

CLARA
Centre for
Technology
Alternatives for
Rural Areas

2018-20



Technology & Development

**M.Tech & PhD
Brochure**



IIT Bombay

Introduction

The Centre for Technology Alternatives for Rural Areas (CTARA), is an independent center at IIT Bombay started in 1985 with the purpose to sensitize technical professionals to the problems of rural India. CTARA has an M. Tech. and a Ph. D. program in 'Technology and Development' since 2007. We train our M. Tech. graduates in the skills and perspectives about role of Government, Social Institutions and Technology for sustainable development. CTARA graduates are trained to analyze development situations and design data-driven, need-based and human-centric technological and policy solutions. Students have different undergrad backgrounds like Mechanical, Civil, Electrical, Electronics, Agriculture, Architecture and Town Planning.

In order to develop analytical, operational and sectoral understanding, students are exposed to a plethora of courses based on Agriculture, Water, Nutrition, Energy, Policy and Development and allied sectors. Additionally, Social Science Research Methods, Advance Statistics, Appropriate Technology and Project Management courses helps to build the analytical thinking. Various labs like soil testing, food testing, environmental, energy, along with workshop and TCTD fab lab enables students to understand the concepts experimentally. Ground level exposure is given to students through field visits to interior rural areas. The 9 week field stay for M. Tech and 4 week stay for Ph. D. students in a village help students understand "exactly where the shoe pinches". Here the students collect and analyze primary raw data, study various sectors and government schemes followed by a focused research on at least 2 problems by performing an exhaustive need assessment study through PRA activities. The students develop perspective and build it through M. Tech projects during their second year.

The students of CTARA are trained in qualitative and quantitative research methodology, policy aspects and devising appropriate technology with a strong focus on its dissemination to the masses. They are the next generation development professionals who are technologically advanced but resolve to use it for the betterment of rural India.



Faculty Profile

Prof. Satish B. Agnihotri

Professor and Head of the Department

Research Interests:

Child Malnutrition, Renewable Energy and Energy Policy, Gender, Rural Development and technology Scale-up, Use of Mapping Techniques in Social Sector Planning, Public Policy, Street Level Bureaucracy,

Prof. Anand Rao

Research Interests:

Energy and Environment, Climate Change, Carbon Capture and Sequestration, Renewable and Energy Efficiency, Sanitation and Waste Management, Rural electrification, Energy Policy and Planning, Technology Assessment.

Prof. N C Narayanan

Research Interests:

Water Policy and Governance, Environment and Development (Political Ecology), Scaling up Technology Alternatives, Development Theory, Public Policy, Decentralisation and Local Governance, Trans-disciplinary Research (Concept and Practice).

Prof. Pennan Chinnasamy

Research Interests:

Surface water and Groundwater Modeling, Water Accounting and Budgeting, Remote Sensing and Climate Change Impact on Water Resources.

Prof. Pankaj Sekhsaria

Research Interests:

Science and Technology Studies, S&T Visioning and Policy making, Technology, Society and Development, Environment and Development, Citizen Science, Wildlife Conservation, Island Studies, Andaman and Nicobar Islands, Media Studies.

Adjunct Faculty

Prof. Rupal Dalal

Research Interests:

Maternal, Infant & Young Nutrition, Early Childhood outcomes, Importance of Correct Breastfeeding Techniques, Behaviour Change of Caregiver through Counselling and Training.

Prof. Amit Arora

Research Interests:

Bioenergy, Bioprocessing, Downstream Processing, Food Processing, Membrane Separations, Process Design and Development, Microwave Technology, Paper and Pulp Engineering.

Prof. Milind A Sohoni

Research Interests:

Combinatorial Optimization, Mathematical Programming, Algorithms, Drinking Water for Rural Areas, Development Engineering.

Prof. Narendra Shah

Research Interests:

Food Process Engineering, Food-Nutrition Connect, Small Scale Bio-Energy Applications, Agro-based Industrial Development.

Prof. Bakul Rao

Research Interests:

Environmental Impact Framework for Rural Areas, State of Environment Studies, Field Assessments & Remediation, Matrix Characterization, Climate change.

Prof. Priya Jadhav

Research Interests:

Rural Electrification, Energy efficiency, Energy Usage in Irrigation: Technology and Farmer Behavior, Solar Photovoltaics, Organizational Models in Electricity Distribution.

Prof. Subodh Wagle

Research Interests:

Analysis of On-Ground Performance of Public Policies, Policy and Institutional Dimensions of Solar Technology Dissemination, Analysis of Regulatory Governance in India, Urban Water Issues.

Prof. Vishal R. Sardeshpande

Research Interests:

Thermal Engineering and Heat Transfer, Product Development, Energy Efficiency and Benchmarking, Solar energy, Social enterprise, Technology for Rural MSME (Micro Small Medium Enterprises), Biogas / Biomass Systems.

Ergonomics and possible automation in jaggery making |

Project was to understand the physiological load imposed on the jaggery making workers, and attempts had been made to understand the physiological cost of the entire work content and their time-based relation by following the Time-Motion analysis and Heart Rate measurement techniques. Based on the severity of strain suffered by workers, measured as energy expenditure, tasks were ranked and rankings were used to select tasks after which prototype for assistive devices were designed, fabricated and tested.

Impact/ Outcome : It helped to reduce energy and time in manually-intensive production activity in jaggery making which is being threatened in many states of India due to labour disinterest.



Economic Feasibility Study of Small Scale Dal Mills in Vidarbha Region and Value chain analysis of Pulses |

With the help of extensive field data for price variation and supply and demand analysis for pigeon pea, this study attempted to show that the farm level milling provides more income to the small and marginal farmers by primary value addition to agricultural produce.

Impact:

Impact/ Outcome : This analysis showed that the pulses value addition requires low cost, easy to maintain having benefit cost ratio of 2.5. Thus, this technology is helpful for agripreneurs to improve the distress condition of farmers .



Design & Development Of A Small Scale Turmeric Processing Plant For Waigaon Village in Wardha District |

This project optimized curcumin content by studying different processes and experimenting it. The curcumin result of all processes were compared by varying parameters which affect quantity of curcumin with statistical tool which help in developing sustainable turmeric economy.

Impact/ Outcome : This project helped to reduce druggery in turmeric post harvest processing. It also increased profitability due to curcumin more retention of curcumin content.

Design and development of an integrated Curing and Storage structure for onions |

Aim was to develop a Climate agnostic Storage structure for Onion. Due to mismanagement in Post harvesting and storage process, 50-60% of Onion get wasted (Weight loss, Rotting and Sprouting). Project aimed to create Cost effective storage structure using Vapour compression refrigeration system and Ultrasonic humidification system to control inside environmental conditions.

Impact/ Outcome : Project is in research stage and preliminary results are positive and indicates prevention of losses to good extent



Analyse & Understand Agriculture Energy Usage of Maharashtra & Develop Methodology for Determining Energy Consumption on Un-Metered Agriculture Consumers |

Studied the crop pattern through surveys in 14 zones of Maharashtra, calculated water requirement with Blaney-Criddle formula and estimated the hours of pumping taking irrigation methods in to account. Energy consumption is measured based on average pumping hours of major crops and their pattern. Conducted feeder level audit of energy data and compared with the calculated energy consumption.

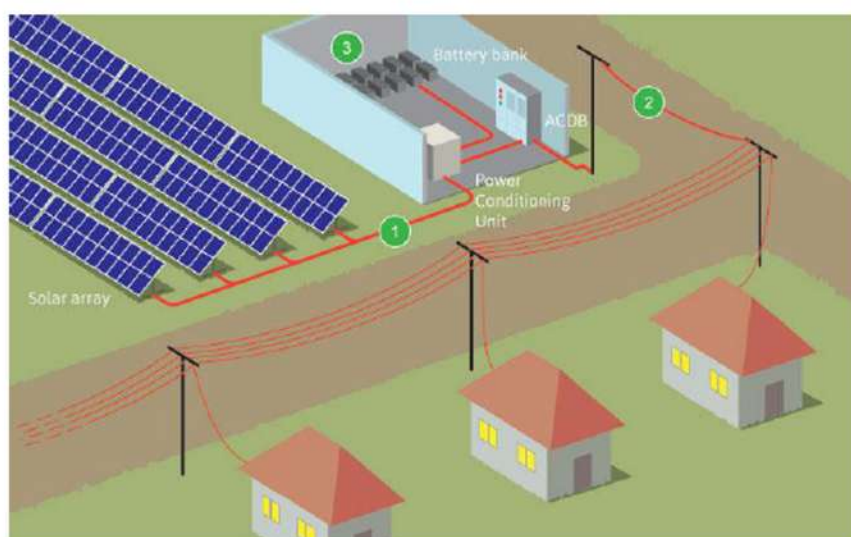
Impact/ Outcome : Efficient metering and clarity in supply to agriculture will lead to better health of the distribution utility and hence better supply to rural consumers.



Microgrid based electrification of a remote tribal hamlet in Maharashtra |

Developed a microgrid, a complete system capable of generating and distributing reliable energy to consumers. Assessed the electricity requirements and various alternative solutions by which electricity services could be provided and chose solar photovoltaic microgrid. Built the organisational and financial model to manage the system and ensure sustainability. A detailed project report for the alternative to be implemented was prepared and handed over to a government agency for funding..

Impact/ Outcome : A microgrid can be an important technology pathway for electrifying remote rural villages or hamlets and improve the standard of living of many.



Alternative business models for deployment of solar PV applications in rural areas |

Various socio-economic, technical and market barriers were studied through case studies surveys and interactions with various stakeholders and found that the presence of local market, Innovative finance mechanism for affordability and awareness were the main factors influencing consumer behaviour.

Impact/ Outcome : To promote sustainable renewable energy technologies among rural areas all the factors that influence the decision-making need to be studied and implemented.

Remote Monitoring for Solar Photovoltaic Systems using GSM Voice Channel |

Most of the off-grid solar PV installations in remote areas lack appropriate and reliable monitoring. For better performance and maintenance the Parameters of solar PV systems should be monitored continuously. GSM Voice channel helps to help to monitor the system remotely.

Impact/ Outcome: This helps to gain the confidence of the people who are opting for solar PV solutions and leads to further acceptance of solar PV solutions not only in rural but also in urban areas.

Key Projects

Health & Nutrition

Evidence based Multi-Sectoral Nutrition Planning (MSNP) for high burden district in Assam |

The study approaches the problem of malnutrition through various socio-cultural perspectives which include role of Dais, role of mother's education, sanitation and health infrastructure

Impact/ outcome : The analysis brings out the importance of region specific plan due to wide variation between the state and district level features. It suggests the importance of inclusion of Dais into the district action plan due to their large involvement with society.



Tackling child malnutrition: introducing an innovative training approach |

The project aimed to develop ICT based tools to bolster the working of ICDS system through introducing interactive app based features which can be used by AW/Ws to manage the children in her Anganwadi Centre.

Impact/ outcome : A pilot study was done to test the acceptance of the tool and satisfactory results were found. The study showed that proper channelizing of ICT tools to Anganwadi workers through training can enhance their efficiency



Formulation of health-drink for malnourished children of age group 6-24 months |

The health drink is one of the possible solution considering non-penetrability of the commercially available products in the market. They can prove to be helpful if used along with RuTF. Thus, they are one of the considerable alternatives to RuTF when it comes to treat malnourished children.

Impact/ Outcome : Health drinks were developed to treat SAM and MAM children and a pilot study was conducted in Mumbai-Sion Hospital in collaboration with CTARA. The product showed good weight gain if consumed in recommended amount.

Key Projects

Education & Services

The study on ICT interventions in School education in Kerala |

Education sector is crucial as It is the backbone of the development of the society. The study was done by Jaykrishanan M. The research was focused on finding Scope and limitations of the kerala model in the other contexts. It utilizes the assessment framework and tried to identify the perceived outcomes.

Impact/ Outcome : The study provided reaffirmation of the fact that understanding technology-society linkage and tailoring the technology to suit the societal needs are crucial for an effective technological intervention.

Evaluating the Efficacy of FOSS education in villages and remote areas |

In another project titled 'Evaluating the Efficacy of FOSS education in villages and remote areas' by Anurag Kumar, case study was conducted on a sample of students, including school children, unemployed youth, housewives and school dropout. The study investigated the methodologies of teaching and learning strategies adopted by different people based on varying age group, gender and educational qualification, used to acquire basic levels of computer literacy and education in a minimal way.

Impact/ Outcome : Study suggested that an affordable computer with free and open source software (FOSS) with an interactive medium of learning through audio-visual interaction can provide equal opportunity. Further it would be helpful for different people or children from all types of socioeconomic and cultural backgrounds to achieve basic levels of literacy and education.

Design modifications in RuTAG IIT Bombay fish cages for inland aquaculture |

The study focused on dimension modification of RuTAG fish cages and modification in RuTAG design to make it less costly as RuTAG cages are relatively costly than the other structures available in the market for cage fishing. The modified designs were analysed using SAP 2000 for structural stability in different load combination and compared with each other, being threatened in many states of India due to labour disinterest.

Impact/ Outcome : This project had the potential to increase fish production in inland water reservoir and generate livelihood. Encouraged by the success of the project, the Ministry of Tribal Development, Govt. of Maharashtra had approved funds for



Study of Business Performance and Sustainability of Producer Companies |

The study was performed on the business performance and sustainability of PCs with the help of an analytical framework based on the similar studies done on agri-business enterprises, cooperatives and micro-finance institutions. The issues related to governance and management, capital and membership was studied and analysed.

Impact/ Outcome : The application of the framework was made on the current designs of PCs based on the financial data and various observations are made through field visits to PCs and interviews with stakeholders. The analysis showed that the producer companies and its promoter should carefully plan its business strategy in accordance with the demands of the market.



Scope of Livelihood Generation from Valorisation of Pineapple Waste |

The study focused on the mapping and quantification of the pineapple waste generation in the two-major pineapple growing regions in India – West Bengal and Karnataka. The composition analysis of pineapple leaves was done to understand the possible value addition alternatives and the alternatives were analysed for their techno-economic feasibility.

Impact/ Outcome : Reusable value added products such as bioethanol, composites, organic acids, xylitol can be extracted from pineapple leaves. The biorefinery approach could be formulated to effectively and efficiently use the pineapple waste as a promising source for livelihood generation for farmers.

A Pragmatic Approach to Develop an ICT Tool for Citizen Empowerment |

The study was aimed at facilitating the understanding of each scheme and the identification of barriers in service deliveries at the user level. A sophisticated tool was developed in the study with the objective of Services on demand and Digital Empowerment of Citizen of Digital India to Rural Areas. Impact/ Outcome : Project is in research stage and preliminary results are positive and indicates prevention of losses to good extent. Impact/ Outcome : The approach developed would help in the proper delivery of the services and benefits. A huge opportunity would be created for MoRD as well as local level institutes to transfer the knowledge of various government schemes.



Key Projects

Water Resources

Modelling and Water Balance for Highly Irrigated Area in Sinnar |

Impact of Diversion based Irrigation (DBI's) at Village level were studied. Built water balance and modeling at the village level. Built groundwater model and simulated in steady-state condition using MODFLOW software.

Impact/ Outcome : Due to the presence of canal water, flow increases in the hillside from 2.8 TCM/day to 5.27 TCM/day.



Deployment of A Designed Protocol for Evaluation of the Performance of Jalanidhi (Rural Drinking Water) Project in Kerala |

This Project suggests the intervention to make governance in rural water supply schemes better and making technical education more real-world oriented by deploying students or academic institutions to take the analytical role.

Impact/ Outcome : This study provides large scale data which helps the Gram Panchayats bringing in Transparency and Accountability in the governance of drinking water supply schemes by evaluation and monitoring.



Implementing Climate Resilience in Agriculture |

The concepts of climate change such as risk, vulnerability, adaptive capacity, climate resilient agriculture were analysed by different sources and link it with mitigation strategies in Maharashtra state. Impact/ Outcome : Improvement in Accessibility to protective irrigation, providing information regarding water availability before rabbi season.

Key Projects

CSR

Role of corporate social responsibility in achieving sustainable development goals for India |

It has been observed that Schedule VII, Companies Act 2013 listed activities are vague in nature and companies are failing to make an achievable impact with their work.

SDGs have given us specific target-oriented time- bound goals, targets, and their indicators that are in line with the CSR motives (except culture and sports related activities).

Project used statistical technique to understand the trend in CSR spending pattern of the companies of India. On the basis of that model was proposed through which academic institutions can assist government through its programs and schemes and businesses through its CSR activities achieve SDGs by 2030.to assist government

Impact/ outcome : Academic institution will play a crucial role in supporting Government and businesses to achieve SDGs group effectively and model help for their inclusion.

Status of Corporate Social Responsibility in India. CSR Dashboard Design to Facilitate Transparency and Accountability |

This study describe key aspects of this CSR legislation, points out various lacunae in the legislation and the implementation of CSR activities, suggests recommendations to address these issues and proposes an online web portal model for standardising CSR reporting.

Impact/ Outcome : Online web portal help the Ministry of Corporate Affairs to facilitate transparency and accountability for companies performing their CSR activities.

Key Projects

Monitoring & Evaluation and Impact Studies

1. Evaluation of Pradhan Mantri Gram Sadak Yojana (PMGSY) |

Subsequent to MoRD fellowship project on life cycle assessment of PMGSY and on developing deterioration models for PMGSY roads in Maharashtra, a team under Prof. Bakul Rao evaluated the implementation of PMGSY roads in Maharashtra. The whole scheme was evaluated for its implementation and monitoring with appropriate sampling. The evaluation was carried out with respect to physical financial progress, scheme's achievements, technical quality, environmental and social impact assessment.



Evaluation of Hilly Area Development Program (HADP) |

Evaluation studies for implementation of developmental programmes which are specially planned for development of Hilly Areas of Maharashtra were conducted for Directorate of Economics and Statistics, Planning department, GoM. The evaluation of the scheme was done in 22 hilly districts of Maharashtra with respect to parameters such as implementation on ground, procedures followed, and quality of the infrastructures developed through HADP.



3. Evaluation study of MOIL CSR activities by BAIF-MITTRA |

The CSR activities implemented by BAIF NGO through the CSR fund of MOIL Ltd. were assessed for its impact on ground. This evaluation study provides analysis based on secondary data and primary data collected through household level survey in the project villages. The project is executed in three clusters and has multiple activities. Segregated comments by activities, with special remarks about clusters are provided in the report.

Key Projects

Environmental Services & planning

Design of WATSAN for a large village or small town |

The project is sponsored by WHEELS Global and Niswarth (WIN) Foundation. The project is design and planning of four environmental services i.e. water, sanitation, storm water and solid waste management through integrated approach for a small town. Vadgaon Maval and Faizpur are two towns selected for this as case study and the whole project is with participation of all elected members as well as government representatives of the town. The project aims at designing and preparing guidelines all four environmental services for small towns.



Route mapping and optimization for solid waste management using GIS |

An attempt was made by M.Tech student for selection of site for solid waste and optimization of best routes for collection and transportation using Remote Sensing, Geographical Information System (GIS) and multi criteria information approach. The same model is being used for design and optimization for various small towns.

Key Courses

Details of course structure are available on department website:

<http://www.ctara.iitb.ac.in/en/academics/mtech-course-structure>

Elective Courses :

Agro-Based Industries: Design and Case Studies

Biofuels: Technology & Policy Perspective

Technology in Practice (Advanced Statistics)

Development Monitoring & Evaluation

Energy Policy and Planning

Food Processing and Nutrition Delivery

Core Courses :

-Project Management and Project Analysis

-Social Science Research Methods
(Basic Statistics and Qualitative Analysis)

-Public Policy and Governance in
Technology & Development

-Soil, Land Use, GIS and Agriculture

-Water Resources Management

-Energy Sources and their Utilization

-Ecology and Environment

-Appropriate Technology

Rural Electrification and Development in India

Development in Practice (Advance Qualitative Analysis)

Rural Environmental Services Planning and Design

Food Processing: Technology and Policy Perspective

Initiatives and Engagements of CTARA

Units

TDSC

TDSC is an ongoing initiative of CTARA, which aims to supply consultancy services to the development needs of various entities such as habitations, gram panchayats, small towns, district and taluka administrations. Some of the completed and ongoing projects are Watershed interventions for habitations in Kurlod and Botoshi, Mokhada taluka, Building a Hydrological Modeling for Deo Nadi Basin, Providing support for the assessment of Jalyukta Shivar Abhiyan works in Amravati district, Technical Support to Regeneration of DBIs project by Yuva Mitra, Sinnar, Assessment of drinking water supply system for Parbhani district.

RuTAG

Rural Technology Action Group (RuTAG) is a brain child of the Principal Scientific Advisor (PSA) to the Government of India which has been running since 2010. The unit aims at improving the rural economy through appropriate S & T interventions in the traditional methods. The interventions are essentially demand driven and have focus on problems associated with marginal communities in rural areas.

The vision of RuTAG Centre IIT Bombay is to become an innovative rural technology development group comprising academicians, scientists, personnel from NGOs, Governmental agencies and technical institutes, traditional craftsmen and artisans, farmers and social entrepreneurs with a passion to serve the rural people.

CSR Study Unit

CTARA has set-up a dedicated CSR Study Unit operating as a joint project between the Department of Public Enterprises, Government of India and IIT Bombay in 2018. The objective of the unit is to analyze the trends in CSR policy, program implementation, monitoring and evaluation, identifying scalable best practices and support for explore social entrepreneurs.

Nutrition Group

The group of students are working on various projects covering different aspects of child malnutrition, nutrient-rich product development, maternal health, nutrition education and awareness, data collection and interpretation etc. At present, they are actively engaged in different states of India e.g. Maharashtra, Chhattisgarh, Assam, Odisha etc.

Programmes and Workshops

TDSL

CTARA, IIT Bombay offers a sequence of Supervised Learning courses under the Technology and Development umbrella at the undergraduate level. These courses offer the students an opportunity to work on a live project, urban or rural, which involves direct interaction and interface with the larger society and stakeholders. All the projects offered through TDSL fall under 3 broad categories- Study, Analysis and Design.

RISE

The Rural Immersion program for students of Science and Engineering (RISE) is an initiative by IIT Bombay Alumni of the 1992 batch to expose and sensitize undergraduate students to the problems faced by rural India, and to encourage them to find possible solutions to those problems. Students get an opportunity to stay in a rural household and get a glimpse of the hardships as well as the delights of rural life.

District Development Dialogue

CTARA organised the 1st CSR Workshop on 'Scalable Best Practices- Learnings from the Field' through its DPE-IITB CSR Study Unit. The workshop had participation from CPSEs, District Administrations, award-winning Start-ups and CSR implementation agencies and showcased their work as well as ongoing work at IIT Bombay. The workshop had a presentation from participants and a poster presentation of about 50 cases. The District Development Dialogue will be an annual flagship event of CTARA covering various themes every year.

Farmer's Workshop

Over 30 farmers from Parbhani district in Maharashtra participated in the workshop. The workshop highlighted an overview of CTARA's work efforts towards alleviating the problems faced by the farming community.

Menstrual Waste Disposal and Management

This was the first workshop in our proposed 'Policy in Practice' series of workshops. It focused on nature and extent of the problem, current policy scenario, production and supply issues: reusables, biodegradables, current conventional sanitary pads and menstrual cups, collection and segregation, disposal including composting and incineration – technical and procedural aspects.

Energy-Water-Food

The workshop involved discussion on current emerging models of cooperatives such as water users associations (WUAs) to manage water budgeting and farmer producer organisations (FPOs) to link farmers directly to markets.

Fecal Sludge Management

The workshop discussed the policy issues and practice challenges of FSM in India by bringing policy makers, practitioners and academics together. This forum provided a platform for decision makers to interact with practitioners and industry to deliberate upon the scope and challenges in planning and implementing FSM.

Tribal Education: Gaps in Current Policy and Practice

The workshop aimed to address issues about tribal education, identify gaps in current policy and best practices for tribal education. It focused on pedagogy and content development, organisation and capacity building, tribal education & linkages with livelihood and discussed if CSR can be a game changer.

IITB-APAARI-NABARD Workshop

A two-day workshop was organised by CTARA to exchange ideas and learnings from the field related to sustainable farming, current agricultural practices and challenges faced, malnutrition abatement strategies, regional food and nutrition security challenges and allied sectors.



FELLOWSHIPS

TATA fellowship awarded by the Tata Centre for Technology & Design, set up in collaboration with Sir Dorabji Tata Trust, focuses on developing technologies, products and systems to deal with the challenges facing India's bottom sector.

HAL promotes students who are willing to work in development sector for the underprivileged societies and 5 fellows are selected for this.

MoRD fellowship aims to assess the ground-level implementation of flagship programs under MoRD. Some of these programs include MGNREGS, IWMP, NRuM, DDuGKY, NRLM. The fellows work for 1 year after completing the M. Tech degree.

UNICEF Fellows are already working on issues related to child malnutrition in specific areas and for context specific planning at the District Level. Projects are covering different aspects of child malnutrition: nutrient-rich product development, maternal health, nutrition education and awareness, data collection and interpretation. UNICEF fellows also work for 1 year after completing the M. Tech degree.

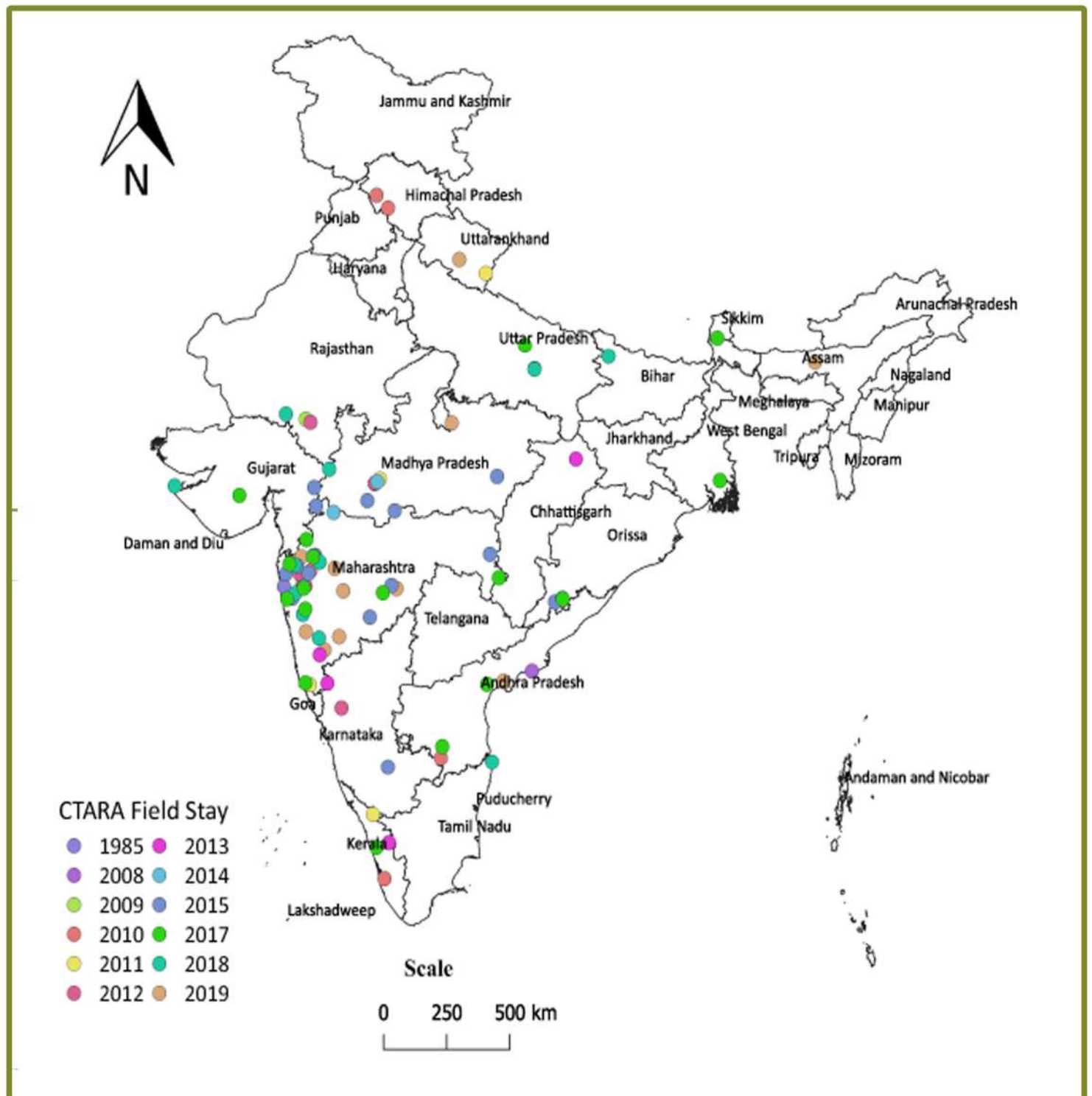
Participation in International Conferences

7 CTARA-UNICEF fellows represented the centre in the 5th annual International Health Conference 2019 held in Oxford University, wherein they participated in oral and poster presentations. The presentations primarily focussed on the health and nutrition sector, which included issues on recommended ready-to-use-therapeutic-food (RUTFs) for malnourished children, field and facility-based observational problems, demographic health survey-based data analysis and food fortification strategies for tackling malnutrition in children and anaemia in adolescents and women.



The Centre puts a special emphasis on a 9 week field stay in a village which helps students understand the rural reality. Here the students collect and analyze primary raw data, review various sectors and Government Schemes followed by a focused research on at least two problems by performing an exhaustive need assessment study through PRA activities and System Dynamics study.

Following map shows the locations of Summer field stays of M. Tech and Ph. D students of CTARA from 2007 to 2019.





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