Water, Sanitation, and Hygiene (WASH) Interventions:

Water Purification Technologies: Low-cost water treatment solutions, such as filtration systems, solar disinfection, and chlorine tablets, improve access to safe drinking water and reduce the risk of waterborne diseases in rural communities.

Sanitation Infrastructure: Innovative sanitation solutions, including composting toilets, bio-digester systems, and decentralized wastewater treatment plants, promote proper hygiene practices and prevent environmental contamination.

Behavioral Change Communication: Community-led hygiene promotion campaigns and participatory approaches raise awareness about the importance of handwashing, sanitation, and safe food handling practices, fostering sustainable behavior change.

Nutrition and Food Security Interventions:

Biofortification: Breeding crops with enhanced nutritional content, such as vitamin A-rich sweet potatoes and iron-fortified beans, addresses micronutrient deficiencies and improves dietary diversity among rural populations.

Agroecology and Sustainable Farming Practices: Agroecological approaches, such as organic farming, permaculture, and conservation agriculture, promote biodiversity, soil fertility, and resilience to climate change while enhancing food security and nutrition.

Food Distribution and Supply Chain Management: Digital platforms and blockchain technology improve transparency, traceability, and efficiency in food distribution systems, reducing food loss and ensuring equitable access to nutritious food in rural areas.

Areas Covered

- **General Health:** Food supplemented products and Homemade napkins in tribals population of Anaikatti, Coimbatore, Tamil Nadu; Fluorosis mitigation through S&T intervention, in Scheduled Caste community of Chapri, Bihar, Holistic Health: Traditional Siddha Varmam Therapy, Kanyakumari Tamil Nadu, Pain and Infertility Management in Women suffering from Endometriosis and Adenomyosis, Kolkata West Bengal
- **Nutrition:** Value-added products from Rhododendron flowers, having nutraceutical value at Village Parwai, Chamba (H.P.); Production of Low-calorie, Fortified nutraceutical food products at Talhar village of Mandi (H.P.); Newly developed anthrocyanin biofortified black wheat, Moga Punjab, Vidisha (M.P)
- **Disease Management:** Sensitization and awareness building on safe drinking water in Vaishali, Bihar, Rainwater Harvesting Structure to ensure safe drinking Water in Chirawa Block of Jhunjhunu District Rajasthan, Access to clean and safe drinking water through solar power in Datia, Bundelkhand; Establishing Digital Clinics in Rural region of Assam, West Bengal and Bihar
- **Other Sectors:** Introduction to Basic Technology (IBT)' Program for Secondary Schools to train school dropouts into innovators and entrepreneurs at Chikali, Aurangabad, Lucknow

Solar Mamas - Shining Rural India with the Power of the Sun

In our village, untouchability is a huge issue. But after joining Barefoot College, I realised that we are all human beings. I have been training here for 40 days, and now I can make solar lanterns and 4-watt LED circuits on my own, as well as repair and maintain them.

- Pooja, Trainee at Barefoot College, Tilonia

3.4. Strengthening Social Capital

S&T interventions that helped in improving access to occupational opportunities, improvement in social service delivery and collective action that led to strengthening of social capital. It is necessary to strengthen social capital to enable poor people to deal in an efficient manner with livelihood vulnerabilities. Social capital is the ability of individuals, groups, organizations, and institutions to collaborate and use social relationships to achieve common goals and gain common benefits. It also

plays role in promoting access to resources especially by the resource poor or marginalized communities.

Areas Covered

- **Promoting Traditional Knowledge system:** Computer-Aided Designing software; DigiBunai; Assam Meghalaya; Improved technology for Attar manufacturing, Bareilly, Uttar Pradesh; Modernization of traditional Pottery, Pallakad, Kerala
- **Energy Saving Devices:** Recycling Techniques from waste Charcoal Briquette from Agro-Waste, Uttar Pradesh; Technology-based Coconut Fiber Extraction and Value addition, Vellanad Kerala; Crop Residue Biomass Composting Demonstration Units, Palakuzhy Farmer community
- **Agricultural Tools and Technologies:** Women-friendly farm mechanization in various agricultural implements, Erode & Salem, Kerala; Agro-Technology equipment on Drudgery Reduction, Pachamalai, Kerala; Pepper Thresher Machine-Innovation Science Technology Entrepreneurship Development project, Idukki, Kerala.

The Micro Solar Dome is a great opportunity for us. Earlier, especially for children and women. Apart from studies of children and work for women, now we don't fear going out to toilet at night, and studying at night. We now know everything about the system. It is very helpful for us in our village.

- Rinki Rupini, Resident, Herma Village

Powering up Villages, using Micro-Solar Dome, West Tripura

3.5 Integrated Community Resilience

Resilient communities enable their members to tackle and adapt to catastrophes, have self-regulating economies that remain operational during crisis, and are capable of carrying out their operations without posing any detrimental to the

environment. Science, technology, and innovation are essential for each component of a resilient society. S&T interventions equip communities that are vulnerable to catastrophes, crises, and underlying vulnerabilities with the skills they need to anticipate shocks and stresses, prepare for them, lessen their impact, manage them, and recover from them without jeopardising their long-term prospects. Through the creation of value-added goods from locally produced raw materials and the ensuing foundation of enterprises, S&T interventions also assist communities in remote rural areas to become more resilient.

Improved Mud Cookstove takling Health Hazards, Madhya Pradesh

CHAPTER

4

METHODOLOGY

Techनींव@75 was launched with the aim of highlighting the transformative influence of science, technology, and innovation (STI) in promoting social equity, inclusion, and aspiration. Recognizing the longstanding recognition of the imperative to leverage science and technology for rural development in India, the program underscored the pivotal role of STI interventions in empowering diverse communities, including tribal, rural, and urban populations.

The overarching objective of the programme was to showcase the grassroots impact of STI initiatives across Indian society over the span of 75 years since independence. It sought to assess the penetration of STI at the grassroots level and evaluate its implications across various societal structures. Additionally, the program sought to gauge the aspirations and expectations of communities while deliberating on strategies to scale and sustain these interventions effectively.

The goal and programme schedule of Techनींव@75 were highlighted during its inaugural session and the achievements in the concluding session. The field-based interactions among various stakeholders were planned and executed through virtual as well as physical meet and communicated

The modified design of gur bhatti has reduced fuel consumption and increased jaggery production multifold. The saved bagasse is the added profit. My three modern gur bhattis and their success has motivated many farmers to install these units.

- Pravesh Kamboj, a sugarcane farmer and owner of a jaggery-making unit at village Manoharpur (Biharigarh), district Saharanpur, Uttar Pradesh

Energy efficient, Economical and eco-friendly Technology for Jaggery Production, Uttar Pradesh

through print, electronic, digital and social media for over a year. The learnings, insights, and sharing of experiences of the users, beneficiaries, implementors, S&T led NGOs, CBOs, FPOs, SHGs, and Start-ups, etc. were presented in the public domain in regional and local languages for better national and international out-reach.

Members of the various communities shared their experiences with STI interventions and interacted with scientists and experts. Community groups from the far-flung areas of India, from Leh and Ladakh to Cape Comorin, Rann of Kutch to inhospitable mountainous terrain of North-East India, mangrove forest of Sunderbans to Thar desert in west were touched upon. On the other hand, scientists and experts also received the opportunity

Social acceptance of prison inmates through scientific innova

When I am released from jail in a few years, I can start with one or two machines, gather some rural youths, and become self-reliant. ... I hope that this would help in better social acceptance.

- Ashok Kumar
prison inmate

ıtions, Himachal Pradesh

to interact with community members and have an idea on what are the problems that confront them and what can be done to scale up and replicate the local innovations. Further, they also imparted ideas on what modulations could be done in the innovations at scientific institutes so that it could cater to the requirements at the grassroots.

4.1 Implementation Mechanism

Implementing mechanisms for interactions between communities, gathering feedback, sharing experiences, and facilitating roundtable discussions were essential for effective science and technology (S&T) implementation at the community level. The implementing mechanisms followed some of the following:

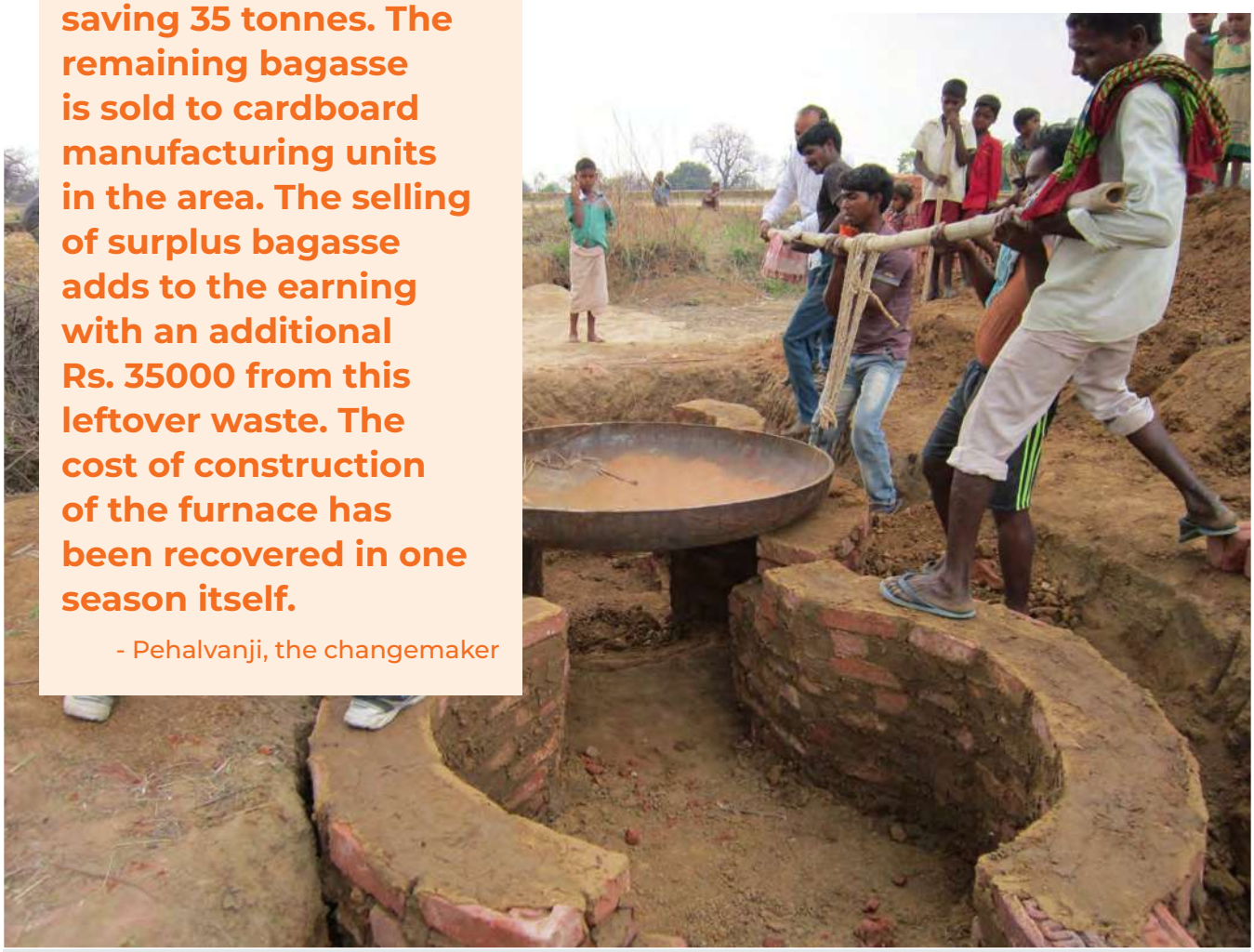
The improved design of the furnace has reduced the use of bagasse by nearly 20%, saving 35 tonnes. The remaining bagasse is sold to cardboard manufacturing units in the area. The selling of surplus bagasse adds to the earning with an additional Rs. 35000 from this leftover waste. The cost of construction of the furnace has been recovered in one season itself.

- Pehalvanji, the changemaker

Community Engagement Strategy Development

Stakeholder Mapping: Identified key stakeholders within the community, including societal change makers/ leaders, representatives of community-based organizations, healthcare workers, educators, and residents.

Needs Assessment: The community members across the country shared their experiences in technology use and their changes in their overall lives and livelihood. Conducted a comprehensive needs assessment to understand the priorities,



Energy-efficient jaggery furnace for a sustainable future

My electricity bill has also dropped significantly. "The solar system is cost and timesaving. I can now give more time to other activities as I do not have to collect more wood.

- Jai Kumar,
a beneficiary

Energy Access Makes Live Easy Across India's Hilly Districts, Himachal Pradesh

and co-create solutions. The roundtable sessions and the ISTI portal platform created opportunities for knowledge sharing and peered learning by showcasing successful S&T interventions, case studies, and best practices from within the community

challenges, and aspirations of the community regarding S&T interventions through online and offline interactions to gather input from community members. Facilitated ongoing communication and information sharing and roundtable discussions, to foster face-to-face interactions.

Roundtable Discussions and Collaborative Decision-Making

Facilitated Roundtable discussions and structured dialogues that brought together diverse stakeholders to exchange ideas, share experiences,

We have been trained to clean the filter and know how to do it. There are no problems at all. We have access to safe drinking water and is sufficient for our households.

- Sunil Dudi

A Tech-Driven Solution to Boost Groundwater in Chirawa Block, Jhunjhunu, Rajasthan

and beyond. Encouraged storytelling, testimonials, and experiential learning to inspire and motivate community members. The community members were encouraged to interact in their regional languages with the Experts. The programme also fostered partnerships and collaborations with Departments and Ministries from State and Central departments, knowledge organizations, non-governmental organizations (NGOs), academic institutions, and private sector entities to leverage resources, expertise, and networks for S&T implementation. Pooling together diverse perspectives and resources for enhancing the effectiveness and sustainability of interventions were also discussed and explored.

The overall objective was to engage communities effectively with S&T initiatives that could harness local knowledge, local innovation and resources, and promote sustainable development outcomes that address the unique needs and priorities of rural communities.

4.2 Mode of Implementation

The programme was structured to bring three types of community impact presenters and story tellers (that is, NGOs, field leaders and beneficiaries) on one platform for experience sharing. First, users of technology/innovation/traditional knowledge were heard directly to assess the technology absorption at the grassroots, and the reflective change it brought out on their quality of life. The interaction with the community people were facilitated by the PI of the initiative, where societal changemakers were also present. In several cases, the PI were also the changemakers.

Sessions

1. Session – I (Technical Impact Presentation)
    - Community Feedback through experience sharing by beneficiaries
2. Session –II (Technical Impact Compilation)
    - Community Change leaders and changemakers conclave
3. Session-III (Technical Impact Vision)
    - Round Table Discussions on the Role of STI in Preparedness and Resilience of the Community and the Discussion of a Future Roadmap

On each day of 25 days, three communities were reached out for the assessment and interaction, and documenting the feedback through their experience sharing. These sessions were followed by the round-table panel discussion among the invited experts of the specific domains, PIs of those three technology implementers and societal changemakers. The main objectives of this multi-dimensional discussion were to identify the role of STI in preparedness and resilience of the communities, identify the systemic gaps, document the inputs to fill, repair and manage those gaps, and suggest the future roadmap.

The Programme was inaugurated by Hon'ble Union Minister of State (Independent Charge) Science & Technology and Earth Sciences Dr Jitendra Singh, on 15 November 2021 on the Janjatiya Divas. He emphasised on the need of multiplying the successful models of community capacity development through STI across the nation and nurturing the local level innovation for sustainable development while interacting with community groups. The Hon'ble Minister stressed that the time has come for creating more science and technology based local entrepreneurship for strengthening vocal for local Mission of the nation and also said that there was a need to showcase the impact of STI capacity building among the community to raise the value of our scientific competence and achievements as a part of the Azadi Ka Amrit Mahotsav.

With the inauguration of the Techनींव@75 programme, the programme goals were introduced and the programme continued in both physical visit and online mode directly reaching out to the communities, social change makers, experts, scientists and policy makers.

While capacity building is a continuous and dynamic process, efforts were made for increasing economic opportunities and diversification, developing effective solutions for building the resilience among communities, building effective education systems to increase the capacity of communities to learn, adapt to changes and contribute to the innovation process of finding new and better solutions for risk reduction.

Communities strengthening the capturing and dissemination of community learnings and insights through video films were carried out as part of the programme. This had a significant impact on community engagement, empowerment, and knowledge sharing. Around thirty communities

Value-added and Nutritionally fortified products, Himachal Pradesh

Ever since I am associated with this unit since 1998, my life has completely changed for the better. I am having steady income which has been used to educate my children, get my daughter married, construct a house for my family and to meet my regular household expenditure.

- Roshan Lal,
a beneficiary

were selected out of seventy five communities due to time and resource constraint and there were featured in 15 films produced for this purpose. This selection was inclusive and representative of the diversity within the larger population. The films produced captured the voices of the community members who shared their stories, experiences, and solutions in their own words.

These films captured the impact of Science, Technology and Innovation in creating social equity and inclusion on the special occasion of Azadi Ka Amrit Mahotsav. These provided opportunities for active participation and ownership throughout the filming process, allowing communities to express themselves authentically and share insights that are meaningful to them.

The films were screened during National Conclave and review meetings organized by DST

and uploaded at the ISTI Portal for wider reach and dissemination.

National Conclave on Societal Change Makers

Techनींव@75 emphasized the identification, enhancement, and dissemination of grassroots innovations to enhance their efficacy and reach. By amplifying these innovations, the programme aimed to improve livelihood opportunities and foster socio-economic development. To further this objective, a Conclave on Societal Change Makers was convened at IIT Guwahati in November 2022 on the occasion of Janjatiya Divas..

This Conclave served as a platform to showcase the pivotal role of changemakers in bridging the gap between science and society. Approximately ten social change makers were invited from various communities to share their experiences and insights on leveraging STI interventions to drive positive change within their communities. Their stories illuminated the transformative impact of STI on livelihoods and societal well-being, highlighting the importance of collaborative efforts in realizing sustainable development goals.

Sustainable water solutions in Bundelkhand, Uttar Pradesh

Change makers at National Conclave at IIT, Guwahati

Millets for India's Food and Nutritional Security

We have close to 70 technologies in millets value-addition and we can train more such self-help groups and other farmer producer organizations if we get an opportunity through the DBT or DST to create a healthy society through millets.

- Dr Sangappa, ICAR- IIMR

National Conclave on Techनींव@75:

A National Conclave on Techनींव@75 was organised on 21st December 2022 at New Delhi to showcase the significant outcomes, key learnings and the way forward of the Techनींव@75 before an august gathering of experts, policymakers, scientists, and custodians of STI-based livelihood system, representing all science ministries and departments. The conclave aimed to explore how much absorption of science and technology took place at the community level and set a framework for developing a knowledge economy from a welfare economy. The conclave was hosted at ISTI Portal and around 1600 people watched the programme live on ISTI Portal. The conclave aimed to explore how much absorption of science and technology took place at the community level and set a framework for developing a knowledge economy from a welfare economy.

During the Conclave a panel discussion with the filmmakers who produced video films on Techनींव@75 as part of the programme was held. The panelist shared their field-level experiences and their interaction with the communities and the scientific organizations while shooting the films. The films produced were also screened during the conclave.

The Conclave was attended by the Experts from different ministries and departments including

NITI Aayog, Office of PSA, Ministry of Tribal Affairs, Ministry of Rural Development, MSME etc.

4.3 Digital Platform Used: ISTI Portal

ISTI Portal is a centralised repository of the content generated related to science, technology and innovation within the Indian STI ecosystem with a significant thrust on reaching out to students, scientists, researchers, youth and the general public to help them choose fellowships, scholarships, funding, and startup opportunities in India. The Portal is a user- friendly destination with repositories of ongoing and recently completed research projects, developed technologies, recognised innovations, funding opportunities, fellowships & scholarships, organisations, academia-industry partnerships, etc.

The Portal also provides information about the programmes and schemes the government of India offers to boost scientific activities and the ways in which India's government is fostering innovations. It projects India's STI policies, regulations, & vision through various documents developed by the government's various science ministries and departments. It focuses on bringing all stakeholders and Indian STI activities on a single online platform; helping efficient utilisation of resources; highlighting the functioning of scientific

Digi-bunai software has enabled weavers to reduce pre-looms time consuming process and cut down the time taken to create designs. It has impacted the overall production and livelihood of the community.

- Kandarpa Kachari, User

Digi Bunai threads a new chapter for the handloom community, Assam

These briquettes are preferred over lumpy charcoal because they have a high combustion value, burn for longer duration of time, are smokeless, easy to transport, less expensive, and simple to use.

- Dr Daya Srivastava, Scientist, KVK-ICAR, Sitapur, Uttar Pradesh

Women in Uttar Pradesh turn agro-waste into smokeless fuel, ignites earnings

organisations, laboratories and institutions; aggregating information on science funding, fellowships & award opportunities spanning from school to faculty level; pooling together conferences and science events; and projecting science in India with its major achievements.

The Portal also acts as a platform that brings together scientists and researchers to pool knowledge, expertise, wisdom and skillsets required for their research, translation of research into products, technology transfer and escalation. It reaches out to a wide range of audiences through science and technology communication and engagement, garnering their support for the celebration of science.

The mammoth amount of knowledge and information, with open access, available at ISTI Portal and its activities towards mechanising facilitation

I lead an SHG named 'Chitra Kala' with the help of IRTC. We are also getting orders from Government banks, schools and industries like Saint Gobin for gift items. We are 15 in the group and each member of the SHG can comfortably earn around Rs 15000-20000 from this.

- Mrs Reema, President, Chitra Kala SHG

between science and various stakeholders were the primary reasons it was chosen to host the Techनींव@75 initiative. The communities while interacting with the experts and representatives from various funding agencies could leverage the availability of repositories related to developed technologies and could explore the various funding opportunities available for bridging the science and the society.

4.4 Questionnaires for Community Feedback

Techनींव@75 programme brought three types of stakeholders to one platform for their experience sharing, feedback, and expectations regarding scientific interventions in communities. The stakeholders were asked a multitude of questions and the whole programme was captured and stored in the database of the ISTI Portal. Community groups provided societal input through the sharing of experiences and the presentation of impact tales from various groups.

Reshaping the lives of potter community through technology, Kerala

Questionnaires for the Community Group

1. Introduce yourself and your work
2. What were your problems/ issues that were addressed by S&T interventions?
3. Tell us how these Knowledge Institutions S&T hubs reached you.
4. To what extent has the problem been solved?
5. How are you utilizing the technologies? What are your products/services?
6. Do you feel that S&T intervention has helped in creating livelihood opportunities?
7. Please provide your feedback on how the S&T interventions benefited you.
8. What are the major roadblocks that you faced?
9. How do you maintain or repair the technology?
10. Any suggestions on improving the process?

Questionnaires for Social Changemakers

Changemakers shared their experiences and recommendations to help identify and address systemic gaps and to determine the community's capacity for absorbing technology and knowledge.

Technology for sustainale composting of crop residue in Kerala

For using this composting unit I buy half of the manure from outside and the rest I am getting from this cabin. We are collecting the waste from the field and putting it in the cabin. This way we are saving money that we usually spend on purchasing fertilizer.

- S. Gopinath, another beneficiary

1. What motivated you to work for the community group?
2. What was the driving force behind your contribution?
3. Share your story of bringing the changes at the community level.
4. How did you go about these changes?
5. Do you think that S&T interventions helped you in the change process?
6. Do you feel that the support from the Scientific Organization/Knowledge Institution was adequate enough to contribute to the community group in an effective manner?
7. What kind of support (e.g., training, awareness, skill development, linkages, establishing units for manufacturing, testing, standardization, marketing) do you provide to the community group?
8. What are the challenges faced in technology absorption by the community?
9. Has technology intervention helped in creating livelihood opportunities and capacity building?
10. Are there any major gaps at the implementation

and administrative level? What, according to you, are the roadblocks between the implementers and the administrators?

11. What led you to conclude that this technology has been able to address community issues and problems?
12. What kinds of local-level enterprises are being developed through your innovation and contribution?
13. What kind of value addition to products has been done through S&T interventions?
14. Do you think that technological adsorption has taken place at the community level and helped in laying the foundation and improving the quality of life?
15. What are your suggestions? What else needs to be done?

Questions for Roundtable Discussion to strengthen and nurture local innovation

The scientists who created the necessary technology or enhanced the TRL of the indigenous technologies offer information on the S&T intervention used their benefits and drawbacks, scalability, and readiness. A Roundtable discussion was held to lay a roadmap and identify the gap areas and bottlenecks.

1. How to prepare the communities for technological absorption?
2. What are the indicators for measuring technological absorption?
3. What kinds of innovations can be implemented?
4. How to make these technologies widely available and sustainable?
5. Need for scaling up of technologies.
6. Need for raising the Technology Readiness (TR) Level for sustainable marketization.
7. How to strengthen capacity building at the local level?
8. What types of training and awareness need to be established?
9. How to empower local innovators with the help of formal innovation centres?
10. What could be the possible role of networking and cooperative culture?

The responses to these questions were recorded online and taken as data. On the basis of responses to the above questions, the indicators for S&T-enabled livelihood had been enlisted. The standard list of indicators for all types of livelihood interventions in different contexts to 75 different communities was the pre-requisite for obtaining a standardized and sufficiently summarized list comprising all types of interventions. To better understand the strengths of rural communities, it is important to conduct an analysis of capital or assets, opportunities, and challenges of the communities. One way to do it is through community mapping. Community asset mapping is a good way to identify the people, their living conditions, the availability of tools, machinery, and technologies to them, and their accessibility to finances and credits and social networking and social leadership present in the community.

The testimony of empowering communities through science and technology (S&T) highlights the transformative impact of innovative interventions on the lives of individuals, families, and entire communities. It was observed in the study that the S&T interventions aimed to unlock new economic opportunities and enhance livelihood prospects for community members, particularly in rural and marginalized areas. S&T interventions provide communities with access to valuable information and knowledge, empowering them to make informed decisions about their lives and livelihoods. Innovations such as improved agricultural

With technological intervention, we cultivate oyster mushrooms and plan to scale up our enterprise.

- Sonam, Ladhak tribal community

techniques, renewable energy technologies, and e-commerce platforms enabled communities to diversify their income streams, increase productivity, and access global markets.

The programme brought out that the technological interventions contributed to improved community health and well-being by facilitating access to healthcare services, preventive measures, and health information. The projects implemented by DST, DBT, CSIR and Ministry of Earth Sciences also supported infrastructure development and enhanced community resilience to environmental hazards and climate change impacts.Technologies such as decentralized water purification systems, renewable energy microgrids, and early warning systems help communities adapt to changing environmental conditions, mitigate risks, and build resilience against natural disasters.

The programme aimed in empowering communities by fostering participatory decision-making processes, collaborative problem-solving, and inclusive governance structures. Through this unique initiatives government and funding bodies can strategies more people centric projects, community-driven research, and digital platforms for

civic engagement, community members to become active participants in shaping their own futures and advocating for their needs. Another important point emerged from the study is the understanding of the local knowledge systems and the local innovations within communities, ensuring their continuity and relevance in a rapidly changing world safeguarding their cultural traditions and also strengthening the local systems with advanced S&T tools and techniques to promote indigenous practices. This would also promote the social cohesion and inclusion by bridging divides, fostering dialogue, and strengthening community networks.

Cheer ki pattiyan (pine needle leaves) were a huge problem for us. We were always scared of forest fires happening in our region. It came as a surprise to me that this menace can be used to make fuel and generate employment and money.

- Draupadi Devi, a beneficiary and pine needle collector

Based on how much land is available, we make these nurseries. After harvesting one crop, another is sown. The portable nursery can be moved about depending on water-logging, rain or sun. We can now grow that crop whose demand is high in a particular season. I have one metre by two-metre portable life nursery.

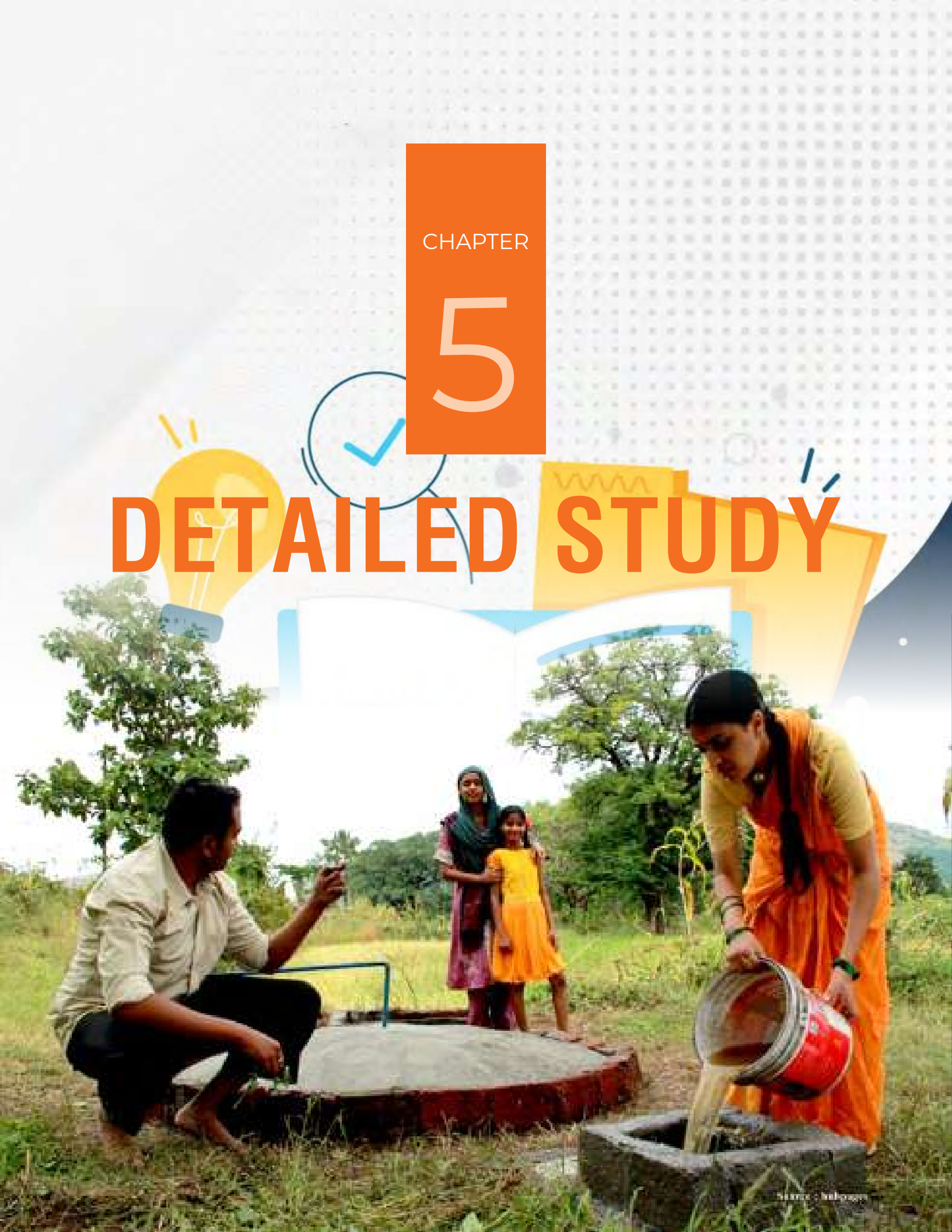
- Harishchand, a farmer, Kaudia, Gorakhpur

The testimony of empowering communities through science and technology underscores the transformative potential of S&T interventions in driving sustainable development, fostering resilience, and empowering individuals and communities to realize their full potential. By leveraging innovation and collaboration, S&T can serve as a catalyst for positive change, creating opportunities for inclusive growth, social justice, and shared prosperity.

CHAPTER

5

DETAILED STUDY



By harnessing the power of modern methodologies, we aim to ensure the long-term viability of our honey collection practices, while safeguarding the delicate web of life that sustains us all. We remain steadfast in our dedication to preserving our cultural heritage and protecting the majestic Sunderbans.

- says one of the beneficiaries

5.1. Study Approach

Techनींव@75 was a year-long programme to collate the data of impactful technologies developed by field-based organizations supported by S&T-based departments Department of Science and Technology, Department of Biotechnology, Council of Scientific Research, and Ministry of Earth Sciences. The programme was organized to assess the absorption and adoption of scientific technologies at the community level and its role in bringing change in the quality of life resulting in a strong societal foundation through interaction with community and change makers, eminent scientists, experts, and policymakers. It also aimed to evaluate the effectiveness of technologies on the basis of feedback and experiences of actual beneficiaries about the technologies.

The organization, Vigyan Prasar implemented the whole programme Techनींव@75 through an online platform. There was an interaction between the three types of groups; the community, the change

makers from different types of livelihood systems and scientists and experts, and representatives from Technology implementing bodies. Besides that, there was the presence of change makers, who motivated the community people or the early adopters of technology. A set of questionnaires was designed for interaction with these three groups. The communities were questioned regarding their problems and challenges, how S&T interventions addressed these problems, how they contacted the S&T institutions, how they tackled the roadblocks, how they maintain and repaired technology, and how S&T created products/ services, market accessibility, skill development & training, social networking, development of infrastructure and livelihood opportunities and its role in the improvement of other facets of life such as health and literacy. Change makers also provided information about the ground-level problems, and how they worked with the communities to sort out the problem with S&T institutions' technical, educational, and financial support under different projects, and what challenges they faced to implement technologies at the grass root level.

The scientists and experts gave their recommendations for better implementation of technologies at the grassroots level and the development of robust and sustainable livelihood systems at the community level. The questions are basically related to the capabilities, assets, livelihood activities of the communities, stress, and shocks faced by the communities. The information gathered during the interaction among different stakeholders indicated the livelihood of the community. The information and feedback received during Techनींव@75 Programme mapped against each technology under different heads such as training and skill development, community participation, linkage with banks and markets, and many more. When the responses to these questions were integrated together into a study, it indicated five basic capitals of the

At Bekajan, the weaving team of CSIR and SNEHPAD jointly gave training to 40 women. After 3 months, each woman was given a Jacquard loom. Three batches have been trained in Ajoynagar. If earlier 19 gamusas were woven, now 300 gamusas are woven in a day by these women.

- Kalpana, Coordinator of Bekajan Handloom Cluster, Titagorh, Assam

Jacquard looms make women weavers financially independent

livelihood. So, we adopted a livelihood approach for the study of the Techनींव@75 programme giving emphasis on the strengths and weaknesses of the communities, identifying the factors which diminished or enhanced their livelihoods on the one hand, and policies and institutions in the wider environment, which were the main technology implementers.

5.2 Livelihood Framework

Ellis (2000), - A livelihood comprises the assets (natural, physical, human, financial and social capital) the activities and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household!. It is defined as the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and improve their standard of living.

Livelihood Framework identifies five core asset categories or types of capital upon which livelihoods are built. No single category of assets on its own is sufficient to yield desired livelihood outcomes. This is particularly true for poor and marginalized or underprivileged groups whose access to any given category of assets tends to be limited. As a result, they must seek ways of nurturing and combining their assets innovatively to ensure survival.

The livelihood framework describes the main features of the livelihoods approach, and its strengths, and weaknesses. It then explores how the approach can be put into practice through appreciative inquiry and participatory problem analysis. The framework shows how, in different contexts, sustainable

Transforming livestock rearing in border villages

We work in a community mode, some supply us with milk, others work with us to make products. We are around 200-250 members who are now involved in making milk-based products.

- Sushma Devi,
Changemaker and User

livelihoods are achieved through access to a range of livelihood resources (natural, economic, human, and social capitals) which are combined in the pursuit of different livelihood strategies (agricultural intensification or extensification, livelihood diversification, and migration). Central to the framework is the analysis of the range of formal and informal organizational and institutional factors that influence sustainable livelihood outcomes.

At the same time, an understanding of the livelihood framework must be clear. The livelihood framework is a way of understanding how households derive their livelihood by drawing on capabilities and assets to develop livelihood strategies composed of a range of activities.

The livelihood framework helps to identify what people are already doing to cope with risks and

vulnerability. It tries to make connections between factors that constrain or enhance their livelihood on one hand and policies and institutions in the wider environment and identify measures that strengthen assets, enhance capabilities, and reduce vulnerability. There are different types of livelihood frameworks developed by various agencies like CARE, Oxfam, UNDP, and DFID. The approaches of different agencies are much in common, but also there are some variations and differences in emphasis.

Five main principles guiding the livelihood approach

i. The approach is people-centric and participatory

Livelihoods are about people, so livelihood analysis is based on understanding how people make their living. It uses participatory methods and serves as a framework to decide which participatory livelihood assessment method to use at the appropriate time, and how to frame key questions.

ii. The approach uses differentiation

The livelihood approach recognizes that there are important differences among households in a given community. Differentiation may involve relative well-being or it may focus on issues such as gender, age, and ethnicity. Differentiation enables organizations to improve their ability to design sensible interventions with target groups. It helps to understand where resistance may develop.

iii. Holistic analysis leads to targeted interventions

The approach encourages holistic analysis, with attention to identifying positive and negative factors inside and outside the households that affect the livelihood. However, it does not assume that one must address all issues simultaneously. Rather based on the analysis of the most important influences on livelihoods, one can select specifically focused interventions while understanding how these related issues are not being addressed. The livelihood framework can be useful for organizations that focus on specific sectors like health or natural resource management. It creates opportunities for organizations that have a different sectoral focus to work together in cooperation or partnership. It helps to increase the impact of development interventions. Holistic diagnosis allows us to identify the most strategic interventions in a situation to achieve the best result.

iv. Targeted interventions should result in maximum leverage

Successful poverty reduction strategies must address a whole range of issues. There are many possible interventions, but resources are limited. Therefore, it is crucial to select and target interventions in ways that will have the greatest impact and reduce poverty and vulnerability for most people.

v. Reflective practice improves the quality of analysis and intervention

The livelihoods framework recognizes that households and livelihoods are constantly changing in response to shocks, stresses, and seasonality (the impact of the seasons). This highlights the need for ongoing learning and structured reflections on practice. Reflective practice must apply both to the 'implementing agent' and the community/ households involved. Engaging the community

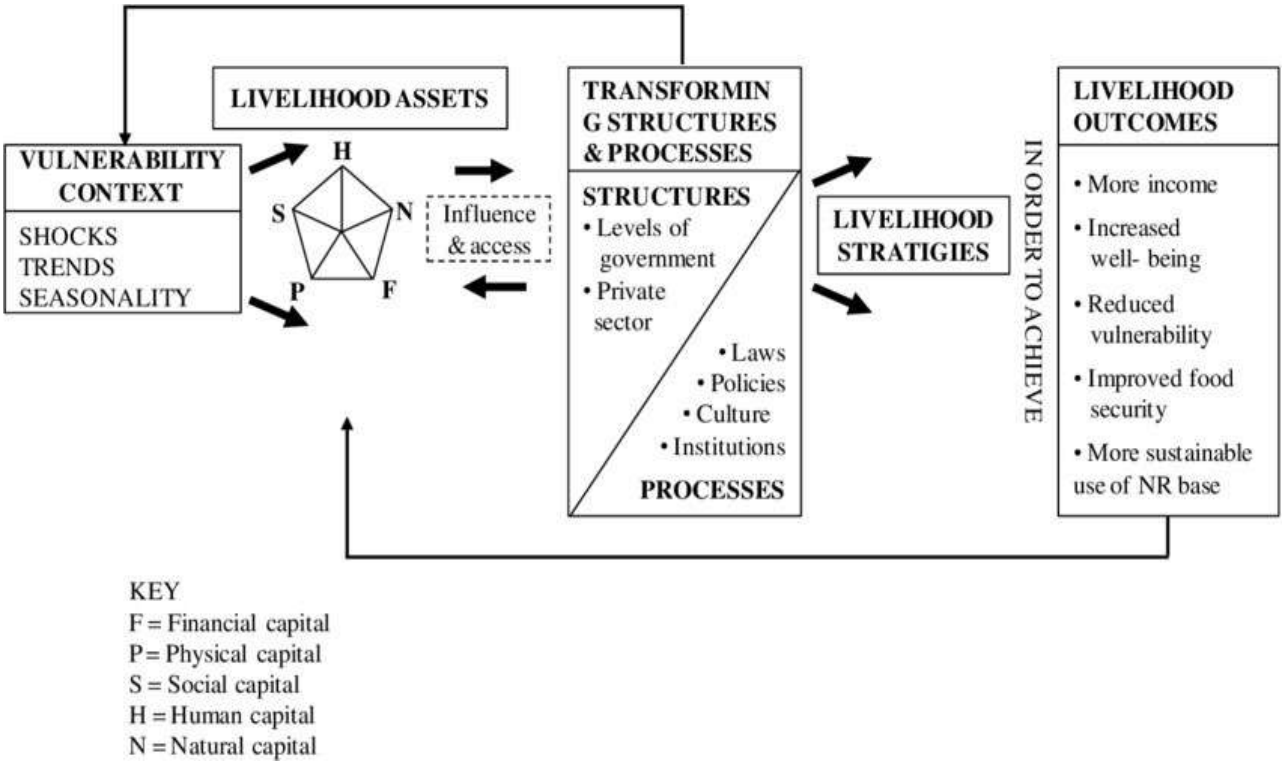


Fig 5.1 DFID Framework for Livelihood System

in an ongoing discussion and analysis of changes in their livelihoods over time helps make people at all levels more aware of potentials and linkages. Livelihood analysis can provide a useful framework for monitoring the impact of development initiatives and can pinpoint unintended consequences.

5.3 Livelihood Approaches of Different Agencies

Co-operative for Assistance and Relief Everywhere (CARE) Framework

The international NGO 'CARE' uses the livelihood approach as its primary framework. It identifies three fundamental attributes of livelihoods - the possession of human capabilities, access to tangible and the existence of livelihood activities. It mainly does three types of activities, namely livelihood protection, livelihood promotion, and livelihood provisioning.

The CARE framework emphasizes the dynamic interrelationship between different aspects of the framework but does not use the 'five capital' approach to assets. It also does not allow to identity transforming structures and processes and places less emphasis on macro-micro linkage within the framework.

CARE framework was not found suitable for analysis of the Techनींव@75 Programme as it does not use a 'five capital' approach to assets, has no emphasis on macro-micro linkage, and does not identify transforming structures and processes.

Oxfam's Framework

Oxfam also draws on Chambers and Conway for its definition of sustainable livelihood. It believes that everyone has the right to a sustainable livelihood. It emphasizes that sustainability has different dimensions – Economic, Social, Institutional, and Ecological. Its main activity is strategic planning.

After receiving adequate training, the artisans were able to produce yarn of different counts from provided roving and make coarse yarn of 10 nm from mixed wool. Up to forty beneficiaries were trained in spinning, weaving, and shearing operations. Ten of these forty beneficiaries were trained as master artisans to instruct more people.

- Dr. Mohd. Tufail, Assistant Professor, Department of Higher Education, Government of Jammu and Kashmir

Oxfam framework does not consider human capital as a dimension for sustainability but Techनींव@75 included the questions related to skill development and training of communities on various technologies and gathered information on this aspect. This is an important aspect of human resource development and human capital. So, this framework was not found suitable for analysis of the Techनींव@75 Programme.

UNDP Framework

UNDP understands livelihoods as the means, activities, entitlements, and assets by which people make a living. It defined livelihoods are those that are able to cope with and recover from shocks and stresses. It focuses on people's strengths rather than their needs and emphasizes macro-micro links. It promotes adaptive strategies rather than transforming structures and processes.

UNDP Framework is not holistic and dynamic in nature. It does not take transforming structures and processes into account. Transforming structures means levels of government and private sectors while transforming processes means laws, policy, culture, and institutions.

The Techनींव@75 programme was dynamic in nature. The uniqueness of the programme was it was concptualised as people-centric programme rather than techno-centric. Techनींव@75 gave an opportunity to interact directly with the communities from all over the country who shared their insights and experiences directly with the scientists, experts, implementers of the programme and funding agencies. The programme also helped us in identifying social change makers who has brought the changes to the communities with the upgraded technologies, products and services. These change makers acted as a bridge between the solution providers and solution receivers' i.e the community group. This component was missing in the UNDP framework. So, this framework was not considered for the analysis of the impact of S&T interventions.

DFID's Framework

One of the most widely used frameworks is the DFID Framework used by the UK Department for International Development. The DFID framework sets out to conceptualize – how people operate within a vulnerability context that is shaped by different factors, like shifting seasonal constraints (and opportunities), economic shocks, and longer-term trends; how they draw on different types of livelihood assets or capital in different combinations which are influenced by the vulnerability context; a range of institutions and processes; how they use their asset base to develop a range of livelihood strategies to achieve desired livelihood outcomes; the arrows in the framework try to show how the different elements all of which are highly dynamic interrelate and influence one another; the framework is informed by certain core concepts.

It is people-centered in the sense that it advocates that development policy and practice should flow from an understanding of the poor and their livelihood strategies; the poor should directly contribute to determining development priorities and be able to influence the institutions and processes that impact their lives. DFID's core idea is people-centered, multilevel, poverty-focused, dynamic, and various types of sustainability presented in Fig 5.1.

Livelihood strategies in order to achieve livelihood outcomes include more income, increased wellbeing, reduced vulnerability, improved food security and more sustainable use of natural resource base. In the Fig.1 the DFID Framework for Livelihood systems depicts the following:

- **H represents human capital:** the skills, knowledge, ability to labour, and good health important to the ability to pursue different livelihood strategies.
- **P represents physical capital:** the basic infrastructure (transport, shelter, water, energy, and communications) and the production equipment and means that enable people to pursue livelihoods;
- **S represents social capital:** the social resources (networks, membership of groups, relationships of trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods;
- **F represents financial capital:** the financial resources which are available to people (whether savings, supplies of credit or regular remittances, or pensions) and which provide them with different livelihood options; and

Previously, the jungle animals used to destroy our crops, but after planting lemongrass, even elephants stopped coming to our field. We didn't have knowledge or plants for this crop, and we had to go to other fields to get the lemongrass to sell. Now, we have our own plant, and we make a profit by selling the oil for Rs 1500 per kilo to government organisations.

- says Lakshmi Dutta Gupta, Entrepreneur

- **N represents natural capital:** the natural resource stocks from which resource flows useful for livelihoods are derived (e.g. land, water, wildlife, biodiversity, environmental resources).

The DFID Framework discusses transforming structures and processes structures as represented in the above figure and the role of various levels of government, private sectors, policies, culture, and institutions. All these influences the each capital of livelihood assets and provides access to people in strengthening each and every capitals of livelihood system.

Similarities between DFID's Sustainable Livelihood Approach and Techनींव@75 Programme

The unique features of the Techनींव@75 Programme were:

i. Techनींव@75 programme was a people-centric and community-centric programme rather than techno-centric programme.
ii. The programme
iii. It was conducted to know the impact of technological interventions done under different projects on the livelihood system of communities.
iv. It also emphasized on strengths of communities rather than problems.
v. It tried to get holistic information about various components of livelihood (Human Capital, Social Capital, Economic Capital, Physical Capital, and Natural Capital) through the discussions.
vi. It was focusing on cross-bridge collaborations between different levels like community level, local institutions, policymakers, etc. for the development of communities through S&T interventions.
vii. It aimed to highlight sustainable and resilient livelihood in different contexts. There was a presence of communities from different contexts of livelihood. The communities have different backgrounds, different socio-economic preferences, and different existing resources. For example, Fishermen communities have marine-based livelihoods. Their life got affected by seawater levels, and tsunamis-like natural phenomena and their livelihood depend on the availability of fish, the conditions of boat nets, and information about oceanic conditions, so different types of scientific interventions like information Hub, echo sounders and motorized boats are effective for them and help them in their livelihood generation. On the other hand, farmers have agriculture-based livelihoods. They need good quality seeds, manures, tools, and pieces of machinery, and information about agronomic practices of crops and management of pests and diseases. These two livelihoods had different contexts. So, the Techनींव@75 programme considered different contexts of livelihood.
viii. It also conducted sessions on natural resource management and also highlighted those communities that did judicious use of natural resources with the help of scientific interventions.
ix. The different stakeholders were community groups, societal change makers, and scientists from various disciplines and policymakers who discussed the present condition of S&T-enabled livelihood and how to improve the ways of appropriate technological interventions in the societies so that it got properly absorbed in the communities. In the case of the DFID's framework transforming structures and processes are important components of the framework.

Techनींव@75 gathered information on the outcomes of technological interventions through various questions like:

- Did technology help to increase the income of people?
- Did technology help to improve the living condition of people?
- Did technology help to improve their health, education, and so on?

For the study and analysis of the Techनींव@75 Programme, we found the DFID framework most

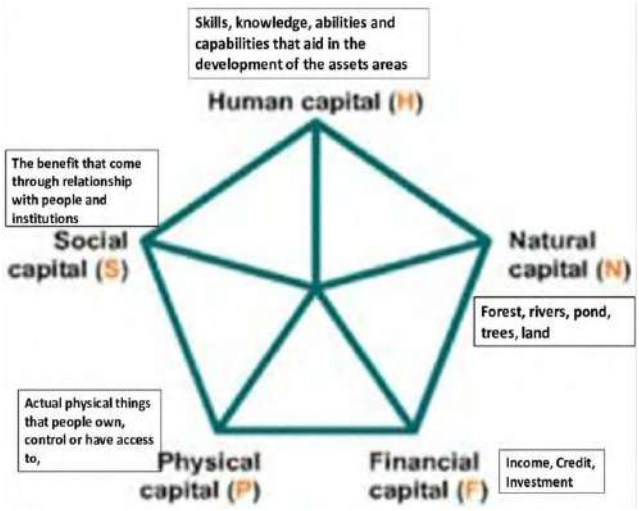


Fig 5.2 Asset Pentagon

appropriate as it is the most prominent framework among other frameworks. It is a people- centric approach and it can be used as a tool to understand the socio-economic condition of community people's views and their own understanding of their livelihood system. Techनींव@75 programme and DFID sustainable livelihood framework both emphasized the strengths of people rather than problems. Both advocated for micro-macro linkages and collaborations. The information gathered during Techनींव@75 programme gave basically the information or inputs for five capitals of livelihood systems of communities. The DFID's sustainable livelihood framework identifies five capitals upon which livelihoods are built, namely human capital, social capital, natural capital, physical capital, and financial capital. In the case of Techनींव@75, the livelihood strategies of communities are dependent on asset status and policies, institutions, and processes. This is an important element of the DFID livelihood framework.

A detailed investigation of the living conditions of the target population is the starting point of the development project based on the DFID sustainable livelihood framework. The second step is to identify limiting factors that hinder the adaptability of sustainable livelihood strategies. Similarly, the interactions done during Techनींव@75 sessions started from detailed investigations of the living conditions of communities and discussed gap areas that hindered the proper utilization of technologies for the welfare of communities.

There were lots of similarities found between DFID's framework and the Techनींव@75 Programme. The only component of S&T is not a part of the DFID framework. This study used DFID's framework as the base framework for the study of findings of the Techनींव@75 Programme. Both the concepts follow Sustainable Livelihood approach.

5.4 Implementation of the Approach

The DFID framework was taken as the base for the study of technological interventions done in the community. DFID is operationalizing the livelihood approach in different contexts. It aims to promote sustainable livelihood through direct support to assets (providing poor people with better access to its assets). Support the more effective functioning of the structures and processes (policies, public, and private sector organizations, market and social relations) that influences not only access to assets but also livelihood strategies that are open to poor people. If people have better access to assets they will have more ability to influence structures and processes so that these become more responsive to their needs.

At a higher organizational level, DFID identifies three activities – enabling actions are those which support the policies and context for poverty reduction and elimination; inclusive actions are broad-based and improve opportunities and services generally and they also address the issue of equity

and barriers to the participation of poor people; focused actions are targeted directly at the needs of poor people.

A detailed study of each story of Techनींव@75 had been done and the collected information was put on this framework to get a structural idea of the story so that it can be applied in the livelihood analysis to gauge the depth of scientific interventions in the communities. In Techनींव@75 different contexts of livelihood systems were present like the Coastal region livelihood system, Hilly region livelihood system, Weaving livelihood system, and Pottery livelihood system, were present. Many technologies promoted sustainable livelihood through direct access to assets like clean and safe drinking water, health services, tools, and machinery were present. The S&T enabled communities to tackle their challenges through appropriate technological interventions.

This framework was found as a useful tool for understanding the strengths and weaknesses of communities, different types of capitals present in the communities, different vulnerability factors of communities, appropriateness of technologies, need assessment of communities and what need to be done to get the desired livelihood outcomes and multi-dimensional poverty.

5.5 Livelihood Framework and its Capitals

Livelihood Framework identifies five core asset categories or types of capital upon which livelihoods are built. No single category of assets on its own is sufficient to yield desired livelihood outcomes. This is particularly true for poor and marginalized or underprivileged groups whose access to any given category of assets tends to be limited. As a result, they must seek ways of nurturing and combining their assets innovatively to ensure survival.

The Asset Pentagon

The asset pentagon lies at the core of the livelihood framework.‘ Within‘ the vulnerability context. The Pentagon defricted in fig 5.2 was developed to present information about people‘s assets visually, thereby bringing to life important inter-relationship between various assets.

The Pentagon represents five capitals of livelihood. These are Human Capital (H), Social Capital (S), Financial or Economic Capital (E/F), Physical Capital (P), and Natural Capital (N). The shape of the pentagon can be used to show schematically the variation in people‘s access to assets.

Human Capital

Human Capital includes labour and other resources that humans can provide—education, experience, or unique skills—that contribute to production. Investment in health, education, and skill training is the major investment done in human capital formation. With recent challenges such as globalization, a knowledge-based economy, and technological evolution, success depends in large part on people with higher levels of individual competence. The people are becoming valuable assets and can be recognized within the framework of Livelihood. It has expandable, self-generating, transportable, and shareable characteristics. To begin with, the expandable and self-generating characteristics of human capital are closely linked to the possibility that the stock of knowledge increases the individuals‘ human capital. Furthermore, the increase of human capital can be expanded by either endogenous or exogenous factors. In the case of technological development, the original knowledge of a person can be continuously elaborated and developed through the S&T

knowledge, information, skills, experiences, and other knowledge-based factors as well. Without the consideration of sociocultural background, it is difficult to exactly understand the status of human capital in a nation. Finally, it is necessary to identify indicators to precisely measure human capital more accurately. For understanding the livelihood of communities, education and traditional knowledge, skill development, ability to labour (technical capability), health and local innovative ideas of an individual were taken as human capital indicators. Human capital is closely linked to social capital.

Social Capital

It is the social resources upon which people draw in pursuit of their livelihood objectives. The core of social capital is networking among constituents. The degree of one's knowledge creation and sharing depends on the variety of networks focusing on tie density, frequency, strength, and so on. This characteristic can result in stronger human capital in this rising era. Networks and connectedness, either vertical (patron/client) or horizontal (between individuals with shared interests) that increase people's trust and ability to work together and expand

their access to wider institutions, such as political or civic bodies; Relationships of trust, reciprocity and exchanges that facilitate co-operation, reduce transaction costs and may provide the basis for informal safety nets amongst the poor. The membership of groups and associations can extend people's access to and influence over other institutions. Similarly, trust is likely to develop between people who are connected through kinship relations or otherwise. Of all the five livelihood building blocks, social capital is the most intimately connected to Transforming Structures and Processes.

Economic/Financial Capital

Economic capital refers to those financial resources that people use to achieve their livelihood objectives. It also means flows as well as stocks and it can contribute to consumption as well as production. It determines the availability of cash or equivalent that enables people to adopt different livelihood strategies.

Savings are the preferred type of financial capital because they do not have liabilities attached and usually do not entail reliance on others. They can be held in several forms: cash, bank deposits or assets such as livestock, farm land and financial resources can also be obtained through credit-providing institutions. Livestock is an asset when it is kept for its value. It can be converted into money when the need arises. Livestock is a resource for agricultural and domestic production. Crops in farmland are an asset for farmers. Fishes are asset for fishermen. Excluding earned income, the most common types of inflows are pensions, or other transfers from the state, and remittances, grants.

Access to financial services improves the incomes and of an opportunity for the rural poor and provides support to their families over difficult times. Access of the poor to credit could be increased through specialized banks, including Regional Rural Bank, NABARD and some other banks, cooperatives, semi-formal credit agencies and informal lending networks. Generally, there are two major groups within the rural poor can be identified for banking purposes: the bankable poor and the non-bankable poor. The former one often in the subsistence sector with small commercial sales. They have a very small level of savings and loan demands. This group is not served by commercial banks unless and until the bankable poor organized in a form of self-help group or joint liability group through collective saving and

access to some resources.

The other group are marginal farmers who have little resources to draw upon. They need assistance on grant basis, which are made to groups. In this case bank does not expect repayment. Access to credit positively affects household income. Micro finance potentially reduce vulnerability by helping micro entrepreneurs diversify their sources of household income, increase their savings, expand their options for credit, and improve household money management Households with improved access to credit are better able to adopt technology; they spend more on food and, in some cases, have higher calorie intakes. Poor households strive to repay loans so that they will be able to borrow another time.

Livelihood activities assist communities to secure income through their own inherited local knowledge system. Income generating activities (IGAs) has potential to change the livelihood of the poor in terms of living condition, housing, nutrition, education, health, savings, dress, medical treatment, health, sanitation, education and liberalization (Ullah and Routray, 2007). Income generation helps the households to cope with income shocks, to ensure food security, to avoid an increase in poverty or to prevent vulnerable households from falling below the poverty line. It also plays a protective role by helping to accumulate physical assets, increase expenditures on housing, and strengthen women's role in collaborative economic decision making. Small and medium scale enterprise play an important role in economic development. Access to entrepreneurship and self-employment can offer effective coping strategies for poor and vulnerable communities to strengthen their livelihoods and create new opportunities for decent work and self-resilience among communities.

Physical Capital

It refers to tangible items that are necessary and available to communities to do livelihood activities. The machinery, buildings, office or manufacturing units, manufacturing equipment and tools, vehicles, and computers that a community owns are all considered part of its physical capital. These items are reusable and cannot consumed during production process, These resources occupy space, have value and used for livelihood generating activities. Product based livelihood activities use physical resources for production of goods. Raw materials are those which are transformed into other products. Accessibility of communities to physical resources helps people to fulfil the requirements of production process and access measured in terms of utilisation is dependent on the affordability, physical accessibility and acceptability of services and not merely adequacy of supply.

Natural Capital

Natural capital is essential to the sustainability of the economy. The natural resource stocks from which resource flows useful for livelihoods are derived (e.g. land, water, wildlife, biodiversity, environment. The land, agricultural fields, livestock, forest, trees, rivers, oceans are the most abundant resources available to communities. The depletion of a country's natural capital hinders poverty reduction and sustainable development objectives. Environmental assets, such as timber or fisheries, orchards, agricultural crops, animals and ecosystem services, such as water filtration, groundwater recharge are critical for human well-being and provide significant economic and social benefits. so, the conservation of natural resources is very important for well-being of communities.

5.6 Livelihood System Indicators

To analyze different S&T-enabled livelihood systems, a common list of indicators (at the outcome level) was selected on the basis of subjects relevant to the community on the basis of the literature review and the DFID model. All these indicators tend to assess the improvement in society through science and technology and, reinforce the consistency or viability of the scientific interventions done in that particular community. The Techneev @75 programme brought on board three types of stakeholders to one platform for their experience sharing, feedback, and expectations regarding scientific interventions in communities. The stakeholders were asked a multitude of questions and the whole programme was captured and stored in the database of the ISTI Portal. The entire deliberations captured led to identification of 25 qualitative indicators which have been categorized under fie capitals of Livelihood system.

An indicator indicates the influence of certain considerations which suggests a degree of influence when employed. The indicators of the technological progress of communities are generally developed to inform policy decision-makers in some way or another. Indicators are measures of individual perceptions and evaluations of social conditions. Techनींव@75 assessed the impact of STI on aspirations and the socio-economic development of communities through indicators. The most important measures of community well-being were the happiness and satisfaction of community members. Thus, measuring subjective satisfaction would amount to, - measuring how well they are adapted to their present conditions (technological intervention) and technology improved their quality of life. The indicators also provide valuable complementary information for policymakers' assessment of policy outcomes, selecting policy goals, and prioritizing policy goals. To analyze different S&T-enabled livelihood systems, a common list of indicators (at the outcome level) was selected on the basis of subjects relevant to the community on the basis of the literature review and the DFID model. All these indicators tend to assess the improvement in society through science and technology and, reinforce the consistency or viability of the scientific interventions done in that particular community.

5.7 Identification of Qualitative Indicators

Assessing the technology absorption capacity of rural communities requires a comprehensive evaluation across multiple dimensions. Firstly, access to infrastructure plays a pivotal role, encompassing essentials such as electricity, internet connectivity, and telecommunications infrastructure. Additionally, the existence of transportation networks facilitating the movement of goods and people, along with accessibility to basic amenities like roads, water supply, and healthcare facilities, further delineate the community's readiness for technological integration. Moreover, educational levels and skills are critical, encompassing literacy rates, availability of vocational training programmes, and proficiency in digital literacy and modern technologies. Socio-economic factors, including economic diversity, livelihood opportunities, and social cohesion, profoundly influence a community's capacity to absorb technology. Cultural acceptance and attitudes towards technology shape the receptivity to innovation, with considerations for risk-taking, experimentation, and integration of traditional knowledge systems. Local entrepreneurship and innovation, evidenced by the presence of entrepreneurs, support mechanisms, and a history of successful technology adoption, reflect

the community's innovation potential. Collaboration and networking amplify these efforts through participation in networks, collaborative initiatives, and information-sharing platforms. Resilience and adaptive capacity, institutional frameworks, policy environment, and governance structures collectively contribute to the community's ability to adapt to changing technological landscapes. Lastly, knowledge transfer, capacity building, user experience, and feedback mechanisms serve as vital components, ensuring continuous improvement and community involvement in technology implementation. Integrating these indicators offers a holistic understanding of rural communities' technology absorption capacity, empowering informed strategies for socio-economic development.

During the interaction with communities, the following indicators were considered under various capitals:

1. Human Capital – Education & Knowledge, Skill Development, Technological Capability, Health, and Local Innovation.
2. Social Capital – Interpersonal Relationship, Networking & Community Participation, Collaboration & Cooperation, and Leadership/ Social Change/Empowerment.
3. Financial Capital – Access to Credit & Finances, Income Generation, and Enterprise Development.
4. Physical Capital – Adequate Water Supply & Sanitation, Clean & Affordable Energy, Access to Information & S&T Knowledge, Access to/ Production of raw Material, Access to ICTs, Handholding, Assets, and Access to Markets.
5. Natural Capital – Agriculture & Livestock, Natural Resource Management, Environment Management, Water Conservation & Treatment, and Disaster Management.

These indicators were mapped with each community which have been detailed in Chapter 6 to understand the technological absorption capacity of the communities, their needs and challenges and finally the entire programme helped in evolving a science and technology based livelihood system taking into consideration the local knowledge system and local innovation system. The study proposed a Framework and several models that is participatory, integrating the top down and bottom approach and people-centric technology delivery and solutions.

The entire focus of the programme was to bring out the the technology absorption capacity of the people who are the receivers of the technologies and the role played by the other stakeholders viz technology developers, solution providers, implementors, policy makers and the social changemakers.

These indicators can be used in combination to assess the technology absorption capacity of rural communities qualitatively, providing a holistic understanding of their readiness and ability to harness technological advancements for socio-economic development.

CHAPTER

6

ANALYSIS OF THE STUDY

Analyzing livelihood systems involves assessing various parameters that influence how people sustain their lives, including economic, social, cultural, and environmental factors. Livelihood refers to the means by which individuals and communities secure their basic needs, sustain their well-being, and pursue their aspirations. It encompasses various dimensions, including economic, social, cultural, and environmental aspects, as well as the assets and resources that support livelihood activities.

Economically, livelihood entails engaging in income-generating activities that provide financial stability and economic security. This may involve formal employment, entrepreneurship, agriculture, or other forms of productive work that generate income to meet basic needs and support household expenses.

Socially, livelihood is intertwined with networks, relationships, and social capital that provide support, solidarity, and opportunities for collaboration. Strong social networks foster resilience and facilitate access to resources, information, and collective action, enhancing individuals' and communities' ability to cope with challenges and seize opportunities.

Culturally, livelihood reflects traditions, values, and practices that shape people's identity, sense of belonging, and ways of life. Cultural assets, such as traditional knowledge, skills, and cultural heritage, contribute to livelihood resilience and sustainability, preserving unique cultural identities while adapting to changing circumstances.

Environmentally, livelihood is closely linked to natural resources and ecosystems that provide essential goods and services for human well-being, including food, water, shelter, and energy. Sustainable management of natural resources is critical for maintaining ecological balance and ensuring the long-term viability of livelihood activities, particularly for communities dependent on agriculture, fishing, forestry, or other natural resource-based livelihoods.

Livelihood assets encompass a range of tangible and intangible resources that individuals and communities rely on to sustain their livelihoods. These assets include physical assets (such as land, infrastructure, tools, and equipment), financial assets (such as savings, credit, and investments), human assets (such as knowledge, skills, education, and health), social assets (such as networks, relationships, and social support systems), and natural assets (such as natural resources, biodiversity, and ecosystem services).

Livelihood is a multidimensional concept that encompasses economic, social, cultural, and

environmental dimensions, as well as the assets and resources that support individuals' and communities' efforts to secure their well-being and pursue their aspirations in a sustainable manner. Recognizing and understanding these diverse dimensions is essential for promoting inclusive and sustainable development that improves livelihoods and enhances human flourishing.

Analyzing the technology absorption capacity of rural communities involves identifying systemic gaps that hinder their ability to adopt, adapt, and effectively utilize technology for livelihood generation and socio-economic development. Assessing the impact of science and technology interventions on rural communities requires a comprehensive understanding of systemic gaps that may hinder or facilitate the effectiveness of such interventions. Some of the key systemic gaps considered during the study were:

Access to Infrastructure: It was observed that the limited access to basic infrastructure such as electricity, roads, and internet connectivity has hampered the implementation and adoption of technology-based solutions. Assessing the state of infrastructure is crucial in understanding the feasibility and potential impact of interventions. Without reliable infrastructure, rural communities may struggle to access and utilize technological innovations effectively.

Availability of Affordable Technologies: Limited access to technology and trainings that has prevented rural communities from benefiting from scientific and technological advancements. Understanding the level of technology penetration and access within rural areas is essential. The cost of technology products and services may be prohibitive for rural communities with limited financial resources. The lack of affordable and appropriate technologies tailored to the needs and capacities of rural users can hinder technology absorption efforts.

Awareness and Information Dissemination: Limited awareness and information dissemination about available technologies and their potential benefits can hinder rural communities' ability to adopt new innovations. Effective communication strategies are essential to ensure that rural residents are aware of and understand the value proposition of technology solutions.

Institutional Support and Capacity: Weak institutional support and capacity at the local level can hinder technology absorption efforts in rural communities. Lack of technical assistance, extension services, and support networks can limit rural residents' ability to adopt and utilize technology effectively.

Regulatory Environment: Inadequate or restrictive regulatory frameworks may hinder the adoption of certain technologies in rural areas. Complex licensing procedures, bureaucratic hurdles, and outdated regulations can discourage technology providers from investing in rural markets, limiting access to innovative solutions.

Socio-Cultural Factors: Socio-cultural factors such as gender norms, traditional beliefs, and social hierarchies can influence technology adoption patterns in rural communities. Cultural barriers may need to be addressed to ensure that technology solutions are inclusive and accessible to all members of the community.

Market Access and Value Chains: Limited market access and poorly developed value chains can hinder the uptake of technology-enabled solutions in rural economies. Lack of access to markets, credit, and distribution channels can reduce the incentives for rural entrepreneurs to invest in technology adoption.

Resilience and Adaptability: Rural communities often face environmental and economic challenges that require resilient and adaptable technology solutions. Technologies that are not suited to local conditions or lack flexibility may fail to gain traction in rural contexts, highlighting the importance of context-specific approaches to technology absorption.

Government Policies and Support: Government policies and support mechanisms can either facilitate or impede the implementation of science and technology interventions in rural areas. Assessing the regulatory environment, availability of funding, and government initiatives related to rural development is critical for understanding the broader context in which interventions operate.

Collaboration and Partnerships: Effective collaboration and partnerships between various stakeholders, including government agencies, non-profit organizations, academic institutions, and local communities, are essential for the success of science and technology interventions in rural areas. Assessing the existing partnerships and identifying potential collaborators can enhance the impact and sustainability of interventions.

Monitoring and Evaluation: Establishing robust monitoring and evaluation mechanisms is crucial for assessing the impact of science and technology interventions over time. Regularly collecting data on key indicators and soliciting feedback from the community can help identify challenges, measure progress, and make informed decisions for continuous improvement.

Addressing these systemic gaps requires a multi-dimensional approach that combines policy interventions, capacity-building initiatives, community engagement strategies, and targeted investments in technology infrastructure and education. By addressing these systemic gaps and understanding the unique context of rural communities, the department and other stakeholders can design and implement science and technology interventions that have a positive and sustainable impact on the lives of rural residents.

6.1. METHODOLOGY OF ANALYSIS

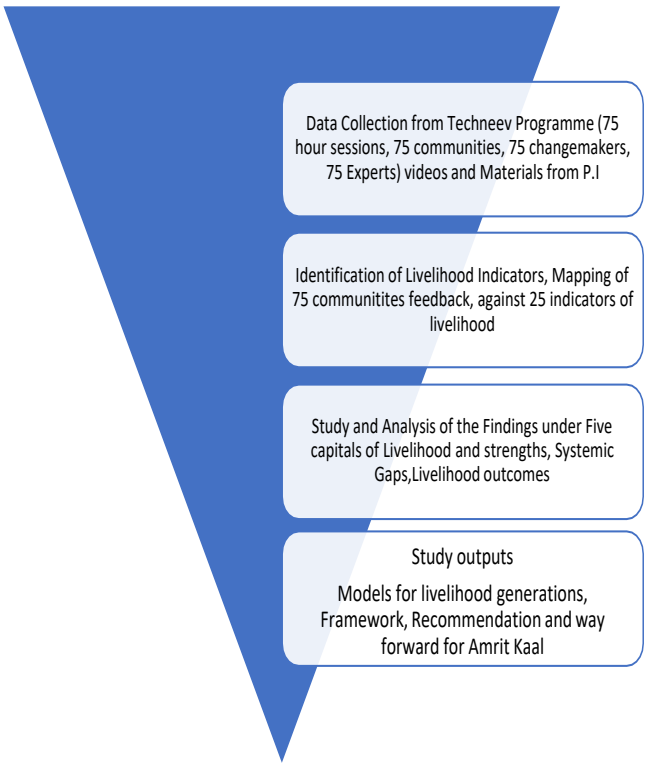
Analyzing livelihood parameters for a community involves a comprehensive methodology that integrates qualitative methods. In the Techनींव@75 programme, the impact of interventions science and technology and its absorption capacity on rural communities was assessed under the framework of the Five Capitals of Livelihood, as well as identifying strengths, systemic gaps, and livelihood outcomes.

Based on the questions formulated during the direct interaction with the communities and the experts were related to the impact of technology on each capital of livelihood (human, social, natural, physical, financial) and associated outcomes. The conceptual framework was drawn from the DFID framework for livelihood system as described in the Chapter 5.

The qualitative data was collected through 75 hour sessions of Techनींव@75, interaction with 75 communities, their insights, feedback and 75 Change makers. The discussions with 75 Experts and their recommendations in the form of suggestions were been taken into account. The project reports and other materials received from the Principal Investigators and Scientists of the Knowledge Organsiations were also taken in the analysis of the programme. Qualitative data were analysed thematically to identify patterns, themes, and narratives related to the impact of technology

on each capital of livelihood and associated strengths and gaps. The feedback received from each community was mapped against 25 indicators of the livelihood study and were analysed. Based on the analysis a framework has been proposed with seven models .

The methodology for assessing livelihood absorption capacity begins with comprehensive data collection through 75 hours of interactions with communities and key stakeholders, such as change-makers. This qualitative approach allows for a deep understanding of the socio-economic dynamics at play. Following data collection, indicators relevant to livelihood sustainability are identified and mapped onto the framework of livelihood capitals, including financial, human, social, natural, and physical capitals. Through rigorous study and analysis, the findings are examined within the context of these capitals, illuminating the strengths and weaknesses of each community's capacity to absorb livelihood opportunities. By categorizing and analyzing data under these capitals, insights are gained into the multifaceted nature of livelihood absorption. Finally, the study outputs inform the proposal of models and frameworks tailored to enhance livelihood absorption capacity, offering actionable strategies for sustainable development and community empowerment.



Flow Chart for Methodology of Analysis

6.2. MAPPING OF COMMUNITIES ON THE BASIS OF QUALITATIVE INDICATORS

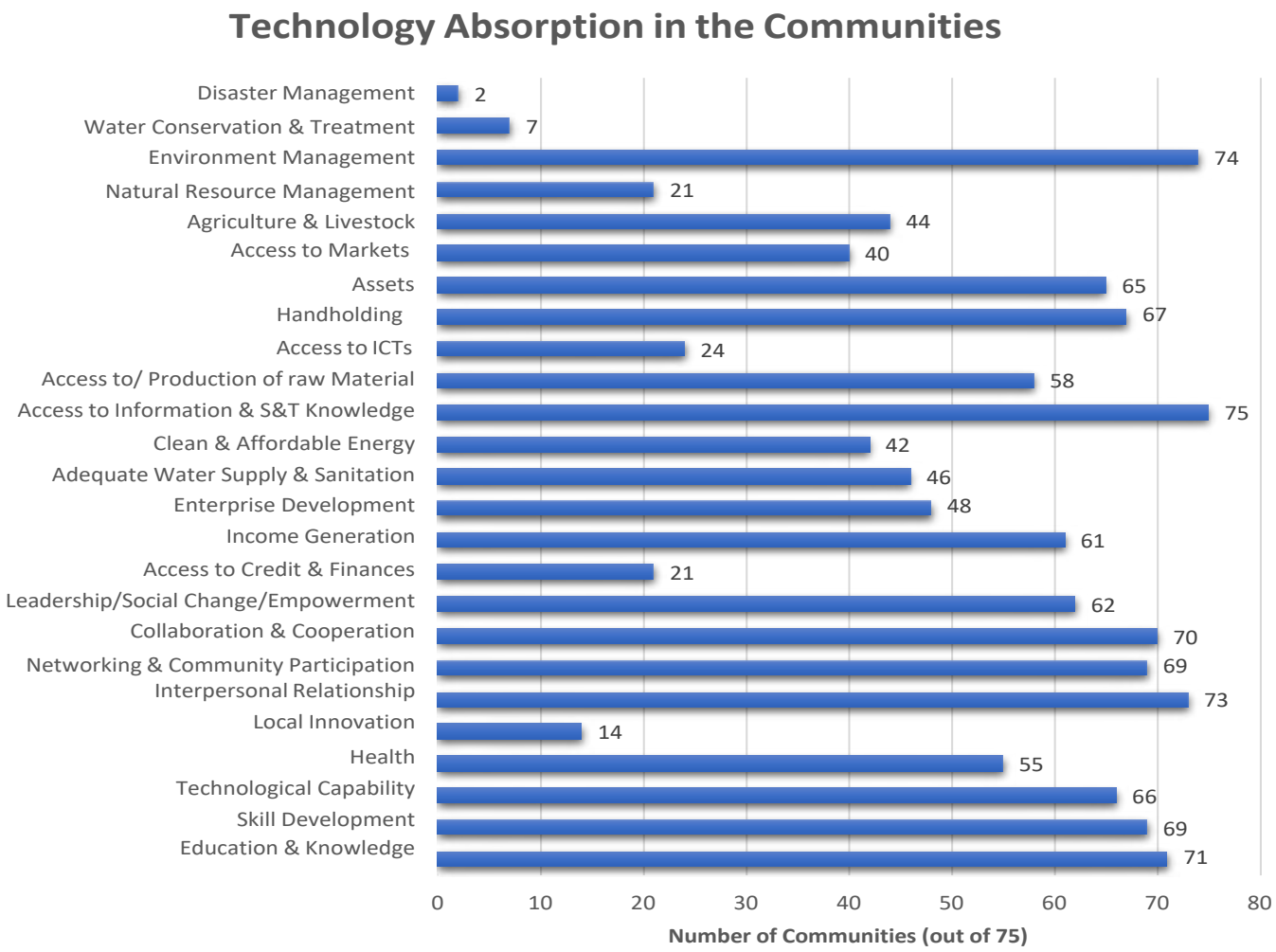
Mapping rural communities based on qualitative indicators involves a meticulous process aimed at understanding the diverse socio-economic landscape. Through qualitative data collection methods, a range of indicators is identified to reflect the nuances of each community's livelihood dynamics. These indicators could include factors such as access to resources, infrastructure, social cohesion, and economic opportunities. Once the indicators were identified, a frequency distribution analysis was conducted to examine the prevalence and distribution of these indicators across different communities. This analysis provides insights into the commonalities and disparities among rural areas, shedding light on areas of strength and areas in need of support. Visual representations, such as graphs, further elucidate these patterns, allowing for a comprehensive understanding of the qualitative data and facilitating informed decision-making in targeted interventions and development initiatives.

Table – 1: Frequency Distribution of Communities and Indicators under Five Capitals

Sl. No.	Indicators	Number of Communities (out of 75)
Human Capital		
1.	Education & Knowledge	71
2.	Skill Development	69
3.	Technological Capability	66
4.	Health	55
5.	Local Innovation	14
Social Capital		
6.	Interpersonal Relationship	73
7.	Networking & Community Participation	69
8.	Collaboration & Cooperation	70
9.	Leadership/Social Change/Empowerment	62
Financial Capital		
10.	Access to Credit & Finances	21
11.	Income Generation	61
12.	Enterprise Development	48
Physical Capital		
13.	Adequate Water Supply & Sanitation	46
14.	Clean & Affordable Energy	42
15.	Access to Information & S&T Knowledge	75
16.	Access to/ Production of raw Material	58
17.	Access to ICTs	24
18.	Handholding	67
19.	Assets	65
20.	Access to Markets	40
Natural Capital		
21.	Agriculture & Livestock	44
22.	Natural Resource Management	21
23.	Environment Management	74
24.	Water Conservation & Treatment	7
25.	Disaster Management	2

Table 1 provides a frequency distribution of communities and indicators under five different capitals: Human Capital, Social Capital, Financial Capital, Physical Capital, and Natural Capital. Each indicator represents a specific aspect within these capital categories, and the table lists the number of communities (out of a total of 75) that have been associated with each indicator. The higher the number of communities, the greater the presence or importance of that indicator within the respective capital category. For example, within Human Capital, indicators such as Education & Knowledge, Skill Development, and Technological Capability have high numbers of associated communities (71, 69, and 66, respectively), indicating their prominence in those communities. On the other hand, indicators like Disaster Management and Water Conservation & Treatment have very low numbers of associated communities (2 and 7, respectively), suggesting that these aspects are less prevalent or prioritized among the communities interacted. This provides a snapshot of the distribution and emphasis of different indicators within each capital category, allowing for further analysis and comparisons across communities.

Examining technology absorption within communities through the lens of livelihood capitals involves a thorough analysis of qualitative indicators distributed across these capitals. The five capitals framework encompasses financial, human, social, natural, and physical resources, each influencing the community's capacity to adopt and integrate technology effectively. Through frequency distribution analysis, the prevalence and distribution



Graph – 1: Frequency Distribution of Community Indicators across Five Capitals

of indicators related to technology absorption within each capital were examined. This approach provided insights into the extent to which communities utilize technology to enhance their livelihoods and address socio-economic challenges. For instance, indicators such as access to digital infrastructure, technological skills, social networks facilitating technology transfer, and natural resource management technologies could be analyzed within this framework. By understanding how technology absorption varies across different capitals, policymakers and knowledge organisations can tailor interventions to strengthen the capacity of communities to harness technology for sustainable development and improved livelihood outcomes.

Table 2: Frequency distribution of communities under Human Capital

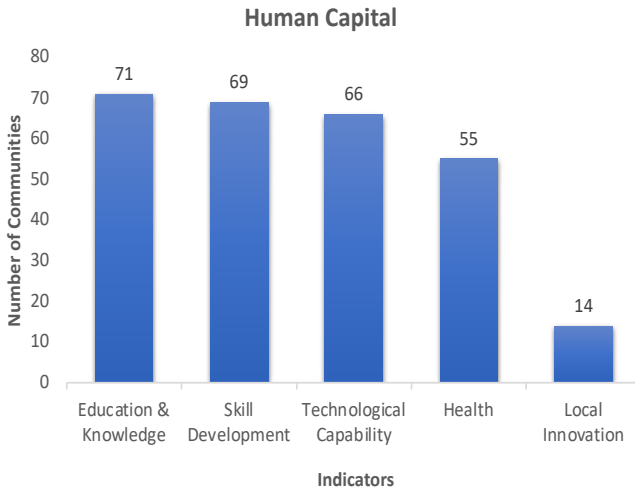
Sl. No.	Indicators	Number of Communities (out of 75)
1	Education & Knowledge	71
2	Skill Development	69
3	Technological Capability	66
4	Health	55
5	Local Innovation	14

Table 2 provides an overview of the indicators related to human capital and the corresponding number of communities out of a total of 75 that

exhibit these indicators. The indicators include education and knowledge, with 71 communities demonstrating a focus on this area.

Skill development follows closely with 69 communities emphasizing the acquisition of skills. Technological capability is present in 66

Graph – 2: Mapping Human Capital: Distribution of Communities across Indicators



communities, highlighting their capacity to utilize technology effectively. Health indicators are observed in 55 communities, indicating their attention to the well-being and healthcare of their members. Lastly, local innovation is a focus in only 14 communities, suggesting a relatively lower emphasis on fostering and promoting innovation at the local level. Overall, this table offers insights into the distribution and prioritization of human capital indicators among the communities interacted.

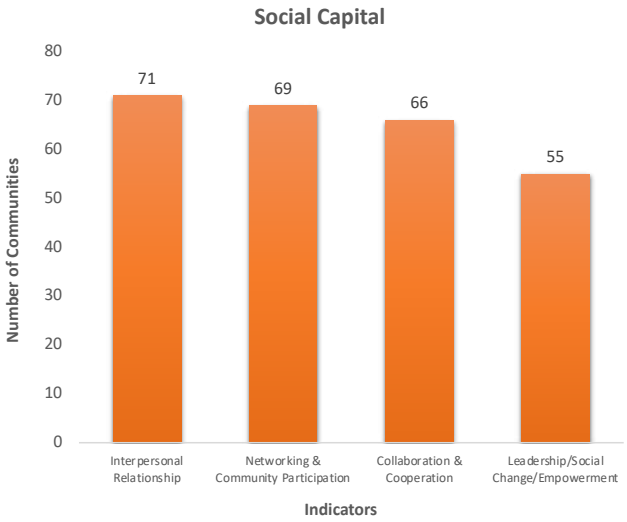
Table 3 presents indicators of social capital and the corresponding number of communities out of a total of 75 that exhibit these characteristics. The first indicator, interpersonal relationship, is observed in 73 communities, highlighting the importance of personal connections and bonds within these groups. The second indicator, networking and community

Table – 3: Frequency distribution of communities under Social Capital

Sl. No.	Indicators	Number of Communities (out of 75)
1.	Interpersonal Relationship	73
2.	Networking & Community Participation	69
3.	Collaboration & Cooperation	70
4.	Leadership/Social Change/Empowerment	62

participation, is present in 69 communities, suggesting active engagement and involvement in collective activities. Collaboration and cooperation, the third indicator, are evident in 70 communities, indicating a willingness to work together and share resources. Lastly, leadership, social change, and empowerment are observed in 62 communities, reflecting the presence of individuals who drive positive transformations and inspire others. Overall,

Graph – 3: Mapping Social Capital: Distribution of Communities across Indicators



this table showcases the varying degrees of social capital indicators among the communities that interacted, emphasizing the significance of these factors in fostering cohesive and thriving societies.

Table 4 presents indicators related to the financial capital of communities, with the number of communities out of a total of 75 that have achieved certain milestones. The first indicator, "Access to Credit & Finances," shows that 21 communities have successfully gained access to credit and financial resources. The second indicator, "Income Generation," indicates that a significant majority of 61 communities have successfully generated income, suggesting positive economic development within these communities. The third indicator, "Enterprise Development," reveals that 48 communities have made progress in fostering and nurturing entrepreneurial activities. Overall, the table suggests that while access to credit and finances is relatively low, a substantial number of communities have successfully generated income and are actively engaged in enterprise development, indicating positive strides towards economic empowerment and sustainability.

Table – 4: Frequency distribution of communities under Financial Capital

Sl. No.	Indicators	Number of Communities (out of 75)
1.	Access to Credit & Finances	21
2.	Income Generation	61
3.	Enterprise Development	48

Graph – 4: Mapping Financial Capital: Distribution of Communities Across Indicators

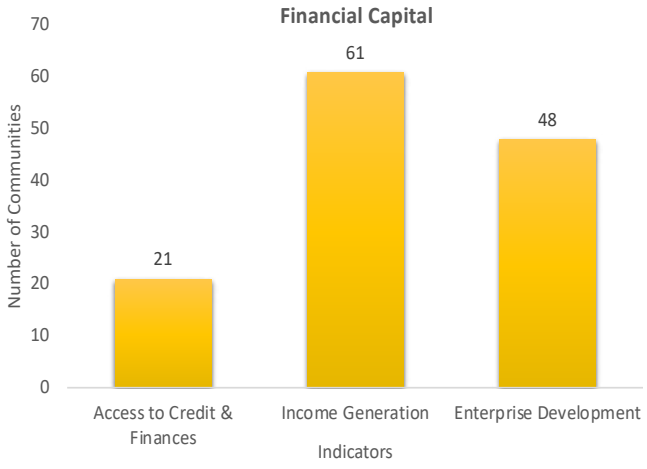


Table 5 presents an overview of the indicators related to physical capital and the number of communities out of a total of 75 that meet each indicator. The data suggests that 46 communities have adequate water supply and sanitation, while 42 communities have access to clean and affordable energy. All 75 communities have access to information and science and technology knowledge, indicating a widespread availability of these resources. Furthermore, 58 communities have access to or are

Table – 5: Frequency distribution of communities under Physical Capital

Sl. No.	Indicators	Number of Communities (out of 75)
1.	Adequate Water Supply & Sanitation	46
2.	Clean & Affordable Energy	42
3.	Access to Information & S&T Knowledge	75
4.	Access to/ Production of raw Material	58
5.	Access to ICTs	24
6.	Handholding	67
7.	Assets	65
8.	Access to Markets	40

Graph – 5: Mapping Physical Capital: Distribution of Communities Across Indicators

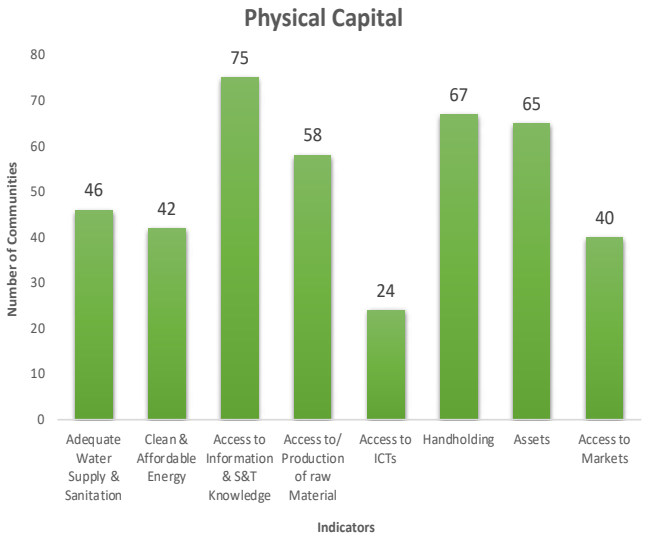
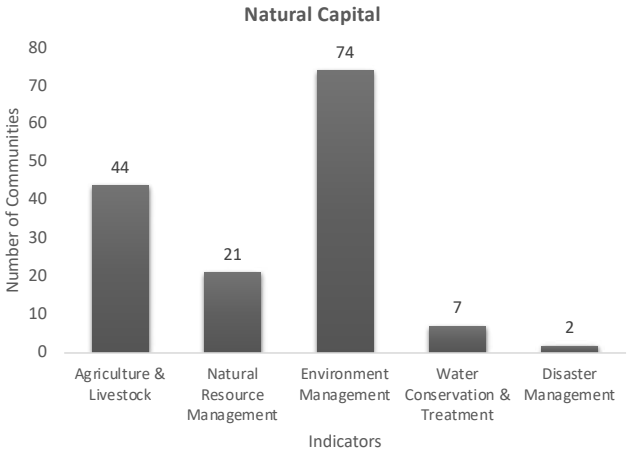


Table – 6: Frequency distribution of communities under Natural Capital

Sl. No.	Indicators	Number of Communities (out of 75)
1.	Agriculture & Livestock	44
2.	Natural Resource Management	21
3.	Environment Management	74
4.	Water Conservation & Treatment	7
5.	Disaster Management	2

Graph – 6: Mapping Natural Capital: Distribution of Communities Across Indicators



engaged in the production of raw materials. However, only 24 communities have access to information and communication technologies (ICTs), highlighting a potential area for improvement. On a positive note, the majority of communities, 67 and 65 respectively, have handholding support and possess assets. Lastly, 40 communities have access to markets, implying a significant number still need to improve their market access. Overall, this table provides a comprehensive snapshot of the physical capital indicators and reveals variations in community achievements across the different categories.

Table 6 presents the distribution of communities (out of a total of 75) across various indicators related to natural capital. The data reveals that 44 communities are engaged in agriculture and livestock activities, indicating a significant reliance on these sectors for their livelihoods. Additionally, 21 communities are involved in natural resource management, showcasing their efforts to sustainably utilize and protect valuable resources. The indicator of environment management encompasses a vast majority, with 74 communities actively focusing on preserving and enhancing their natural surroundings. However, water conservation and treatment initiatives appear to be relatively limited, involving only seven communities. Furthermore, disaster management efforts are comparatively scarce, with only two communities prioritizing measures to mitigate and respond to natural calamities. Overall, this table highlights the varying degrees of community engagement across different aspects of natural capital, shedding light on the areas that demand greater attention and investment.

Table – 7: Community Score Distribution: Ranges and Number of Communities

Score Range	Inter-pretation	No. of Communities (out of 75)	Per-centage
0-13	Need Overall Incubation	8	10.67%
14-19	Need Customised Hand-holding	58	77.33%
20-25	Sustainable	9	12.00%

Table 7 illustrates the level of technology absorption at the grassroots level, evaluating the performance of different communities. It showcases the score ranges and the corresponding number of communities out of a total of 75, providing insights into their technological progress and adoption. The score range is divided into three categories: "Need Overall Incubation" (0-13), "Need Customised Handholding" (14-19), and "Sustainable" (20-25). Out of the 75 communities, 8 (10.67%) fall into the "Need Overall Incubation" category, indicating a requirement for extensive support and guidance. The majority of communities, 58 (77.33%), are classified under "Need Customised Handholding," suggesting they would benefit from personalized assistance to address their specific needs. Lastly, 9 communities (12.00%) are considered "Sustainable," indicating that they have successfully achieved stability and self-sufficiency. Overall, this table provides an overview of the distribution of communities based on their scores and suggests the varying levels of support required for their development.

Table 8 represents the assistance needs of 75 communities based on a scale ranging from 0 to

Graph – 7: Representation of Community Scores and Number of Communities

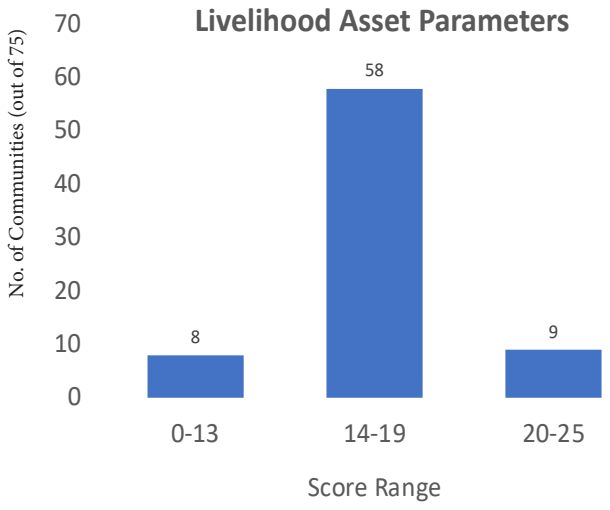
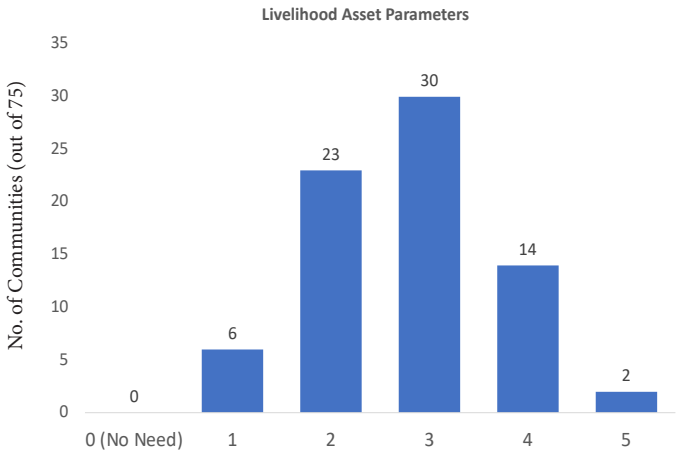


Table – 8: Community Assistance Needs: Distribution and Number of Communities

Assistance Need (in Capitals)	No. of Communities (out of 75)	Percentage
0 (No Need)	0	0%
1	6	8.00%
2	23	30.67%
3	30	40.00%
4	14	18.67%
5	2	2.67%

Graph – 8: Assistance Need by the Communities (in Capitals)



5, with 0 indicating no need for assistance. Out of the 75 communities, none of them reported no need for assistance, indicating that all communities require some form of support. Only 8% (n=6) of communities need assistance in only 1 capital. The majority of communities, 40% (n=30) in total, reported a need for assistance in 3 capitals, followed by 30.67% (n=23) communities needing assistance in 2 capitals. A smaller number of communities reported needing higher levels of assistance, with 18.67% (n=14) communities in 4 capitals and only 2.67% (n=2) communities at the highest level of assistance in 5 capitals. This data highlights the varying degrees of assistance needs across the communities interacted, emphasizing the importance of providing appropriate support based on the identified levels of need.

6.3 EXISTING STRENGTHS OF COMMUNITIES

Communities have their own capabilities to deal with real life challenges without any external support. They were surviving the same circumstances year after year naturally with their own knowledge system and also sustaining their own livelihood and providing different types of products related to arts, crafts and clothing, knowledge, food products, medicines, and therapies. These qualities of communities are considered as strengths.

There were numerous strengths identified in the communities:

1. Traditional wisdom of communities
2. Local Innovation in communities
3. Judicious use of local produce
4. Social capital is rich and well-developed
5. Presence of changemakers in communities
6. People adopting technology and disseminating technology in their communities
7. Communities living in forest fringe areas know to live in harmony with wild animals
8. Communities understand the importance of time
9. Communities showed interest for education and learning
10. Survival of communities in difficult terrains

1. Traditional knowledge and local knowledge of communities

The traditional knowledge of India is available in various forms such as classical texts, manuscripts, and/or oral communication that have been passed on from generation to generation and sustained within our communities for centuries Each community has its own traditional wisdom. Traditional Knowledge system includes all types of knowledge about traditional technologies of subsistence; it may be Traditional art and craft skill, navigation skills, the traditional medical system, or any type of agricultural and manufacturing practices. Some such prominent traditional wisdom is still the part of livelihood generation of communities. Handloom weaving skill of weaver‘s community in Assam, Pottery making of Prajapati communities, Seaweed cultivation knowledge of communities of Rameswaram,

Tamil Nadu knowledge of jaggery making of the sugarcane growing farmers, knowledge of coir in Kerala, knowledge of honey collection from rock bees by the communities in Sunder ban delta. Navigation skills of communities in coastal areas, traditional Siddha Varman therapy of some communities of Southern part of Tamil Nadu and southern parts of Kerala, and Fine korai grass mat is an important handicraft of weaving communities of Pattamadai and Veeravanallur in Tamil Nadu.

2. Local Innovation in the communities

Innovation is done by the communities themselves to solve their real-life challenges. They also try to find out solutions with their own acquired knowledge over a given period of time. There were some innovations done by any individual that benefitted the community as a whole. There were cotton wick machine, cow dung pot machine, and bamboo splint machine innovated by Mr. Paresh Bhai Panchal from Ahmedabad and Black Pepper Thresher machine by Mr. P.K.Ravi from Idukki , Kerala. National Innovation Foundation identified all these innovations.

3. Nature bestowed communities with different types of resources

The availability of resources is a necessary condition for development of any community. There are many communities that are rich in resources. These resources had potential to generate livelihood for people. The tribal communities of Noklak, Nagaland, Women Technology Park, Bolmoron, communities of Uttarakhand, communities of Arunachal Pradesh were generating income from locally available fruits through food processing technology. The coconut plantation of Kerala , Mahasir and different types of fishes in rive Ganga and Oceans are the source of livelihood for communities living on the bank of rivers and seashores. The intervention of technology in communities helped them to utilise the resources optimally and conserve the resources for future.

4. Social networking is good within communities

The core of social capital is networking among constituents. The degree of one's knowledge creation and sharing depends on the variety of networks. Networks and connectedness increase people's trust and ability to work together and expand their access to wider institutions, such as political or civic bodies; Relationships of trust, reciprocity and exchanges that facilitate co-operation, reduce transaction costs and may provide the basis for informal safety nets amongst the poor.There were many formal groups like Self-Help group, Farmer Producer Organization and Co-operatives exist for different purposes.

5. Presence of change makers in communities

Many individuals or social groups present in villages who think about people's problems and put their own efforts for social welfare. These change makers connect communities to many organisations, educational, scientific and financial institutions to bring development in the societies. They handheld the communities at each and every step of technology implementation at community level. Their involvement in development of community as a social leader or early adopter of technology had been identified. They were acting as a link between S&T institutions and communities. Examples: Balia Bedia , Biswanath Dasgupta, Titu Yoka, Mr. Laishram Yelhounganba Khuman, Manipurare , Ms Sunita Halder, Bilaspur, Chhattisgarh, Mrs Mongshai Hanthing, Noklak district, Nagaland & Mr Pankajbhai Manjibhai Dharodia (Prajapati), Morbi, Gujarat, Shri Ram Narayan Sharma, Moonew Busty, Sombaria, West Sikkim.Kavita Beede,Bidar, Karnataka. Besides that some NGOS also act as changemakers for carrying and disseminating technologies to communities like SNEHPAD, LAKKSHYA, Aarohan, HESCO, India Vision Foundation, Gorakhpur Environmental Action Society, ARTI, Phaltan were some of them.

6. People adopt technologies and disseminate them in their communities

People were found enthusiastic about technologies. They want solution providing technologies for their day to day activities and earning income. They were found interested for learn skills through training from scientific organisations. After trainings, they adopted the technologies for their own benefits and disseminated their Knowhow in their communities.

Sri Ram Sharma of Moonew Tayebhir Cluster disseminated his know how of vermicomposting in his society. The eleven women of Taste of Noklak Society were the master trainer for other people of their own village and nearby villages on food processing technologies and making thirteen types of different products from fruits and other local produce.

7. Communities living in forest fringe areas know to live in harmony with wild animals

The community living in Chopra village had to encounter wild animals off and on.but they did not harm them and try to find some scientific solutions for keeping them away to protect their houses.

8. Communities understand the importance of time

Communities were found satisfied with those S&T interventions which saved time and reduced drudgery.They not only looking for increase in productivity of items but they were also looking for better quality of life, The solar heaters in Uttarakhand saved the time of women from bringing wood for fuel from forests which helped them to devote time for educating children and other activities. The artisan women from Prajapati community was also happy with the technologies which saved time and reduced drudgery.

9. Communities shown interest for learning

Communities shown interest to learn those technologies which helped them to develop new skills and increase their productivity. They have capability to learn, absorb and understand technologies as expected from them.

10. Survival of communities in difficult terrains

Communities living in difficult terrains like hilly mountains, dense forests, seashore, river banks where their life and livelihood was in extremely vulnerable condition. But they were surviving in those areas year after year. It was possible due to their own understanding and practical experience about the situations of that geographical areas. They manage their all their work with scarce resources

6.4. ANALYSIS OF APPROACHES

Assessing technology absorption capacity in rural communities can be approached through both top-down and bottom-up methodologies. The top-down approach involves the examination of overarching policies, infrastructural frameworks, and macro-level indicators set by government organizations or apex bodies. This method provides a broad understanding of the institutional environment and the availability of resources at the community level. On the other hand, the bottom-up approach delves into the grassroots level, focusing on community-specific dynamics, local knowledge, and socio-economic contexts. It entails gathering insights directly from community members, understanding their needs, capabilities,

and challenges regarding technology adoption. By combining these approaches, a comprehensive analysis was attempted, capturing both the macro-level landscape and the micro-level nuances of technology absorption within rural communities. This dual perspective enables policymakers and scientists to design interventions that align with both the broader policy framework and the specific needs and capacities of rural populations, fostering effective technology uptake and sustainable development.

6.4.1. Top-Down Approach

The top-down approach to fostering increased science and technology knowledge and information dissemination involves the strategic deployment of appropriate technological interventions tailored for livelihood generation. This method begins with comprehensive policy frameworks and institutional support aimed at promoting innovation and knowledge sharing at the macro level. Through targeted initiatives, such as capacity-building programs and investment in research and development, efforts are directed towards enhancing technical human power through skill development initiatives. Additionally, this approach emphasizes the optimal utilization of natural resources through the application of innovative technologies and sustainable practices. By leveraging top-down strategies, implenting organisations can effectively facilitate the integration of science and technology into rural communities, empowering them to harness these advancements for sustainable livelihoods and economic growth.

6.4.1.1 Increased S&T Knowledge and Information

1. **Beach nourishment through dredging:** Around 50% of India's land is located in the coastal region, where the natural and dynamic process of sediment transport helps to maintain equilibrium in the level of coastal sand. However, human-made structures and natural obstacles have caused disturbances in the transportation activities, leading to beach erosion in these areas. Since 1986, the deposition of sedimentation has adversely affected the biodiversity in Puducherry and other coastal parts of India, mainly due to the construction of harbors. To prevent beach erosion, three types of prevention methods are available, out of which the hybrid solution is commonly used. This method involves nourishing beaches by constructing groins, offshore breakwaters, and reefs, which help restore the condition of the beach. In Pondicherry, a 1.5 km beach was restored using this method. Apart from preventing beach erosion, these methods have also helped promote marine culture and sustain it in and around the reef. This approach has not only prevented beach erosion but also increased tourism and fishing activities, preserved and increased marine life, and enhanced the heritage build and road in nearby sea beaches. Upscaling and replicating this method in other beaches could prove to be beneficial.
2. **Wireless sensor systems for landslide early warning in the Munnar, Kerala:** In the Western Ghats and Northeast Himalayas, landslides have resulted in numerous casualties. To address this issue, an IoT-based mobile app called "Landslide Tracker" has been developed to sense deep layers of the earth and provide early predictions of landslides. The Amrita Vidhyapeetham has provided training to local people on how to use this app effectively to avoid casualties and safely navigate through landslide-prone zones. This innovative technology has

proven to be effective in improving living conditions by safeguarding communities from disasters. People are now well- informed about landslide-sensitive areas, roadblocks, and power outages, allowing them to take appropriate precautions and avoid hazardous situations. Considering the success of this technology in the Western Ghats and Northeast Himalayas, it can be replicated in other landslide-prone areas, such as the Himalayas. Overall, the Landslide Early Warning System and "Landslide Tracker" app have played a crucial role in improving living conditions and reducing casualties caused by landslides.

3. **Gramin Krishi Mausam Sewa:** Agricultural products are heavily reliant on various factors such as soil, water, seed quality, and most importantly, weather. Weather affects all stages of plant growth and development, as well as the quality and quantity of the seed. Climate change can result in a 15-25% reduction in agricultural income. To combat the effects of climate change and weather variability, farmers require day- to-day weather information to make informed decisions regarding crop management and selection. Effective agriculture management depends on high productivity, which, in turn, necessitates the use of crop, soil, water, and integrated pest management, all of which require meteorological information. The need for agromet advisory services is evident. Forewarning of crop pests and diseases can provide critical timing and infection stage information, enabling farmers to manage these problems at the right time, reducing the use of harmful chemicals, lowering plant production costs, and decreasing environmental pollution. Weather forecasting provides tremendous benefits in managing the negative impacts of weather. Agromet advisory is an invaluable tool for enhancing production and income by lowering the cost of farm inputs and promoting climate-resilient agriculture. The project runs throughout India in collaboration with the IMD, with 130 AMFU (Agromet Field Units) established in each agroclimatic zone in the country, located in various ICAR institutes such as IARI, State Agriculture Universities, IIT Roorkee, and Kharagpur. DAMU (District Agromet Field Units) are situated in various KVKs under ICAR. The weather bulletins contain information on the weather summary for the preceding week, climatic conditions for the week, medium-range weather (rainfall, temperature, wind speed and direction, and cloud cover), extreme weather events (frost, heat & cold waves, thunderstorms, strong winds, and fog), crop information (type, state, phenological stage, pest and disease, and crop stresses), and advisories for weather- related farm management (crop-wise farm management information for weather- sensitive agricultural practices such as sowing, irrigation, transplanting, disease prediction, pesticide spray time, fertilizer use, intercultural operations, weeding/thinning, date of harvesting, and post-harvest activities). Overall, weather forecasting plays a vital role in agriculture by helping farmers make informed decisions regarding crop management, improving productivity, reducing losses and input costs, increasing the quality of yield, and decreasing pollution resulting from agricultural chemicals.

6.4.1.2 Providing Appropriate Technology Intervention for Livelihood Generation

1. **Science Technology and Innovation (STI) Hub in Sidho-Kanho-Birsha University, Purulia, West Bengal for the Socioeconomic upliftment of ST Communities of Eastern Region West Bengal, Jharkhand and Odisha through Science and Technology Intervention:** Before S&T interventions, community people grow only a few crops and did not know about scientific farming practices. Seasonal migration of rural people from each village to other places was common practice. They also suffer from malnutrition. The traditional work of these communities is rope-making from forest plants and honey collection. But, after the S&T interventions, they started growing vegetables like capsicum, brinjal, beans, moringa, papaya, and high-yielding cash crops. They have also started pisciculture and are trained in producing value-added products from lemon grass tea, tulsi, tea, green tea, and lemon grass powder. Now, they have started adopting new agricultural practices and are packing lemon grass powder and various types of tea for sale. This can further be upscaled and replicated.
2. **Mushroom Cultivation in the North-East regions of Papum Pare, East Siang and West Siang districts of Arunachal Pradesh:** Before getting agricultural advisory, shifting cultivation was practised in Naharlagan. 80 SHGs are getting training and also getting microloans. Now, with low investment, farmers are getting high incomes. Upscaling the technology can be done by improving the packaging and doing nutritional analysis. It can be replicated in other places.
3. **Socio-economic upliftment of yak rearing communities in Northeastern region by capacity building and technological interventions:** The key problem of yak rearing in North Sikkim is the animal feed and fodder scarcity, particularly in the winter month. Yak die due to starvation in winter. In 2018, many yaks died due to continuous rainfall. Feed blocks from Arunachal Pradesh were transported to Sikkim to save Yak. Yak cost 80,000 rupees. ICAR-National Research Centre on Yak and Animal Husbandry department, Govt. of Sikkim since 2010-11 working on pasture development and growing temperate grasses in different locations in North Sikkim and Complete Feed block making technology. Now, the yak rearers are getting feed blocks and poly silage of green fodder from the institute. Youth are also getting training on value addition to yak milk and yak fibre products. The tourism associated with yak rearing could upscale the yak rearing. The milk production from yak increased by two times, and feeding during the lean period from December to May increased the calving percentage by 50 % in a year.
4. **Growing of HRMN 99 low chilling apple variety in non-apple areas:** People adopted the new variety (HRMN 99) of apple and learnt about basic techniques and protocol of apple farming.
5. **Water Technologies deployed at rural area of Bundelkhand, Madhya Pradesh:** The Bundelkhand region of Central India is highly susceptible to droughts and experiences severe water stress, particularly with regard to drinking water availability. Recent surveys show that only 7-10% of villages in the area have access to drinking water throughout the year, with over

70% of water tanks and wells drying up. The scarcity of drinking water also has a significant impact on the health of the local population, as women must spend up to 4-5 hours each day collecting water, and water scarcity can cause dehydration and diarrhoea in the scorching summer temperatures of over 40°C. Poor sanitation practices further exacerbate health problems. To address these issues, JalTara water testing kits have been developed to analyse water quality according to BIS norms, which can be used at both the individual and community levels. These kits have been used to identify biological contamination and turbidity in the water of Bundelkhand. The slow sand filter, which filters 3000 liters of water per day, has been introduced with low maintenance costs, allowing for local people to do the maintenance work themselves. This initiative has created green jobs, with 24 women and 4 youths engaged in income generation. Training on water testing quality, maintenance, and procurement of necessary parts has also been provided. The availability of good quality water has helped to improve the health of the local population and reduce their burden of collecting water.

6. **Enhancement of livelihood for scheduled caste households through an ICT enabled inegrated rural nutrition center in Madukkarai block of Coimbatore District, Tamil Nadu:** The community surrounding Madukkarai block in Coimbatore District, Tamilnadu, was facing numerous challenges with minimal access to essential healthcare and livelihood facilities. To address these challenges, a range of advanced technologies such as image processing, artificial intelligence, data analytics tools, and GIS-based mobile applications were developed and implemented. One of these technologies was a nutritional deficiency diagnosis android application that monitors diet diversity, educates the community on food groups, and checks for symptoms of micro and macronutrient deficiencies. By identifying vulnerable individuals and referring them to diet counseling and other referral services, the application aims to improve the health outcomes of the community. To tackle the issue of post-harvest losses and maximize the value of agri-foods, various technologies such as solar dehydration, oil extraction, pulverizer, and vacuum packing food were adopted as part of a food processing unit. These technologies have been successfully implemented in the community, benefitting more than nine communities and villages and generating employment for 60-62 people. Furthermore, local farmers and individuals interested in establishing food-based enterprises are identified and provided with skill training on value addition, packaging, and marketing. Currently, 1800 beneficiaries are utilizing common facilities and applications to improve their livelihoods and promote economic growth in the region.

7. **Empowerment of Women through Application of Multifaceted Biotechnological Innovations in Millets for Sustainable Income Generation and Nutritional Security:** Millets have yet to gain popularity among the masses due to limited awareness of food processing technologies among farmers. As a result, millets are often sold at low prices without any value-added processing. However, there is now a growing understanding of the nutritional value of millets, and innovative

processing technologies such as flaking, baking, popping, parboiling, semolina, and flour blending have been developed. Through the adoption of these technologies, farmers and members of self-help groups (SHGs) have been able to earn profits from millet cultivation and the production of value-added products such as millet-based instant idli mix and millet flakes. Millets, being resilient to climate change as C4 plants, can withstand poor water and soil conditions, leaving a low carbon and water footprint. Notably, the consumption of millets has contributed to improved health outcomes. Additionally, value addition to millets has empowered women and generated income, leading to an increase in the overall consumption of millets. Overall, millets offer great potential as a sustainable crop for small farmers, and with the right knowledge and utilization of processing technologies, they can become a valuable source of income and nutrition.

8. **Charcoal Briquette from Agro-Waste:** In India, approximately 435.98 million tonnes of agro-residues are produced each year, with 313.62 million tonnes being surplus. Unfortunately, due to various constraints, these residues are either partially or completely unused. However, Dr Daya Srivastava developed a recycling and environmentally friendly technology that promotes the efficient use of charcoal and agricultural waste by converting it into charcoal briquettes. These compressed blocks of coal dust and other combustible biomass materials are used for fuel and kindling to start a fire. The use of charcoal briquettes has several advantages, including a high combustion value, longer burning time, and uniform and stable burning process. It is smokeless, lighter in weight, cheaper than lumpy charcoal, and simple to handle and use. Furthermore, briquettes made from charcoal help to reduce electricity consumption during the winter season and generate livelihoods for the underprivileged. Around 6-7 trainers have been trained, who in turn train the Self Help Groups (SHGs). As a result, the livelihoods and quality of education provided to children have improved. This technology aims to generate employment opportunities at the local level by utilizing agro-waste. It is possible to replicate and upscale existing technologies in more surrounding areas, including those where more agro- waste is generated and remains unused.

9. **Eco-friendly utilization of hazardous pine needles for social benefits:** Pine needles pose a significant threat to the environment, biodiversity, and local economy in the Himalayan region. The accumulation of dried pine needles hinders grass growth on the ground, requiring considerable spending by the forest department to avoid forest fires. This is typically done through controlled burning or mixing materials like cow dung or soil to create fuel. A new S&T intervention, Briquetting', involves chopping and compressing pine needles at high pressure. The resulting briquettes are clean, dense, and easily manageable, and the collection of pine needles has generated income for local women. Four functional briquetting plants have been established in Kangra, Hamirpur, Mandi, and Kullu in Himachal Pradesh, accessible to the community. The people in these areas depend on agriculture and animal husbandry for their livelihoods and possess extensive knowledge of forest resources. They willingly collect pine

needles, generating livelihood opportunities for themselves. Briquetting machines should be provided to Self Help Group (SHG) groups to develop social entrepreneurship at the community level. This approach can be replicated in other areas rich in pine trees, and other biodegradable materials should be explored for briquetting. By promoting sustainable methods of collecting and utilizing pine needles, we can reduce their negative impact on the environment and promote economic development in local communities. This will support local livelihoods and contribute to environmental conservation in the long run.

10. **Technological intervention in value-added livestock product:** Animal husbandry is a significant occupation for the people of Jammu and Kashmir, particularly those living in border areas who face constant firing. To overcome this challenge, they have established milk cooperatives and started selling various processed products in the local market. These products have a longer shelf life, thereby increasing their profitability. The cooperatives produce seven processed products from milk, four from meat, and three from fish. During the COVID-19 pandemic, milk products were not sold from FPOs, and members suffered significant losses. However, they were able to revive their business, becoming successful entrepreneurs in this field. This initiative has led to self-confidence and motivation among women, and they aspire to reach global markets. Other milk producers can replicate the success of this model, and it can be upscaled by promoting the traditional sweet 'Kaladhi,' a hard-pressed cheese with a shelf life of 28 days. The cooperative can also expand its product range to include milkshakes, butter, and other dairy products. This approach has significantly improved the lives of the people engaged in animal husbandry and has the potential to be a game-changer in the dairy industry.

11. **Technology developed for upliftment of the tribal community of Ladakh region:** Sher-e-Kashmir played a pivotal role in advancing the animal husbandry sector by introducing cutting-edge technological interventions to improve the processing of livestock products, with a particular focus on milk. These science and technology interventions included the development of high-quality commercial spawn production, the creation of a Mushroom structure design unit that maintains optimal temperature and humidity using zero energy, and the design of an innovative vermicomposting structure. Furthermore, Sher-e-Kashmir trained local youths to establish mushroom production units, further driving growth and development in the sector.

12. **Spinning on Ambar Charkha Weaving on Handlooms Sheep Wool shearing through Machine:** The first aim of this project is to revive the traditional practice of hand spinning and hand weaving of cloths using the Gandhian Science of Charkha. In the higher reaches of the mountains in Jammu and Kashmir, the Bakharwal and Gujjar tribes are the third largest ethnic group and depend largely (90%) on animal husbandry and rearing of desi breeds of sheep for their livelihood. However, the quality of wool yarn produced from the traditional Gandhian charkha was coarse and inferior, limiting their ability to produce blankets with little monetary value. Consequently, they sold

their wool for low prices to traders from Punjab. To address this issue, the S&T intervention introduced the Ambar Charkha, which is manually operated and has eight spindles, resulting in eight times more output than the Gandhian charkha. The yarn produced by the Ambar charkha is finer and of better quality, enabling the production of shawls, stoles, and garments. As a result, the income of the nomadic tribes increased eight-fold. The second aim of the project was to introduce mechanical sheep shearing at the village level in the five cluster villages of Rajouri and Poonch. Hand shearing only removes about half of the hair length from the animal skin, resulting in low-quality yarn. In contrast, machine shearing can remove the wool from the roots, resulting in good quality yarn. The project established five village clusters in Rajouri and Poonch districts for spinning sheep wool on the Ambar Charkha, and five handlooms were set up in these clusters to weave the yarn into shawls and mufflers for both men and women. In addition, a machine shearing facility was created at Pir Ki Gali mountain, which is crossed by 80% of the nomads in the summer. Machine shearing increases the wool yield by almost 15% and helps raise the income of the farmers by enabling the production of good quality yarn that fetches a good price from Khadi Mills outside Jammu and Kashmir.

6.4.1.3 Promoting Enterprise Development

1. **Community Group on Socio-economic upliftment of rural weaker section (SC/ST) by scientific interventions and amelioration of production diseases in dairy animals:** Before S&T interventions, Jammu and Kashmir used to import milk from other states. Also, the milk-producing capacity of cattle got severely decreased due to the prevalence of cattle diseases like mastitis. Additionally, the animals used to consume readymade feed, which was the cause of the smell in the milk. But now, new start-ups have come up in the dairy sector. With these start-ups' help and technology adoption, farmers are running co-operatives and have started value-added milk products, earning two to five times more than their previous income. Farmers have also taken the initiative to grow raw materials like maize, rice and other crops for feed in their fields. Also, young people are returning to their conventional occupations and putting their efforts into income generation. This can further be upscaled and replicated.
2. **Development of Integrated Model Villages in Uttarakhand:** The village Khoi is ecologically and economically sound. It has a common community centre for day-to- day discussion on various developmental issues of the village, not for income generation. Most development runs through women as most men migrate to towns to earn. Model village formation with the association of S&T elements in agriculture after training from HESCO. They learnt food processing and make juices from rhododendron. Beekeeping, farm development etc. Each group was organised so that they helped themselves and formed a network to help one another. Now this village is doing beekeeping with appropriate honey harvest and processing techniques. Value addition in various local resources through developing protocols was also initiated. She saved food/ fruit products after value addition in the market. On the farm, better cultivation practice,

especially in off-seasonal vegetables, has been an intervention. Mera Point (developed by HESCO) and run by Gopalji is a popular point in the region. Many governments and private organisations have visited to find associations that others can benefit from further marketing the product to metro cities. Now the Mera Point' has become a famous landmark of this region. Women empowerment through various pieces of training by HESCO on food processing, beekeeping and farm development.

3. **Science, Technology and Innovation Hub for Creating Sustainable Livelihood Opportunities of Scheduled Tribes in Angara Block, Ranchi District, Jharkhand:** Before the introduction of the new technology, tribes of Angara block used to harvest honey from Indian Hive bees or rock bees present in the forest or their village. They adopted new technology after training and learned the domestication of Italian honeybees, which helped them generate income and form Jharkhand Prakirtik Madhu Utpadan Company.
4. **Multipurpose processing machine for processing fruits and herbs to make food products, extract essential oils etc. (Taste of Noklak Society)**: Initially, there was poverty, lack of education, school dropout problems, drug addiction, wastage of fruits like guava, kiwi, apple, orange etc. in Noklak. S&T intervention helped in the empowerment of the community (both men and women), income generation, new enterprise development, Social Entrepreneurship and Capacity building by training members of SHG of other villages like Kingniu and Pangsha, development of a chain of sustainable livelihood generation through food processing technology and multiprocessing unit. This model can be upscaled and replicated by introducing a perilla oil extractor, better packaging of products, and better marketing facilities.
5. **Women-friendly farm mechanization in various agricultural implements:** Agricultural operations have historically been associated with drudgery, particularly for women. However, thanks to the efforts of the Central Institute of Agricultural Engineering (CIAE) in Coimbatore and the Indian Council of Agricultural Research (ICAR), this burden has been reduced. Women have been trained to use simple tools that increase productivity and reduce drudgery, making it easier for them to perform all agricultural activities. As a result, 57 members of four Self Help Groups (SHGs) and 400 members of Chamraj Nagar District have benefited from this training. The reduction in drudgery has led to time savings and improved physical health, ultimately resulting in women empowerment. With the ability to perform heavy farming work more easily, women have increased their income, while male members can focus on other work to improve the economic condition of their families.
6. **Agro -Technology equipment on Drudgery Reduction:** To alleviate the challenges of drudgery faced by farmers during agricultural operations, agro-technology equipment has been introduced. Moreover, training sessions have been conducted to educate farmers on the proper use of these tools. Additionally, sensitization and awareness programmes have been implemented to promote better health and hygiene practices as well as improved food and nutrition. As a result of these efforts, farmers can experience a reduction in physical

exertion and greater ease in their agricultural activities.

7. **Handloom with Jacquard Weaving and design-based S&T intervention for product development:** Weaving was traditionally a family-based occupation that involved a time-consuming, labor-intensive process using conventional looms and poor marketing linkages. However, with the introduction of the Jacquard machine and CAD designing, the time consumption has decreased, trained weavers now work in an organized manner, and cluster-based weaving activities have started. Approximately 90-95% of trainees have become self-employed, making it a vital traditional occupation that provides livelihood to many weavers. Upgrading the loom has directly improved the quality of life for weavers, resulting in good earnings and improved education for their children. However, occupational hazards such as hand injuries may occur during weaving while handling yarn or machines. The weaving industry has also empowered women, attracting young people, and even leading to the development of social entrepreneurship. Overall, the weaving industry has undergone significant changes, from a time-consuming family-based occupation to a modern, organized sector that provides employment opportunities and improves the quality of life for many weavers.
8. **Nursery Business Based on Seasonal Crop Species:** Farmers have adopted the practice of cultivating sugarcane and seasonal crops by setting up nurseries. Advanced Rural Technology Intervention (ARTI) has provided scientific and technological support to improve the cultivation of sugarcane by modifying some agronomic practices. Tissue cultured plants obtained from the National Chemical Laboratory were used for cultivation and a single bud cutting method was adopted instead of the conventional three bud cutting. Spacing between plants and rows was also increased, resulting in increased production and yield. Training was provided on nursery development for various seasonal crops, including sugarcane. Over 500 farmers have been trained by Dhanashree Prasad, a changemaker in the field.
9. **Electronic Jacquard Handloom from grass weaving:** The intricate art of weaving Fine Korai Grass Mats is a significant handicraft in Tamil Nadu's Pattamadai and Veeravanallur regions. However, weavers often face difficulties, including uncomfortable seating positions and extended periods of sitting. To address these challenges, electronic handloom was introduced, resulting in a remarkable 200% increase in production, increasing output by four times. Moreover, productivity soared, with complex patterns now being woven in just three to six days. The SHGs also helped improve the weavers' sitting posture, alleviating body pain and discomfort.
10. **Establishment of Rural Nutri-Bakery for fulfilling nutritional requirements and income generation of tribal and rural communities**: The livelihood of the tribals in the area is dependent on non-timber forest products, agriculture, and schemes such as MNREGA. Additionally, bakery products are widely consumed due to their low cost and delicious taste, and are popular among both rural and urban populations. However, a primary study conducted by MPVS on the nutritional content of bakery products available in rural areas found that they were all supplied from

urban areas, draining rural money, and were not contributing much nutritional value to the rural population. Anemia and malnutrition are also prevalent among rural women and children. To address these issues, MPVS has been working for the last 25 years to facilitate livelihood through non-timber forest products in raw or dried form. They have developed bakery products using locally available raw materials such as Mahua flower, Aonla, Bael, Imli, Amla, Maize, and primitive crops like Minor, Millet (Kodo, Kutki), etc. The S&T intervention is local resources specific technology, with the aim of developing the local rural economy and preventing the outflow of rural money to urban areas. MPVS is trying to address the malnutrition and anemia problems prevalent in rural communities, especially among tribal populations, by establishing rural nutri-bakeries in rural areas. The Rural Nutri-Bakery Concept consists of two integral parts: system designing of the bakery unit and product development. Currently, four main types of products are manufactured, such as Mahua cookies, Bael and Mahua cookies, which are rich in iron, vitamin C, and protein and provide a complete package to rural women and children who are anemic and suffering from malnutrition. The products are in high demand in local areas due to their taste and nutritional value.

11. **Impact of Aromatic crops cultivation in aspirational district:** Nardurbar district is facing several issues, including drought, tribal farmers' migration, unpredictable rainfall, water scarcity, crop failures, and farmer suicides. To address these issues, the aim is to increase farmers' income and livelihood development of tribal farmers by making Nardurbar the hub of aromatic plants cultivation. Aromatic and medicinal plants are in high demand in the Indian and international markets, and the oil is widely used by traditional healers in the tribal areas. The CSIR-Aroma mission is promoting different aromatic plants in Maharashtra, and in this particular region, the project was introduced to uplift the farmers who were not benefiting from the existing cropping pattern and were migrating. Initially, people were hesitant to grow new varieties of aromatic plants due to fear of crop failure and losses, so the project was initiated at a small scale. The collaborating institutes introduced plants like geranium, palma rosa, lemon grass, and tulsi, among others. Within six months, these plants were cultivated on 100 acres of land by 50 farming families, who began to extract and sell the oils, thereby receiving the benefits. The project has been ongoing for only six months, and it has already involved 50 families, providing income and improving their livelihoods. The income generation has increased, particularly from palma rosa and lemon grass oil. The improved varieties yield more oil, resulting in higher income. The income is further expected to improve with the cultivation of better varieties, and it provides timely income. Moreover, the cultivation of aromatic plants and some field crops like millets has almost doubled the income. More families are now joining the project and cultivating new crops after witnessing the income generated.

6.4.1.4 Increased Technical Human Power through Skill Development

1. **Science Technology and Innovation (STI) Hub in Dr Babasaheb Ambedkar Marathwada University, Establishment of**

Science Technology and Innovation Hub for the empowerment of SC/ST populations: Initially, the youth did not know about computers. BAMU started this project, and youth were trained on basic computers. Few people learnt the course and started online services, and SC/ST candidates got scholarships. The shop also provided other services: online ticketing, online banking services, land record, banner making, print out and Photoshop. It is an example of Atmanirbhar Bharat. This idea can be replicated among rural youth for self-employment. It can be upscaled by opening such computer training centres at the village level by trained youth.

2. **IoT based solar charge controller for rural electric workshop- Solar lantern:** The rural area had an electricity problem, so people had to invest in kerosene oil for lightning. Women were trained in the installation and repair maintenance of solar utility products, and now illiterate people and primarily women, are able to install and repair solar electricity systems. It has solved the electricity problem in rural areas.
3. **Clean energy:** In the Himalayan region, where the weather is super cold for around 2-4 months, the women there regularly burn challahs to keep the house and water warm throughout the day. And during summer, the women were busy collecting fuel wood and preparing a heap of cow dung cakes to keep water and house warm. The women in this region suffered from drudgery and health issues and were busy throughout the year. To address the issues, the Himalaya Research group have developed an economical heating system and provided a clean energy source for the villagers in this region. 29 artisans have been trained so far, earning 1200-1500 per unit. Around 6000 population got benefited. The locally available resources were used for the manufacturing of solar water heaters. Because of the use of local resources, the system is economical. This initiative helps biodiversity conservation with 40% wood saving, mitigating an average of 2.5 t of CO2 emission. The efficiency of this system is 70% compared to the other solar heater. 1200 systems have been installed so far. Despite its effectiveness, the system is not disseminated in other colder regions with power and fuel issues. This system heat water frequently is easy to use, has no requirements of repair and has easy maintenance, is affordable, is approachable, has easy installation, and has easy access. Reduced drudgery, and exposure to indoor pollution, saving their time. Life comfort, time-saving and better hygiene.
4. **Introduction to Basic Technology (IBT) Program for Secondary Schools:** Previously, school education was limited to theoretical knowledge. However, after Science and Technology (S&T) interventions, basic hand tools and conventional machines for fabrication, agricultural tools, electrical instruments, and more are provided to schools. With these basic tools, students from class 8 to 12 work on various projects and create many interesting innovations. The schools have labs for skill training in areas such as engineering, energy, environment, agriculture, animal husbandry, and food processing. The program has several benefits, including improving students' understanding of curricular subjects, increasing enrollment and attendance, helping students discover their preferences for future vocations, making schools a more happening

place, and providing services to the community. The program is currently implemented in 122 schools across Maharashtra, Chhattisgarh, and Karnataka, benefiting over 7,000 students.

5. **Computer Aided Designing software DigiBunai:** Manually creating weaving designs requires a significant amount of time and specialized skills. However, computer-aided textile designing offers a variety of modules that optimize the design process, including color and pattern selection, and allows for digital fabric display. This technology enables visualization of different designs in various colors. Currently, 2532 trainees across 25 states are being educated in 72 textile institutes on computer- based textile designing. Weaving is a traditional occupation, and these trainees are eager to learn and educated. This approach saves time and reduces fabric wastage, while also increasing awareness about the benefits of computer-based designing.

6.4.1.5 Improvement in Health and Nutrition

1. **Promoting community health by addressing incidence waterborne diseases in Village of Bihar:** Local people consume arsenic, iron and microbially contaminated water from tube wells. They suffer from diarrhoea and other water-borne diseases. Poor people were unaware of it. They were not able to treat the water before consumption. Excess of iron in water causes haemochromatosis, and sometimes the death of children is due to diarrhoea. After recognising the problems of water, awareness among local people about the importance of safe drinking water, adoption of Jalkalp, a bio-sand water filter, and Water testing were demonstrated. People adopted the technology after attending meetings by S& T organisation. It helped them save 700 to 900 rupees per month earlier they used to buy medicines and pay doctors. 3500 filtres have been installed so far. This also reduced water-contaminated diseases. People are now having a better quality of life due to health improvement. Also, the education of their children has improved.
2. **Newly developed anthrocyanin biofortified black wheat:** Previously, farmers used to cultivate only one type of wheat. However, the National Agri-Food Biotechnology Institute (NABI) in Mohali has developed new colored wheat varieties, such as blue, purple, and black. Colored wheat is abundant in Anthocyanins, and its crossbreeding provides the advantage of growing the progeny in different agro-climatic zones. The consumption of black wheat can be beneficial for pregnant women, lactating mothers, adolescent girls, and children under six years of age due to its high nutritional value. Moreover, black wheat can be stored for a longer time, making it more convenient for consumption and distribution. Farmers are now viewing this as an opportunity for higher income generation, as they can make and sell products at the village level. Companies are also interested in contract farming and marketing various products such as atta, dalia, roasted snacks, and bakery products. Farmers are receiving training, and they are happy with the higher income generated per acre after the sale of their produce. Malnourished infants and children are identified with the help of Aanganwadi centers, and they are provided with various food items made of black wheat, such as biscuits, dalia, flour, etc., addressing malnutrition in children. Additionally, black

wheat can be utilized to create therapeutic diets for specific conditions.

3. **Food fortification technology to combat primary health care deficiencies and economic empowerment of dwellers in forest fringe villages:** The utilization of food fortification technology in forest fringe villages presents an opportunity to address primary healthcare deficiencies and promote economic empowerment. In Anaikatti village, Tamil Nadu, children belonging to the tribal community are particularly affected by undernutrition and malnutrition. To combat these issues, a bio village model was established to educate the rural community about the benefits of traditional foods and the importance of consuming a balanced diet. The awareness camp emphasized the significance of healthy food through the use of food supplements, while also demonstrating the preparation of these supplements. Additionally, women from the rural area were trained to produce value-added products from nutrient-rich plants such as Moringa, millets, and Ragi. This training not only empowers women in the tribal community but also enables them to improve their family's health and sell their products in local markets. To further support the economic empowerment of women, training was provided on the preparation of various nutritious food recipes. These recipes serve to promote the use of traditional foods and ensure the consumption of a balanced diet within the community. By leveraging food fortification technology and providing education and training opportunities, the rural community can combat primary healthcare deficiencies and promote economic empowerment.

4. **Fluorosis mitigation through intervention, diet editing and management in Scheduled Caste community of Bihar:** Previously, individuals residing in rural areas were at risk of developing health issues as a result of environmental factors and pollutants. The consumption of fluoride-contaminated water for drinking and cooking purposes by members of the community had led to an increase in exposure to fluoride. However, following S&T interventions, community members now have access to de- fluorinated water, which has resulted in a decrease in joint pain, as well as improvements in neck and hip movements and overall health in individuals affected by fluorosis. In addition, childbirth among underweight individuals has also improved. The installation of filters that require no electricity or machinery and can be attached to existing hand pumps has proven to be highly effective, filtering up to 10 ppm of fluoride. As a result of the improvements in the health status of community members, they have experienced enhanced physical and mental abilities, resulting in an increase in the number of working days per month and an improvement in their socioeconomic status. Previously, individuals experienced back pain and joint pain due to the consumption of fluoride-contaminated water. However, they now report feeling better and an improvement in their health condition, leading to the development of a healthier community and improvements in earning and socioeconomic status.

5. **Promoting a pilot of bio-sand filters for access to clean drinking water for future dissemination:** In the Paderu region of Visakhapatnam district, Andhra Pradesh, the availability of clean water has been a major

concern. During the rainy season, water rushing through streams at high pressure can lead to contamination with dirt and other debris. To address this issue, the installation of Bio-sand filters has proven to be an effective solution. These filters can efficiently reduce the turbidity of water and eliminate sediments, bacteria, viruses, compounds, cysts, worms, and other impurities. As a result, the availability of good quality filtered water has improved the health and well-being of families and communities in the area. To encourage rural women to engage in entrepreneurial activities, initiatives were undertaken in the Godavari region to provide employment opportunities. The training was provided to prepare biodegradable, disposable plates from easily available adda leaves and tamarind cake making and packaging for sale in the market. The Laya group successfully installed 150 filters across villages based on the level of water contamination. Bio-sand filters are effective because they can be used intermittently and remove pathogens and suspended solids through a combination of biological and physical processes in the bio-layer and the sand layer. These filters are durable and robust, made from local materials, small enough to fit into the smallest kitchen, and easy to maintain. Additionally, this technology removes turbidity and improves water quality, providing safe drinking water without boiling water on traditional cookstoves. This has positively impacted the health of communities, which has been further supported through the promotion of nutri-gardens, education on prenatal and postnatal care, and the use of bio-sand water filters for potable water. To promote women's health, prenatal and postnatal care education was offered. Rural youth were trained in herbal- based health care, enabling them to respond systematically to basic day-to-day health care issues. The availability of good quality filtered water has also improved the health and well-being of families and communities, as the beneficiaries have reported fewer cases of malaria, stomach ache, and vomiting. In addition to these initiatives, women were taught "video skills," including photography and making simple videos, to provide employment opportunities for young women with some education.

6. **A New Approach towards Pain and Infertility Management in Women suffering from Endometriosis and Adenomyosis:** In today's society, infertility has become a prevalent issue, which is exacerbated by social oppression and criticism faced by women. Endometriosis and Adenomyosis are two common reasons behind infertility, and patients often have a history of 2-3 miscarriages. However, commercial surrogacy is restricted in India. To combat this issue, awareness is being created among the clinical society and gynaecologists of government bodies to identify the problem of Adenomyosis. Medication with Letrozole, administered thrice weekly, is being used as an STI intervention for this problem. It is important to spread awareness among women in other areas, as this treatment can be replicated. Further research in this field can help upscale this solution to better combat infertility.
7. **Assessment of Bone health in Transgender Population:** The transgender community faces severe social exclusion and is deprived of the opportunities that others in society enjoy. They are economically, educationally, and

socially disadvantaged. In 2018, the Indian government recognized them as transgenders, but they still face numerous challenges. They often avoid seeking medical attention, resorting to unregulated self-treatment using hormone therapy to change their gender, which negatively impacts their health. Due to poor economic conditions and negative attitudes towards them, they rarely visit hospitals, leading to mental health issues such as depression, mood swings, split personality, alcoholism, and drug addiction. A team of doctors from AIIMS is currently studying the bone health of the transgender community. However, the study is not easy, as the community is often hesitant to participate due to a belief that they are being used for experimentation. To support this community, the NGO 'Arohan' is working towards achieving equal status for transgenders in society. The AIIMS team is working with Arohan under this project. The transgender community is talented and cooperative, with an interest in education. Providing education can bring about significant positive changes. This study can be replicated for other groups of transgenders and can be scaled up to include psychological and other health problems, as well as organizing counseling sessions. By including the entire spectrum of health issues faced by the transgender community and offering a supportive environment, we can work towards empowering them to lead fulfilling lives.

6.4.1.6 Optimum Utilisation of Local and Natural Resources through Value Addition of Local Products

1. **Tree-based farming (Wadi) for Arid desert (Horticulture tree species/ grafts like Ber**): Agriculture production and income are vulnerable in arid and semi-arid regions of India. There is limited reach to technologies. Due to the poor soil, high salinity, irregular rainfall, harsh climate and irregular irrigation, only rainfed crops like Bajra, Moong and Mothbean are grown. With the help of S&T interventions for the farming system, including agriculture and horticulture, soil restoration, water resource development technique, livestock integration, a tree-based farming model including the introduction of moong moth, bajra combined with grafts of Ber (Zizyphus mauritiana), Pomegranate (Punica granatum, Gunda (Cordia dichotoma) with use of drip irrigation, organic manure and promoting nitrogen-fixing bacteria. It can be upscaled by including economically important crops and replicated in drought regions of our country.
2. **Women Technology Park "Bolmoram Technology Resource Centre Cum Knowledge and Innovation Park", East Garo Hills, Meghalaya:** Women in this region were working without proper knowledge and guidance about food processing, and their talent was unutilised. After imparting training programmes, women were able to produce food items with increased shelf-life and store them for a longer time and sell them in the market. The local vegetables and fruits were utilised as raw materials. This can be replicated in other parts of that region.
3. **ASRLM Project with CLEAN network:** It was found that there was a great demand for a drying technology in the region to preserve fruits, vegetables, meat, spices etc., as the production was more, but the marketing was

less. Previously, they dry the vegetables on fire, which makes the product black. Also, millet crops are available, but people did not know about the value addition to these crops. To solve these issues, the biomass dryer was installed by TIDE (Technology Informatics Design Endeavour) in Arunachal Pradesh. This dryer proved very useful for the Roing community. The technology of the biomass dryer keeps the quality of the product superior. Also, it doesn't destroy the colour and texture of the product. Biomass dryers can be upscaled and replicated by increasing their capacity and using it for various products. In the case of millet products, marketing on e-portal and more financial support to individual small entrepreneurs from banks can upscale it because everybody cannot visit the WTP centre. Both technological interventions can be replicated in the communities that need them.

4. **Food processing of value added products:** Mandi is a dry region with minimal rainfall, making it challenging for farmers to benefit much from irrigation. However, local value addition initiatives have proven successful. Self-Help Group (SHG) members, particularly women, were trained to produce value-added food products such as juices, jams, pickles, and squashes. The group obtained FSSAI certification in 2000 and has since operated sustainably. The Society for Technology and Development (STD) developed 25 new products with health benefits, including low-calorie foods and nutraceutical food products. This technology was then transferred to the FARMERS group. Recently, this has included fruit papads, honey and honey products, low-calorie fruit jams, apple spread and biscuits, amaranthus-wheat flour biscuits, and fortified nutraceutical biscuits of amaranthus with broccoli, spinach, and apple pomace. The annual sales turnover of the FARMERS unit, which was about Rs. 2.0 lakh in 2000-2001, has now increased to about Rs. 45 lakh in 2019-2020. Due to COVID-19, there was a 50% decline in 2020-2021, but the group hopes to reach Rs. 40 lakh in 2021-2022. The share of new and fortified nutraceutical products is around 15-20%. The food products such as fruit papads, honey and honey products, low-calorie fruit jams, apple spread and biscuits, amaranthus-wheat flour biscuits, and fortified nutraceutical biscuits of amaranthus with broccoli, spinach, and apple pomace are sold to nearby tourist destinations like Kullu and Manali. The advisory committee discovered that wild mangoes, which were previously unused, could be used to produce squashes and pickles.

5. **Value Added Products from Natural Plant Material:** Field surveys and participatory approaches identified two major issues in the community. The first issue was related to the limited work available in the months of November-January, which impacted the income of the farmers who mainly relied on agriculture and dairy. To address this issue, the farmers were introduced to seasonal mushroom cultivation, specifically button and oyster mushrooms, which are in high demand in the market. The organization also provided information on mushroom cultivation and compost making, resulting in a new source of income for the farmers. The second issue was related to the destruction of crops by wild animals in the Chidiyapur forest range of Rajaji National Park. To tackle this issue, lemongrass cultivation was

introduced since wild animals do not destroy it, and its processing for the extraction of essential oils was established. Additionally, neem and hemp, which were underutilized plants in the area, were used to develop value-added products. The farmers started receiving profits from lemongrass cultivation after 2-3 years of farming it. Two essential oil extraction plants were set up, and the oil was sold for Rs. 1550 per kg, which resulted in increased profits. Moreover, the organization also worked on developing a small-scale unit to produce materials in bulk, which would create livelihood opportunities in rural areas. Cannabis, which grows as a weed in Uttarakhand, was introduced as a crop by the government. The organization isolated important value-added products from cannabis, including fiber and cellulose, which were extracted and used for paper making. Furthermore, 400 active compounds were extracted from cannabis, including cannabinoids, polyphenols, flavonoids, terpenes, and terpenoids used in the pharmaceutical industry. The seeds of cannabis were used to make chutneys, which contained 39-40% oil with high omega-3 and omega-6 fatty acids. The sub-critical water treatment of cannabis biomass was used to produce fiber, soluble sugar, and high-value chemicals. Neem, which is a rich source of azadirachtin, was harvested using a harvester to collect high-quality fruit with 40% pulp, which could be used for making jams or jellies with jamun or mango. The neem fruit skin could be used for biogas, and the neem seed could be used for agarbatti or as mosquito repellent products. Neem seed kernel was used to extract azadirachtin-containing oil, which was used to develop neem products such as neem oil, neem oil bio-pesticide, neem cake biofertilizer, and mosquito repellent. The neem oil cake was also used as a biofertilizer. Overall, the farmers were able to earn around Rs. 8000-10000 per month from mushroom cultivation and Rs. 8,75,000 profit from lemongrass cultivation in one hectare of land. The organisation's efforts developed value-added products and livelihood opportunities in rural areas.

6.4.1.7 Strengthening Traditional Knowledge System with S&T

1. **Integrated Pottery Development Project for Development of Gujarat State Pottery Sector:** Initially, due to the competition with steel and plastic products and the low entrepreneurial skill of potters, potters were selling their products at a low price and getting low income. The quality of the products was inconsistent with poor marketing. Also, there was less involvement of the young generation in pottery work. But after the S&T intervention, there was a reduction in the time taken to make the products (2-3 hours less), better finishing of products, and less pollution. Production increased from 50 matkas to 150 matkas in one day by 40 workers. This also helped reduce drudgery (working by hand) and pollution-related problems.
2. **Low Temperature Thermal Desalination Plants of One Lakh liters per day capacity:** There was a lack of potable water in the islands. Previously they used groundwater for drinking, but it was contaminated water. 30,000 tribal populations on the island used to go to distant places to fetch potable water. In 2004, NIOT approached them and installed Temperature

Thermal Desalination (LTTD). The process works with two streams of water where the warm sea water is evaporated at low pressure, and the resultant vapour is condensed with cold seawater. The naturally available temperature gradient in the ocean, with a temperature difference of about 16°C between surface water and about 400m depth, provides one scenario for sources of such water, while a coastal thermal power plant discharging vast amounts of condenser reject water into the adjacent sea provides another scenario. The technology is entirely indigenous, robust, and environmentally friendly and requires much less operation and maintenance effort. This technology has been successfully demonstrated in the islands of Lakshadweep, at a coastal power plant in Tamil Nadu and with a barge-mounted desalination plant off Chennai for mainland requirements. In 3 islands, it is working well; in the other 3, it is in process. Now, local people are getting safe drinking water. and Fish Cage Technology introduced by NIOT is helping generate income for the community.

3. **Technology based Coconut Fiber Extraction and Value addition:** The traditional method of defibring coconut husks is not only hazardous but also less productive, and local farmers often lack the skill of fibre extraction and value addition. However, a new technology has been developed to address these challenges - a coconut fibre extractor with a 10 HP motor capable of debiring 600 husks per hour. This innovative machine has the potential to significantly increase productivity and can be replicated among coconut growers. With further development, the quantity of coir and the speed of the machine can also be increased. By adopting this technology, farmers can save time and increase their income while reducing the risks associated with the traditional method of defibring.
4. **Modernization of traditional Pottery:** The potter community in Kerala was facing social, economic, educational, and technological challenges. Many individuals were unemployed, and school dropouts were prevalent. However, the introduction of motorized potter's wheels, mini pug mills, and decoupage techniques for painting pottery has helped to improve their income significantly. As a result, they can now earn comfortably, with an additional income of 15,000 to 20,000 rupees. SANKALP, a government initiative, has financed 500 artisans across the state and trained more than 1 lakh potter communities. The younger generation is also showing an interest in this field. This successful model can be replicated in potter communities in other states. It can be further scaled up through forward linkages and the use of motorized potter's wheels, mini pug mills, decoupage techniques, and ornament making. By incorporating computer-aided design and branding, such as printing photos on pottery, production has doubled.

6.4.2. Bottom-Up Approach

The bottom-up approach to advancing science and technology knowledge and information dissemination prioritizes grassroots engagement and community-driven initiatives. This method begins by empowering local communities with the tools, resources, and knowledge needed to understand and adopt appropriate technologies for livelihood generation. Through participatory processes, such as community workshops, knowledge-sharing sessions,

and hands-on training programs, individuals are equipped with the skills necessary to effectively utilize technology in their daily lives and livelihood activities. Moreover, this approach fosters the development of technical human power by nurturing local expertise and talent through skill development initiatives tailored to community needs. By engaging directly with communities, this bottom-up approach ensures that technological interventions are contextually relevant and responsive to local realities, thereby promoting the optimum utilization of natural resources in a sustainable manner. Ultimately, by centering on the needs and capacities of communities, this approach fosters inclusive and equitable development, empowering individuals to leverage science and technology for improved livelihoods and environmental stewardship.

6.4.2.1 Increased S&T Knowledge and Information

1. **Poly houses & Solar Street light:** Prior to the implementation of science and technology, livelihood was a means of subsistence for communities, and the conservation of wildlife was imperative for maintaining a healthy ecosystem while mitigating human-wildlife conflict. However, after the integration of science and technology, the objectives of wildlife conservation are now aligned with the needs of local communities. This has resulted in a significant reduction in the fear of conflict and an improvement in tolerance towards wildlife. Furthermore, the implementation of science and technology has facilitated the promotion of Self-Help Groups (SHGs) in the processing and marketing of locally grown spices, as well as the processing, packaging, and marketing of organically grown products. These initiatives have contributed to the growth of the local economy, reducing the burden on local communities, and making their daily lives easier.
2. **Climate Resilient Farming Technology:** Before the S&T intervention, the farmers relied on weather-based agriculture, and more than 80% of them were small and marginal. Additionally, over 84% of farmers had landholdings of less than 1 hectare, leading to poverty and indebtedness. However, after the S&T interventions, the farmers received skill training and capacity building, resulting in reduced vulnerability of their livelihoods and sustainable income. Moreover, the technology for eco-friendly insect repellent was transferred to 18 villages and 3 SHGs in Gorakhpur and West Champaran, and these groups are now engaged in commercial production. As a result, a total of 3141 men and 1346 women farmers have adopted the technology and benefitted from it. Furthermore, the farmers have learned multilayer farming techniques with appropriate crop combinations, portable nursery, and eco-friendly insect repellents. This intervention has improved the farmers' overall productivity and sustainability.

6.4.2.2 Providing Appropriate Technology Intervention for Livelihood Generation

1. **Socializing the Micro-Solar Dome: Empowering Rural SC, ST and Tribal Communities:** Herma has been an untouched, remote tribal village of West Tripura district mainly inhabited by the Tribal Populace of Tripura. The village is located about 40km from the city of Agartala, and it has 100 habitant families. It has been a village without a proper indoor lighting system for rooms and toilets.

This village previously used kerosene lamps to light up their houses and had no lighting provisions in toilets. People were unaware of the benefits of clean lighting and thus suffered from several health problems due to indoor air pollution and potential fire risks. NBIRT has developed The Micro Solar Dome (Patented) to provide a 24 x 7 lighting solution for remote tribal areas where conventional power is unavailable or unreliable. It has been installed in the houses of the village beneficiaries through the Herma Village Community and in the low-cost toilets (constructed by NBIRT). The Micro Solar Dome (MSD) is a day and night lighting single device unique in its features that has a transparent semi-spherical upper dome made of acrylic material which captures the sunlight, and the light passes through a sun tube having a thin layer of highly reflective coating on the through the support of the Core Support Program and with the active involvement of the core support inner wall of the passage. It also contains a lower dome made of acrylic. A shutter at the bottom of the lower dome can be closed if the light is not required in the daytime. The integrated PV module fitted in the dome charges a battery during the daytime, providing light from the MSD for about 4 hrs through LED included in the lower dome. The MSD has been thoroughly tested and is not only a standard and commercial product but also a very popular one. It is a sustainable model because the trained people are confident that they can technically manage the solar light installation and are training more people in the community. An improved finished look could upscale the product, and new products could be designed. The product has a good market in the local market. It should be disseminated in markets of other areas by increasing its production.

2. **Solid State Biogas Plant Organic Farming and Solar Dryer:** Chota Udaipur is located in forest areas, and transportation is a problem. Generally, the women of Chota Udaipur use wood for their cookstoves, and they use brick chulha. Smoke emission was high, and more wood consumption. The farmer approached SPRERI-TECH for a solar dryer and got technical support there. This solar dryer (5.75 kW capacity) forced-draft dhabha size improved biomass cookstove primarily consists of the facility for continuous fuel feeding during the operation. The cookstove was mounted on metal wheels so that the user could move the cookstove and feed the fuel during the operation. Cookstove was designed to run on both modes of operations, i.e. forced and natural. The biomass cookstove is designed with fuel flexibility and can utilise mixed fuel wood blocks efficiently. SPRERI-TECH forced-draft dhabha size IBCS in Zand village. Nasta Centre – to be owned and managed by a SHG group. The second work done by SPRERI is a Solar dryer on the Farm of Jal brahmi in Gujarat. The farmer is getting a fair price for his crop than the sun-dried Jal brahmi crop. Women are efficiently doing work, and their time is saved. The women are receptive to training. Vimalbhai is implementing and discussing his ideas with the knowledge organisation. and growing organic medicinal plants. The biogas stove is upscaled or downscaled as per need. In Papad making industry, this cookstove must be downscaled, and in other places, it is replicable. The solar dryer is replicable.
3. **Cotton Wick Making Machine:** Wick making is manual work done mostly by women

for small-scale production in the cottage industry. Initially, no machine was available in the market for making round cotton wicks. Using S&T interventions, an automated machine was designed to produce cotton wicks efficiently. This machine is compact, portable and affordable. Two models of machines were designed. This is good for small-scale industries. Now, women are earning income, there are no occupational hazards. This also leads to women's empowerment. This technology can be replicated and used for economic activity for the community.

6.4.2.3 Promoting Enterprise Development

1. **Pepper Thresher Machine-Innovation Science Technology Entrepreneurship Development project (i-STED project):** Pepper threshing is typically done manually, which is a laborious and time-consuming task, primarily undertaken by women. During the process, the berries may get damaged, and the overall threshing percentage tends to be low. However, a new machine has been developed that can thresh pepper berries both mechanically and manually. The machine is available in two models, and it significantly reduces the drudgery of the work while saving time. Over 200 people have been trained in the use of this machine, and as a result, 12 pepper processing units have been established. The introduction of this technology has led to a marked reduction in the drudgery of the pepper threshing process, benefiting those who were previously engaged in this task.
2. **Crop Residue Biomass Composting Demonstration Units:** Previously, burning crop residues was a common practice among farmers, who viewed it as an easy solution due to a lack of awareness regarding the negative impacts of this method. However, following S&T interventions, significant progress has been made in converting agricultural debris into useful material. R&D components have been developed, including the design of a crop residue shredding device and inoculum for the degradation of lignocellulosic content, along with studies on soil carbon improvement through bio compost. The technology developer and their team have trained farmers in the process of turning their crop residues into compost. Farmers have been made aware of the benefits of crop residue management, including the potential use of compost as a soil conditioner and biofertilizer. The developer is also working on improving the design of the composting unit, using lightweight materials instead of fiber-reinforced cement boards and steel sheets. Currently, there are 250 crop residue composting units established in different clusters of the Palakkad district. All of these farmers have received training in bio-composting, including 20 female farmers and eight migrant farmers. More than 20 farmers have also been trained as master trainers in bio-composting through this program. The benefits of the unit include easy transportation, installation, and maintenance, as well as being economical. The matured larvae produced from the composting cabin are used as fish feed in homestead aquaculture, adding an integrated and holistic approach to the technology-aided agricultural and allied production process. Farmers have also been trained to develop inoculum for composting from their previous compost, which makes the process easier and helps reduce feed cost burdens

for their livestock. The beneficiary farmers are trained to operate and maintain these facilities independently, and the compost products are utilized for various applications. After installing the unit, farmers use manure prepared in the unit and buy only half of the manure from the market, reducing their expenses. The family members of these farmers also contribute to the process by collecting waste from the field and adding it to the composting unit.

6.4.2.4 Increased Technical Human Power through Skill Development

1. **Social Enterprise & Farmer's own fabricator for agriculture tools and transport vehicle hoods:** Farming is the fundamental activity of the village, but there was a lack of maintenance services for tractors and other implements in this village. Mr. Aniket got trained from Vigyan Ashram and done Diploma in Basic Rural Technology. He learned about welding, fabrication, and scientific agriculture. Now he provides services such as tractor-driven implements, seed drills and earns lakh rupees/ month with the help of the involvement of 2-3 people. With this kind of skill development, youth is strengthening rural social capital, infrastructures are being developed in rural areas, and a new idea of income generation is being implemented in the village.
2. **Moonew Tareybhir Enriched Composting (Vermicomposting) Cluster:** Sikkim is an Organic State that only uses organic manure or compost for farming. So, vermicomposting could be a potential source of livelihood generation. Initially, the farmers did not believe in the profits from vermicomposting, and milk was the primary source of income. Biomass and cow dung were being wasted. Ramnarayan Sharma took training from Rajendra Agricultural University, Pusa. At starting, Mr Sharma trained six people and started vermicomposting in Sikkim. Two hundred farmers are working on vermicomposting. Women are also working in vermicomposting. They are earning by selling vermicompost.
3. **Compact Food Waste Biogas Unit:** The conventional method of biogas generation requires large space, agriculture waste, cow dung and water in massive amounts and generates less biofuel. The improved system generates 200 litres of biogas from food waste compared to the conventional, which produces only 50-120 lit of biofuel. This system does not require any water; it is a dry system method specially developed for water scarcity areas. After mechanical crunching can directly feed in the plant and can generate biogas. Significantly less space is required for installation. It is also easy to relocate. The discharge slurry volume is also less. Through this system, 6000 litres of biogas per day can be generated, which is equal to around 2.70 kg LPG per day. Approximately 80 kg LPG per month and Rs.8000 per month can be saved. Bioenergy from waste is recovered more efficiently and provides putrefiable organic waste, providing energy security & economic benefits to the end user. It also ensured better sanitation conditions and cop productivity.

6.4.2.5 Improvement in Health and Nutrition

1. **Digital Clinic to combat Primary Healthcare:** The healthcare system has been exposed to flaws due to the corona epidemic, and there is a shortage of healthcare workers. In rural

areas, people have little access to doctors and hospitals, resulting in 39 million people falling below the poverty line due to health-related expenses. To address this issue, Digital Clinics were developed in West Bengal in 2017-18, using software created by Satadal Saha, a practicing surgeon in Kolkata. Rural women were trained as community health workers to provide healthcare services. Recently, the Government of India has developed guidelines for telemedicine and created healthcare infrastructure that works on a 10-15 bandwidth. Additionally, frugal diagnostic machines have been developed in India, including a non-invasive machine for oral cancer. These clinics have a presence in three states in India (West Bengal, Assam, Bihar) and outside India (Nigeria). Through Google Meet, patients can receive consultations and save time for doctors. The consultation fees for doctors are 30 rupees. However, the medical equipment used is not suitable for rural areas, and 80% of healthcare facilities are imported. As a result, 4,500 youths have been trained, and there has been upliftment of SC/ST and empowerment of women. A majority of the 605 candidates trained were women and SC/ST, with 80% placement achieved. Trained health workers conduct various clinical examinations at the doorstep of patients. Over 11,000 patients from remote rural areas have availed of healthcare services, including generalist and specialist services, through 174 trained and certified community health workers from SC/ST communities, the majority of whom are women. These clinics are customizable, replicable, and their upgrading of skills will upscale them.

6.4.2.6 Optimum Utilisation of Local and Natural Resources through Value Addition of Local Products

1. **Namami Gange Praharis:** The Ganges, India's largest river, is facing a grave pollution threat that poses a significant risk to human health and the environment at large. To address this issue, efforts are being made to raise awareness about the benefits of a clean and thriving Ganga, as well as foster a sense of ownership among the people towards this iconic river. Additionally, there are efforts to connect local communities and their livelihoods with the broader initiatives undertaken by various agencies working towards a cleaner Ganga. This convergence of efforts at the grassroots level aims to link the well-being and prosperity of local communities with the goal of achieving a healthy and vibrant Ganga.

6.4.2.7 Strengthening Traditional Knowledge System with S&T

1. **Seaweed Cultivation and Processing:** Seaweeds are macroscopic algae, also called the 'Medical Food of the 21st century' due to their use as laxatives. They are used to make pharmaceutical capsules and treat goitre, cancer, bone replacement therapy, and cardiovascular surgeries. This has been in use for almost two decades. Initially, there were few cultivators in the small village of Samba, 15 km from Rameshwaram. Now there are 80 seaweed cultivators. The price was initially Rs. 18, but it has now increased to Rs. 50. All the seaweed is sold to Aquagreen Industries, based in Madurai. The cultivators are increasing it to Rs. 50. The technology has now been handed down to the second generation. It has improved

the overall livelihood of the villages. It can be upscaled by established seaweed processing units for the production of laxatives, capsules and other products from seaweed at the local community level.

2. **Women Organised Group working on Agro technology and Semi processing of High-value Himalayan Medicinal Plant Swertia cordata (Chiraita), Mandi, Himachal Pradesh:** The local people did not know about vermicomposting and Chiraita cultivation. They did not know to cure their health issues. No, Self Help Group (SGG) was formed earlier. After training, they learnt Vermicomposting, Chiraita cultivation and its benefits and earning money from vermicompost and Chiraita. This can be upscaled by selling the product at a high price, as Ayush Pharmacy is paying less to the growers. This can be grown commercially by involving more farmers as the demand in the Indian market is 500 MT. during Corona, it was sold at 1000 rupees/kg. A local nutritional analysis centre can be opened, and grading can be done. Also, research on new types of products could be done.
3. **Potential Zone Advisories and Ocean State Forecasts:** Wave Riders Buoy in Puducherry, Tuticorin and Cholachel Coast, Documentation of ITK, Capacity Building & Validation of INCOIS Services in TN & AP: The community has some traditional knowledge about ocean currents. The community got training to operate GPS, repair boat engines and connect with the coastal guard. They adopted the technology, which helped them know precisely about the potential fishing zone.
4. **Leaf Grinder used for making Bio Manure:** SHG used to make compost from the leaves by a traditional method that took a very long time of approx. 3 months with the requirement of very hard work, and it also required some worms. After getting support from NIF, people shifted from vermicomposting to leaf-grinder because there was a reduction in time consumption and drudgery after using the leaf-grinder machinery. Such small steps will help to keep the environment clean, production of organic fertilisers, and capacity building of human resources along with income generation. It is strengthening natural and human capital. Such interventions should be continued.
5. **Improved Mud Cookstove "PAVAK" for disadvantaged communities in rural India:** Generally, the Korku tribal population in the Khandwa district use mud cookstoves for cooking their food. They use wood for cooking food. Due to the use of firewood, they suffer from acute respiratory diseases. They do not use LPG gas cylinders due to the high cost. The affordability and adoption of the metal cookstove and LPG gas are a big challenge. Besides that, the children are malnourished. To address this issue, CSIR-NEERI, in association with Glenmark Foundation, has designed and developed an improved cookstove PAVAK. The efficacy of PAVAK meets IS 13152 by the BIS standard. It is aimed at resolving affordability, availability and adoption challenges. It reduced firewood consumption as well as indoor air pollution. The local artisans make the product from small iron pipes.
6. **Improved Jaggery-Making Plant "Gur Bhatti":** Jaggery-making is a prominent cottage industry in rural India. The industry struggled with specific issues of low profitability and high air pollution. For 40 years, a beneficiary with

50 biogas in his field has been cultivating sugar cane and producing jaggery. After identifying the problems of farmers, one of the Scientists from IIP, Dehradun, intervened in the issue and modified the technology, which was able to save 25% of bagasse used as fuel, worked on the combustion process, which has not only reduced the smoke level but also increased the overall thermal efficiency of the plant. The production of jaggery also increased. The farmer has installed three plants using this technology, earning more profit (almost 50% increase in jaggery production and quality; 15 to 20 quintals per day; 4 to 5 lakh profit). Its replication could be done in other sugarcane-growing states.

7. **Innovations in Correctional Home - A model of Inclusive Development:** Conventionally, plastic bags are used for growing plants. These are not biodegradable and do not have porosity. The bags have to tear off to facilitate root growth. The innovator has developed eco-friendly pots using cow dung and agricultural waste. The raw material is easily available and has importance in Indian society. Acceptability of this innovation is good. So, to streamline the production of cow dung pots, the innovator designed a cow dung pot machine. it is new technology and appropriate for gaushalas and dairy farms. Its replication could be done in dairy farms. This innovation improved inmates' mental health and helped convert waste into wealth. Such innovations should be used for economic activity for the community and should be encouraged.
8. **Deployment of Bamboo Splint Making Machine:** This machine is a boon for the Aggarbatti industry. This machine has two sets of devices: one for making bamboo strips and another for incense sticks. The first machine slices the bamboo into definite shapes, thicknesses and lengths. The slices are then fed into strip making machine to produce the sticks. With the help of one or more machines, rolling machines, one may transform an ordinary stick into an incense stick. This is manually operated and reduces drudgery. Aged people can also use this machine. It is suitable for the rural and tribal populations for supplementary employment. This innovation is helping generate awareness, income and women empowerment.
9. **S&T intervention gives Traditional Water Mill a Lift:** Gharat is old technology from the IInd century, but water millers started losing interest due to less benefits and limited functions like grinding only. The shaft was wooden, break frequently and had turbine issues in the old machine. HESCO intervened after identifying the gap areas and taken care of 1. The easy-handled and locally repairable system, 2. Matching with old technology, 3. Low installation cost. After modification, the efficiency was increased thrice, and a multipurpose water miller was developed (like Grinding, power generation, masala grinding, etc.). The water millers adopted the technology, and they are earning approx. Rs. 40000 per month. 5000 modified water miller was installed successfully. For this, the natural flow of water was utilize to grind grains. HESCO is still working on improving the efficiency of the Watermill and trying to upscale the technology. The system is eco-friendly and helps save electricity by using the natural water flow. This is being replicated in nearby villages where the water source is available. This intervention

has identified that the old traditional method needs only a few modifications to help the old artesian showcase their work/expertise.

10. **Solar and Biomass driers for Mahua Processing and Vegetable Dehydration:** The old jaggery-making process was highly energy-consuming and pollution-causing. After a few modifications in the existing furnaces, it increased its production efficiency by producing almost 16 batches per day compared to 12, reducing fuel consumption by 20% and CO2 emission by 25% approx. The farmers adopted the modified technology, and now they are earning approx. Rs. 30000 per month. Farm waste (bagasse) was utilised as fuel for jaggery production, reducing the impact of solid waste. Insulating bricks were used in furnaces to utilise the heat at its maximum, which reduced fuel requirement by 20% and increased the furnace's efficiency. The farmers were earning more benefits from this energy-efficient jaggery furnace. This can be upscaled and replicated.
11. **Integrated Approach for augmenting ground water in Chirawa Block of Jhunjhunu District Rajasthan:** In the past, Fourwall wells that were 150 ft deep were commonly used for drinking water, and rainwater was also used for this purpose. However, the Ramkrishna Jaidayal Dalmia Seva Sansthan (RJDSS) recognized the need for improved groundwater management and took action through various programmes, advocacy, and training. By raising awareness about the issue of groundwater depletion and showcasing successful examples, RJDSS was able to encourage the adoption of new technologies. As a result, 55000 people from 89 villages now have access to safe drinking water provided to 5500 households, benefiting 44000 individuals. In addition, 3189 water harvesting tanks have been constructed in 22 villages with poor water quality, along with 76 recharge wells and 5 ponds. The organization also provided training on filter cleaning, crop pattern changes, orchard establishment, rooftop water harvesting, and recharge wells. These initiatives have proven successful, and the model can be replicated in other water- scarce areas. Previously, the community relied on Fourwall wells for storing water at the community level, but the high Total Dissolved Solids (TDS) caused health problems such as digestion issues and discolored teeth and knees. However, after adopting Tanka water consumption, the teeth color of children has improved. The community has also learned about the advantages of safe drinking water and water- saving techniques such as growing horticultural crops and rainwater harvesting. RJDSS has also empowered women through the formation of Self Help Groups (SHGs) and promoted Resilient Agriculture, Live Stock Development, and Total Sanitation in the desert-prone area.
12. **Cultivation of Aromatic Plants and Distillation of Aromatic Oils (Wild Marigold):** The farmers in Parwai village primarily engaged in conventional farming, cultivating wheat, maize, and paddy, which are not very profitable and often plagued by issues such as wild animals, particularly monkeys. However, upon further investigation, it was discovered that the region was ideal for cultivating aromatic plants, which are less susceptible to damage from wild animals and can yield nearly double the income of traditional crops. As part of the CSIR Aroma Mission, 1,200 farming families across India

have benefited from the cultivation of these plants on 1,400 hectares of land. In addition, 51 processing units have been established, benefiting farmers, self- help groups, and gram panchayats, with an additional 13 processing units set up in the aspirational district of Chamba. These efforts have generated revenue of 31.27 crore. The diversification into aromatic crop cultivation has resulted in higher earnings for the farmers, with crops such as wild marigold, Rosemary, and lavender being cultivated.

13. **Holistic Health - Traditional Siddha Varmam Therapy:** In the southern regions of Tamil Nadu and Kerala, traditional methods of treating various ailments have been practiced for many years. Recently, the establishment of the Varma Research and Resource Centre (VRRC) within the Vivekananda Kendra Natural Resources Development Project (VK-NARDEP) has combined traditional wisdom with modern science. The VRRC has been instrumental in identifying rare herbs, cultivating medicinal plants, manufacturing healthcare products, and documenting indigenous medicine systems, with a focus on promoting holistic development and well-being encompassing physical, mental, social, and spiritual dimensions. Young people have enrolled in various courses, including Bachelor's or Postgraduate degrees in Siddha medicine and surgery. Furthermore, many people have engaged in the cultivation of herbs and the manufacturing of herbal products through Self Help Groups (SHGs). Siddha physicians and surgeons have been trained to serve the society, making it a replicable model for other parts of the country. It is noteworthy that the Ministry of Ayush, GOI already recognizes Siddha medicine as a course of study. To upscale this model, it is possible to open Varma centres in Primary Health Care Centres and establish a department within trauma centres of Government and Private hospitals. By doing so, more people can benefit from the traditional methods of treatment and the integration of modern scientific advancements.

14. **Hameri work & Honey Bee farming:** For communities, livelihood is a crucial means of sustenance, and wildlife conservation is essential for maintaining a healthy ecosystem, while also mitigating human-wildlife conflict. However, the integration of science and technology has enabled the alignment of wildlife conservation objectives with the needs of local communities. This has resulted in the development of a livelihood model for these communities, leveraging their traditional knowledge of food processing and incorporating modern food science and safety principles to cultivate organic and handmade varieties of FSSAI-certified processed food products. Women within these communities have taken the lead in producing and marketing over 20 different food products, including pickles, chutneys, jams, juices, squash, and more, made from locally available produce. To promote a shared understanding of the importance of saving the environment and promoting sustainable livelihoods, WWF India provides training to these communities. The field team of WWF India continues to support these women in achieving quality assurance and increased production, contributing to the growth of the local economy while also reducing the burden on these communities.

6.5. SYSTEMIC GAPS

The significant gaps between estimated outcomes from technology delivery at the societal level and the actual outcome of technology absorption due to other reasons besides the technology part also play a major role in S&T intervention at the community level.

1. Infrastructural gaps

Even the technologies were adopted by communities. But there was a lack of infrastructure like buildings, roads, common facilitation centres, hostel machines, tools, and many other public facilities in the villages. Lack of production centres at the village level: To engage more community members and build a self-sustaining model, there is a need to initiate training and production at the village level. The communities identified the scarcity of infrastructure was creating hindrances in their activities.

The communities of Noklak and Bolmoron discussed the systemic gaps like lack of roads and transportation, lack of cold storage, Oil extractor machines for perilla seeds, and Packaging machines for sealing products which are creating problems in transporting their products to other places. The potter community faces challenges like lack of hostel facilities for trainees and keeping products in sheds.

The communities of Obar village of Jharkhand identified gaps like inadequate quantities of equipment like extractors of bee venom and royal jelly. The farmers of Nandurbar had a single aromatic oil distillation plant.

2. Lack of proper channelization of products to markets

The production unit was producing goods but the supply chain to market was unorganized, so they sell their products in local markets at low cost. Among all participant communities, there were only a few communities were able to sell their products on the online platform or to distant places through proper marketing linkages

3. Migration of people and Village Abandonments of communities

Rural communities are abandoning their villages in mountains, leaving it deserted even after having the diverse rich natural resources, clean, air and water. This is due to the non- availability of basic facilities, education and sources of livelihood and incomes.

Migration causes lack of manpower in communities. Only women, elderly people and children stayed in villages. The Khoi village of Uttarakhand, and the Birhor communities of Purulia observed migration as a challenge in developmental activities of villages.

4. Lack of One Stop solution at local level

There were many activities required to produce any product at commercial level. Only training, skill development and production of any product was not sufficient but it needs nutritional analysis, packaging, branding to ensure its authenticity and marketability.

The communities producing food processed products were sold without nutritional analysis and proper packaging, so the market value of the product was low although the product quality may be good.

5. Lack of Raw Materials for production

In some communities‘ lack of raw materials was noticed. The Naroda centre of Gujarat trained many people on pottery but red clay not available at many places and they were not able to start their

work. Raw material for water bottle(Red clay) is needed. As the raw material is available 400km away from their home it is difficult to procure it. For mold preparation, small amount of POP material is required, but there is lack of availability of good quality POP in local market. There is a need for organized supply chain management.

The lack of spawn availability to mushroom growers of Arunachal Pradesh also a limitation for their business. They have only one centre at CSIR-NIIST increases input cost of mushroom cultivation. Absence of backward linkage was affecting the performance of the community.

6. Lack of Funds with the communities

Most of the communities had poor socio-economic conditions. Even after getting training they were unable to start their livelihood activities due to lack of funds. Lack of financial support to buy machinery and equipment for training and making good quality soil and products and continue with advanced level and inter-disciplinary trainings. Some of them get financial support under some projects from S&T institutions. Only few are linked to banks. A beneficiary Aniket Kanade also talked about this issue.

7. Few collaborations between S&T institutions, NGOs, and Administrative bodies had been observed

The collaboration among the above organizations was found in some cases and other scientific development agencies were not getting the support of local administration as the NGO, Gorakhpur Environmental Action Plan had mentioned.

The Herma community of Tripura and Solar Mamas also talked about the lack of support from the administration.

8. Communities hesitate to take loans even after their creditability to banks

In some communities, scientific organizations and NGOs link self-help group members with banks. But they were not interested to take loans due to lack of knowledge or preconceived notions. CSIR-NEIST scientists said that it took five years to convince women to take loans for their weaving activities.

9. Lack of outreach of technological intervention

Technology is being developed in research and knowledge institutions but still it has not reached villages. With over 60% of the rural population in India, it is primarily important to give exposure to the rural communities on the use and implementation of first-generation technology.

The outreach of technical knowledge is not widespread. It reaches only a limited number of people. Lack of digital knowledge. Lack of knowledge about various schemes run by the government and do not get the benefits of these schemes,

10. Lack of mechanisms to collate information on local innovations and less recognition of local innovations to collate information on local innovations

Local innovations take place in every corner of India. These innovations require proper recognition in the country‘s economic development. Every community innovates many solutions to their problems in day-to-day life and strong and interconnected mechanisms need to be developed to document the many, interesting, and intelligent local innovations.

11. Negligible participation of Stakeholders means community and change makers in the identification of appropriate Research projects for their area:

Lack of community participation during the designing of the technology, project conceptualization, etc. Stakeholders should be part of our research Projects, which are lacking in a top-down approach. The understanding of communities' perspectives towards the problems and sustainable solutions at grass root level was missing in a top-down approach.

12. Lack of Ownership and Collective Efforts:

Innovations don't happen overnight but are a continuous process happens, hence multiple departments/organizations need to capitalize upon each other Collective Efforts: Innovations don't happen overnight but are a continuous process.

13. Lack of baseline survey before Implementation:

A proper baseline survey about different types of resources available with the communities, their concerns, their priorities, their challenges, and available solutions with them were not considered before implementation.

14. Provision of incomplete information about technology with the communities

Example

In some cases when we do water purification but then the problem arises with how to deal with waste production. Hence, we have to look at any issue in its entirety for example water management (purification, use, and disposal) point of view. Similarly, mushroom growers did not have knowledge about spawn production and they were dependent on S&T institutions for spawn for mushroom cultivation.

15. Lack of Resource maps and S&T Knowledge Banks:

We need to go back to the preparation of water maps just like normal maps (roads) with all the essential information and make sure that they are easily available to everyone for larger dissemination, awareness, and scientific utilization.

16. Lack of Multiplication of Technology:

Sometimes technologies were appropriate and working well but the technology was implemented at a small -scale which was not sufficient to serve the whole community. For example, seawater usage in the Tamil Nadu district Ramnath, Village Nari-Puran. To address this the technology Low Thermal Desalination Plant by NIOT. It can produce 20 thousand liters of water on a daily basis. The technology is complete in itself and the freshwater was effectively distributed but the problem is that we have set up only one plant and still remain the only plant across the vast 7500 km coastal line of India. So we need to focus on the multiplication of technologies for large-scale change and new pathways. Hence different types of technologies need to be multiplied in different regions of India as per the need to address the problem.

17. Limited Outreach:

Generally, projects funded by a particular institution like DST, DBT, CSIR, or MoES are limited reach to a particular target group. That is absolutely perfect but what is missing link here is we don't take care to take up these successful technologies to the other regions of villages of the county for mass-scale use and development. For

example, A DST project on Geophysical studies was done but it remains limited to the Chirawa Block of Rajasthan only. Lack of implementation of the results to other blocks or regions of interventions facing similar issues.

18. Engaging with trust and cooperation:

Cross-sectoral coordination and participation were lacking in the communities. There was a dire need to build a strong livelihood-related network of communities between farmers, local organizations (formal and informal) beekeepers (for bee migration), weavers, potters, university/research institutions (for validation and experimentation), potential marketing, promotion and advertising ventures and avenues for the products (for income generation).

Cross-sectoral coordination and participation were lacking in the communities.

19. Lack of ownership rights of communities over land and other resources

Communities living in forest fringe areas and many marginal farmers lack ownership rights over land. They learned agriculture-related technologies but they were unable to use the technology to its full potential because of a lack of ownership rights until and unless any handholding and support were provided to them. Local people of Erode and Salem districts faced drudgery in agricultural operations. Women are unskilled in these rural areas. Local community women have no control over land and other production assets. Agricultural wages for women are 30- 50% less than for men, and the meagre literacy rate among local tribal women is a major issue. Most tribal people are cultivators, agricultural labourers, or dependent on forests and got benefits from minor forest produce. Access of tribal to technologies of research\organisation, institutional finance, organized markets, value addition, and quality information services is still at a primordial level. Tribal communities of Tamil Nadu have Low scientific and precision farming practices.

20. Lack of Resources Centre:

Every community is blessed with traditional knowledge technology, but only a little information were available in a scattered way. Hence, there is a dire need to build a resource center in every community/ village so that all the information about unique knowledge and innovation can be documented there for larger dissemination and development.

21. Limited Trained Work Force:

There were very limited trained people and master trainers available at the community level and if there is a need for them at multiple places or for commercial production. it becomes extremely difficult for us to handle such situations.

22. Lack of interest among young educated people in their traditional family occupation:

They do not find Agriculture as an attractive and lively hood option. They look for white- collar jobs. For example, in Kerala, local people do not want to work as farm labourers due to the state‘s higher literacy rate. Kerala is now getting labourers from states like Bihar and Odissa.

23. Lack of Region-wise Technology Transfer:

Technology needs to be region-specific for harnessing the potential of technology. Absence of systems to channelize region specific technology transfer.

6.6. KEY FINDINGS

The study's key findings reveal that advancements in Science and Technology (S&T) have markedly strengthened agriculture and allied activities, enhancing the capacities and livelihoods of communities. Through interventions like food processing, vermicomposting, mushroom cultivation, and leaf manuring, communities have seen improved productivity and sustainability in their agricultural practices. Additionally, S&T has revitalized traditional livelihood activities such as pottery, handloom weaving, and grass mat weaving, making them more profitable and productive than ever before.

Both top-down and bottom-up S&T interventions have effectively addressed the fundamental needs of communities, providing alternate sources of livelihood, particularly for women, thereby fostering their empowerment. The integration of traditional knowledge with modern technologies has not only revived age-old occupations but has also promoted the conservation of natural resources and the eco-friendly utilization of waste materials.

Many technological innovations have facilitated the transition of community-produced goods into commercial products, often under specific brand names, thus opening new markets and income streams. Changemakers play a crucial role in this transformation by motivating individuals and bridging the gap between communities and S&T organizations. These local leaders help identify technological needs and advocate for the development and implementation of suitable solutions.

Overall, the strategic application of S&T interventions has led to substantial improvements in community livelihoods, resource conservation, and the commercialization of traditional and new products, underscoring the pivotal role of technology in sustainable development.

1. Agriculture and Allied activities are strengthened through S&T interventions

There are 75 communities participated in the programme. Most of the communities are involved in primary sector activities like agriculture and allied activities to sustain their lives.

The communities of Jungle Kaudia of Gorakhpur, Sugarcane farmers of Maharashtra, Wild marigold growers of Uttarakhand, and Aromatic plant growing farmers of Nandurbar district of Maharashtra. Besides that, yak rearers of Arunachal Pradesh, Cattle rearers like Gujjar and Bhakarwals of Jammu and Kashmir participated in the programme. The S&T interventions had strengthened the livelihood system of farmers through movable nurseries, agricultural implements, eco-friendly biopesticides and insect repellents, single bud cutting of sugarcane instead of three buds cutting transplantation and alteration in spacing and some farming practices. Besides that, solar polyhouse, and Gramin Krishi Sewa App were helping farmers to protect their crops from unprecedented rainfall. The cultivation of aromatic plants like Lemon grass, Palma Rosa, and Wild marigold was also increasing the income of farmers and these crops are not destroyed by wild animals.

2. Capacity building of communities enhanced through food processing, Vermicomposting, mushroom cultivation, leaf manuring activities

Many women groups, self-help groups and farmer‘s groups were earning their livelihood through food processing technology, vermicomposting,

mushroom cultivation and many such activities after getting training from S&T institution.

They had adopted those technologies for improvement in their incomes and a group of trained and skilled manpower developed in the societies.

3. S&T had strengthened the livelihood activities like Pottery, Handloom Weaving, and Grass mat weaving more profitable and more productive than before.

The Prajapati community of Gujarat depends on pottery for livelihood generation. They increased the production through some technologies like jigger jolly, slip casting and other interventions. The introduction of the motorized potter's wheel, mini pug, and decoupage (painting of pottery) helped to improve the income of potter communities in Kerala.

The handloom weaving community of Assam had improved the production of gamushas 3 to 4 times through the intervention of a Jacquard machine with CAD designing. The Electronic Jacquard machine improved sitting postures and doubled the incomes of grass mat weavers in the Pattamadai district.

4. Both Top-down and Bottom-up S&T interventions had effectively addressed the basic needs of communities

There are many S&T institutions that did S&T interventions which solved problems like drinking water scarcity, lack of nutritional food, health-related issues and safe living conditions of communities. The Low-temperature Thermal Desalination Plant, augmenting groundwater in Chirawa block of Jhunjhunu in Rajasthan, Water technologies deployed at Bundelkhand, M.P., bio-sand filter etc. improved the access of communities to clean and safe drinking water Similarly, Black Wheat, food fortification, Rural Nutritional centre, Digital Clinic at Maddhkarai improved nutrition and health of communities. Landslide tracker and ocean state forecasts through INCOIS services in Tamil Nadu and Andra Pradesh improved the safety of communities against calamities.

Besides that, different types of tools and machinery developed by some innovators of communities helped solve the problems of drudgery and generating income through small- scale enterprises. Examples black Pepper machine, cow dung pot machine, cotton wick machine, bamboo splint machine etc.

5. Revival of traditional knowledge-based occupations through the implementation of technologies

The production of jaggery-making industries of Uttar Pradesh increased through the application of low-cost techniques like improving the plant design, and fuel efficiency of plants. Similarly, Deg Bhakpa technology in attar making by Fragrance and Flavour Development Centre (FFDC) enhanced product quality, product yield and fuel efficiency as compared to traditional units.

6. Alternate source of livelihood generations identified for women and empowerment of women

Earlier, village women in the Pilot village did not directly participate in non-household activities they were dependent on their husbands for income, but with S&T intervention they have become empowered to start their economic activities. New technologies like solar lantern making, RURAL Electricity workstation (REW), and LED bulb Units

of WTP, Orissa had opened doors for women and were getting recognition in this field named Solar Mama. The solar energy-based solar dome in Tripura solved the problem of electricity in the Herma community at a local level.

7. Digital S&T interventions had benefitted the communities

Digital technology had benefitted weaver's communities through Digi Bunai, CAD designing, and Electronic Jacquard Machine interventions. Another technology of Digital Clinics empowered educated youth of West Bengal, Assam and Bihar rural areas in primary health services to villagers in remote areas. The Rural Nutritional Centre at Madhhukarai was also doing the nutritional status of human beings in rural areas through advanced technologies. STI Hub in Baba Ambedkar University, Marathwada empowering youths through digital literacy.

8. Many technologies worked on the conservation of natural resources and eco- utilization of waste materials for the benefit of communities

Conservation of natural resources like rivers, forests, and land and maintenance of their biodiversity are quite important for livelihood generation. The Namami Gange Project by WII, Dehradun and another project by WWF (World Wildlife Fund) were continuously working on the conservation of biodiversity and providing training on diverse technologies like food processing, and Hameri work and also helping them in marketing the products.

Other technologies like Pine needle briquetting, Crop Residue Biomass Composting Demonstration Units, and Charcoal Briquetting from Agro waste and leaf grinder machines utilizing waste materials and keep the environment clean and safe for people.

9. Financial linkages of communities with commercial banks or funding organisations witnessed

The SHGs are getting training on different technologies and getting microloans for developing enterprises. Fruit processing through women group of Khoi village, Uttarakhand getting financial support from HESCO, Mushroom grower SHGs of Arunachal Pradesh getting finance from State Rural Bank, Tribal women SHGs and men apiculturists of availing loan from NABARD and Bank of India. Similarly, HRMN Apple growers of Manipur are getting loans from the Manipur Development Bank, Manini SHGs linked with NABARD and the Biomass Dryer project financed under the State Livelihood Mission of Arunachal Pradesh (Day 6). Society for Technology and Development, Mandi (Day 12) getting a loan from the State Bank of India.

10. Many technologies push the product into commercial production under some specific brand name

The tribal youth were trained in apiculture and formed FPO "Vivekanand Madhu Utpadak Swablambi Sahkarita Samitee" and were linked with National Bank for Agriculture and Rural Development (NABARD) for financial assistance. This Farmer Producer Group were selling its product under the name Jharkhand Madhu. The weaver community of Jharkhand were selling weaved items under the brand name 'Mahura'. The Mouli rock bee hunters sell their products under the brand name 'Vibek'

11. Various collaborations like KO-NGO, KO-KO, KO-NGO-Bank, and KO-Private Companies have been observed in the enhancement of livelihood generation activities in communities.

Different types of collaborations were observed in some communities. The collaboration between Himalayan Resource Group, National Botanical Research Institute, Lucknow and Ayush Pharmacy in Chiraita growers of Mandi, Himachal Pradesh, is an example of knowledge organisation collaboration. Another type of collaboration was KO- NGO was CSIR-NEIST, Itanagar and Action Aid Society of Arunachal Pradesh had been found in communities involved in mushroom cultivation in West Siang and East Siang Districts of Arunachal Pradesh. The example of KO-NGO-Private company collaboration found in Jacquard weaving with CAD designing intervention had been found. The association between CSIR-NEIST, Jorhat, SNEHAPAD and Amazon Karigor had been found.

12. National Innovation Foundation played an important role in recognizing local innovations and also did some scientific interventions

The useful local innovations had been recognized by National Innovation Foundation. The products developed by local innovators were manufactured in crude form. NIF helped them through handholding, upgradation in design, testing and analysis and codification and recognition. The products were patented and microloans had been provided to innovators. The cow dung pot machine, cotton wick machine, and bamboo splint machine were local innovations recognized by NIF.

13. Role of Changemakers in motivating people and acting as a link between communities and S&T organisation had been observed

Changemakers were persons or NGOs who belong to the same community independently through their own efforts or it can be an NGO or Local administration (working for social welfare) The S&T has recognized some changemakers (during or after the Baseline survey).

Sometimes scientists motivated community people to adopt new technologies for their upliftment and better production. Some examples were Vishwa Nath Dasgupta was a changemaker for the Birhor community of Purulia as he motivated the community for adopting technology intervention done by STI Hub, Purulia. Similarly, Sri Ram Sharma started vermicomposting at the individual level and motivated and trained his community members. Now they are producing a huge amount of vermicompost at the individual level.

14. Technology development needs were identified by local people and they approached S&T organisations

Ex. Mr. Patel approached SPERERI for the requirement of drying technology for storing and drying his Jalbrahmi plants and as a result Solar dryer had been developed. Similarly, the animal herders of Jammu and Kashmir identified the reason behind wastage and the unpleasant smell of milk and approached SKAUST University for its solution.

6.7. LESSONS LEARNT

The study provides critical lessons on assessing the technological absorption capacity of rural communities for livelihood generation opportunities. Firstly, it highlights the importance of tailoring technological interventions to the specific needs and existing skills of the community to ensure effective adoption and utilization. The successful integration of technologies demonstrates that when technologies align with local practices and resources, communities are more likely to embrace and sustain them. Additionally, the continuous capacity-building and hands-on training are vital for enhancing technological literacy and competence among users. The empowerment of women through targeted livelihood opportunities indicates that gender-sensitive approaches can significantly boost community engagement and adoption rates. The role of changemakers as intermediaries underscores the necessity of local leadership and trust-building in facilitating technological acceptance. Furthermore, the commercialization of community products underlines the importance of market access and support systems in maximizing the benefits of technological adoption. Overall, the study underscores that successful technological absorption in rural communities requires a comprehensive approach that includes education, alignment with local needs, strong leadership, and market integration.

1. The first step for any technological implementation in the community, the S&T institution should do the baseline survey regarding the need identification of the communities. Their communities'priorities, aspirations, and expectations should be considered.
2. S&T interventions should be community-specific, region-specific, and need-specific.
3. A holistic analysis of livelihoods is vital for understanding how to increase the sustainability of rural livelihood interventions. S&T institution should do mapping of different types of capital like human, social, physical, natural, and economic capitals present within the communities. Understanding these capitals gives a clear picture of the status of assets present in the communities.
4. The strengths and, systemic gaps of communities should be kept in mind before deciding project for that particular community.
5. Identification of changemakers within communities should be done. Changemakers act as a catalyst for the dissemination of S&T interventions in the communities.
6. Community should be involved from the initial stage of project formulation. There should be transparency in project implementation and clarity about the objectives of projects among the communities.
7. The method of project evaluation by the review committee should be done along with the target community and community changemakers. Changemakers must be kept as a part of the Local Project Management Committee.
8. Adoption and adaptation to technology/ innovation must be ensured, for which awareness needs to be created among the local people.
9. Handholding of communities required at different stages of product and enterprise development, for bringing any social change. Few communities need handholding for backward linkages, some communities need for finance and marketing for ensuring sustainability of the livelihood.
10. It was also learned that communities were not only looking for monetary gains but other aspects like the availability of safe drinking water,

accessibility to electricity, clean fuel, their health, time-saving, and reduction in drudgery must be considered for their welfare and improvement in their quality of life.

11. It was also learned that there was 80 to 90 percent participation of women in different types of livelihood-generating activities. So, women-friendly technologies would definitely bring good results.
12. It was also learned that marginalized communities would be empowered through training and skill development. They could also contribute to societal development and the making of a healthy and dignified society.
13. There should be a tailor-made solution for each type of livelihood activity.
14. Networking between people with similar activities should be done for better results. There should network of apiculturists, potters, farmers, and weavers across the country.
15. Regular and intermittent training on need-based technologies was required.
16. Some simple and need-based technologies had the power to bring big change in society.
17. To get desired output of S&T intervention after training and proper learning of technology, the machines, tools, and any other materials should be provided in sufficient amounts along with proper and consistent backward and forward linkages.
18. It was also learned that sustainability of livelihood could be achieved if technologies were aligned with local knowledge systems, locally available resources, and local innovative ideas. Any technology is sustainable when it is locally relevant, socially acceptable and environmentally safe.
19. It was also learned that traditional knowledge had the potential to sustain the livelihood of a large number of communities if shortcomings of those activities were addressed through S&T knowledge.
20. The S&T interventions should be community-centric and solution-centric.
21. Both Top-down and Bottom-up S&T interventions should be done simultaneously toward strengthening livelihood activities.
22. Product testing and quality checking labs need to be created at the local level for the validation of indigenous products. This would help in establishing the credibility of the products.
23. A need was realized to establish some institutions like NIF at the community level.
24. The standards for products like mushrooms, vermicompost, and other such products need different types of quality analysis. So, new standards should be developed for such products.
25. A platform should be provided to the rural people to directly interact with scientists and researchers, particularly those associated with the development of rural technology. The villagers must open up about their problems and ask for the appropriate technology intervention to help solve their issues (Biotech-Kisan Mission by DBT to bring farmers and scientists on one platform is one such example).
26. Scientists must also encourage community people to ideas or local solutions or to develop a solution-centric approach towards the problem. This would help in identifying the innovations or interventions that common people have made or have found out themselves. Scientific Institutions can take up and do research on these so as to promote such innovations.

CHAPTER

7

OUTPUTS

In this chapter, the outcomes of the comprehensive study on the analysis of technology's impact on communities and its potential to enhance livelihood opportunities have been discussed. During the programme and interaction with the communities across the country and discussions with the Experts, Scientists and Policymakers, the team has delved deep into understanding the intricate dynamics between technology absorption and community development, with a keen focus on fostering sustainable growth.

The culmination of the study efforts has resulted in the formulation of proposed frameworks and models. These blueprints are designed to facilitate the effective delivery and implementation of technology, ensuring a seamless transition from top-level strategies to grassroots initiatives. Central to our approach is the recognition of the importance of bottom-up perspectives, allowing for a holistic understanding of community needs and aspirations and their local knowledge system.

The proposed frameworks and models aim to bridge the gap between technological advancement and community empowerment. By prioritizing bottom-to-top understanding, it is ensured that solutions are not only technologically viable but also socio-culturally sensitive and socially inclusive. Through this approach, it is proposed to aspire to catalyze positive change, fostering environments where technology becomes a powerful enabler of livelihood enhancement for all.

The insights and strategies outlined in the study will serve as valuable resources for policymakers, practitioners, and stakeholders alike, guiding them towards more effective and sustainable interventions in community development. The journey of translating these outputs into tangible actions, requires a collective effort in realizing the shared vision of empowered and resilient communities through technology and developing livelihood-centric programmes and policies.

7.1. PROPOSED FRAMEWORK

There are a number of methodological approaches that can be used to put the livelihoods framework into practice. The study during Techनींव@75 has contributed to this framework combines a wide range of methods in their practice.

Social sciences provide opportunities to know the variables in the environment, how to interact with it and develop the attitudes, skills and knowledge that will enable them to become engaged, active, informed and responsible citizens. Recognition and respect for individuals and collective identity

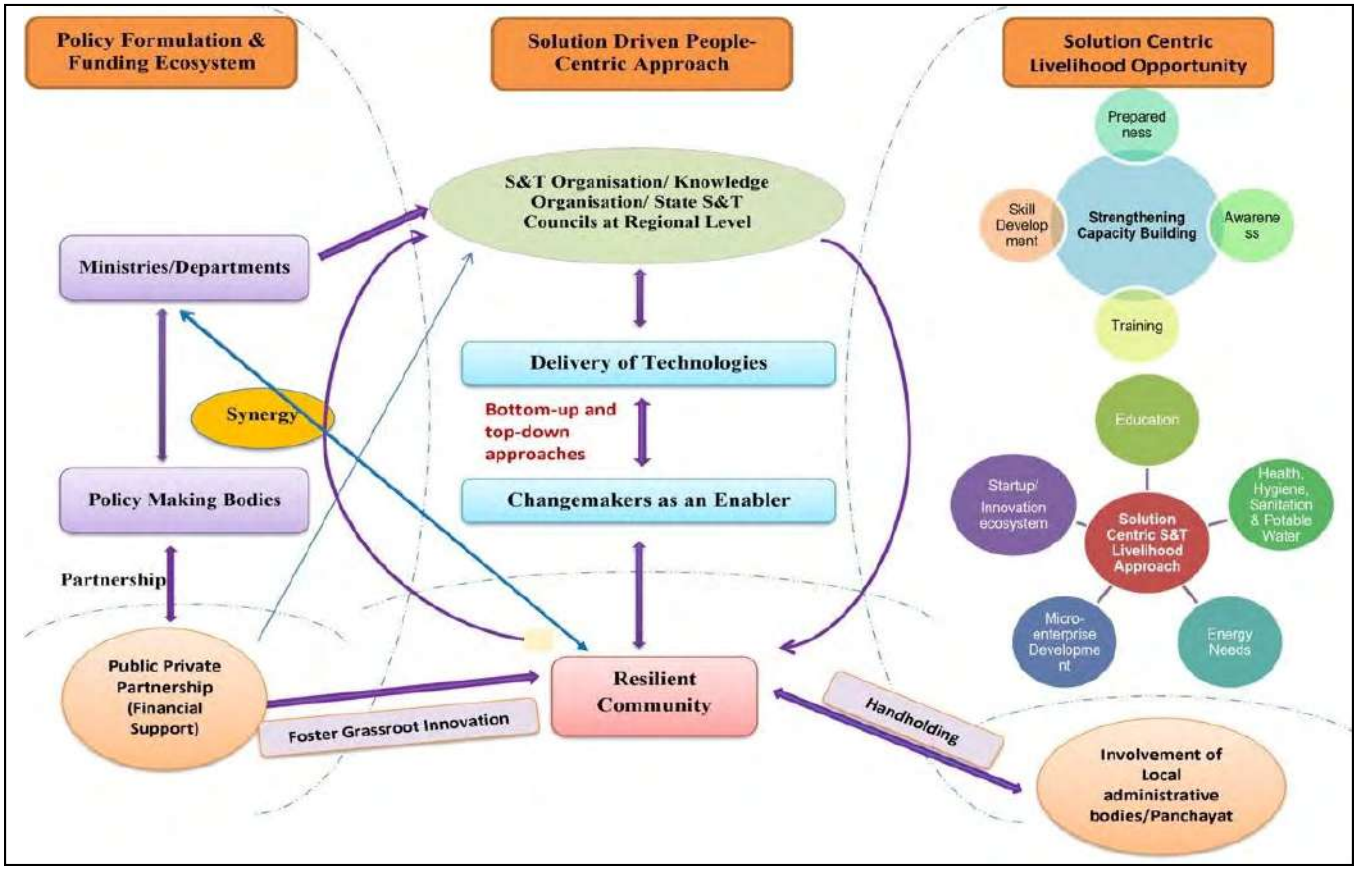
is essential in a pluralistic and democratic society. Social and Human Capital help develop the sense of self worth and community inter-independence, and encouraging them to affirm their place as citizens in an inclusive society. The relationship between parameters of livelihood and certain STI interventions brings out the eclectic nature of robust models for effective human capacity- building and sustainable livelihood systems.

The objective of a science and technology-enabled livelihood system for adoption and absorption of technologies are those that improves the productivity of community assets; enhance capabilities and provide new livelihood opportunities for the communities; are sustainable in an environmental and socio-economic sense i.e.: technology that promotes equality in society and empower communities especially vulnerable and marginalized groups.

Strengthening Social Capital

Establishing linkage between indigenous knowledge and the scientific knowledge are to ensure that local problem identification and insights remain the starting point for inquiry; and secondly to accelerate innovation by systematic and focused efforts that build on indigenous scientific methods as well as examples from outside the community. This process involves building networks using to the fullest extent possible modern, to facilitate the exchange of knowledge and best practices. Therefore, the social capital asses can be strengthened by linking

Proposed Framework: S&T Enabled Livelihood System-
Strengthening Local Innovation System with Formal Innovation System



communities in similar circumstances and relevant stakeholders through appropriate networks.

Ensuring Community Participation in Technology Delivery

Community must play a central role in the technology development strategy. Effective community participation in the technology development strategy will ensure that outside technology and know-how does not dominate in the development process. Traditionally, an outside team of scientists and researchers would be brought in to survey a community and the information from this would then be used to develop technology for this community.

Effective technology delivery requires a thoughtful and inclusive approach that recognizes the unique context, challenges, and opportunities present in rural areas that is solution - driven & people - centric.

Firstly, conducting thorough needs assessments within rural communities is crucial. Engaging local leaders, stakeholders, social changemakers and communities is required to identify existing challenges, aspirations, and priorities for understanding the specific needs of rural communities will inform the development of tailored technology solutions.

Empowering rural communities through local capacity building is essential to actively participate in technology delivery processes. This can be done by offering training programmes, workshops, and educational initiatives focused on digital literacy, technical skills, and entrepreneurship.

Adopting a co-creation approach where rural communities are involved in the design and development of technology solutions from the outset. In order to ensure that technology solutions are contextually relevant, user-friendly,participatory design workshops, focus groups, and community meetings to gather insights, feedback, and ideas directly from community members need to be organised. This ensures customize technology solutions to address the specific needs and realities of rural communities considering factors such as limited infrastructure, low internet connectivity, low resource availability, and unique socio-economic dynamics.Technologies are required to be designed that are scalable, affordable, and adaptable to rural contexts, ensuring that they effectively address local challenges and contribute to livelihood improvement.

Establishing community-based organizations, committees, or cooperatives to oversee technology implementation, decision-making, and resource allocation would foster a sense of ownership and governance among rural communities regarding science and technology interventions. Forging partnerships with local governments, NGOs, private sector entities, and academia to leverage resources, expertise, and networks in support of technology delivery need to be encouraged. Collaborate with local organizations and grassroots initiatives to ensure that interventions are responsive, sustainable and adapted to address evolving needs and opportunities.

Strengthening Local Innovation System

Innovation taking at the grass root level has the ability to provide bottom-up solutions that acknowledge the local issues related to economy, social and environmental situations for rural and tribal communities. In order to identify the local innovation and strengthen it through science and technology, the role of communities, innovators and enablers are important to analyse the local innovation practices and ecosystem.

The process of local innovation involves engagement of individuals, civil groups, community based organizations. The local innovations are borne out of necessity and provide a potential ground to generate a diverse set of products and services that cater to the local needs. It includes diverse actors and stakeholders that strengthen human and social capital. In Techनींव@75 programme, it was found that how local innovators turned scarcity into opportunities by utilizing local resources and engaging various stakeholders. The innovators were engaged in local innovation were addressing the local problems in their local context.

Innovation is perceived to be a knowledge-intensive process which is supposed to be linked to the human and social capital. In other words, the human capital forms a significant part of innovation and is required to be equipped with skills, knowledge, expertise and capabilities that needs to be enhanced with the help of science and technology. For example, the Barefoot College of Rajasthan shared their experiences of eliminating poverty and inequality by teaching the community basic skills to survive and become self-reliant.

Creating a system of local innovation and strengthening it requires enhancement of human and social capital for an inclusive and sustainable development. Local innovation system enables direct socio-economic development of the people of grass root. Local innovation sytem also enables democratization of technology at community level by increased participation. It creates opportunities to the access of affordable solutions to the people who had no prior knowledge about it. When the women were imparted training on the use of technology and information related to testing, packaging and, marketing, it improved their capabilities and enhanced the social and economic independence and gave them a sense of ownership and opened a channel of communication.

Interconnected Technological Options

Technology absorption capability include: capacity to search, evaluate and select appropriate technology, ability to choose learning mode, absorb technology; price negotiation and technology transfer contracts (UN - ESCAP, 1989). At the development level, technology absorption capability is the lowest level of technology capability (OECD, 1995), which can divide technology capability into three levels from low to high: **Technology absorption capability; Technology innovation capability; Technology creation capability.** Accordingly, technology absorption capability is reflected in technology adoption through technology transfer.

It was observed that one technology can never offer the solution to a complex challenge such as improving the quality of life and sustainable livelihoods. A combination of interconnected technological options will be needed. Second, that the solutions useful and valid today, are not the same solutions tomorrow. It was further observed that the technologies which are valid in a first phase of development, may be transitory and be phased out in a second stage. Technologies are not static, but evolve over time as the circumstances change and the needs evolve. As subsystems such as environment, culture, and available local knowledge change, so will the mix of technologies change. Third, a system-based technology strategy will recognize that there are no unique solutions and that there is a need to call upon science and technology which is adapted to the specific dynamics of the system and community where S&T-enabled Livelihood is implemented.

The proposed framework is a comprehensive

structure whereby the objective is not to improve income levels, but also non-quantifiable parameters such as human well-being, resilience to stress and capacity to overcome calamities. Further prior to the introduction of new technology or processes, one first searches for the technologies which will improve the efficiency and the opportunities inherent to the available resources in the local context.

The Study shows how the livelihood framework can strengthen the voice and influence of the underprivileged and the marginalized to enable them to secure full social and economic rights through STI interventions at the grassroots. At the same time the framework provides a way for the funding agencies and apex bodies to develop livelihood-centric policies and programmes. The framework reflects on the issues associated with sustainability and highlights the social and economic transformation that must take place to make this a reality.

Developing a holistic approach to technology absorption in rural communities demands a thoughtful integration of both bottom-up and top-down approach. At the community level, it begins with a deep understanding of the unique challenges, aspirations, and existing resources within each community. Through participatory methods such as community meetings, surveys, and focus groups, community members with the social change makers are actively engaged in identifying their needs and co-creating solutions tailored to their specific context. This bottom-up approach ensures that technological interventions are not only relevant but also embraced by the communities they are meant to serve.

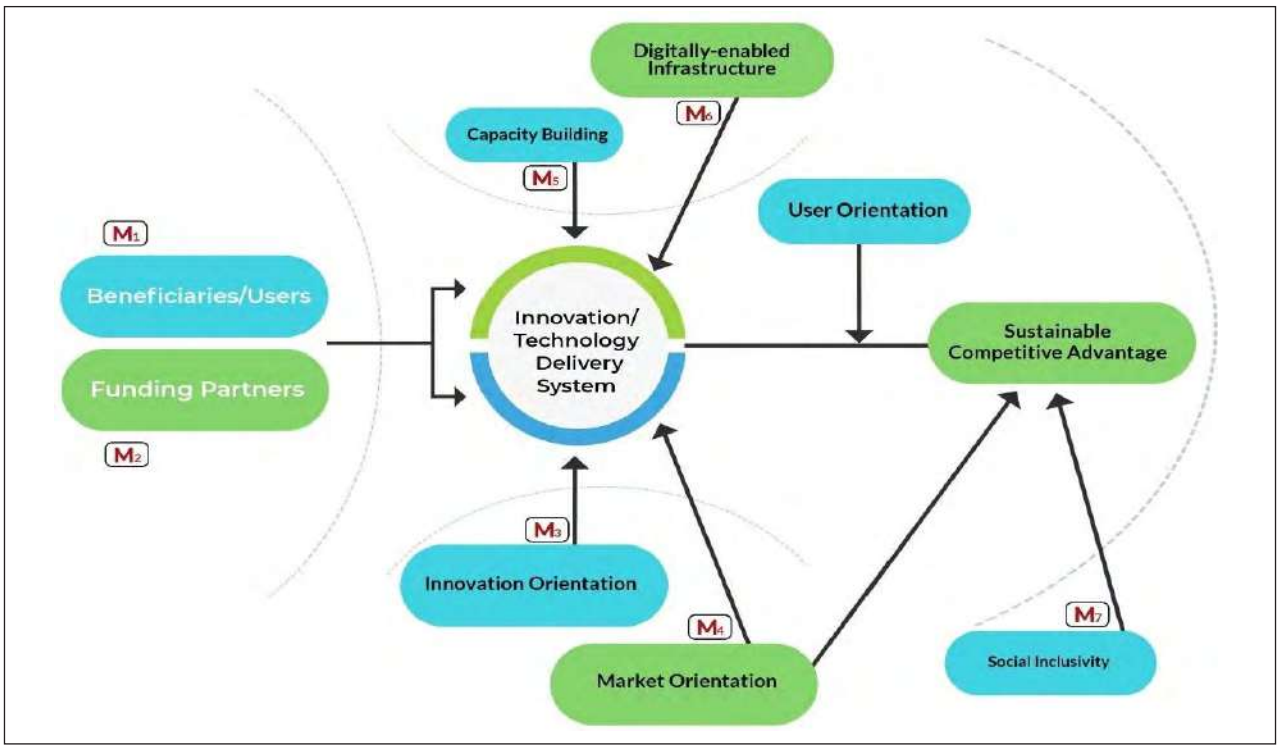
Simultaneously, the top-down dimension of this approach involves advocating for government, funding agencies, and institutional support through knowledge organisations to create an enabling environment for technology delivery, technology upgradation and technology absorption in rural areas. This includes urging for policies, funding mechanisms, and infrastructure development initiatives that prioritize digital inclusion, innovation, and entrepreneurship. Strategic partnerships between government agencies, non-profit organizations, private sector entities, and community-based organizations further amplify the impact of technology adoption initiatives by leveraging diverse expertise, resources, and networks.

Monitoring, evaluation, and learning are integral components of this iterative process, enabling continuous feedback loops to refine strategies, adjust interventions, and scale successful approaches for greater reach and impact. Long-term sustainability is ensured through the design of interventions that prioritize local ownership, resource mobilization, institutionalization, and scalability. By integrating bottom-up and top-down approaches, this holistic strategy empowers rural communities to strengthen their own knowledge systems and innovation while leveraging external support and resources to maximize impact and sustainability.

7.2 CONCEPTUALISING MODELS

The livelihood system approach is a way of thought process about the objectives, scope and priorities for societal development. An attempt has been made through the Techनींव@75 programme to develop a robust and sustainable livelihood framework and objectives have been developed to assist with implementation. But the actual approach of this study aims to go beyond these, and, in essence it is a way of putting people at the centre of development, thereby increasing the effectiveness of development assistance, enabled through S&T interventions.

Conceptual Model : Strengthening Technology Delivery System for Robust Livelihood System



The basic supposition of this architecture of developing sustainable livelihood system is that all the resources, linkages and collaborations play a significant role in the process of technology delivery system. Accordingly, local innovations in livelihood system are regarded as novel mechanisms of technology delivery that improve overall quality of life in a community and offer sustainable development.

Based on the theoretical background, we derive the premises of conceptualising and developing the model framework in which the prime variable of study is the community-centric local innovation and traditional knowledge as bottom-up approach, and solution-centric technology delivery system in top-down approach. Both the approaches of this livelihood system are primarily dependent on backward linkage of availability of desired raw materials naturally. The prime variable defines the capability of a community to bring in users and other external stakeholders such as business partners as driving the community's forward linkage aspirations and orientation of utilising them as mechanisms to foster change in the community's collaborative competence. The direct effects of forward linkages have also been studied with community's performance measured in terms of sustainable competitive advantage. With the help of drivers of innovation architecture, we proposed a conceptual framework.

The study models have been framed on the basis of the variables studied under the proposed framework for livelihood system. The enablers of technology delivery system – with or without local innovation system and traditional knowledge – have been studied at the three levels of collaborative efforts – **backward linkages**, **technology resources** (technological upgradation and knowledge integration mechanism), and **forward linkages**

(marketing, networking and orientation) in relation to the community's sustainable development. These dependent variables have been further explained in the proposed models.

7.3 PROPOSED MODELS

Here, the natural resources are identified and access are attained to have enriched value potential and benefits. Innovations consisting of traditional knowledge are being practiced at the grassroots from centuries. With the advent of technologies and for the ease-of-doing-work, these traditional local knowledge systems got conserved at the grassroots and getting depleted in the absence of proper documentation, as the genre progresses.

To fortify the technology delivery system for a resilient livelihood framework, several key strategies must be pursued as given in the conceptual model above. Firstly, customizing solutions to address the distinct needs and hurdles of rural livelihoods is imperative. This entails either tailoring existing technologies or innovating new ones that align with rural contexts. Secondly, investing in capacity building is crucial, ensuring that rural communities possess the requisite skills and knowledge to effectively utilize and maintain technology. This encompasses diverse training initiatives encompassing technical proficiency, entrepreneurial acumen, and education on the advantages of technology integration.

Moreover, enhancing infrastructure is indispensable to augment the accessibility and usability of technology in rural areas. Reliable infrastructure forms the backbone of successful technology delivery. Ensuring financial inclusion is equally vital, granting rural communities access to financial services and credit facilities essential for technology investment. This fosters affordability and adoption of technology solutions that can uplift livelihoods.

Encouraging partnerships between government bodies, private enterprises, NGOs, and local community organizations is pivotal to bolstering the delivery of technology solutions. Such collaborations leverage resources, expertise, and networks to effectively penetrate rural communities. Additionally, involving rural community members in the design and development process of technology solutions ensures alignment with their needs and preferences. User-centered design approaches heighten the relevance and usability of technology for rural livelihoods.

Designing technology delivery systems that are scalable and sustainable over the long term is fundamental. This entails establishing local support networks, maintenance systems, and training programmes to ensure continuous assistance for technology users. Robust monitoring and evaluation mechanisms are indispensable for assessing the impact of technology delivery systems on rural livelihoods. Regular monitoring enables the identification of challenges and opportunities for improvement, ensuring that interventions remain effective and responsive to community needs. Through the implementation of these strengthened strategies, rural communities can fortify their livelihoods, enhance economic prospects, and build resilience against future challenges.

In developing a robust livelihood system, integrating local innovation and local knowledge with science and technology requires a systematic approach. Initially, it's essential to identify the specific needs and challenges of the target community through comprehensive needs assessments and local stakeholder engagement. From there, innovative solutions must be crafted to address these identified needs, whether by adapting existing technologies to local contexts or innovating entirely new solutions tailored to community requirements. Promoting

the adoption of these technologies involves raising awareness, building trust, and demonstrating their tangible benefits, alongside providing necessary training and ongoing support to ensure effective utilization. Accessibility is paramount, requiring measures such as subsidies, financing options, or alternative delivery models to ensure that technology reaches all members of the community, including marginalized groups. Building capacity within local communities to use and maintain technology is crucial, necessitating investment in technical training, entrepreneurship skills development, and ongoing support mechanisms. Collaboration between various stakeholders, including government agencies, the private sector, NGOs, and State-level Departments, local organizations, is indispensable to support the development and implementation of technology solutions, leveraging resources, expertise, and networks for maximum impact. Regular evaluation of the technology's impact on livelihoods allows for the assessment of effectiveness and identification of areas for improvement, ensuring interventions remain responsive to community needs. Finally, an iterative approach, guided by community feedback and lessons learned from implementation, is vital for continuously improving technology solutions and maintaining their relevance and effectiveness over time. Through these concerted efforts, innovation and technology can be effectively integrated into the development of a robust livelihood system, empowering communities to enhance their economic opportunities and resilience.

Proposing effective technology delivery models to strengthen the livelihood system for rural communities requires a multifaceted approach. Firstly, establishing community-based technology hubs that can serve as centralized points for accessing and disseminating information and resources. These hubs could offer training programmes, technical support, and demonstration projects to facilitate technology adoption and skill development among community members. Additionally, leveraging mobile technology and digital platforms can extend the reach of services and information to remote areas, enabling access to markets, financial services, and agricultural extension services. Furthermore, public-private partnerships can play a pivotal role in delivering technology solutions by combining government support with private sector innovation and expertise. By incentivizing private investment in technology infrastructure and service provision, these partnerships can catalyze the development and deployment of tailored solutions for rural communities. Moreover, integrating technology into existing community networks, such as farmer cooperatives or women's groups, can enhance social capital and foster peer-to-peer learning and collaboration. Finally, embracing a participatory approach that engages local communities and stakeholders in the design, implementation, and evaluation of technology interventions is essential for ensuring relevance, sustainability, and ownership within rural communities. By adopting these diverse delivery models, rural communities can harness the power of technology to strengthen their livelihoods, promote economic development, and enhance resilience in the face of evolving challenges.

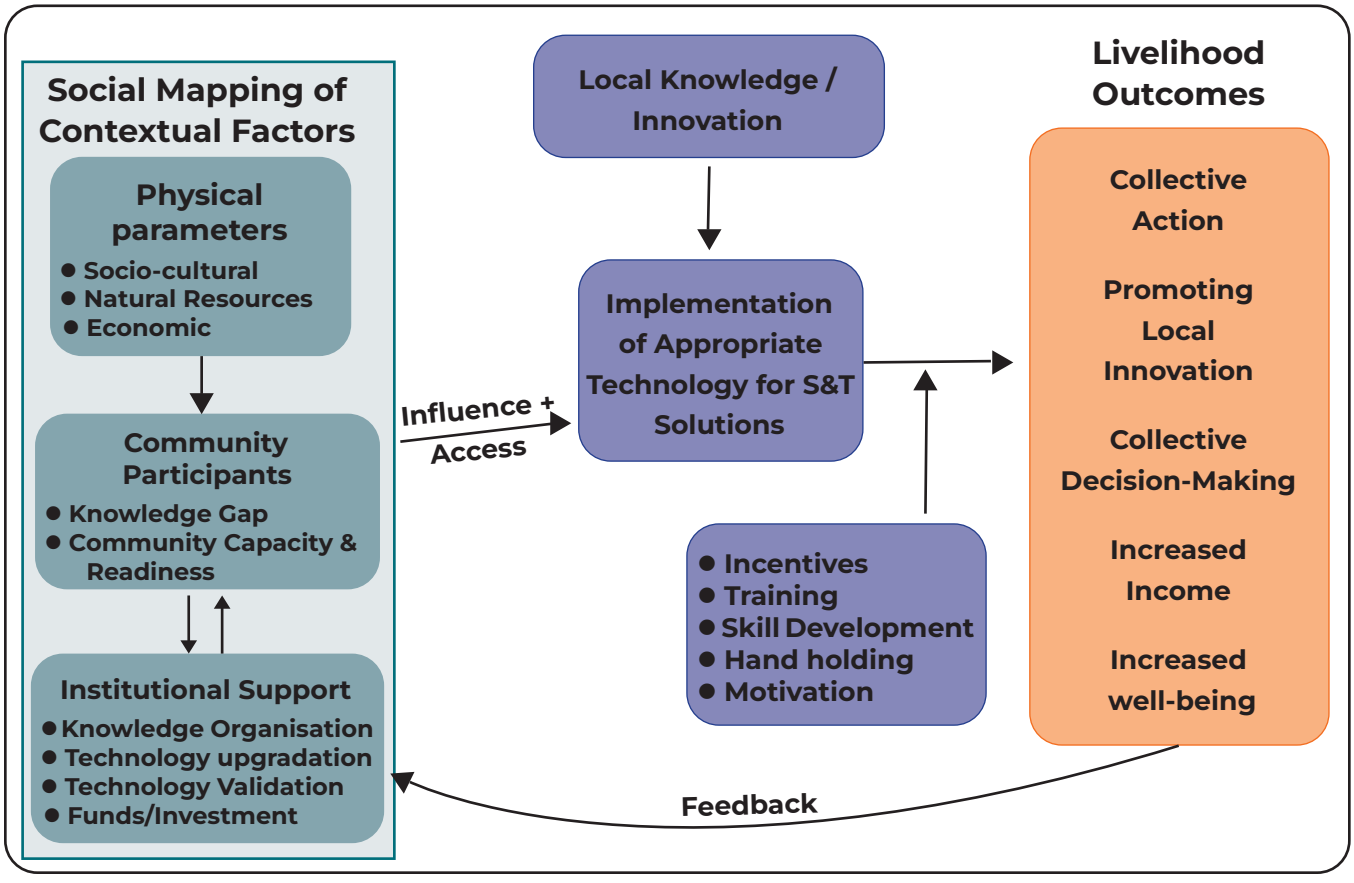
The Conceptual Model shows a comprehensive technology delivery system for robust livelihood that is driven by Science and Technology. In the figure of Conceptual Model M1 to M7 depict seven proposed models which can become independent models for sustainable livelihood options and can be developed into seven different livelihood system. The mapping of these proposed models of technology absorption at the community level have been captured in section 7.4.

Model 7.1 User (Community) – Orientation Model for Enhanced Livelihood system

Implementing technology solutions for community development requires a thoughtful approach that considers the specific needs, resources, and capabilities of the community. One key strategy involves strengthening existing traditional knowledge technology, which is both practical and sustainable.

Encouraging collaboration between scientists, researchers, and community members is crucial for blending scientific expertise with existing local knowledge, leading to co-created technology solutions that combine traditional practices with scientific advancements. Recognizing the value of local knowledge systems is key, as integrating them into research and technology development processes enhances understanding of local dynamics and improves solution effectiveness. By leveraging technologies already in use within communities, technology developers can repurpose them to address pressing community needs without requiring significant additional investment. This approach ensures cost-effectiveness and accessibility, laying the foundation for impactful technological solutions. Empowering community members to participate in data collection using scientific tools fosters ownership and generates valuable data. Adapting scientific technology to local contexts increases accessibility and adoption rates, while investing in capacity building and education enhances community members' technical skills and scientific literacy. Facilitating knowledge sharing between stakeholders

Model-7.1: User - Orentation Model of Livelihood System



through forums and workshops promotes mutual learning and the co-creation of culturally appropriate, socially inclusive, and environmentally sustainable solutions. By promoting community participation, the collective action and wisdom can be harnessed to address complex challenges and drive sustainable development.

Furthermore, soliciting feedback from communities is essential for the success of any technology initiative. Actively involving community members in the technology development as well as implementation process provides developers with valuable insights into local challenges, preferences, and priorities. This participatory approach not only ensures that technology solutions are technically sound but also culturally appropriate and contextually relevant. Moreover, involving communities fosters a sense of ownership and empowerment, as community members become active participants in shaping their own future.

Additionally, the development of disruptive technologies has the potential to radically transform traditional practices, leading to significant improvements in efficiency, accessibility, and affordability. For instance, repurposing traditional pottery technology to create applications for rural communities illustrates how innovation can drive positive change. By providing farmers with access to vital information and markets, the ICT based technologies enhance agricultural productivity, increase incomes, and stimulate economic growth in rural areas.

Above all, a focus on sustainable growth and empowerment is crucial. Sustainable development requires considering the long-term implications of technology interventions and ensuring that they contribute to lasting positive change. Empowering communities with the knowledge, skills, and resources to sustainably manage and adapt technology solutions to their evolving needs is paramount. Whether in rural or urban settings, the ultimate goal remains the same: harnessing the power of technology for the greater good and improving the quality of life for all members of society.

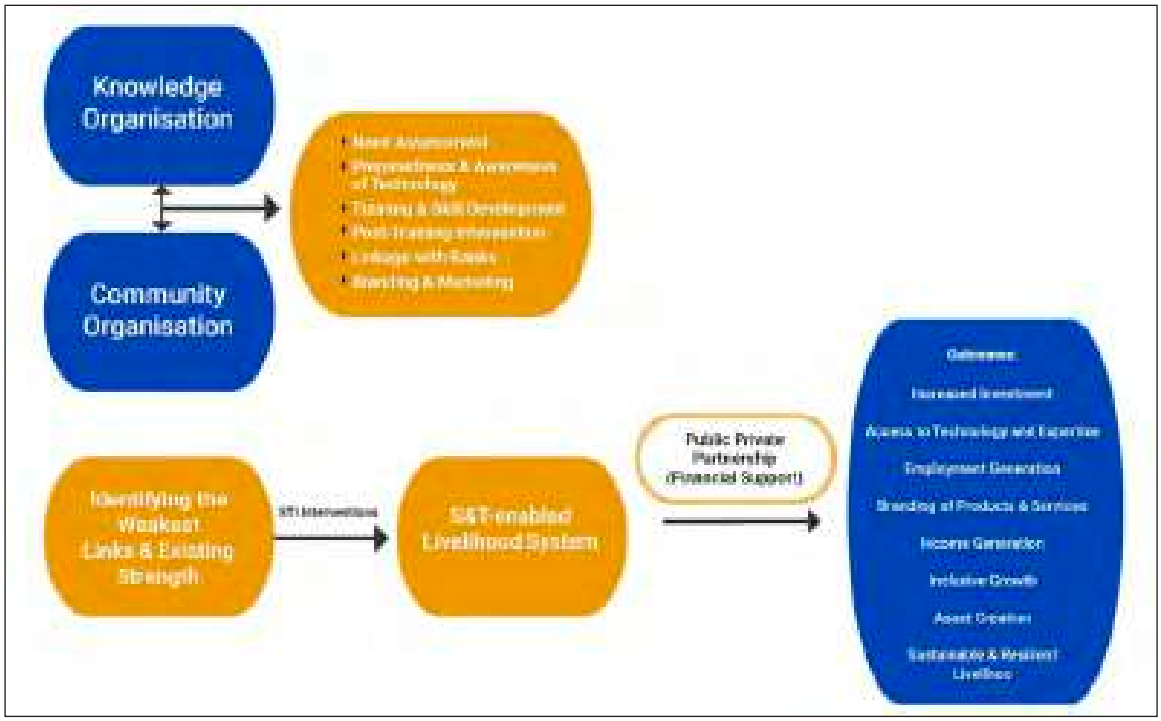
Model 7.2 Financially Supported Technology Delivery Mechanism

Developing financially sustainable technology delivery mechanisms for rural communities is crucial for ensuring the long-term success and impact of sustainable systems.

Strategic financial investment plays a pivotal role in overcoming barriers to technology absorption in rural communities, unlocking their potential for economic development and social progress. By channeling resources into essential infrastructure development, such as electricity and transportation systems, financial investment enhances rural accessibility, facilitating the deployment of technology. Moreover, subsidies and grants offset the initial costs associated with technology adoption, making modern technologies more affordable and accessible to rural communities, thereby encouraging their uptake.

Investments in training programmes and capacity-building initiatives equip rural communities with the necessary skills and knowledge to effectively utilize and maintain technology, including technical training and entrepreneurship skills. Access to credit tailored to the needs of rural communities enables local innovators and households to invest in technology without upfront payment, further facilitating adoption. Collaborative efforts through public-private partnerships leverage financial resources and expertise to support technology absorption, sharing risks and responsibilities among stakeholders. Additionally, investment stimulates

Model-7.2: Exploring Public-Private Partnership (PPP) Model for Sustainable Livelihood System



market demand for technology products and services in rural areas, fostering innovation and competition among suppliers. Funding research and development initiatives focused on adapting existing technologies to rural needs leads to customized solutions that address unique challenges. Finally, allocating resources for monitoring and evaluation ensures that investments in technology absorption are effective and sustainable, optimizing their impact on rural communities. Overall, strategic financial investment plays a crucial role in driving positive change and improving the lives of rural residents by addressing infrastructure gaps, providing incentives, building capacity, and fostering collaboration.

The Model 7.2 suggests the following:

Public-Private Partnerships (PPP): Collaborate with both government agencies and private companies to leverage their resources, expertise, and funding. PPPs can facilitate technology adoption and implementation in rural areas by combining public sector oversight with private sector efficiency and innovation.

Community-Based Organizations (CBOs): Empower local community organizations to take the lead in technology delivery and implementation. CBOs often have a deep understanding of local needs, cultures, and social dynamics, which can enhance the effectiveness and acceptance of sustainable technologies within rural communities.

Microfinance and Credit Facilities: Provide access to microfinance and credit facilities tailored to the needs of rural populations. This can enable individuals and communities to invest in sustainable technologies such as solar panels, improved agricultural practices, or clean water systems, with the understanding that the investments will yield long-term benefits.

Technology Subsidies and Grants: Offer subsidies or grants to offset the upfront costs of adopting sustainable technologies. This can make these technologies more accessible to rural communities, particularly those with limited financial resources.

Capacity Building and Training: Invest in capacity building and training programmes to ensure that rural communities have the knowledge and skills to effectively utilize and maintain sustainable technologies. This can include technical training, business management skills, and education on the environmental and social benefits of the technologies.

Cross-Subsidization: Cross-subsidize the cost of providing technology services to rural communities with revenues generated from urban or more affluent areas. This can help bridge the affordability gap and ensure that rural populations have access to essential services at affordable prices.

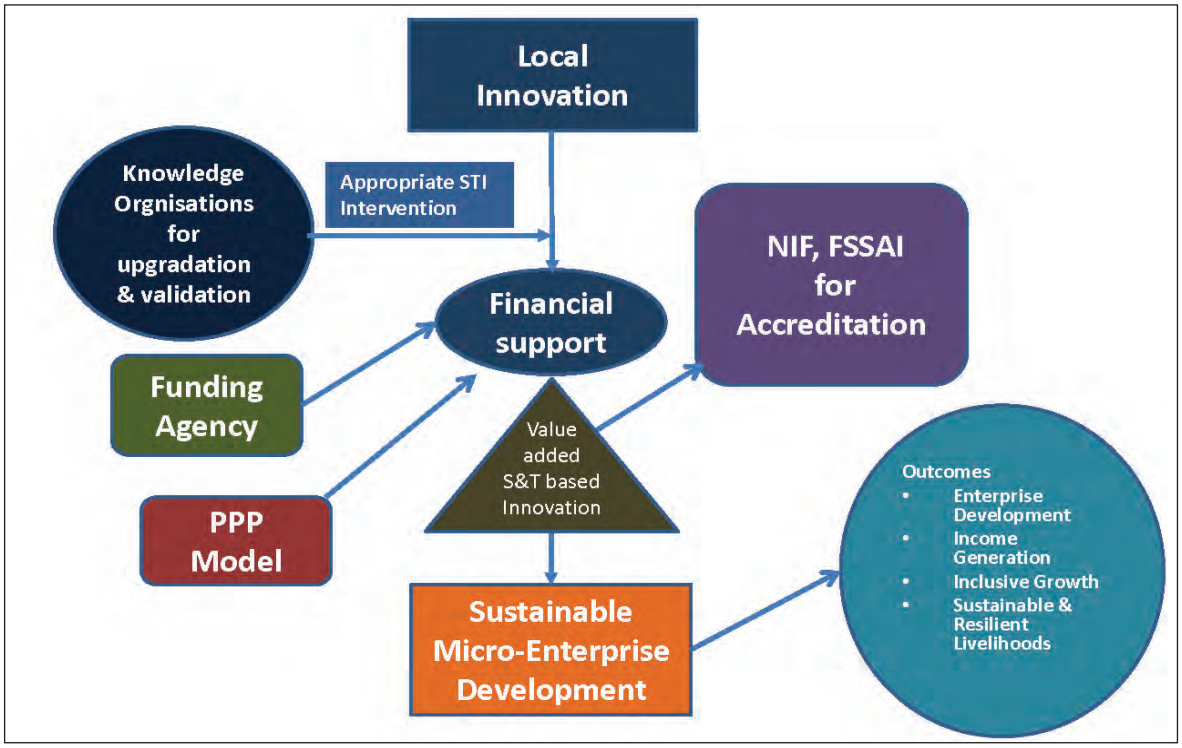
Social Enterprises: Support the development of social enterprises that focus on delivering sustainable technologies to rural communities in a financially viable manner. These enterprises can generate revenue through the sale of products or services while also fulfilling social and environmental missions.

By combining these approaches, it's possible to create financially sustainable technology delivery mechanisms that empower rural communities to adopt and benefit from sustainable systems over the long term.

Model-7.3: Innovation Orientation for Micro-Entrepreneurship Development for Livelihood System

Grassroot innovations can be made sustainable by fostering collaboration among the end-users, knowledge organisations and societal changemakers.

Model-7.3: Innovation Orientation for Micro-Entrepreneurship Development for Livelihood System



The changemakers identify the grassroot innovations with the help of community, and do the value addition with the help of knowledge organisations through S&T interventions. In the process, the innovations get converted into viable technologies through S&T enabling and further doing quality assurance by validation.

In Model 7.3, the concept of external partner collaboration is provided by defining it as an interaction process whereby complementary assets are exchanged with external partners. Knowledge Organisations are the external partners here. The purpose of this exchange is to identify resources and have access to those resources that have value potential and benefits.

The technology delivery in the Model 7.3 may be either way, that is, technology may be taken form the shelves of the knowledge organisations, in top-down approach or a local innovation may be finetuned to be converted/upgraded to an output-based technology/service/product.

Once the technology delivery module to the communities get streamlined and institutionalized, local innovation systems and/or technologies are identified, for which all the backward chain linkages, like raw material availability, S&T interventions, validation are established, the funding support systems are explored and established. The funding support may include public funding, crowd funding, public-private-partnership, and so on. Public funding includes direct funding from respective ministries and departments under various schemes, and funding under state or national level missions (when the livelihood system is thematically aligned). Crowd funding may also be arranged for a livelihood system following bottom-up approach in initial stage, which may be provided top-up funding – later on for handholding and sustenance – by various funding agencies. Loans from various finance and microfinance agencies may also be sourced for sustainable and viable livelihood systems, at lower interest rates.

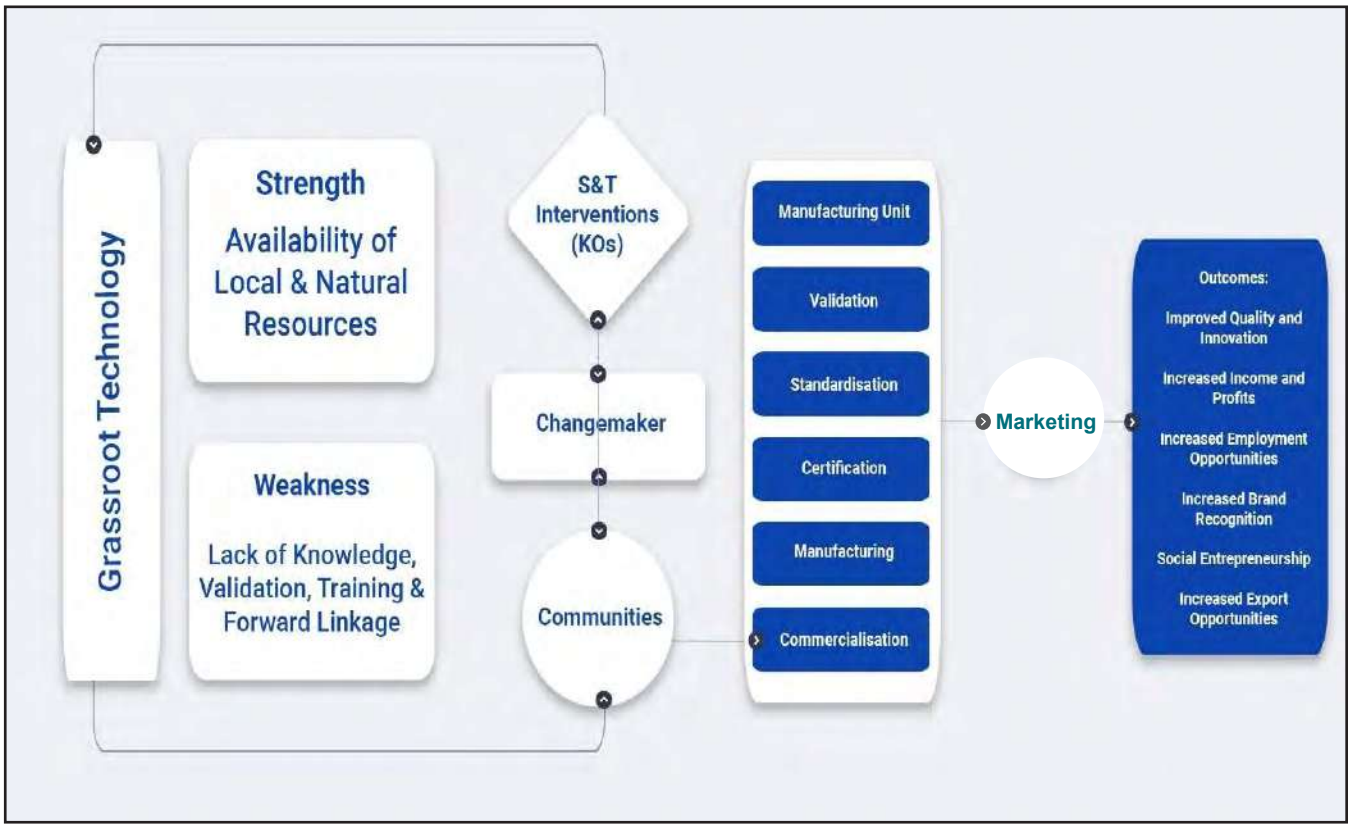
This model is techno-centric in nature and follows both bottom-up and top-down approach. In this ecosystem, backward linkages are identified first, assessed for their availability and access, and then an appropriate technology is sourced from the shelves of knowledge organisations, which are pre-validated. Additional fine tuning to the technologies are incorporated through demand-based innovation system to customize the local need.

New product and service development and setting up of micro enterprises have been recognized as key contributors to community‘s performance. The customer active process of technology orientation may be explained as community‘s openness to new ideas and propensity to change through adopting new technologies, resources, and skills. Technology orientation is defined as the knowledge structure composed of a learning philosophy and functional belief that directs the strategic actions of the communities.

Model-7.4: Market Orientation of Products/Services for Sustainable Livelihood System

Market orientation is the pre-requisite of a community to determine needs and wants of target markets and satisfy them through the delivery of appropriate products and services. Market orientation is a systematic culture that most effectively and efficiently creates the necessary behaviours to create superior value for buyers and thus superior business performance. It is also the central ingredient of a successful innovation process and hence the decision criteria for the sustainability.

Model-7.4: Market Orientation of Products/Services for Sustainable Livelihood System



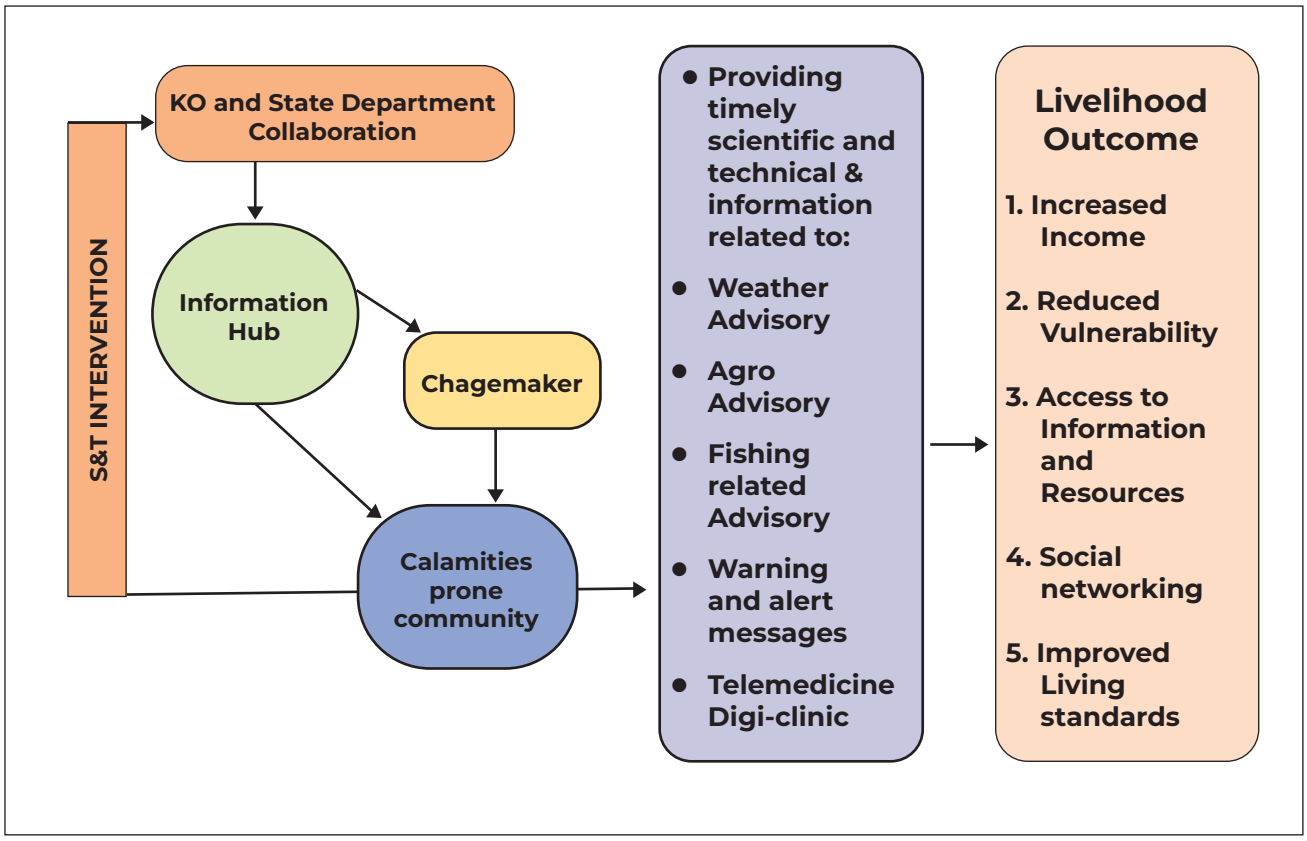
Moreover, market orientation serves as a central ingredient of a successful local innovation system. By actively engaging with the market and responding to changing consumer needs, local producers can drive innovation, differentiate their products, and stay ahead of competitors. This iterative process of innovation and adaptation is essential for maintaining relevance in dynamic market environments and fostering sustainable business growth.

Incorporating market orientation into decision-making processes also provides valuable insights and direction for sustainability. By considering market dynamics, competitive landscapes, and consumer preferences, local producers can make informed decisions regarding product development, marketing strategies, and resource allocation. This ensures that investments are directed towards initiatives that are aligned with market needs and have the potential to generate long-term value.

Ultimately, a market-oriented approach enables local producers to maximize the market potential of their products, strengthen their competitive position, and enhance their contribution to local economic development. By continuously striving to understand and meet the needs of target markets, local producers can unlock new opportunities, drive business success, and foster sustainable growth within their communities.

Knowledge integration is a formal process and structure that facilitate capturing, analysis and synthesis of knowledge and the dissemination of that knowledge among different functional units. Hence, knowledge application requires integration of different functional areas. It suggests that apart

Model-7.5 Digitally-enabled Livelihood System



from business and customer collaboration, a strong knowledge integration mechanism is imperative for service delivery innovation.

Model 7.5: Digitally-enabled Livelihood System

Undoubtedly, technology's transformative impact on community life cannot be overstated, reshaping how information is accessed, communication occurs, and daily activities are conducted, thus significantly enhancing overall quality of life. An exemplar of this transformation lies in the advent of mobile health applications, digi-clinic in Sunderban area of West Bengal, which have empowered residents in rural areas by granting access to vital medical information and facilitating connections with healthcare providers, thereby notably enhancing healthcare access and outcomes.

Furthermore, digital literacy programmes have emerged as indispensable tools for mitigating disparities in digital literacy, particularly among women in rural regions. These programmes not only impart crucial digital skills but also serve as agents of empowerment, enabling women to actively engage in economic, social, and political realms within their communities. For instance, within a rural village in Maharashtra, a digital literacy initiative equipped women with the proficiency to utilize e-commerce platforms, thereby enabling them to market their handmade crafts to a broader audience and generate sustainable income for their families.

Implementing Information and Communication Technology (ICT) solutions for disaster-prone communities through weather advisories and alert messages is a critical initiative that can save lives and minimize damage during natural disasters.

By leveraging ICT tools, such as mobile phones and internet connectivity, fishing communities can receive timely and accurate information about impending hazards, enabling them to take proactive measures to protect themselves and their property.

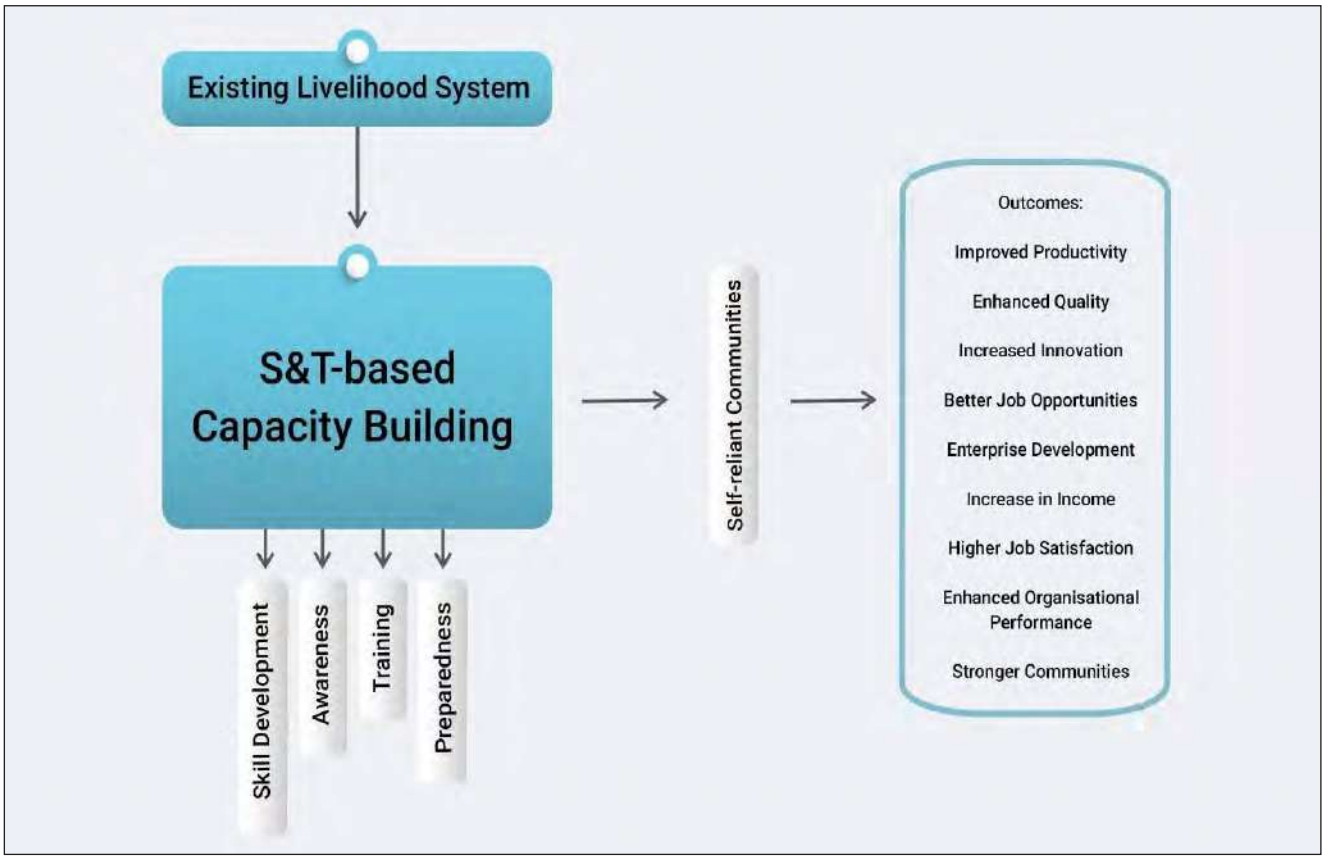
In addition, the widespread penetration of the internet harbors immense potential to catalyze economic growth and tackle prevailing challenges in education, training programmes, online marketing and healthcare. Similarly, internet connectivity has facilitated telemedicine endeavors, empowering healthcare professionals to remotely diagnose and treat patients in underserved regions, consequently ameliorating healthcare outcomes. These instances underscore the pivotal role of technology in instigating positive change and nurturing holistic community development.

By enhancing communication, information sharing, and response coordination, these technologies help save lives, protect livelihoods, and build stronger, more resilient communities in the face of adversity.

Model-7.6: Capacity Building and Skill Development based Livelihood System

Establishing an effective capacity building mechanism and skill development is essential for empowering individuals and communities within the local livelihood system. A formal process that captures, analyzes, synthesizes, and disseminates knowledge plays a pivotal role in enhancing skills, fostering innovation, and promoting sustainable development.

Model-7.6: Capacity Building and Skill Development based Livelihood System



The capacity building mechanism should involve systematic methods for identifying skill gaps, assessing learning needs, and designing tailored training programmes. This process begins with capturing knowledge through various means such as surveys, interviews, and assessments to understand the current skill levels and learning requirements within the community.

Next, the captured knowledge is analyzed to identify trends, patterns, and areas for improvement. This analysis helps prioritize skill development initiatives and allocate resources effectively. Synthesizing this knowledge involves designing comprehensive training modules, curricula, and learning materials that address the identified needs and objectives.

Dissemination of knowledge is crucial for reaching a wide audience and maximizing the impact of capacity building efforts. Utilizing diverse communication channels such as workshops, and community networks ensures that training opportunities are accessible to all members of the community. Moreover, incorporating interactive and participatory learning approaches fosters engagement, collaboration, and knowledge sharing among participants.

A strong knowledge integration mechanism is imperative for the local livelihood system to thrive. By integrating newly acquired skills, knowledge, and best practices into daily activities and decision-making processes, individuals and communities can enhance their productivity, resilience, and adaptive capacity. This iterative process of learning, application, and feedback loops fosters continuous improvement and innovation within the local economy.

Model-7.7: Social Inclusion Model for Livelihood System

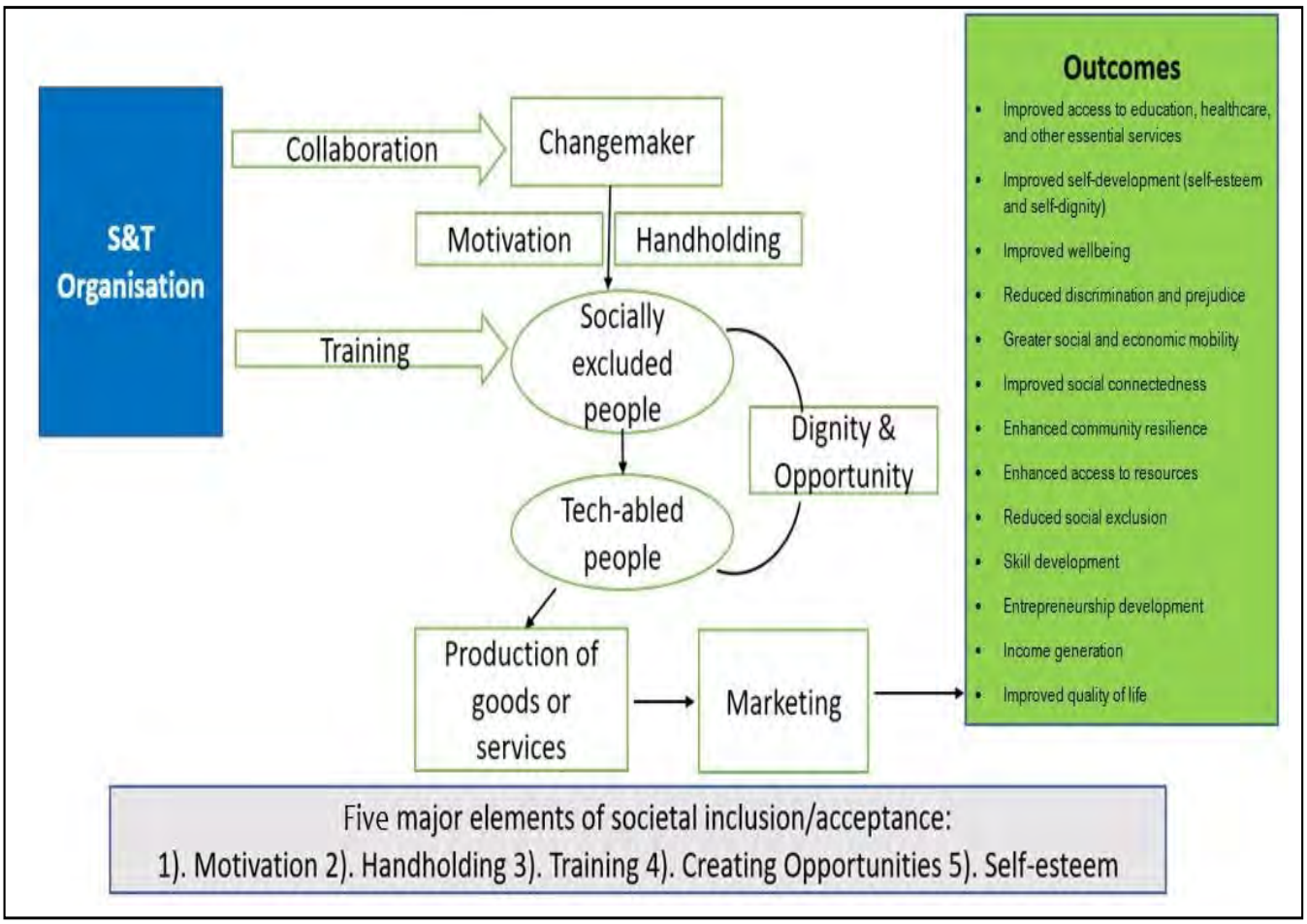
Creating a Social Inclusion Model for a livelihood system that encompasses socially excluded communities such as transgenders, correctional home inmates, specially-abled people, rehabilitation center inmates, old-age homes, and orphanages requires a holistic approach that addresses their unique needs and challenges. This model is built upon five core elements: Motivation, Handholding, S&T based Training, Opportunities, and Self-esteem.

Motivation: The first step in the Social Inclusion Model is to instill motivation within the target communities. This involves raising awareness about the importance of economic empowerment and social inclusion, highlighting the potential benefits of participating in livelihood activities, and fostering a sense of hope and aspiration for a better future.

Handholding: To facilitate the integration of socially excluded communities into the livelihood system, they require personalized support and guidance. Handholding involves providing mentorship, counseling, and advocacy services to help individuals overcome barriers, build confidence, and navigate the complexities of assessing opportunities.

S&T based Training: Skill development is a cornerstone of social inclusion and economic empowerment. Training programmes tailored to the specific needs and abilities of each community member are essential for enhancing employability, fostering entrepreneurship, and promoting self-reliance. These program,mes should cover a range of relevant skills based on their local knowledge system, including vocational training, financial literacy, communication skills, and business management.

Model-7.7: Social Inclusion Model for Livelihood System



Opportunities: Creating inclusive opportunities within the livelihood system is crucial for ensuring the participation and success of socially excluded communities. This may involve establishing affirmative action policies, promoting diversity and inclusion in the workplace, and creating platforms for market access, networking, and collaboration. Additionally, providing access to microfinance, grants, and other financial resources can empower individuals to start their own businesses or pursue income-generating activities.

Self-esteem: Building self-esteem and confidence is essential for the long-term success and well-being of socially excluded communities. Recognizing and celebrating their contributions, providing positive feedback and encouragement, and fostering a supportive and inclusive environment are key components of enhancing self-esteem. Moreover, promoting dignity, respect, and equal rights for all members of society is essential for combating stigma, discrimination, and social exclusion.

By incorporating these five elements into the Social Inclusion Model, we can create a more inclusive and equitable livelihood system that empowers socially excluded communities to participate fully in economic and social life. This model not only promotes individual empowerment and well-being but also contributes to the overall prosperity and cohesion of society as a whole.

7.4 Mapping of Technology Absorption at the Community Level with Proposed Models

Mapping technology absorption at the community level involves understanding how communities engage with and adopt various technologies to address their needs and challenges. This process helps identify gaps, opportunities, and areas for improvement in technology utilization. The section outlines a framework for mapping technology absorption at the community level along with proposed models:

M1-M7 represents respective Models explained in 7.3

Sl. No.	Name of Technology	Model based on Techनींव@75 Study
1.	Science Technology and Innovation (STI) Hub in Sidho-Kanho-Birsha University, Purulia, West Bengal for the Socioeconomic upliftment of ST Communities of Eastern Region West Bengal, Jharkhand, and Odisha through Science and Technology Intervention	M1, M5
2.	Community Group on Socio-economic Upliftment of rural weaker section (SC/ST) by scientific interventions and Amelioration of production diseases in dairy animals	M3, M4, M5
3.	Seaweed cultivation and processing	M1, M5
4.	Social Enterprise & Farmer's own fabricator& for fabrication of agriculture tools (tractor attachments, and tools) and transport vehicle hoods.	M2, M3, M4, M5
5.	Women Organized Group working on Agro echnology and semi-processing of High-value Himalayan Medicinal Plant Swertia cordata (Chiraita), Mandi, Himachal Pradesh	M1, M4, M5
6.	Science Technology and Innovation (STI) Hub in Dr. Babasaheb Ambedkar Marathwada University, Establishment of Science Technology and Innovation Hub for the empowerment of SC /ST populations	M1, M3, M4, M5
7.	Development of Integrated Model Villages in Uttarakhand	M1, M5
8.	Potential Zone Advisories and ocean state forecasts: Wave Riders Buoy in Puducherry, Tuticorin and Cholachel Coast, Documentation of ITK, Capacity Building & Validation of INCOIS Services in TN & AP	M5, M6
9.	Mushroom Cultivation in the north-east regions of Papum Pare, East Siang, and West Siang districts of Arunachal Pradesh	M1, M2, M3, M5
10.	Tree-based farming (Wadi) for Arid desert (Horticulture tree species/ grafts like Ber)	M1, M5
11.	Socio-economic upliftment of yak rearing communities in Northeastern region by capacity building and technological interventions,	M1, M5

12.	Moonew Tareybhir Enriched Composting / Vermicomposting Cluster	M4, M5
13.	Women Technology Park - Bolmoram Technology Resource Centre Cum Knowledge and Innovation Park, East Garo Hills, Meghalaya	M1, M5
14.	Integrated Pottery Development Project for Development of Gujarat State Pottery Sector	M4, M5
15.	Science, Technology, and Innovation Hub for Creating Sustainable Livelihood Opportunities of Scheduled Tribes in Angara Block, Ranchi District, Jharkhand	M2, M4, M5
16.	Growing of HRMN 99 low chilling apple variety in non-apple areas	M2, M4, M5
17.	Leaf grinder used for making bio manure	M1, M5
18.	Multipurpose processing machine for processing fruits and herbs to make food products, extract essential oils, etc	M1, M4, M5
19.	IoT-based solar charge controller for the rural electric workshop-Solar lantern	M1, M5, M6
20.	Low-Temperature Thermal Desalination Plants of One Lakh liters per day capacity	M1
21.	ASRLM Project with CLEAN network	M2, M4, M5,
22.	Socializing the Micro-Solar Dome: Empowering Rural SC, ST, and Tribal Communities through Solar Illumination and Solar Electricity)	M1, M3, M5
23.	LED Bulb Unit	M1, M4, M5
24.	Improved Mud Cookstove - PAVAK for disadvantaged communities in rural India	M1, M5
25.	Improved Jaggery Making Plant - Gur Bhatti	M1, M5
26.	Compact Food Waste Biogas Unit	M1. M2, M4
27.	Cotton Wick Making Machine	M1, M3
28.	Innovations in Correctional Home: A Model of Inclusive Development- Cow Dung Pot-Making Machine	M1, M3
29.	S&T Intervention Gives Traditional Water Mills A Lift	M2, M4, M5
30.	Solar and biomass driers for Mahua processing and vegetable dehydration ENERGY-EFFICIENT JAGGERY FURNACES	M1, M5
31.	Clean energy	M1, M5
32.	Promoting community health by addressing the incidence of waterborne diseases in a village in Bihar	M1
33.	Integrated Approach for augmenting groundwater in Chirawa Block of Jhunjhunu District Rajasthan	M1
34.	Water Technologies deployed at rural area of Bundelkhand, Madhya Pradesh	M1
35.	Cultivation of aromatic plants and distillation of aromatic oils (wild marigold)	M2, M4, M5,
36.	Food processing of value-added products	M2, M4, M5

37.	Introduction to Basic Technology (IBT)' Program for Secondary Schools	M3, M5
38.	Digital Clinic to combat primary healthcare	M1, M5, M6
39.	Newly developed anthocyanin biofortified black wheat	M4, M5
40.	Food fortification technology to combat primary health care deficiencies and economic empowerment of dwellers in forest fringe villages	M1
41.	Enhancement of livelihood for scheduled caste households through an ICT enabled Integrated rural nutrition center in Madukkarai block of Coimbatore District, Tamil Nadu	M4, M5, M6
42.	Fluorosis Mitigation through Intervention, diet Editing, and Management in Scheduled Caste Community of Bihar	M1
43.	Promoting a pilot of bio-sand filters for access to clean drinking water for future dissemination	M1
44.	Empowerment of Women Through Application of Multifaceted Biotechnological Innovations in Millets for Sustainable Income Generation and Nutritional Security	M4, M5, M6
45.	Holistic Health: Traditional Siddha Varman Therapy	M1
46.	A New Approach towards Pain and Infertility Management in Women Suffering from Endometriosis and Adenomyosis	M1, M7
47.	Computer-Aided Designing software: Digi Bunai	M5, M6
48.	Improved technology for Attar manufacturing	M1, M4, M5
49.	Charcoal Briquette from Agro-Waste	M1,
50.	Women-friendly farm mechanization in various agricultural implements	M1, M5
51.	Technology based Coconut Fiber Extraction and Value addition	M1, M5
52.	Agro equipment technology for drudgery reduction	M1, M5
53.	Modernization of Traditional Pottery	M2, M4, M5
54.	Pepper Thresher Machine-Innovation Science Technology Entrepreneurship Development project (i-STED project)	M1, M3, M4, M5, M2
55.	Crop Residue Biomass Composting Demonstration Units	M1, M5
56.	Namami Gange Praharis	M5
57.	Hameri work & Honey Bee farming	M5
58.	NAVACHAITHANYA: Herbal Processing Unit	M1, M5
59.	Assessment of Bone Health in the Transgender Population	M7
60.	Eco-friendly utilization of hazardous pine needles for social benefits	M1
61.	Climate Resilient Farming Technology	M1
62.	Beach nourishment through dredging	M1
63.	Mouli – the Rock Bee Honey Hunters in Sundarbans	M4, M5

64.	Handloom with Jacquard Weaving and design-based S&T intervention for product development	M1, M2, M4, M5
65.	Wireless sensor systems for landslide early warning in Munnar, Kerala	M1, M6
66.	Technological intervention in value-added livestock product	M5
67.	Nursery Business Based on Seasonal Crop Species	M5, M6
68.	Technology developed for the upliftment of the tribal community of the Ladakh region	M1, M5,
69.	Electronic Jacquard Handloom from grass weaving	M1, M5
70.	Spinning on Ambar Charkha Weaving on Handlooms Sheep Wool shearing through Machine	M1, M5
71.	Establishment of Rural Nutri-Bakery for fulfilling nutritional requirements and income generation of tribal and rural communities	M1, M5, M4
72.	Establishment of Coastal Fisheries Information Hub for Nicobar tribes at Car Nicobar Island	M4, M5
73.	Gramin Krishi Mausam Sewa	M5, M6
74.	Impact of Aromatic crops cultivation in the spirational district	M1, M5,
75.	Value-Added Products from Natural Plant Material	M1, M5

CHAPTER

8

RECOMMENDATIONS

The assessment of the technology absorption capacity of the communities carried out through the programme Techनींव@75 laid the groundwork for consideration of the issues and attempts to set forth some of the strategies for developing a science and technology-enabled sustainable livelihood approach. The study proposed a set of recommendations which are detailed in this section.

The proposed framework explained in the previous chapter, starts from the identification and assessment of the local knowledge system and takes into account the strategic management of value co-creation, potential innovation complying with the socio-economic, ecological and environmental factors. In order to strengthen the local innovation system value co-creation needs to be enabled by science and technology, knowledge exchange, and social dimension. It was observed in the study that to be truly appropriate, technology must be compatible with available natural, human, and financial resources and correspond to the cultural practices of users/ communities. Technology should be adopted wisely to engage users/community, enablers such as social change makers, and knowledge organisations to continuously stimulate resource integration and knowledge updation and renewal throughout the whole process.

The framework for enhancing the livelihood enabled through science and technology as an output of the analysis was to identify the different enabling dimensions of value co-creation and innovation at the different stages of technology delivery and implementation at four levels : micro, macro, meso and meta. These levels need to be aligned with funding agencies, apex bodies, different stakeholders, Technology providers, implementers and the science and technology ecosystem by integrating bottom-up approach with top-down approach.

Micro-Level

Micro-level includes co-creation of knowledge and practices at local and individual levels, use of technology, implementation of science and technology and skill building and strengthening local innovation through the following parameters;

- Baselines socio-economic, ecological, and environmental awareness assessments
- Assessing local knowledge system, and local innovation system to establish community linkages
- Committee mobilization and empowerment initiation
- Socio-cultural & economic valuation study

Enablers at Micro Level: Individual, Community, SHGs, Community Groups, Village level Heads, Local Innovators

Meso-Level

Meso-level highlights co-development practices (enhancing human capital, strengthening social capital), value co-creation by integrating local knowledge with scientific knowledge, technology upgradation, co-delivery, and building partnerships. The recommendations at the meso-level includes

- Up scaling lessons at micro levels to influence decision-making processes (as well as down scaling)
- Integrate lessons from poverty elimination livelihood strategies assessment into key policy and programmes
- Access to S&T Knowledge, Training, Funding opportunities
- Integration of top-down & bottom-up approach
- Bottom-Up Approach for strengthening Local Participatory Mechanism
- Technology-led Entrepreneurship and Social Innovation

Enablers at Meso-Level: Knowledge Organisations, Technology developers, Societal Change Makers

Macro-Level

Macro-level focuses on renewal of knowledge, co-learning practices and synergistic multiple outcomes across economic, social, and environmental dimensions (sustainable innovation),new products service development practices, social outcomes (social innovation), institutional proximity, and feedback collection with the following recommendations:

- Lesson Learnt and dissemination from the micro level
- Act as an enabler for technology upgradation, delivery.
- Capacity building & Skill development
- Development of S&T based sustainable livelihood plans
- Establishing forward and backward linkages
- Mainstreaming projects and programmes
- Enabling Public-Private Partnerships
- Strengthening the S&T Knowledge Capacity of Communities

Enablers at Macro-Level: Apex Body, Funding Organisations and Agencies, Experts and Policy Makers

Meta-Level

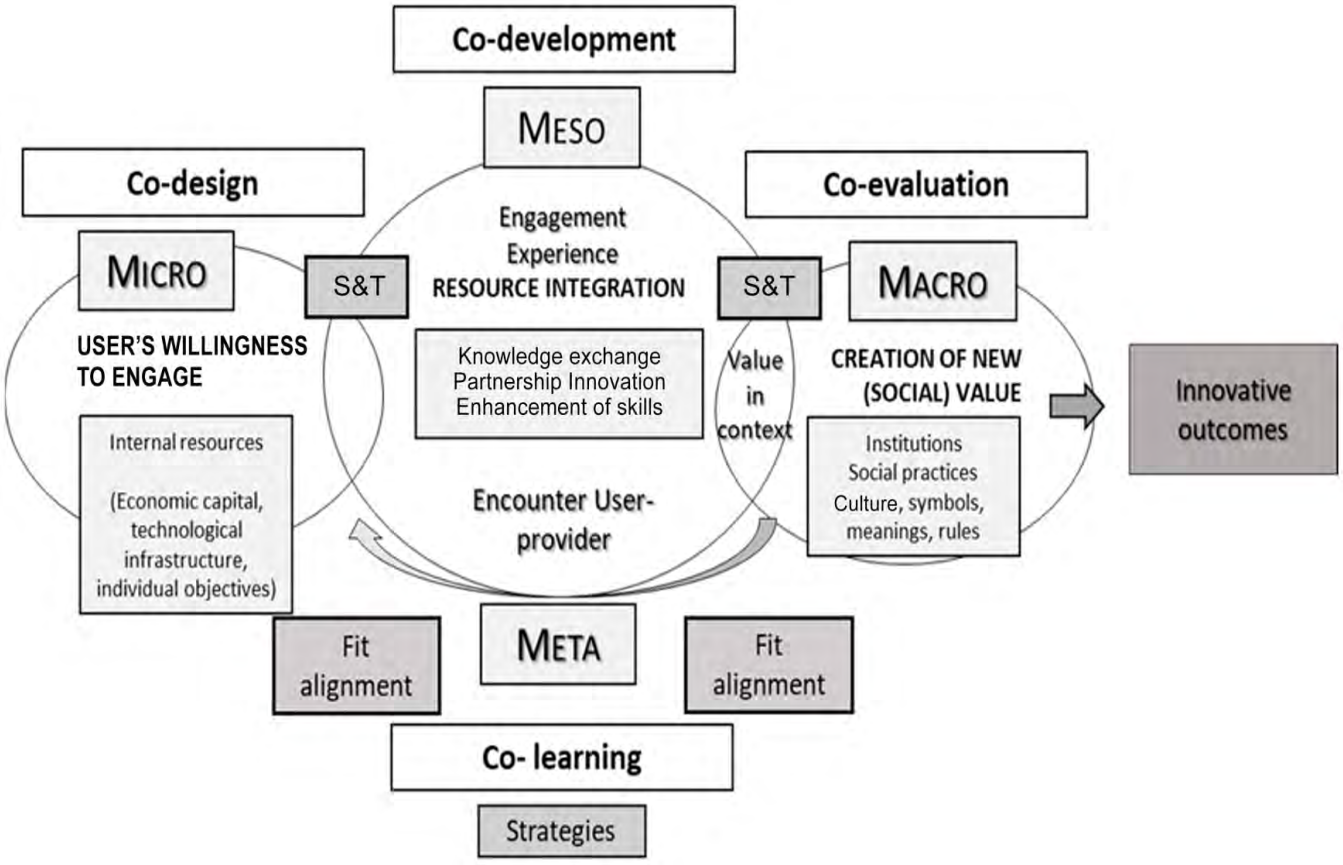
In this stage, the new knowledge generated at the macro-level can be regenerated and co-evolution can be obtained through co-learning that can lead to institutionalization and co-innovation and can potentially be never-ending.

Relationships should be managed through strategic and tactical harmonization of the fit between the value pursued by the different stakeholders and the overall ecosystem's goal. Users' engagement should be monitored constantly to improve resource integration and, thus, co-delivery and co-learning. The meta level includes establishing synergies, building international collaborations for development of a robust structure of livelihood system coupled with science and technology

Enablers at Macro-Level: Apex Body, Funding Organisations and Agencies, Experts and Policy Makers

The following figure depicts the alignment of all the levels.

Figure: Mapping and Aligning Micro, Meso, Macro and Meta Level



Recommendations

The Study shows how the livelihoods framework can strengthen the voice and influence of the underprivileged and the marginalized to enable them to secure full social and economic rights through STI interventions at the grassroots. At the same time the framework provides a way for the funding agencies and apex bodies to develop livelihood-centric policies and programmes. The framework reflects on the issues associated with sustainability and highlights the social, and economic transformation that must take place to make this a reality.

Local innovation ecosystems enable places to produce innovation and sustain processes of innovation over time, yet they are complex phenomena that are not well-defined and as such, are challenging to analyze and assess. Strengthening innovation ecosystems requires identifying the desired purpose of the system and assessing both structural and functional assets and needs as they relate to desired functions necessary to achieve the system's purpose.

A lot of emphasis was given by the expert, scientists and the policy makers in the roundtable discussion during the programme on strengthening the local innovation system. Some of the major suggestions were :

- **Need for Identification of Local Innovations at an early stage**: Early stage identification helps in fostering the innovation in right direction and making it more attuned towards the local need. This enables strengthening the grassroots

innovation ecosystem for providing local level contextual solutions. These identified local innovations would be nurtured and developed into prototype and commercialized with suitable inputs, handholding, upscaling, training and funding.

- **Cohesiveness among stakeholders & collective decision making**: There were many questions raised during the webinar discussions like: Who will identify the local innovations? Is it solely the responsibility of the grassroot innovator? or of the Institution/scientist to whom he approaches? Who will decide that a particular innovation is really of any worth or not? In order to settle these questions, it was advised that in each district a committee of stakeholders should be constituted and should be vested with the prerogative of deciding some basic questions pertaining to the local innovation. The Committee must comprise of members from scientific community, district officials of concerned department, members of the community including the innovator, bank officials, expert from the concerned/related field should be brought on board as deemed necessary to dwell on any particular innovation and a representative from state Innovation Council.
- All the members must take decisions collectively and decide whether a particular innovation is worth investing time, efforts and money or not.

- **Need to make a rich pool of grassroot Innovations:**
  - A data-bank of local innovations across the country, whether successful or unsuccessful, at early or later stages, need to be made. An innovation or simple technological modulation that failed to cut-ice in a region, might hit the charts in some other region of the country. Hence, pooling all the information pertaining to grassroot innovations would not only help reduce the duplicity in efforts but also provide a platform which can be used for optimum utilization of any innovation.
- **Strengthening collaboration among different scientific Institutions/organizations for knowledge-transfer and exchange of ideas:** The Organizations working in the field of grassroot innovations could learn from each other and help in creating a conducive environment for nurturing and promoting the local innovation ecosystem. The Organizations working in the field of grassroot innovations should not work in-silos and rather in tandem. They must also share knowledge among themselves and help each other with the ideas and their studies/research.
- **Need to promote Bottom-up approach in Innovation:** It's next to impossible to have a conducive innovation ecosystem unless people at grassroots are encouraged to innovate in the light of their needs and necessities. Any innovation from the top might yield desired results but it would eventually fail to promote an innovation- based ecosystem that would lay the foundation for an *"Atmanirbhar Bharat"*. Also, in top-down approach, people's participation must be ensured. Locals must be made aware about the pros and cons of any technology or innovation introduced in their area. Therefore, bottom-up approach becomes essential for grassroot innovations.

- **People's feedback and Experiences**: Feedback from those who are the end-users of technology or are the grassroot stakeholders of any innovation is essential to modulate or attune the technology to the emerging needs. Innovations should ideally cater to the hopes and aspirations of people and should ideally meet these.
- **Replication and Scalability**: Replication helps a local innovation to reach areas other than where the innovation is actually made. It helps in catering to the similar requirements or findings solution to the similar type's problems in the areas far-off. Further, the local innovation must be scalable so that it can meet the increasing needs and sustain in a locality.
- **Sustainability:** An innovation must be sustainable and environment friendly apart from being cost-effective.It must be based on optimum utlization of the natural and other resources and its carbon footprints should also be less.
- **Proper channelization and Diversion of Resources and end-products**: End-products of one system can be a raw material for the other while there might be several innovations using similar inputs.A proper channelization and diversion of resources is the need of hour to stop the wastage of raw material and its maximum utilization.

Building up on the local innovation systems and strengthening the local knowledge systems would help in fostering technology upgrading, strengthening innovation capacity and enhancing the systems or ecosystems that support innovation. The programme of Technnev@75 highlighted the need for having tailor-made modular capacity-building activities targeting various elements of the innovation system encouraging the emergence of stronger linkages among these stakeholders.

CHAPTER

9

WAY FORWARD

Addressing the large and systemic challenges, inclusiveness, strengthening and conversion of local knowledge into needed and commercial products is the key to innovative and affordable solutions. To strengthen the local innovations, entrepreneurship, synergistic integration with concerned state and central departments and ministries like Ministry of Rural Development and Panchayati Raj , Ministry of Agriculture and Farmers' Welfare, Ministry of Micro, Small and Medium Enterprises (MSME), Ministry of Tribal Affairs, Department of Food Processing Industries, Jal Shakti Ministry etc. will ensure social, economic and ecological sustainability towards enhanced livelihood system.

This would necessitate the development of forward-looking policies and regulations, as well as more involvement of rural communities. This includes foresight planning to ensure policies are flexible and prepared to face rapid changes in the future, strengthening technology delivery systems and enabling technological testing, as well as community knowledge and involvement in the upcoming changes. A solid policy framework that reflects the need for a broader adoption of bottom-up models with top-down approaches to deploy effective delivery of scientific inputs and technologies, as well as encourage more and more community members to participate in planning and implementation processes in a more participatory manner.

Technology has the potential to transform community development both in rural and tribal areas of India and enable the accomplishment of targets of the "Amrit Kaal". Through collaborative efforts among stakeholders, technology can act as a powerful catalyst, accelerating rural development and paving the way for a prosperous future for rural India. The ability to utilize and implement scientific and technological advances to integrate the local knowledge, local innovation, education, training, entrepreneurship is critical to enhance the livelihood system and create sustainable and inclusive growth to meet the development goals of community.

To address systemic issues in enhancing the technological absorption capacity of the community and promote sustainable systems, a roadmap to achieve the goals of science and technology enabled livelihood system is proposed as way forward. .

A concerted effort is needed to showcase the immense potential and strength of local knowledge and innovation systems for efficient technology

deployment and absorption among the rural people. By showcasing real-world success stories, investors can gain confidence in the viability and impact of rural projects.

Encouraging collaboration among government agencies, private enterprises, NGOs, and academic institutions, financial institutions is crucial for providing need based technological solutions to the people at the local level.

By aligning resources, expertise, and capital, stakeholders can work together to create impactful solutions that address the complex challenges faced by rural communities. This collaborative approach also allows for the development of scalable models that can be replicated across different regions, seeking long-term partnerships.

Emphasizing the social, economic, and environmental impact of rural development projects is crucial. Providing evidence of tangible results and showcasing the positive changes in rural communities can attract impact technology developers, solution providers, investors who prioritize sustainability and social responsibility. Highlighting the long-term benefits, such as poverty reduction, job creation, and atural resource management, will enhance the livelihood systems in the community.

Advancement in science-led technology, the role of public- private partnerships in both technology implementation and technology delivery mechanisms, upscaling for ease of doing their work and businesses is crucial.

Improving linkages between the stakeholders who will be involved in the technology delivery mechanisms by integrating both top-down and bottom –up approach and ensuring community participation in technology development to improve livelihood opportunities by enabling more effective participation in livelihood activities through improved financial inclusion, education, and health.

Advancing the translation of promising local innovations into widespread use, thereby enhancing their social and economic impact, through the provision of financial, technical, and strategic support to the innovators/enterprises to help take their ideas/innovations forward.

Effective integration of traditional knowledge with modern technology will be desired for increasing the productivity and harnessing the treasure of traditional knowledge.

Strengthening the role of social change makers for taking the need-based technologies to the community through exchange of timely information, knowledge, tools and best practices with easy access to technology, policy, financial support and hand-holding from the knowledge organizations. Imparting greater role to youth and women of the communities as Change makers and input providers and for scaling of local innovations.

India has been transformed on many fronts and is ready for take-off during its Amrit Kaal . There has been a massive expansion in social and economic infrastructure through policies and schemes in past years. Innovation in rural regions occurs differently and has a different impact in different parts of the country. It often happens with entrepreneurs in rural regions often creating innovative products and processes through an aggregation of smaller changes, such as learning by doing through adaptive measures that try to overcome market and policy failures.It is important to channelise the innovative ideas of rural youth into nation-building and contribute to the vision of Viksit Bharat by 2047.

As a learning outcome of the Techनींव@75 programme, a national livelihood mission is being proposed through science, technology

and innovation. 'National Livelihood Mission: Science, Technology & Innovation for Sustainable Livelihood System' has recently been approved by the Prime Minister's Science, Technology, and Innovation Advisory Council (PM-STIAC) serves as a noteworthy embodiment of this ethos initiated by the office of Prinicipal Scientific Adviser (PSA) for the Govt. of India. The mission envisages extending outreach of Science, Technology, and Innovation (STI) to rural areas while enhancing capabilities, and facilitating sustainable livelihoods. This is a step towards recognising the important role of Diversity, Equity, Inclusion and Accessibility in the entire S&T ecosystem.

ANNEXURE-I

PRINCIPAL INVESTIGATORS OF KNOWLEDGE ORGANISATIONS & TECHNOLOGY IMPLEMENTERS AT THE COMMUNITY LEVEL

Sl. No.	Technology	Principal Investigator/ Technology Implementors	Email Id	Changemaker
1.	Science Technology and Innovation (STI) Hub in Sidho-Kanho-Birsha University, Purulia, West Bengal for the Socioeconomic Upliftment of ST Communities of Eastern Region West Bengal, Jharkhand and Odisha through Science and Technology Intervention	Prof. Subrata Raha, Sidho Kanho Birsha University, West Bengal	subrata-raha@skbu.ac.in; assttcoe.skbu@gmail.com	Biswanath Dasgupta
2.	Community Group on Socio-economic Upliftment of Rural Weaker Section (SC/ST) by Scientific Interventions and Amelioration of Production Diseases in Dairy Animals	Dr Neelesh Sharma, Sher-e-Kashmir University of Agricultural Sciences & Technology (SKUACT), Jammu	drneelesh_sharma@yahoo.co.in	
3.	Seaweed Cultivation and Processing	Dr M. Ganesan, Principal Scientist Central Salt and Marine Chemicals Research Institute (CSIR-CSMCRI), Mandapam	ganesan@csmcri.res.in	Mutha Muthavel Sambai Rameswaram, Tamil Nadu,
4.	Social Enterprise & Farmer's Own Fabricator& for Fabrication of Agriculture Tools (Tractor Attachments, Hand Tools) and Transport Vehicle Hoods	Dr Yogesh Kulkarni, Director, Vigyan Ashram, Pune	vapabal@gmail.com	Aniket Kanade, Kendure village, Kendure, Shirur, Pune, Maharashtra
5.	Women Organised Group working on Agro- technology and Semi-processing of High-Value Himalayan Medicinal Plant Swertia cordata (Chiravita), Mandi, Himachal Pradesh	Dr Lal Singh, Director, Himalayan Research Group (HRG), Shimla	lalhrg@gmail.com	Dhaneshwari Devi, Maigal village, Mandi, Himachal Pradesh
6.	Science Technology and Innovation (STI) Hub in Dr Babasaheb Ambedkar Marathwada University, Establishment of Science Technology and Innovation Hub for Empowerment of SC /ST Populations	Prof. Mahendra D. Shirsat, Dr Babasaheb Ambedkar Marathwada University, Aurangabad	mdshirsat@gmail.com; drbhartirokade@gmail.com	Dadasaheb Gaikwad, Kannad, Aurangabad.
7.	Development of Integrated Model Villages in Uttarakhand	Dr Himani Purohit, Dr Rakesh Kumar, Himalayan Environmental Studies and Conservation Organization (HESCO), Dehradun	himanipurohit9@gmail.com; drrakeshkumarhesco@gmail.com	Gopal & Nirma Negi, Uttarakhand

8.	Potential Zone Advisories and ocean state forecasts: Wave Riders Buoy in Puducherry, Tuticorin and Cholachel Coast, Documentation of ITK, Capacity Building & Validation of INCOIS Services in TN & AP	Dr S. Velvizhi, Senior Scientist, M S Swaminathan Research Foundation (MSSRF), Chennai	velvizhi@mssrf.res.in	Akila, Panithittu village, Puducherry
9.	Mushroom Cultivation in the North-east Regions of Papum Pare, East Siang and West Siang districts of Arunachal Pradesh	Dr Chandan Tamuly, Principal Scientist, North East Institute of Science and Technology (CSIR-NEIST), Itanagar	ctamuly@neist.res.in	Teetu Yoka, President, Action Aid Society of Arunachal, Arunachal Pradesh
10.	Tree-based Farming (Wadi) for Arid Desert (Horticulture Tree Species/ Grafts like Ber)	Sagar Kadao, BAIF Development Research Foundation, Pune	sagarkadao@baif.org.in	Babulal Meghawal, Kaukheda village, Barmer, Rajasthan
11.	Socio-economic Upliftment of Yak Rearing Communities in Northeastern Region by Capacity Building and Technological Interventions	Dr Vijay Paul, Principal Scientist, ICAR- National Research Centre on Yak (NRCY), Arunachal Pradesh	vpaul.nrcy@googlemail.com	Rinchin Tsering, Rabum village, North Sikkim
12.	Moonew Tareybhir Enriched Composting / Vermicomposting Cluster	Dr Rakshak Kumar, Scientist, Institute of Himalayan Bioresource Technology (CSIR-IHBT), Palampur	rakshak@ihbt.res.in	Ram Narayan Sharma, Moonew Busty, Sombaria, West Sikkim
13.	Women Technology Park - Bolmoram Technology Resource Centre Cum Knowledge and Innovation Park, East Garo Hills, Meghalaya	Dr Augustus Suting, State Council of Science, Technology & Environment, Meghalaya	stcouncilmegh@yaho o.com	Kemfort M. Sangma, East Garo Hills, Meghalaya
14.	Integrated Pottery Development Project for Development of Gujarat State Pottery Sector	Dr Parag M. Solanki, Scientist, Central Glass & Ceramic Research Institute (CSIR-CGRI), Kolkata	pmsolanki@cgcri.res. in	Pankajbhai Manjibhai Dharodia (Prajapati), Morbi, Gujarat
15.	Science, Technology and Innovation Hub for Creating Sustainable Livelihood Opportunities of Scheduled Tribes in Angara Block, Ranchi District, Jharkhand	Dr Avijit Kr. Dutta, Assistant Professor, Ramakrishna Mission Vivekananda Educational and Research Institute, Ranchi	avijitkumardutta@gmail.com	Baliya Bedia, Obar Village, Jharkhand
16.	Growing of HRMN 99 Low Chilling Apple Variety in Non-Apple Areas	Laishram Yelhounganba Khuman, Innovation Fellow, National Innovation Foundation (NIF), Gandhinagar	laishram@nifindia.or g	Shyamchandra Meitei, Bishnupur, Manipur
17.	Leaf Grinder Used for Making Bio Manure	Sunita Halder & Anita Haldar Nature Bodies an SHG group, Bilaspur, Chhattisgarh	nbodies@gmail.com	Sunita Halder, Bilaspur, Chhattisgarh
18.	Multipurpose Processing Machine for Processing Fruits and Herbs to Make Food Products, Extract Essential Oils etc.	Mongshai Hanthing, Chairman, Taste of Noklak Society, Nagaland	mongsailam450@gm ail.com	Mongshai Hanthing, Noklak district, Nagaland & Dr Pritpal Kaur, IPS
19.	IoT-based Solar Charge Controller for Rural Electric Workshop – Solar Lantern	Kamlesh Bisht, Program Manager, Barefoot College, Rajasthan	kamlesh@swrctilonia. org;kamlesh1.bisht@gma il.com	Avinash Pudale, Rajasthan

20.	Low-Temperature Thermal Desalination Plants of One Lakh litres per day Capacity	Dr S V S Phani Kumar, Senior Scientist, National Institute of Ocean Technology (NIOT), Chennai	phani@niot.res.in	C N Shajahan, Superintending Engineer, Lakshadweep
21.	ASRLM Project with Clean Network	William Lahary, Arunachal SRLM Roing Block, TIDE Bangalore & Kiran Murthy	kiran.b@tide- india.org	Danggap Tayeng & Oimang Pertin, Arunachal Pradesh
22.	Socializing the Micro- Solar Dome: Empowering Rural SC, ST and Tribal Communities through Solar Illumination and Solar Electricity	Richik Ghosh Thakur, Scientist, NB Institute for Rural Technology (NBIRT), Kolkata	nbirt2012@gmail.com	Anil Das & Pol Rupini, West Tripura
23.	LED Bulb Unit	Dr Mrutyunjay Suar & Surekha Routray, Head-Social Incubation & CSR, KIIT-Technology Business Incubator (KIIT-TBI), Bhubaneswar	surekha@kiitincubator.in;mrutyunjay@kiitincu bator.in	Rina Rout, Chikarta, Berhampur
24.	Improved Mud Cookstove – PAVAK– for Disadvantaged Communities in Rural India	Dr Nitin Labhsetwar, Chief Scientist and Head, National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur	nklneeri@gmail.com	Tincy George, Deputy. General Manager – CSR, Glenmark Pharmaceutical s Ltd. and Prakash & Seema Prakash, Spandan Samaj Seva Samiti, Khandawa, Madhya Pradesh
25.	Improved Jaggery Making Plant –Gur Bhatti–	Dr Pankaj Kumar Arya, Principal Scientist, CSIR-Indian Institute of Petroleum (CSIR-IIP), Dehradun	pkarya@iip.res.in	Laxmi Narayan Boxi, Bhubaneshwar & Shri Parvesh Kamboj, Manoharpur (Biharigarh), Saharanpur, Uttar Pradesh
26.	Compact Food Waste Biogas Unit	Dr Krishnakumar B, Senior Scientist, National Institute for Interdisciplinary Science and Technology (CSIR- NIIST), Thiruvananthapuram	krishna@niist.res.in; kkbniist@gmail.com	Dipinnath R.S, Ecocure Technologies, Trivandrum
27.	Cotton Wick Making Machine	Shri Mahesh Patel, Scientist, National Innovation Foundation (NIF), Gandhinagar	mahesh@nifindia.org	Vijaybhai Solanki & Dipakbhai Vyas, Ahmedabad

28.	Innovations in Correctional Home: A Model of Inclusive Development-Cow Dung Pot-Making Machine	Tushar Garg, Scientist, National Innovation Foundation (NIF), Gandhinagar	tusharg@nifindia.org; tushar.scit@gmail.co m	Monica Dhawan, Director, India Vision Foundation (IVF) & Vikas Bhatnagar, Deputy Superintendent Jail, Lala Lajpat Rai & Open-Air Correctional Home, Dharamshala, Himachal Pradesh
29.	S&T Intervention Gives Traditional Water Mill A Lift	Dr Himani, Himalayan Environmental Studies and Conservation Organization (HESCO), Dehradun	himanipurohit9@gm ail.com	Heera Lal, Doiwala, Uttarakhand & Jai Singh Panwar, Ghantusera, Uttarakhand
30.	Solar and Biomass Driers for Mahua Processing and Vegetable Dehydration Energy-Efficient Jaggery Furnaces	Dr Kalpana, Centre for Technology & Development (CTD), New Delhi	ctd.delhi@gmail.com	Pehalwanji, Sugarcane Farmer, Bundelkhand, Uttar Pradesh
31.	Clean Energy	Dr Lal Singh, Director, Himalayan Research Group (HRG), Shimla	lalhrg@gmail.com	Dipal Singh
32.	Promoting Community Health by Addressing Incidence Waterborne Diseases in Village of Bihar	Dr Lalit Mohan Sharma, Principal Scientist, S M Sehgal Foundation, Gurgaon	lalit.sharma@smsfoundation.org	Sumit Singh, Field Coordinator, S.M. Sehgal Foundation, Bihar
33.	Integrated Approach for Augmenting Groundwater in Chirawa Block of Jhunjhunu District Rajasthan	Dr Bhupendra Paliwal, Project Manager, Ramkrishna Jaidayal Dalmia Seva Sansthan, Rajasthan	b.paliwal@dalmiatru sts.in	Dr Bhupendra Paliwal & Sanjay Sharma Ramkrishna Jaidayal Dalmia Seva Sansthan, Rajasthan
34.	Water Technologies Deployed at Rural Area of Bundelkhand, Madhya Pradesh	Satabdi Datta, Senior Manager, Development Alternatives (DA)	sdatta@devalt.org; zniazi@devalt. org	
35.	Cultivation of Aromatic Plants and Distillation of Aromatic Oils (Wild Marigold)	Dr Rakesh Kumar Rana, Institute of Himalayan Bioresource Technology (CSIR-IHBT), Palampur	rakeshkumar@ihbt.re s.in	Swarn Singh, Parwai, Chamba, Himachal Pradesh
36.	Food Processing of Value- Added Products	Bhopinder Mehta, Society for Technology and Development (STD), Mandi	stdmandi@gmail.co m	Karam Chand, Roshan Lal & Deepa Devi, Society for Farmers Development, Mandi, Himachal Pradesh
37.	Introduction to Basic Technology (IBT) Program for Secondary Schools	Dr Yogesh Kulkarni, Director, Vigyan Ashram	vapabal@gmail.com	
38.	Digital Clinic to Combat Primary Healthcare	Dr Satadal Saha, Founder & Mentor, JSV Innovations Private Limited, Kolkata	drsatadal.saha@gmai l.com	Pritikona Ghosh (Health worker, Barhra Cluster), Moumita Shit (Health worker, Sabang Cluster), West Bengal

39.	Newly Developed Anthocyanin Biofortified Black Wheat	Dr Monika Garg, Scientist, National Agri-Food Biotechnology Institute (NABI), Punjab	monikagarg@nabi.re s.in	Ashutosh Sharma, CEO, M/s Premier India Seed Company, Vidisha, Madhya Pradesh & Puneet Thind, Director, Northern Farmers Mega FPO, Ambala, Haryana
40.	Food Fortification Technology to Combat Primary Health Care Deficiencies and Economic Empowerment of Dwellers in Forest Fringe Villages	Dr A. Indhuleka, Professor, Sri Krishna College of Engineering and Technology (SKCET), Coimbatore	indhuleka@skcet.ac.i n	Dr A. Indhuleka, Professor & Dr V Ragavi, Professor, Sri Krishna College of Engineering and Technology, Coimbatore, Tamil Nadu
41.	Enhancement of Livelihood for Scheduled Caste Households through an ICT-Enabled Integrated Rural Nutrition Centre in Madukkarai Block of Coimbatore District, Tamil Nadu	Dr Janci Rani P R, Assistant Professor, Food Nutrition and Health Education Center, Amrita School of Engineering, Ettimadai Campus, Coimbatore	b_janci@cb.amrita.e du	Malathi, Madukkari block, Coimbatore district, Tamil Nadu & Annapurani, Madukkari block, Coimbatore district, Tamil Nadu
42.	Fluorosis Mitigation Through Intervention, Diet Editing and Management in Scheduled Caste Community of Bihar	Prof. A Shariff, All India Institute of Medical Sciences (AIIMS), New Delhi	shariff.a@gmail.com; ashariffaiims@gmail. com	Dr Bihari Singh, Centre for Fluorosis Research Center, A. N. College, Bihar
43.	Promoting a Pilot of Bio Sand Filters for Access to Clean Drinking Water for Future Dissemination	Dr Modem Sai Leela, St. Joseph's College for Women, Visakhapatnam	slmodem@gmail.co m	Laya Foundation, Visakhapatnam , Andhra Pradesh
44.	Empowerment of Women through Application of Multifaceted Biotechnological Innovations in Millets for Sustainable Income Generation and Nutritional Security	Dr Sangappa, Scientist, ICAR- Indian Institute of Millets Research (ICAR-IIMR), Hyderabad	sangappa@millets.res.in	Kavitha Beede, Tridala Mahila Society, Tugaon village, Bidar district, Karnataka
45.	Holistic Health: Traditional Siddha Varmam Therapy	Dr V Ganapathi, Director, Vivekananda Kendra-NARDEP, Kanyakumari	drvgdrvg@gmail. com;thirunarayanan.dr@g mail. com	Dr Thirunarayana, Suresh Jothi & Dr Bindya, Vivekananda Kendra- NARDEP, Kanyakumari, Tamil Nadu
46.	A New Approach towards Pain and Infertility Management in Women Suffering from Endometriosis and Adenomyosis	Dr Sunita Sharma, Senior Consultant, Institute of Reproductive Medicine (IRM), Kolkata	sunitapalchaudhuri@yahoo.com	Dr Sunita Sharma, Senior Consultant, Institute of Reproductive Medicine, Kolkata, West Bengal
47.	Computer-Aided Designing Software: DigiBunai	Dr Satyavir Singh, Principal Research Scientist, Digital India Corporation (DIC), New Delhi	satyavir@medialabas ia.in;satyavir@digitalindia.gov.in	Dr Satyvir Singh, Senior Research Scientist, Digital India Corporation, New Delhi

48.	Improved Technology for Attar Manufacturing	Sh S V Shukla, Principal Director, Fragrance and Flavour Development Centre, Uttar Pradesh	shakitiffdc@gmail.co m;ffdcknj@gmail.com	S V Shukla, Principal Director, Fragrance and Flavour Development Centre, Kannauj, Uttar Pradesh
49.	Charcoal Briquette from Agro-Waste	Dr Daya Srivastava, Scientist, Krishi Vigyan Kendra, Sitapur, Uttar Pradesh	sitapurkvk2@gmail.c om;dayaicar@gmail.com	Saheli, Bhim Rao Ambedkar SHG; Savitri & Geeta, Laxmi SHG; Samsun, Madeena SHG; Phool Kumari, Ekta SHG; Aneeta, Radha SHG, Uttar Pradesh
50.	Women-friendly Farm Mechanization in Various Agricultural Implements	Dr R Senthil Kumar, Scientist, ICAR-Central Institute of Agriculture Engineering (ICAR-CIAE), Bhopal	vsenagri@gmail.com	Dr R Senthil Kumar, Scientist, ICAR-CIAE
51.	Technology based Coconut Fiber Extraction and Value addition	Dr Reghu Rama Dasal, Joint Director, Mitraniketan, Trivandrum	kvmitraniketan@gma il.com	Dr Reghu Rama Dasal, Joint Director, Mitraniketan, Trivandrum
52.	Agro -Technology Equipment on Drudgery Reduction	Dr S.Nagarathinam & N.Paramanantham, Madurai Kamaraj University, Madurai	snagarathinam@gmai l.com	Dr K. Selvarani, Assistant Professor, Kalasalingam School of Agriculture and Horticulture, Tamil Nadu
53.	Modernization of Traditional Pottery	Dr M. Lalithambika, Former Director, Integrated Rural Technology Centre (IRTC), Palakkad	lalithambika43@gma il.com	Dr M. Lalithambika, Former Director, Integrated Rural Technology Centre (IRTC), Palakkad
54.	Pepper Thresher Machine-Innovation Science Technology Entrepreneurship Development project (i- STED project)	Dr Siby Joseph, Programme Director, Peermade Development Society (PDS)	sibypaloorkavu@gmail.com; pdsngo1980@gmail.com; pds@pdspeermade.com	P. K. Ravi, Pepper Thresher Machine, Idukki, Kerala
55.	Crop Residue Biomass Composting Demonstration Units	Prof. B.M. Musthafa, Research Coordinator, Integrated Rural Technology Centre (IRTC), Palakkad	musthafachittur@rediffmail.com	
56.	Namami Gange Praharis	Dr Deepika Dogra, Ganga Prahari Programme Coordinator, Wildlife Institute of India (WII), Dehradun	dddeepikadogra@gmail.com	Dr Deepika Dogra, Ganga Prahari Programme Coordinator, Wildlife Institute of India, Dehradun, Uttarakhand
57.	Hameri Work & Honey Bee Farming	Dr Vishaish Uppal, Director, Governance, Law & Policy, World Wildlife Fund (WWF), New Delhi	vuppal@wwfindia.ne t	Sheela Devi

58.	NAVACHAITHANYA: Herbal Processing Unit	Dr N. Anil Kumar, M.S. Swaminathan Research Foundation (MSSRF), Community Agro Biodiversity Centre (CAbC), Wayanad, Kerala	anilmaruthur@gmail. com;anil@ mssrf.res.in	N. Anil Kumar, M. S. Swaminathan Research Foundation (MSSRF), Community Agro Biodiversity Centre (CAbC), Wayanad, Kerala
59.	Assessment of Bone Health in Transgender Population	Dr Rajesh Malhotra, Professor, All India Institute of Medical Sciences, New Delhi	rmalhotra62@gmail.c om	Rani Patel, Founder & President, Shashi Sahai; Dipika Thakur & Ram Prakash, Aarohan (NGO), New Delhi
60.	Eco-friendly utilization of hazardous pine needles for social benefits	Dr Arti Kashyap, Associate Professor, IIT Mandi, Himachal Pradesh	arti@iitmandi.ac.in;arti.kashyap@ gmail.c om	Lakshmi, Founder, Laksshya, Mandi, Himachal Pradesh
61.	Climate Resilient Farming Technology	Dr Shiraz Wajih, Director, Gorakhpur Environmental Action Group (GEAG), Gorakhpur	geag@geagindia.org; mis@ geagindia.org	Archana Srivastava, Innovation and Technology Cell, Pachgawan, Jungle Kaudia, Gorakhpur
62.	Beach Nourishment through Dredging	R. Saravanan, Scientist, National Institute of Ocean Technology (NIOT), Chennai	rsaravanan.niot@gov. in;sarvan@ niot.res.in	
63.	– Mouli – the Rock Bee Honey Hunters in Sunderbans	Dr B.K. Datta, Director, Vivekananda Institute of Biotechnology (VIB), West Bengal	vibsran@gmail.com	Badal Chandra Maity, West Bengal
64.	Handloom with Jacquard Weaving and Design- Based S&T Intervention for Product Development	Dr Dipankar Neog, Principal Scientist and Head, CSIR-North East Institute of Science and Technology (CSIR-NEIST), Assam	neog.dipankar@yah oo.com;dneog@neist.res.in	Prakash Thakur, Secretary, NGO SNEHPAD, Jorhat, Assam
65.	Wireless Sensor Systems for Landslide Early Warning in Munnar, Kerala	Dr Maneeha V Ramesh, Amrita University, Coimbatore	renjithmohan@am.amrita. edu;maneesha@amrita.edu	Selvakumar, Munnar
66.	Technological Intervention in Value-Added Livestock Product	Dr Arvind Kumar, Senior Scientist, Sher-e- Kashmir University of Agricultural Sciences & Technology (SKUAST), Jammu	drarvindlpt@gmail.c om	Sushma Devi, Kaushal Jammu Milk Producer Company Ltd.
67.	Nursery Business Based on Seasonal Crop Species	R. D. Deshmukh, President, Appropriate Rural Technology Institute (ARTI), Maharashtra	hanbar.deshmukh@gmail. comarticontact@gmail.co m;arti. phaltan@rediffm ail.com	Ramakant Narayan Prabhune, ARTI, Phaltan, Maharashtra
68.	Technology Developed for Upliftment of The Tribal Community of Ladakh Region	Dr Vikas Gupta, Subject Matter Specialist Plant Protection, Krishi Vigyan Kendra Leh (Ladakh), Leh	vgskuastpathology@ gmail.com	Dr Vikas Gupta, Subject Matter Specialist Plant Protection, Krishi Vigyan Kendra, Leh (Ladakh)

69.	Electronic Jacquard Handloom from Grass Weaving	Dr Abhijit P. Deshpande, Professor, Indian Institute of Technology (IIT) Madras	abhijit@iitm.ac.in;apdeshpande@smail.i itm.ac.in	Dr S Ganesan, Project Advisor, RuTAG-IITM
70.	Spinning on Ambar Charkha Weaving on Handlooms Sheep Wool shearing through Machine	Dr Mohd. Tufail, Assistant Professor, Govt. Post Graduate College Rajouri, Jammu and Kashmir	tufailjnu@gmail.com;gdcrajouri@gmail.co m	Dr Mohd. Tufail, Assistant Professor, Govt. Post Graduate College Rajouri, Jammu and Kashmir
71.	Establishment of Rural Nutri-Bakery for Fulfilling Nutritional Requirements And Income Generation of Tribal and Rural Communities	Dr S. R. Azad, Madhya Pradesh Vigyan Sabha, Madhya Pradesh	mpvs.bpl@gmail.com;srazad61@gmail.com	Fhoolbati & Kailash Malgam, Durga SHG, Harshdiwari; Sumarbati & Dinesh Dhurvey, Dropadi SHG, Markadhana
72.	Establishment of Coastal Fisheries Information Hub	Dr R Kiruba Sankar, Scientist, ICAR-Central Island Agricultural Research Institute (ICAR-CIARI), Port Blair	rkirubasankar@gmail.com	Mena Thomas, Port Blair
73.	Gramin Krishi Mausam Sewa	Dr K. K. Singh, Scientist, and Head, India Meteorological Department (IMD), New Delhi	kksingh2022@gmail. com	Pritam Singh, Jageer Singh, Arveend Kumar, Mahaveer Singh & Arvind Singh, Bulandshahr, Uttar Pradesh
74.	Impact of Aromatic Crops Cultivation in Aspirational District Nandurbar for Uplifting the Tribal Farmers' Income	Ashween Deepak Nannaware, Principal Scientist, CSIR-Central Institute of Medicinal and Aromatic Plants (CSIR-CIMAP), Lucknow	ad.nannaware@cima p.res.in	Devendra, Nandurbar, Maharashtra
75.	Value-added Products from Natural Plant Material	Prof. Vivek Kumar, Indian Institute of Technology (IIT) Delhi	vivekk@iitd.ac.in	Chakrabhushan Pandey, Y.P. Singh & Meeta Biswas

List of Experts in Techनींव@75

1. Padma Bhushan Dr Anil Prakash Joshi, HESCO, Dehradun
2. Dr Vipin Kumar, National Innovation Foundation (NIF), Gujarat)
3. Dr Sunil Nautiyal, Institute for Social and Economic Change, Bengaluru
4. Dr Chandan Tamuly, CSIR-NEIST Branch Lab Itanagar, Arunachal Pradesh
5. Padma Shri Dr Uddhab Kr. Bharali, Ambassador cum Advisor, DRL-DRDO, Tezpur, Ministry of Defense, Govt. of India
6. Dr Girish G. Sohani, President, BAIF Development Research Foundation, Pune, Maharashtra
7. Dr Rakshak Kumar, CSIR-Institute of Himalayan Bioresource Technology, Palampur, Himachal Pradesh
8. Padma Shri Lakhimi Baruah, Founder, Konoklata Mahila Urban Cooperative Bank for Women, Jorhat, Assam
9. Mr. Nitin Saluja, Amazon India's Senior Policy Manager for Customer Trust
10. Swami Bhaveshananda, Secretary, Ramakrishna Mission Ashram, Ranchi
11. Dr Parag M. Solanki, Scientist in Charge, CSIR-CGCRI Naroda Centre
12. Dr Augustus Suting, State Council of Science, Technology & Environment, Nongrim Hills, Shillong, Meghalaya
13. Mr Kemfort M. Sangma, East Garo Hills, Meghalaya
14. Padma Shri Dr. Anil K. Gupta, Founder Honeybee Network, National Innovation Foundation
15. Padma Shri Sh. Nanadro B Marak, Organic farmer, West Garo Hills of Meghalaya
16. Dr Vivek Kumar, Scientist and Regional Coordinator – Eastern region, National Innovation Foundation – India
17. Dr Nitin Maurya, Scientist, National Innovation Foundation – India
18. Padma Shri Sh.Ali Manikfan, Minicoy Island, Lashadweep.
19. Sh. Sanjit Bunkar Roy, Founder – Barefoot College, Rajasthan
20. Dr. S V S Phani Kumar, Scientist, National Institute of Ocean Technology, Chennai, Tamil Nadu
21. Dr Svati Bhogle , TIDE, Bengaluru
22. Dr K Sumathy, TIDE, Bengaluru
23. Padma Shri Dr. Sharad P. Kale, Head- Technology Transfer and Collaboration Division, Bhabha Atomic Research Centre, Mumbai
24. Prof. S.P. Gon Chaudhuri, President, NBIRT, West Bengal
25. Dr Gaurav Mishra, Director, Sardar Patel Renewable Energy Research Institute (SPRERI), Anand, Gujarat
26. Prof. Saroj Nayak, Professor & Dean at IIT Bhubaneswar
27. Padma Shri Sundaram Verma, Social Worker, Environmentalist and Innovator
28. Shri Vikas Bhatnagar, Deputy Superintendent Jail, Lala Lajpat Rai, Distt. & Open-Air Correctional Home, Dharamshala, Distt Kangra
29. Padma Shri Mr S. Damodaran, Social Worker Tamil Nadu
30. Dr Laxman Prasad, Group Advisor, RKG Gp of Institutions GZB and Ex-Advisor DST, GOI
31. Prof. P. Rajendra Prasad, Sir Arthur Cotton Geospatial Chair Professor, Visakhapatnam
32. Dr Lalit Mohan Sharma, S M Sehgal Foundation, Gurgaon, Haryana
33. Padma Shri Dr Chandrakant S. Pandav, Member, National Council for India Nutritional Challenges, Delhi

34. Dr Renu Agrawal, Ex. Chief Scientist, CSIR-CFTRI, Mysore

35. Dr Sanjay Kumar, Director, CSIR-IHBT, Palampur, Himachal Pradesh

36. Mr Bhopinder Mehta, Society for Technology and Development, Himachal Pradesh

37. Dr Jatinder Kishtwaria, Former Director, ICAR CIWA Bhubaneswar, Odisha

38. Dr Ashwani Pareek, Director, National Agri-Food Biotechnology Institute, Mohali, Punjab

39. Dr Satadal Saha, Founder & Mentor, JSV Innovations Private Limited, Kolkata, West Bengal

40. Padma Shri Dr Leela Joshi, Indian Gynecologist and Noted Social worker, Madhya Pradesh

41. Dr S. R. Rao, Former Sr. Advisor, DBT, Ministry of Science & Technology, India

42. Dr Sridevi Annapurna Singh, Director, Central Food Technological Research Institute-CSIR, Mysore, Karnataka

43. Dr Bihari Singh, Centre for fluorosis Research Center, A. N. College, Bihar

44. Padma Shri Dr Anil K Rajvanshi, Director and Hon. Secretary, Nimbkar Agricultural Research Institute (NARI), Phaltan, Maharashtra, India

45. Dr George John, Former Sr. Advisor, DBT, Ministry of Science & Technology, India

46. Dr Pulok K Mukherjee, Director, Institute of Bioresources and Sustainable Development, Imphal, India

47. Dr Thirunarayana, Vivekananda Kendra-NARDEP, Kanyakumari, Tamil Nadu, India

48. Mr Chandrashekhar Joshi, DFO, Ramnagar Forest Division, Dehradun, Uttarakhand

49. Dr D P Uniyal, Joint Director, Uttarakhand State Council for Science and Technology, Govt. of Uttarakhand, India

50. Dr Nakul Parashar, Director, Vigyan Prasar, DST

51. Dr Vishaish Uppal, Director, Governance, Law & Policy, WWF, Dehradun, Uttarakhand

52. Dr Deepika Dogra, Ganga Prahari Programme Coordinator, Wildlife Institute of India, Dehradun, Uttarakhand

53. Dr Kinkini Dasgupta Misra, Scientist-F, Vigyan Prasar

54. Padma Shri Sh Girish Yashwant Prabhune, Founder, Punarutthan Samarasata Gurukulam, Pune, Maharashtra, India

55. Smt Radha Ashirit, Deputy Director General, DMEO, Niti Aayog New Delhi, India

56. Sh S V Shukla, Principal Director, Fragrance and Flavour Development Centre, Kannauj, Uttar Pradesh, India

57. Mr Dibya Jyoti Puzari, Senior Fashion cum Textile designer, Jorhat, Assam, India

58. Padma Shri Sh Hukumchand Patidar

59. Dr C R Mehta, Director, ICAR-CIAE, Bhopal

60. Dr S.Nagarathinam, Professor, Madurai Kamraj University

61. Dr Reghu Rama Das, Joint Director, Mitraniketan, Kerala

62. Dr Ajit Prabhu V., Chief Scientist, Technology Development & Project Management Division (TDPMD), Kerala State Council for Science Technology and Environment

63. Dr M. Lalithambika, Former Deputy Director, CSIR-NIIST

64. Dr Siby Joseph, Programme Director, Peermade Development Society, Idukki Dist. Kerala

65. Dr Namita Brahma, Centre for Ecology, Environment and Sustainable Development, TISS Guwahati Campus

66. Padma Shri Prof. Najma Akhtar, Vice Chancellor, Jamia Millia Islamia, New Delhi

67. Dr Rajesh Malhotra, Professor, Department of Orthopaedics, AIIMS, New Delhi

68. Dr N Anil Kumar, Senior Director, MSSRF Community Agrobiodiversity Centre, Kerala

69. Dr Arti Kashyap, Associate Professor, IIT Mandi, Himachal Pradesh

70. Dr Debapriya Dutta, Head-SEED Division, DST
71. Dr Heera Lal, IAS, Ad. Managing Director, National Health Mission and Project Director, UP AIDS Control Society
72. Dr Shiraz Wajih, Director, Gorakhpur Environmental Action Group (GEAG), Gorakhpur, UP
73. Dr R. Saravanan, Senior Scientist, National Institute of Ocean Technology (NIOT), Chennai, Tamil Nadu
74. Dr B.K. Datta, Director, Vivekananda Institute of Biotechnology (VIB), Sri Ramkrishna Ashram, Nimpith
75. Dr Ketaki Bapat, Senior Scientist, Office of the PSA to the GoI
76. Sh. Prakash Thakur, Secretary, NGO SNEHPAD, Assam
77. Sh. Selvakumar, Munnar , Kerala
78. Ms Sushma Devi, Kaushal Jammu Milk Producer company ltd, Deoli Village, Jammu
79. Dr G Mahesh, Senior Scientist, CSIR
80. Dr Jatinder Kaur Arora, Executive Director, Punjab State Council for Science & Technology
81. Dr Abhijit P. Deshpande, Professor, IITM
82. Mrs. Dhanshri Prasad Badave, Secretary, Rajamata women Self Help Group, Phaltan
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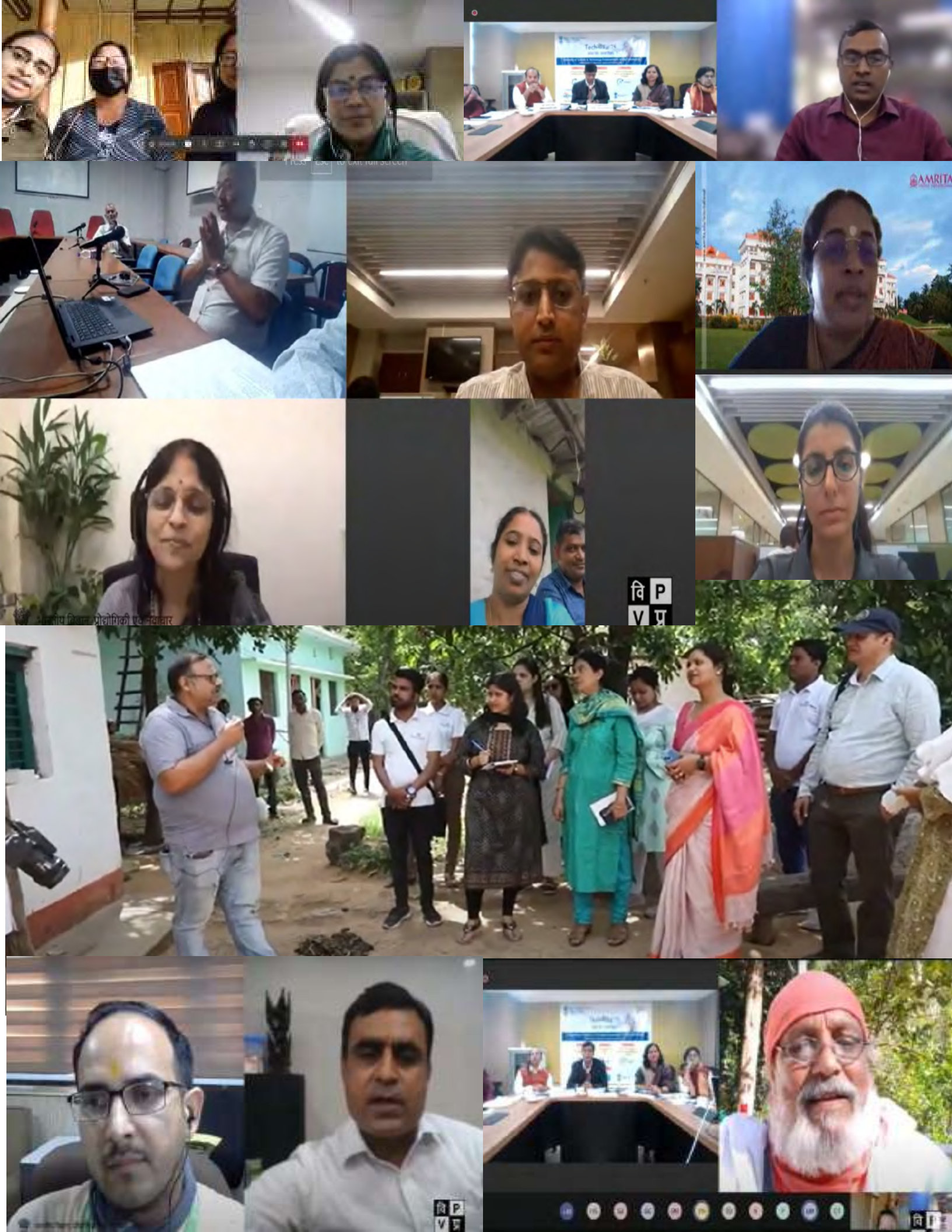

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