TECHNOLOGY INTERVENTIONS IN RURAL AREAS

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RuTAG is a synergizing and catalyzing mechanism. It addresses need based up-gradation of technologies with the help of Indian Institute of Technologies (IITs) and local NGOs. The needs are identified by S&T Institutions, NGOs, Public Sector Undertakings (PSUs) and State and Central Government organizations. The demand-driven interventions could be technology upgradation, delivery, training and demonstration etc. Specific training programmes are also sponsored by RuTAG.

Today India has about 6 lakh villages where more than the two-third of the total population lives, as compared to about 85% at the time of Independence. Apart from the growing rate of urbanization, the ever-increasing share of urban population may be attributed to the large scale migration of rural people to cities and towns in search of employment opportunities and better living conditions. Most of the villages still lack the provision of basic amenities (water, sanitation, electricity, clean cooking energy, roads) and facilities (health, education, communication). The disparity between the rural and the urban areas is driving the unidirectional exodus of rural people looking for better prospects and thus leading to a haphazard growth of the cities.

"Access to technology" is a major differentiator between the urban and rural areas and is often considered as a solution to the development issues faced by the underdeveloped communities. Although many technologies have been developed for the rural areas in India and elsewhere in the world, there are several challenges in taking them to the end users. Typically, the technologies to be used in rural areas may need downsizing, and lose the economy of scale. However, the use of the locally available raw materials, local employment and value addition through processing can provide a boost to the rural economy. It is also important to recognize the externalities of technology. Considering the present situation in rural areas, the technical interventions need to mainly aim at drudgery reduction, efficiency improvement and overall sustainability.

Initiatives by RuTAG IIT Bombay:

The Indian Institutes of Technology i.e. IITs, established in India about 60 years ago, are known for their contribution in nation building through cutting edge technology research and education. How far have they helped the rural masses and the unorganized sectors that are often neglected in the mainstream development process? To address this deficiency, Rural Technology Action Group (RuTAG) was conceived by Dr. R. Chidambaram, the Principal Scientific Advisor to the Government of India. RuTAG was established as a mechanism to enhance rural development through science and technology (S&T) interventions by engaging the expertise available in the IITs. There are RuTAGs set up in 7 IITs (Madras, Kharagpur, Delhi, Roorkee, Guwahati, Kanpur and Bombay) and RuTAG IIT Bombay was established in 2010.

So far, RuTAG IIT Bombay has initiated 20 projects in rural development. Some technologies such as 'Floating fish cages for aquaculture' have been successful and appreciated by the Government. Apart from the project investigators and the project staff, more than 20 faculty

Floating Fish Cage for Inland Aquaculture

members from various departments such as CTARA, Mechanical Engineering, Civil Engineering, Energy science and Engineering, Industrial Design center (IDC), Humanities and social sciences (HSS), and Computer science and Engineering from IIT Bombay are involved in RuTAG projects and activities.

RuTAG IIT Bombay works in close association with the Centre for Technology Alternatives for Rural Areas (CTARA), an independent academic unit within IIT Bombay, where it is housed. CTARA was set up with an objective of catering to the technology needs of rural areas. CTARA's teaching and research is aimed at providing relevant solutions to the rural areas. CTARA believes in demand-driven, participatory approach in identifying and implementing solutions to the problems of the unorganized sectors and under-privileged communities. In order to do this effectively, CTARA has developed linkages with various stakeholders such as NGOs, Government departments and ministries and industry. The faculty members and students of CTARA have been working on some of the RuTAG projects and have made substantial contributions to the activities of RuTAG IIT Bombay.

RuTAG Interventions: The Approach:

RuTAG IIT Bombay operates in the western zone, which includes the states of Maharashtra, Gujarat and Goa. The typical approach that is adopted at RuTAG IIT Bombay in designing technology interventions has been described in this section.

Process for Identification of Projects:

RuTAG projects are 'demand driven', i.e. the problem has to come from the end users. This also helps in getting better engagement from the stakeholders, ensuring success of the intervention. Since the focus is on working for problems in rural areas, initiatives for communication and outreach to target audience are taken.

Voluntary Organizations (NGOs) working in rural areas are relied upon to reach the people and understand their issues. Familiarity and the local context are essential for the better understanding of any situation and problem communication. Over the years, connect with several NGOs has been established. The team members of RuTAG IIT Bombay regularly undertake field visits for networking with NGOs, interacting with stakeholders in rural areas and identifying problems suitable for RuTAG projects. Sometimes, workshops are organized with regional or sectoral focus, that provide a forum for all the stakeholders to brainstorm together and prioritize the problems to be taken up for S&T interventions.

RuTAG IIT Bombay also benefits from the close association with Centre for Technology Alternatives for Rural Areas (CTARA). The CTARA faculty members have an excellent rapport with various NGOs as well as Government officials such as the District Collectors and CEOs. The M.Tech.students undertake a nine weeks field work and in-depth study of a specific rural area under the supervision of a faculty member as a part of their coursework. At the end of nine weeks, the students bring back very rich and valuable data and interesting problems for RuTAG. Apart from them, many faculty members across various other departments are passionate about working on rural interventions and are actively working on RuTAG projects.

Detailed Background Study:

Once the problem is shortlisted, the research engineers interact with local people along with the NGO and confirm that the need for intervention is genuine and also that there is high level of commitment from the stakeholders. The end users are interviewed and detailing of issues is done. The other components of background study include study of current practices along with supply chain and value chain wherever possible. Apart from this, a detailed literature review helps in understanding if some work in target area has already been conducted elsewhere. Horizontal transfer of existing solutions, after the necessary adaptation to the specific local context, has often found to be helpful and efficient.

Design features:

Once the project is taken up, the faculty members associated with the project (Project PI and Co-PI) initiate the project activities. While designing the prototype, care is taken to incorporate the following features:

- **Easy to assemble:** The tools and gadgets usually have simple design and are easy to fabricate or assemble.
- **Low cost:** It is ensured that the machines are low cost and affordable.
- **Engagement of Local Fabricators:** They are usually trained in manufacturing tools so as to build a local ecosystem.
- **Use of locally available material:** As far as possible, an effort is made to use locally available material for fabrication of gadget of tool being designed.

After building a prototype,it is tested for its performance and to identify any potential issues in operation or w.r.t safety. The end users are involved in getting feedback as their suggestions are very valuable. Modifications are made, if required, and the process is iterated. This process continues till we fabricate a machine acceptable and suitable for the end users.

Examples of RuTAG Interventions:

Over the last 7 years, about 20 projects have been completed, mostly aiming at drudgery reduction and livelihood enhancement across various sectors such as the fisheries, animal husbandry, post-harvest processing of NTFPs or agricultural produce and traditional crafts. A few illustrative examples are included here, while further details are available on website (http://www.ctara.iitb.ac.in/en/rutag).

Floating Fish Cage Structure for Inland Fisheries:

One of the most successful interventionsfrom RuTAG IIT Bombay so far is the 'Designing floating fish cage structure for inland aquaculture'. The intervention was driven by a request from NGO 'Shashwat' from Pune district of Maharashtra. Central Institute of Fisheries Education (CIFE) recommended fisheries for livelihood for the tribals displaced by Dimbhe dam and introduced 'aquaculture' with the help of 'floating fish cages'. The structure of fish cages was developed by Prof. Siddharth Ghosh from the Department of Civil Engineering. Fish cage structures are used for protective aquaculture wherein fingerlings are incubated to small fishes (for better survival rate in the open water thus resulting in higher catch), or even grown to table size. The structure is very strong, safe and stable.The technology has potential to improve the livelihood of inland fishing communities across the country and has been appreciated by the Government of Maharashtra. The salient features of the structure are as follows:

- Robust, Safe, Stable Scalable and can be customized.
- Consists of G.I. pipes, fibre gratings, plastic drums etc., which are typically available at most places.
- Cleaning/Maintenance can be done while the structure is still floating in water.

The installed structure has provided better livelihood option for the locals as well as strengthened and empowered women SHGs whose participation in this activity has substantially increased due to the safe and stable structure. After the successful demonstration of this technology in Dimbhe dam, The Ministry of Tribal Development, Government of Maharashtra, sanctioned a project to NGO Shashwat to install 28 RuTAG fish cage structures in 4 dams with the help of RuTAG IIT Bombay, thus helping in dissemination of this technology.

Old Sari Cutting Machine for Handlooms Operated by Visually Challenged Individuals:

In this project, investigated by Prof. Suhas Joshi (Department of Mechanical Engineering) and Prof. Bakul Rao (CTARA), was taken up at the request of an NGO GrameenShramikPratisthan (GSP), based in Latur, Maharashtra. The visually challenged

Old sari cutting machine

Prototype of cow lift

weavers used to cut the old saris into ribbons by using a blade. This was unsafe, laborious, time consuming and also the ribbons formed were of varying width. The Sari Cutting Machine developed by RuTAG helped to overcome all these problems. Thus, it made the operation safe and efficient. It can be run using electric power (reduced drudgery), and rolls the ribbons on bobbins, thus improving the quality of product (mats) as well.

Cow Lift for a "Downer cow":

The project addresses the need for facilitating a 'downer cow' (a cow unable to stand due to weak leg muscles due to various medical conditions) stand on its feet for medical treatment. The device can be dismantled completely and assembled at the site where animal is located. Wheels provided at the bottom make it portable. The project was investigated by Prof. Tanmay Bhandakkar from the Department of Mechanical Engineering.

Hybrid Solar Food Dryer :

This project, investigated by Prof. Shireesh Kedare and Prof. Manaswita Bose from the Department of Energy Science and Engineering, addresses the issue of drying agricultural produce in a fast and efficient way while keeping the cost as low as possible. The main focus of this project is achieving continuous drying of the agricultural produce. Most of the existing solar dryers lack this feature and the quality of the food product is affected due to the drop in temperature in the evening. Continuous drying is achieved by using PCM (Phase Change Material).

Design of Protective Suit for Wild Honey Bee Harvesters:

The project aims at designing a dress for protecting people who harvest honey from beehives in wild. This will make the dress more convenient to wear and at the same time protect the person. The proposed dress is easy to manufacture and use, is lightweight, durable and washable. The project was investigated by Prof. R. Sandesh from the School of Design (Industrial Design Centre).

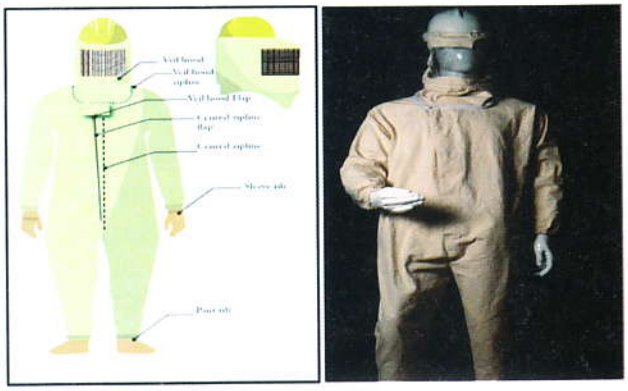
Post-Harvest Processing:

Many of the technologies designed by RuTAG IIT Bombay assist the local communities to process either the agricultural produce or the NTFPs (non-timber forest products) collected from jungles for value addition and enhanced earning. Machines have been developed for the processing of medicinal fruits such as Hirda and Behada and nuts such as Chironji which fetch good market price. Thus, we hope that the local communities can benefit from such intervention that helps them move from primary to secondary sector of the economy.

Conclusion:

RuTAG IIT Bombay has come a long way and designed several useful interventions addressing the problems in rural areas. While designing the interventions, care has been taken to ensure that locally available materials are utilized and local people are engaged in the best possible manner.

Solar Food Dryer



Protective Suit for Wild Honey Harvesters

Many of these technologies have a potential for dissemination in multiple locations across the country. The Ministry of DONER (Development of North East Region) has recently funded a project to disseminate 200 'floating fish cages for inland waters' across the various NE states. It is proposed to involve the faculty members and students of local engineering colleges for enhancing the activities of RuTAG. Better coordination with potential stakeholders and collaborating with other platforms (e.g. CSR and various government agencies) can help realizing better impact in the society.

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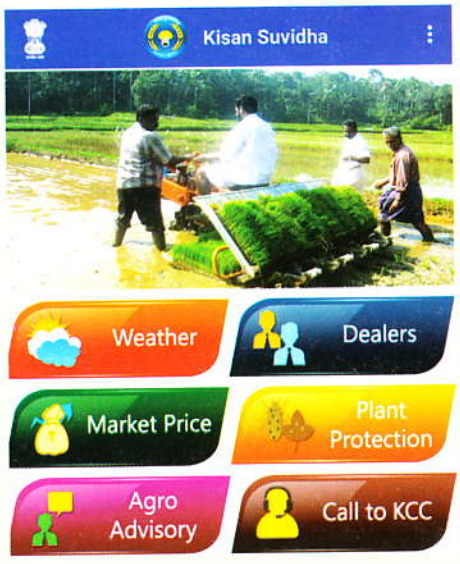
ICAR promoting New Technologies for Rural Areas

To increase productivity, reduce cost of cultivation, reduce drudgery, improve value addition, conserve resources and provide alternate means for energy generation through improve farm mechanisation during the last 3 years, ICAR has developed 72 new farm equipment/machines/gadgets and 34 new products/process protocols and supplied over 16500 prototypes of agricultural machinery to farmers/ entrepreneurs.



In the area of fisheries, ICAR developed breeding and seed production technology of 9 food fish species; the technology of marine cage farming and its dissemination through 1500 cages (principally in Gujarat, Maharashtra, Karnataka, Kerala, TN and AP); 4 feeds for different life stages of important fish and shrimp species and their commercialization, breeding and seed production technology for 9 ornamental fish.

The research efforts of the Institutes/Centres/AICRPs have also led to the development and release of 748 high yielding, stresses (biotic & abiotic) tolerant varieties/hybrids in different field crops for cultivation under different agro-climatic conditions during 2014-2017. Besides, 130 improved varieties of 54 important horticultural crops and 105 improved crop management technologies, package of practices for horticultural crops were also developed.

To disseminate information about such innovation/technologies to the farmers, the ICAR has established a network of 690 Krishi Vigyan Kendras (KVKs) in the country, mandated for conducting front line demonstration at the farmer's field, technology refinement, training and capacity building. The technologies duly tested and refined are thereafter passed on to line departments for large scale demonstration and transfer among farmers.

Around 2.75 crore farmers are registered on mKisan portal who are continuously receiving crop specific advisories in their local language on their mobile sets. No internet is required for receiving such advisories. Experts from ICAR, IMD, and State Government down to the block level send crop specific advisories to registered farmers. Apart from mKisan, Kisan Suvidha mobile App has also been developed for use of the farmers having smart phones and access to internet. Information about Agro advisory, weather, market price, plant protection etc. are provided to farmers with the click of a button.ICAR is giving focused attention towards development, promotion and propagation of new technologies i.e. high yielding and multi-stress resistant/tolerant varieties/hybrids using conventional and genomic tools in major crops through its 102 institutions comprising of 67 Research Institutes, 6 Bureaus, 14 Directorates and 15 National Research Centres mandated for conducting research in agriculture and allied areas besides 11 Agricultural Technology Application and Research Institutes (ATARIs) and 81 AICRPs/ Network Projects.