सत्यमेव जयते

Office of the Principal Scientific Adviser to the Government of India

A Compendium on

Rural Technology Action Group (RuTAG)

Demand Driven Technologies for Rural Entrepreneurships

52 *inside*

Editorial Team: RuTAG IIT Delhi

IIT Bombay

IIT Delhi

IIT Guwahati

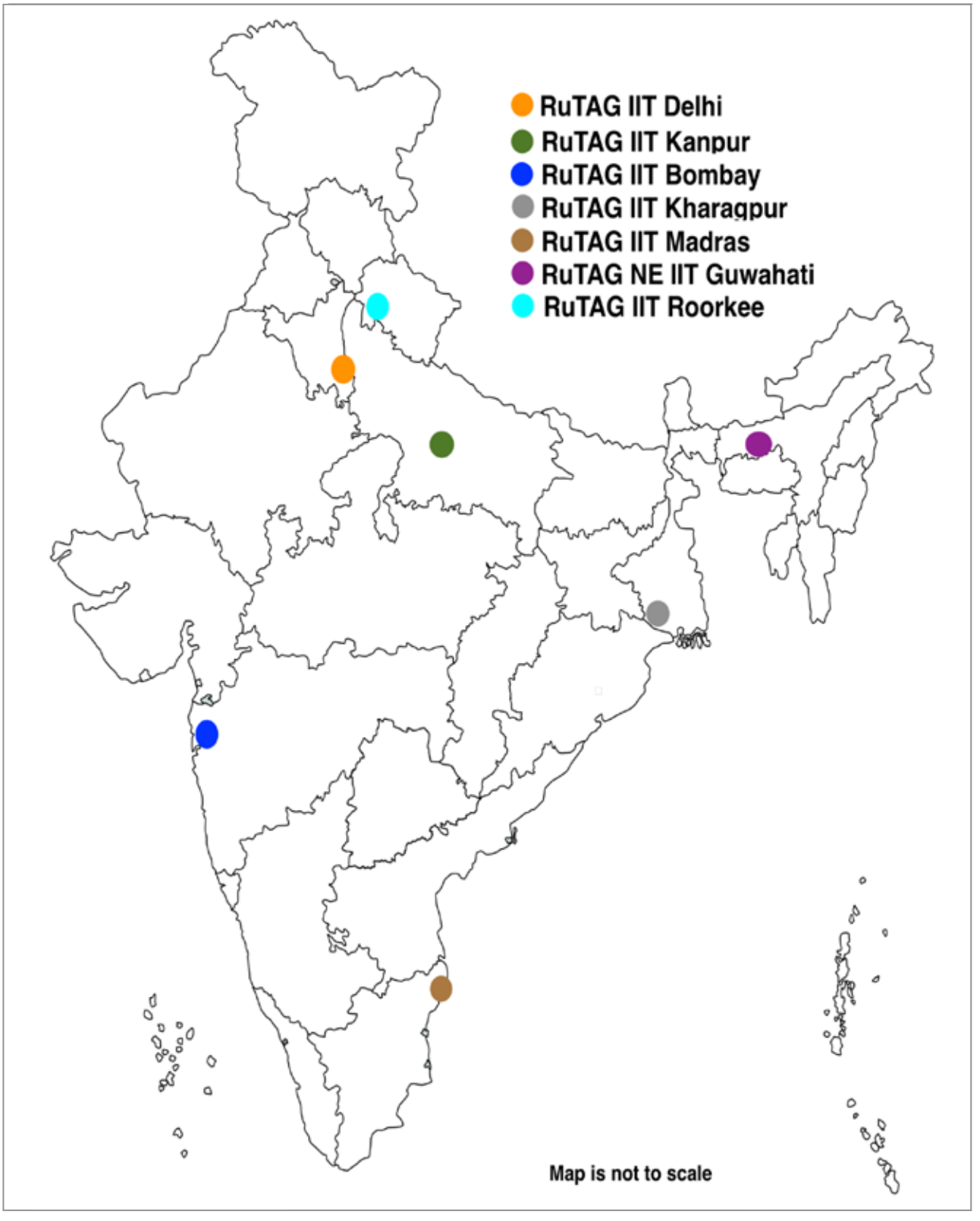
IIT Kanpur

IIT Kharagpur

IIT Madras

IIT Roorkee

Geographical Spread of RuTAG Centres



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K. VijayRaghavan
Principal Scientific Adviser to the Govt. of India

सत्यमेव जयते

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Message

I am happy to note that Rural Technology Action Group (RuTAG) at IIT Delhi, along with the other six RuTAG Centers (Bombay, Guwahati, Kanpur, Kharagpur, Madras, and Roorkee), prepared a compendium on 'Rural Technology Action Group (RuTAG): Demand Driven Technologies for Rural Entrepreneurships' which describes their appropriate technological interventions done at various rural areas across India. I feel that this compendium will act as a catalyst to attract many serious researchers, students, and rural entrepreneurs to understand and consider various scientific research from the domain of rural problems besides making the solutions available in the form of products to the rural people for the improvement of their livelihood.

My office will always encourage such initiatives for the growth of rural India which I believe the need of the hour in our rural sector. It is essential to provide a higher level S&T intervention to the rural problems which demands a serious attention to the cost aspect while keeping the quality of the solutions as best as possible.

As I understand, this publication captures **52** technologies which have been successfully demonstrated in the field over the last 15 years since the inception of RuTAG in 2003-04. I congratulate the team for coming up with a useful rural compendium under RuTAG.

K. Vijayraghavan

(K. VijayRaghavan)
30th January, 2019

Message from the Former PSA

Dr. R. Chidambaram
Former Principal Scientific Adviser (PSA) to the Government of India

India's technology needs range from nuclear and space to rural. During my tenure as the Principal Scientific Adviser (PSA) to the Government of India from 2002 to 2018, the office of the PSA conceptualized the Rural Technology Action Group (RuTAG), executed, and brought several improved innovative products based on demand at the rural grass-root level. Since its inception in 2003-2004, RuTAG has come a long way, and it is appropriate to share some of the technologies developed under RuTAG centers at 7 IITs with the rest of our society. About 52 technologies are listed here which were developed and successfully implemented in collaboration with several field agencies (whether they be an NGO or a Govt. organization), when they brought a demand to a nearby IIT and got the solutions/improvements made before the solutions were returned to those who posed the problems.

I am very glad that RuTAG IIT Delhi, along with the six other RuTAG centers at various IITs (Bombay, Guwahati, Kanpur, Kharagpur, Madras, and Roorkee), has now prepared a compendium of the above technologies entitled 'Rural Technology Action Group (RuTAG): Demand Driven Technologies for Rural Entrepreneurship'. This compendium demonstrates the genesis of research, development, innovation (also re-innovation as appropriate), and delivery of each rural technology, its appropriateness in the rural society, as also entrepreneurship for delivery of these demand-driven technologies in rural areas. I believe that this compendium will be helpful in knowledge and experience sharing among the researchers, students, and rural entrepreneurs in this field around the world who have taken up work for technology development and delivery at the rural grass-root level. I am quite certain that while people living in the rural areas would find the solutions appearing in this compendium useful for their communities, the researchers and rural entrepreneurs will find this an encouragement to come forward and take up such new problems as their research and technology development goal, which indeed will be the measure for true success of this compendium.

I wish the RuTAG teams all the best!

R. Chidambaram

Message from Coordinating Scientist

Dr. Ketaki Bapat
Scientist 'F'
Office of the Principal Scientific Adviser to the Government of India

The office of the Principal Scientific Adviser (PSA) to the Government of India conceptualized Rural Technology Action Group (RuTAG) in 2003-04 to provide appropriate technologies with higher level of science and technology interventions to the demand driven problems of rural areas. The development and dissemination of these technologies are catered through RuTAG centres established in seven IITs.

I am happy to note that Rural Technology Action Group (RuTAG) at IIT Delhi, along with the other RuTAG centers at six IITs (Bombay, Guwahati, Kanpur, Kharagpur, Madras, and Roorkee), prepared this compendium which describes an appropriate technological intervention done by RuTAG centres spread at rural areas across India. The compendium demonstrates the journey of how the rural problems were taken from the field with the help of local NGO/collaborating agencies, and solved with the help of faculty and students of seven IITs and their partner institutions before they were returned to the field with better efficacy.

I congratulate the teams of all the RuTAG centers with special mention of RuTAG IIT Delhi for coming up with this publication 'Rural Technology Action Group (RuTAG): Demand Driven Technologies for Rural Entrepreneurships', highlighting 52 demand driven RuTAG technologies which are also field tested.

I hope this compendium will be useful for rural entrepreneurs to take the technologies forward benefitting a larger section of the society, while colleges and universities may be encouraged to take up such problems as their academic projects and research topics.

Ketaki Bapat

Message from Editorial Team

Prof. Subir Kumar Saha
Professor, Department of Mechanical Engineering
Co-ordinator and PI, RuTAG-IIT Delhi
Indian Institute of Technology Delhi

Dr. Susha Lekshmi S. U.
Project Consultant
RuTAG-IIT Delhi

It is our great pleasure to unveil a compendium on 'Rural Technology Action Group (RuTAG): Demand Driven Technologies for Rural Entrepreneurships' along with six other RuTAG centers at various IITs (Bombay, Guwahati, Kanpur, Kharagpur, Madras, and Roorkee). This describes appropriate demand driven technological interventions done over the last 15 years at various rural areas across India.

As 70% Indians live in rural areas, enhancement of rural livelihood is a key to overall growth and inclusive development of our country. Through appropriate demand driven technological interventions, we can create more rural employment opportunities and thereby improve our rural economy. The main constraint in the advancement of rural technologies in India seems to be the lack of local technology action groups who can assist in the development and dissemination of demand driven technological needs of rural farm and non-farm sectors. Rural Technology Action Group (RuTAG) is such an initiative conceptualized by the Office of the Principal Scientific Adviser (PSA) to the Government of India in 2003-04 with an aim to provide a higher level of science and technology intervention and support for development and dissemination of appropriate demand technologies for our rural areas. This compendium would give you an understanding about the demand driven technological interventions developed and disseminated for various sectors like assistive technologies, rural agriculture, draught animal power, rural energy, rural environment/water, rural handicrafts, and rural textile. Here, we present 52 different demand driven technologies developed by various RuTAG centres at 7 IITs.

This compendium explains the importance and salient features of each rural technology, its major drawbacks, demand from the society, impact of the improved version, prototype cost, feedback from the users, dissemination potential, and research opportunities. In a nutshell, this compendium will give an idea about the ingenious technologies used by the rural people and the interventions done by the RuTAG centers in collaboration with local NGOs upon their demand for those technologies. We hope this compendium would be useful for rural entrepreneurs, researchers, students, and academic/R&D institutions for getting them involved in appropriate rural technology development.

At the end, we must thank the office of the PSA, especially, the PSA, Prof. K. VijayRaghavan, former PSA, Dr. R. Chidambaram, and Dr. Ketaki Bapat to have faith on RuTAG IIT Delhi to prepare the compendium, along with other RuTAG centres, specially, the PIs (Prof. R.P. Saini, IIT Roorkee; Prof. Abhijit P. Deshpande, IIT Madras; Prof. Anand B. Rao, IIT Bombay; Prof. S.K. Kakoty, IIT Guwahati; Prof. Nalinaksh S. Vyas, IIT Kanpur; Prof. P.B.S. Bhadoria, IIT Kharagpur). We are thankful to Prof. R.R. Gaur (Chairman of Core Group at RuTAG IIT Delhi), Prof. M.R. Ravi and Prof. Sangeetha Kohli (Co-PIs of RuTAG IIT Delhi), our Project Staff members, Mr. Rajkumar Gupta, Mr. Davinder Pal Singh, Mr. Ashish Dahiya, Mr. Mangal Sharma, and Mr. Suraj Bhat (PhD Student) for their support while preparing this compendium. We also acknowledge the feedback and support from all PIs, and their Project Staff members at various RuTAG centres.

S.K. Saha
Susha Lekshmi S.U.

Rural Technology Action Group (RuTAG)

RuTAG: Office of the Principal Scientific Adviser (PSA) to the Government of India conceptualized a mission called Rural Technology Action Group (RuTAG) with an aim to provide a higher level of science and technology intervention and support for development and dissemination of appropriate technologies for rural areas in 2003-04. RuTAG is centered in 7 IITs (Bombay, Delhi, Guwahati, Kanpur, Kharagpur, Madras, and Roorkee) at present. The office of the PSA also initiated RuTAG Chapters attached to RuTAG Centres. The first Chapter was opened at University of Jammu, attached to RuTAG IIT Delhi in 2014.

Objectives: To identify the technology needs of rural areas, available technology solutions and problems encountered in adopting the existing technology at grass root levels; find technology solutions through government agencies, S&T institutions, S&T NGOs, academic institutes, corporate sectors and other voluntary agencies; and disseminate refined technologies to rural areas.

Technology Interventions: The technology interventions of RuTAG are essentially demand driven, could be for technology upgradation, hi-tech delivery, technology training and demonstration or through any other innovative method and have focus on problems associated with marginal communities in rural areas for livelihood creation, drudgery reduction, increase in efficiency/ productivity of processes, provisions of higher income, generation of employment, downsizing of existing technologies, and local resource management and knowledge generation for further applications in rural context.

RuTAG acts as a synergizing and catalyzing mechanism for rural technology development and delivery, and not a major funding mechanism

Established Year	RuTAG Centres
2004	RuTAG IIT Madras
2005	RuTAG NE IIT Guwahati
2008	RuTAG IIT Kharagpur
2009	RuTAG IIT Delhi
2009	RuTAG IIT Roorkee
2010	RuTAG IIT Bombay
2013	RuTAG IIT Kanpur

This RuTAG compendium presents a total of 52 demand driven technological interventions developed and disseminated by various RuTAG centres at 7 IITs for various sectors like assistive technologies, agriculture, draught animal power, energy, environment/water, handicrafts, and textile.

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Major Categories of RuTAG Technologies

- **AGRICULTURE**
- **ASSISTIVE TECHNOLOGIES**
- **DRAUGHT ANIMAL POWER**
- **ENERGY**
- **ENVIRONMENT/WATER**
- **HANDICRAFTS**
- **TEXTILE**

AGRICULTURE (13 TECHNOLOGIES)

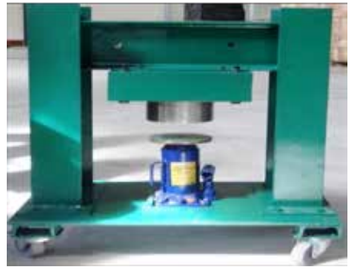










AGRICULTURE

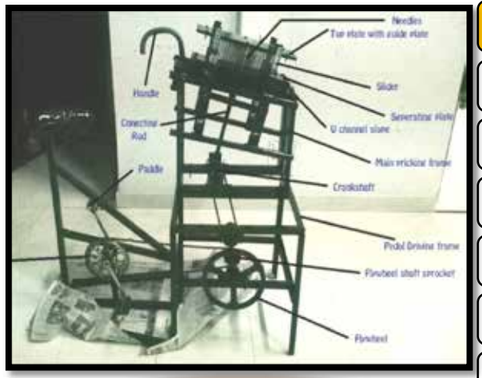
1

Amla Pricking Machine

RuTAG IIT Kanpur/2017/Amla Pricking Machine

Amla Pricking Machine

Amla pricking is traditionally done manually, by hand. The process is slow, injury prone, gives low output (3 kg/hour) and is prone to contamination. A cycle operated amla pricking machine has been designed which enhanced the output to 40 kg/hour. Another version of the machine is motor operated that gives output of 100 kg/hour.



Salient Features of Amla Pricking machine
Portable
Choice of cycle operated and/or motor driven
Stainless Steel body (food grade)
Safe to operate
Pricking rate: 40-100 kg per hour
Can be operated by single user
In 3 to 4 passes, amla becomes spongy

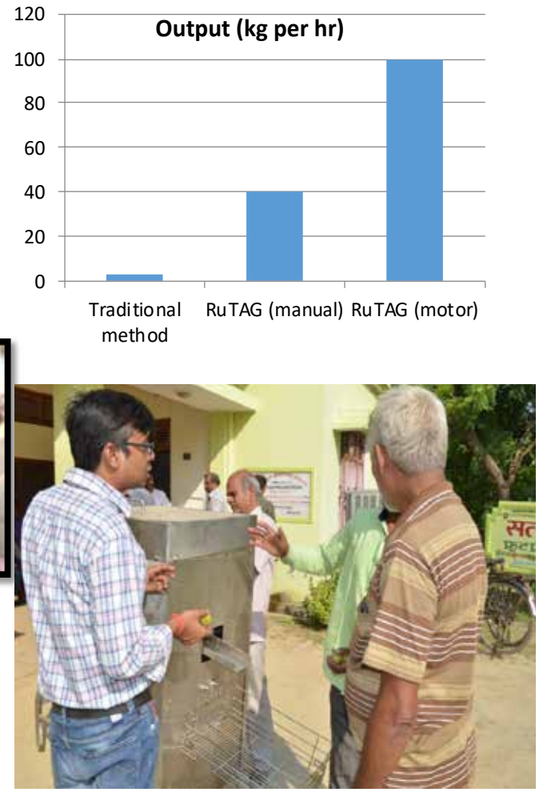
Technology has been Patented

Dissemination Potential
Amla processing cluster of Pratapgarh, Varanasi, Jaipur, Ahmedabad, Pune etc.

Tentative cost of the prototype: ₹ 60,000 which excludes freight, installation, GST and other levies

- Payback Period: 1 year
- Fabricator: NUTECH Industries, Ambala
- Field Trials successfully conducted by UP Council of Science & Technology

Traditional method of pricking



Demonstration in Pratapgarh

Technology Patented by
1) RAJ, Ravi
2)AGARWAL, Shantanu
3)MAITI, Nilanjan
4)RAMKUMAR, Janakarajan

Feedback from the user
Saves time, Much Safer and Amla does not get contaminated

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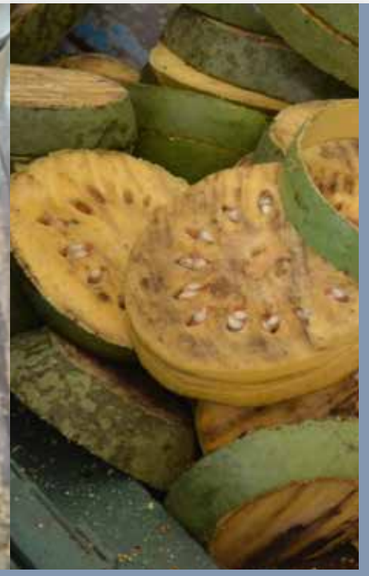

2

Bael Cutting Machine

RuTAG IIT Kanpur/Bael Cutting Machine

Bael Cuttig Machine

Bael is a medicinal fruit, and Bael murabba is gaining popularity amongst health enthusiasts. For making Bael murabba, raw fruit is cut into slices of 2.5 cm thickness. Beal cutting machine enhances cutting of slices from Bael murabba.

Salient Features of Bael Cutting Machine

- Portable
- 4 slices are cut in one pass
- Uniform and neat cuts
- Safety of operation

Dissemination Potential
Food Processing

Tentative cost of the prototype: ₹ 55,000 which excludes freight, installation, GST and other levies

Demand Driven Technology: Bael murraba was put on a flat base and was cut by hand using hacksaw, in conventional way. Hammer was also used to pound on the flat blade of the knife to achieve a clean cut. The entire process was slow and hazardous because shell of the fruit is quite hard and slippery. Also the process was unsafe, yield was low and the slicing was not uniform. Based on the demand of food processors of Pratapgarh, this project has been taken up by RuTAG IIT Kanpur.

Collaborated Fabricator: Panchal Pumps, Kanpur

Traditional method of slicing bael

Major Drawbacks of Existing Bael Cutting Machine

- Hacksaw was used which made it quite unsafe as the outer surface was hard and slippery
- Difficult to operate as the operator sits on ground
- Slices are quite non uniform in size, thus fetching low return

Feedback from the user
Very comfortable to operate; 4 times the output compared to slicing by hexa, clean and uniform slices

Team
Debjyoti (Intern)
Deb Pal (intern)
Prof J Ramkumar
Omprakash (Tech Suptd)
Commercial partner: Panchal Pumps
Support: UPCST

Demonstration at Pratapgarh

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3

Betel Nut Cutter

RuTAG NE IIT Guwahati/Betel Nut Cutter

Betel Nut Cutter
It is a device that can simultaneously cut 8-10 betel nuts at one stroke. This device can replace the use of present tool “Sakta” for cutting betel nuts.

Salient Features of Betel Nut Cutter

- 8-10 betel nuts can be cut in a single stroke
- The productivity rate has increased upto 3.5 times
- Health injuries have reduced
- Cutter can easily be disassembled for sharpening
- 700-750 betel nuts/hr can be cut against 80-100 betel nuts/hr in traditional method

Dissemination Potential
Transport and marketing of agricultural produce

Tentative cost of the prototype: ₹ 15,000

Demand Driven Technology: Dried betel nut selling is a popular business in the districts of Dhubri, Goalpara and Barpeta. It has become a family business for many people and each of the family members including children are involved in cutting the dried betel nut, locally called Supari, into small pieces with the help of a sakta (cutter). The presently used tool (sakta) for cutting supari is a traditional method. This requires more time and the output is very low, hence the efficiency is very poor. It is also not safe, as it may lead to injuries like cutting the finger and other injury due to carelessness. Assam Mahila Samata Society approached RuTAG-NE to solve the problem. In accordance, RuTAG-NE has developed a betel nut cutter.

Major Drawbacks of Existing Betel Nut Cutter

- The present tool, Sakta, for cutting betel nuts is crude and its output is very low
- Traditional method is very laborious
- Finger and palm cuts are common problems of workers

Impact of the Improved Technology

- Mostly children are engaged in supari cutting business. But this technology makes an effort to disengage children from working.
- Due to improved cutting technic, many rural people who are engaged in this supari business are willing to adapt the technology

Feedback from the user

- Poor family having children who are engaged in supari cutting are very much satisfied with the technology.
- Due to safety precautions are considered while developing the device, people find it very user-friendly.

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4

Chaff Cutter

RuTAG NE IIT Guwahati/Chaff Cutter

Chaff Cutter

It is table top machine for cutting of Paddy straw, grass etc. which is one of the essential parts of farming activities. This machine is made of wooden rollers and gears. Advantage of this machine is feeding and cutting mechanisms carried out simultaneously by providing a single motion with hand.

Salient Features of Chaff Cutter

- Manual driven wooden feeding roller of 15 cm diameter and 30 cm length
- Employed for cutting straws of uniform length with a blade made of leaf spring
- Light in weight and easily portable
- Negligible maintenance is required
- The cutter can easily be disassembled for sharpening
- Feeding and cutting mechanisms carried out simultaneously

Dissemination Potential
Farming

Tentative cost of the prototype: ₹ 12,000

Demand Driven Technology: Traditional process is cutting them off by local cutters with sickle or dau which is very time consuming, unsafe and laborious. There are some machines available in southern part of India. But these machines are larger in size than to its ease of mobility. RuTAG-NE has developed a table top low cost simple paddy straw cutting machine. This machine is made of wooden rollers and gears. The substrate for mushroom spawning is prepared from paddy straw by cutting it into smaller pieces. Here they take the advantage of this chaff cutter and as mushroom cultivation is a subsidiary economic activity among these tribal families.

Traditional Chaff Cutting Machine

Major Drawbacks of Existing Chaff Cutter

- Existing machines are larger in size
- Very expensive
- These machines cannot be operated by a single person

Impact of the Improved Technology

- STINER programme has decided to disseminate 100 nos. of this technology across NE region.
- The tribal families of NE region are very much benefited by this chaff cutter.
- It provides an additional income of about ₹ 5,000-6,000/- per month to families that deal with mushroom cultivation.

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5

Conical Roller Jamun Juice Extractor

RuTAG IIT Kharagpur/Conical Roller Jamun Juice Extractor

Conical Roller Jamun Juice Extractor

Jamun (Syzygium Cuminii L) is a fruit of great antiquity and is highly liked for its pleasing flavor. At present, no low-cost machine is available in market to extract Jamun juice. Although this machine is fully hand operated, but is immensely effective in extracting juice in a single step.

Salient Features of the Technology

- Cheap, Compact and Portable
- Hand driven and capable of rotating at the desired speed
- Pulp is extracted out of the fruit without any breakage of the seeds
- Capacity is 6 liters per hour

Dissemination Potential
Food Industry

Tentative cost of the prototype: ₹ 3,000 to 4,000 per unit. (Subject to prevailing market forces)

Impact of the Improved Technology

- Received positive response(s) from NGOs and SHGs

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6

Floating Fish Cages for Inland Aquaculture

RuTAG IIT Bombay/2012-14/ Floating Fish Cages

Floating Fish Cages for Inland Aquaculture

Inland aquaculture is the process of rearing aquatic organisms such as fish in inland water bodies such as lakes, ponds, rivers, backwater of dams etc. to enhance production. Floating fish cage structure provides a controlled and protective environment for growing of fries (fish seeds of size 25-30 mm) to fingerlings (size 100-150 mm) within a 'cage' (a net that allows water flow) floating in a water body. The fingerlings are then released in the water body where they grow to full size.

Salient Features of Floating Fish Cages for Aquaculture

- Safe and Robust- 30 persons can stand at a time
- Simple and modular design
- Can be assembled on site without electricity
- Easy for maintenance
- Broad walkways for additional safety and comfort
- Easy to pull out of water body for maintenance
- Skeleton of structure made of GI pipes (easily available)

Dissemination Potential

Any inland water body such as lakes, ponds, rivers or backwater of dams

Tentative cost of the prototype: ₹5,00,000 which excludes freight, installation, GST and other levies

Demand Driven Technology: The dam displaced tribals from Ambegaon block of Pune district were engaged in fishery for livelihood. The floating fish cages used by them had several problems. The structure was made of jungle wood and sal wood. It was heavy, weak and unstable and needed frequent repair and maintenance. In order to overcome those challenges, Shri. Ananad Kapoor, the then Executive Director of Shashwat approached RuTAG IIT Bombay and requested for a better design.

Collaborating NGO: Shashwat, Pune, Maharashtra

Major Drawbacks of the Existing Fish Cages

- Failure of walkways made of jungle wood
- Corrosion of hooks, bolts, nuts
- Sagging of walkways due to decay of wood
- Failure of drums due to hitting by water waves
- The structure is too heavy to pull out
- Weak and unstable structure

Current Status

- The Tribal Development Department (TDD), Govt. of Maharashtra disseminated 7 batteries of fish cages at Tribal areas of Pune
- Ministry of DONER is also deploying 50 batteries at various states in North-East.
- TDD is also planning dissemination of 7 more batteries in Pune.

Feedback from the end user

Very safe and useful structure for cultivating fish
-Shri. Budhaji Damase, Shashwat, Pune

Relevant Research Publications

- Rupali Khanolkar, Anand B.Rao and Siddhartha Ghosh, (2018). "RuTAG IIT Bombay Floating Fish cages for livelihood opportunities for Tribals in Dimbhe area", Techno-societal 2016, DOI 10.1007.978-3-319-535556-2_4, Springer International Publishing, AG 2018
- Prashant P. Tak, Dharma Teja Nuli, Siddhartha Ghosh and Anand B. Rao (2018). Evolution of 'Floating fish cages for inland waters' developed by RuTAG IIT Bombay-presented during the 1st International conference of RuTAG, Rural technology development and delivery (RTDD) held during 9-11 March, 2018 at IIT Delhi.

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7

Floating Fish Cage with Aquaculture Technology

RuTAG IIT Kharagpur/Floating Fish Cage with Aquaculture Technology

Floating Fish Cage

Fish cages are placed in lakes, ponds, rivers, or oceans to contain and protect fish until they can be harvested. These cages can be constructed with a variety of components, and here we have constructed it with simple bamboo sticks and PVC drums. The mesh retains the fish, making it easier to feed, observe and harvest them.

Salient Features of the Technology

- Cheap, compact, easy construction and maintenance
- Made with simple bamboo poles and PVC drums
- Net area is around 100 square feet

Dissemination Potential
Aquaculture

Tentative cost of the prototype: ₹ 25,000-30,000 per unit (Subject to prevailing market forces)

Impact of the Improved Technology

- Undergoing Field Test

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8

Heavy Duty Bicycle

RuTAG NE IIT Guwahati/Heavy Duty Bicycle

Heavy Duty Bicycle

This modified bicycle is made of heavy duty frame to carry heavier loads that can be carried by ordinary bicycle. The cycle is very much suitable to ride in hilly areas with less effort.

Salient Features of Heavy Duty Bicycle

- Auxiliary chain drive is introduced to minimize effort
- Fabricated with heavy duty frames for carrying heavier loads
- Can be repaired easily in local cycle shop
- It can carry upto 150-200 kg in Gents' model and upto 100 kg in Ladies' model

Dissemination Potential

Transport and marketing of agricultural produce

Tentative cost of the prototype: Gents' Version ₹ 8,500; Ladies' Version ₹ 7,500

Demand Driven Technology: According to a study carried out by NEDFi in the year 2005, the Darranggiri Banana Market is one of the largest banana markets in Asia in terms of transactions. However, the farmers who sell banana in this market have faced some difficulties while trading. One must carry the bananas from the neighbouring hilly areas of Assam as well as Meghalaya to trade in this market. These are carried on normal bicycles. Moreover most of the places have no proper road connectivity, and on an average about 6-8 bunches of banana can be carried to the market per bicycle. RuTAG-NE in association with Sristi Science and Technology, Nagaon has developed two improved models of bicycle which can carry about 14-16 bunches of banana.

Major Drawbacks of Existing Heavy Duty Bicycle

- Cannot carry heavy loads
- Not suitable for hilly areas

Impact of the Improved Technology

- The bicycles were field tested, and banana growers have found them very convenient
- It has been beneficial to the vendor since then as it aids the vendor with additional ₹ 800 per day

Feedback from the user

- Farmers from Goalpara District are now using the bicycle for trading vegetables in markets
- People from hilly areas are very satisfied using the modified bicycle
- Rural women are also benefitted by the bicycle and they are also engaged in trading vegetables

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9

Improvement in Batasha Making Process

RuTAG IIT Delhi/2017-18/Batasha Making Process

Batasha Making Process

Batasha is a sweet dish prepared from sugar. Batasha is mainly used in festivals, worships and marriages of India. The work focuses on ergonomic improvement in the traditional batasha making process. It was found that traditional batasha making process is tiring (due to squatting sitting posture of artisans) and unhygienic. Hence, it needs improvement ergonomically. The factor of adaptability, productivity and economy has been kept in mind while designing the improved process.

Salient Features of Batasha Making Process

- Adjustable and modular set-up.
- The setup is a three rack system supported on a frame.
- The three racks are capable of moving independently.
- The setup aids in continuously making of the batasha, no space crunch.
- The setup is adjustable for various height persons.
- Projected life span: 02 to 04 years.

Dissemination Potential

Food Processing Industries

Tentative cost of the prototype: ₹ 5,000 which excludes freight, installation, GST and other levies.

Demand Driven Technology: Traditionally batashas are made by dropping specially prepared sugar solution onto the ground. The drops solidify in 30 to 40 seconds. However, the working posture and environment is not optimal and can be improved. Improvements were identified in the areas of sitting posture and hygiene. The newly developed set-up ensures that the artisan sits in a comfortable posture while making batashas with hygiene.

Collaborated NGO: Lupin Human Welfare & Research Foundation, Bharatpur, Rajasthan
Daang Vikas Sansthan, Karauli, Rajasthan

Major Drawbacks of Existing Batasha making Process

- Squatting for 5-8 hrs. poses discomfort and health issues
- Muscles and joint pain on prolonged operation
- Unhygienic process due to process conducted on floor
- Weight handling 8-12 kg during lifting and tilting of dhaura
- Safety concern due to handling of high temperature solution

Impact of the Improved Process of Batasha Making Device

- Reduced drudgery in its operation
- Artisan can work for longer duration
- Positive feedback from artisans after testing at Dadri and Sikandrabad, Uttar Pradesh

Feedback from the user

Easy to use with increased comfort

Relevant Research Publications

- Presented a poster, "Study and Improvement of Traditional Batasha Making Process" by Manvendra Rai, Ritik Rathore, Ravi Prakash Kushwaha, Nurul Hassan Laskar, and Vinay Gupta in RTDD-2018 held at IIT Delhi (Poster won first prize).

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10

Integrated Rice Puffing (Muri) Machine

RuTAG IIT Kharagpur/Rice Puffing Machine

Integrated Rice puffing (Muri) Machine

Puffed-Rice is a form of rice where rice grains are expanded to a volume. This Muri making machine comes with biomass and LPG based, which is insulated perfectly with 1 mm iron sheet. The productivity is 40 kg/h compared to 4 kg/h in traditional method.

Salient Features of Muri Making Machine

- Compact and Portable
- Sand sieving mechanism for rapid sand separation
- Both Biomass and LPG are used as fuel
- Productivity 35-40 kg/hr

Dissemination Potential
Food Industry

Tentative cost of the prototype: ₹ 35,000 per unit subject to prevailing market prices

Impact of the Improved Technology

- Better livelihood option for the local artisan and spinners
- Strengthened and empowered women SHGs and NGOs
- 50 units installed at several villages of West Bengal and North Eastern states, and some of them are Bamunmara, Lodhasuli, Suchetna, Jhargram, Keshpur, Haldia etc.

Contact: Prof. PBS Bhadoria, Co-ordinator, RuTAG Cell IIT Kharagpur, Kharagpur 721302, West Bengal, India
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11

Machine for Decortication of Hirda Fruits

RuTAG IIT Bombay/2016-18 /Hirda Decortication Machine

About Hirda

Hirda (Terminalia Chebula) is also known as Harad or Haritaki. It is a common medicinal plant in India. Fruits of Hirda are collected, sun-dried and used for medicinal purpose, e.g., Triphala Churna is a popular medicine that uses powders of Hirda, Behada and Amla fruits. If these medicinal fruits are decorticated (outer cover is separated from the seed), they fetch better price in the market. The existing practice of manually decorticating Hirda is full of drudgery.

Salient Features of Hirda Decortication Machine

- The machine has helped in reduction of drudgery during decortication
- The machine is easy to operate and is user friendly
- Changing gap size is easily possible by rotating only one wheel
- The machine can decorticate different sizes of Hirda at different settings
- All moving parts of the machine are covered for the safety of the operator
- Decortication rate: 100 kg per hour

Dissemination Potential

All Hirda growing locations:
Himalayan region, Maharashtra, Tamilnadu, Karnataka, Assam and West Bengal

Tentative cost of the prototype: ₹ 45,000
(excluding freight, installation, GST and other levies)

Demand Driven Technology: This project was done in association with NGO Shashwat that works for tribals in Pune district of Maharashtra. Hirda trees are commonly found in the Bhimashankar area where the NGO operates. The fruits are collected from the forest and the Sun-dried fruits are decorticated (separated from seeds) with the help of stones. This activity is full of drudgery. The NGO approached RuTAG IIT Bombay with a request to address the above-mentioned problems.
Collaborating NGO: Shashwat, Pune, Maharashtra

Major Drawbacks of the Existing Decortication Method (with stone)

- Not standardized operation
- Full of drudgery
- Very low efficiency

Current Status

- One prototype given at site of NGO Shashwat, Pune
- One prototype given at site of NGO Paoolwaat, Pune
- The Tribal Development Department (TDD), Government of Maharashtra has agreed to give grant for dissemination of 10 machines at tribal areas of Pune.

Feedback from the user

"Very useful device for decortication of Hirda"
- Mr. Ashwin Brahme, NGO Paoolwaat, Pune

Relevant Research Publications

- Prashant P. Tak, Tanjum Haque, Anirban Guha, Anand B. Rao, Narendra Shah and Rupali Khanolkar (2018). Study of supply chain, production potential of hirda and design of hirda decortication machine for livelihood generation for tribal people – presented during 1st International conference of RuTAG, Rural technology development and delivery (RTDD) held during 9-11 March, 2018 at IIT Delhi.

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12

Mechanized Dhenki (Rice Pounder)

RuTAG IIT Kharagpur/Rice Pounder

Mechanized Dhenki

It is directed to provide a motorized rice pounder machine which would generate pounding or impacting action required for milling of rice. It involves mechanical drive means actuated by motor operation with improved efficiency and productivity eliminating the need for manual application of foot pressure resulting fatigue/ drudgery.

Salient Features of Mechanized Dhenki

- Eliminates the need for one operator at the foot pressing end
- 1 hp motor driven pounder and impactor
- Ensures similar frequency, amplitude and gravity fall as traditional
- Productivity is about 15-20 kg/hr compared to traditional

Dissemination Potential
Food Industry

Tentative cost of the prototype: ₹ 35,000 per unit subject to prevailing market prices

Impact of Technology

- Better livelihood option for the local artisan
- Strengthened and empowered women SHGs
- 10 units installed at different villages e.g. Gobindapur, Jhargram, Kenthia etc

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13

Multi-nutrient Compressed Feed Block Machine

RuTAG NE IIT Guwahati/Feed Block Machine

Feed Block Machine

The machine is suitable for making small fodders for cattle viz., Yak, Mithun, etc. The food is compressed with a circular disc inside a vertical cylinder with added vitamin and minerals. The machine is available in two varieties. 1. Manually operated feed block, where food is compressed with screw mechanism, 2. Hydraulically operated feed block, where food is compressed with a hydraulic jack. The technology is very much beneficial for animal rearers who reside at places of high altitude.

Salient Features of Feed Block Machine

- The hydraulic machine is operated with a hydraulic jack of 10-ton capacity
- In one-hour, hydraulic machine can produce upto 7/8 numbers of feed block
- In one-hour, manual machine can produce upto 10/12 numbers of feed block
- Portable and easy to carry in hilly areas

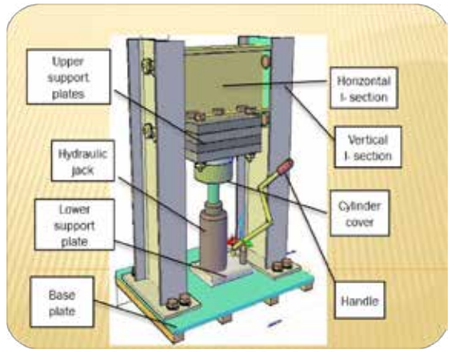
Dissemination Potential
Making of Fodders

Tentative cost of the prototype: Hydraulic model ₹ 35,000, Manual model ₹ 15,000

Demand Driven Technology: The North-East Centre for Sustainable Development (NECSUD), headed by Dr. Mohan Bhattacharjee, former Director, NRC on Yak, ICAR, Dirang, Arunachal Pradesh, approached RuTAG-NE for development of a scaled-down, low cost machine for producing compressed feed blocks using locally available resources. The necessity of this new invention was to eliminate the scarcity of food for Yak during winter season in hilly areas. Due to lack of food, Yak and other animals suffer from malnutrition which causes loss to Yak rearers. Considering this fact, RuTAG-NE has developed a whole new feed block machine which serves its purpose.

Major Drawbacks of Existing Feed Block Machine

- Relatively huge in size. Hence the production cost is higher
- The price is very high up to 9-10 lac, which is not affordable by rural people
- The machine is not portable. It needs installation. The newer machine can be assembled and dissembled at any time for transportation
- Operation is not easy. More operators are to be involved while operating the machine. The feed block developed under RuTAG-NE can be operated by a single person



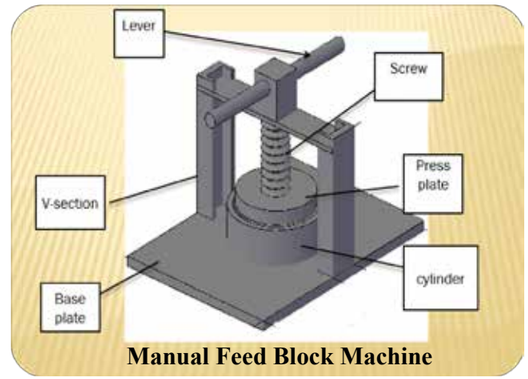
Hydraulic Feed Block Machine

Impact of the Improved Technology

- 5 Nos. of manual model were supplied to NRC on Yak (ICAR), Dirang, Arunachal Pradesh in the year 2013
- 10 Nos. of Hydraulic model were supplied to NRC on Mithun (ICAR), Jharnapani, Nagaland in the year 2016
- 15 Nos. of Hydraulic model were supplied to NEHHDC in the year 2018

Feedback from the user

- Yak rearers of Arunachal Pradesh have found the machine very user-friendly due its low maintenance and easy operations
- People from Nagaland can now easily afford a low cost feed block machine
- People from Meghalaya also want to have this technology to make briquettes so to minimize broom grass waste



Manual Feed Block Machine

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ASSISTIVE TECHNOLOGIES (2 TECHNOLOGIES)

ASSISTIVE TECHNOLOGIES

14

Portable Cow Lift for Assisting a Downer Cow

RuTAG IIT Bombay/2016-18 /Portable Cow Lift for Downer Cow

About The Downer Cow Syndrome

The downer cow syndrome is a common condition affecting pre-calving and post calving cows. The animals suffering from this disease, suffer from weak leg muscles thus making it difficult for the animal to get up (from sitting position) or stand or walk. For treatment, the animal is required to be assisted to stand on its feet to regularize its blood circulation. Assisting the animal manually is very difficult and therefore this easy to assemble and portable instrument was necessary.

Salient Features of Portable Cow Lift for Downer Cow

- The structure is sturdy and stable and supports the animal very well
- Different components of the structure can be easily assembled at site where it is needed
- The animal can be easily lifted by just 2-3 persons
- The supporting structure is designed to give maximum comfort to the animal
- The instrument has been designed after taking into account anatomy of the animal
- The hardware used is of standard category hence structure can be easily manufactured at fabrication facility in rural area

Dissemination Potential
At any location where cattle rearing is done for livelihood

Tentative cost of the prototype: ₹ 15,000 which excludes freight, installation, GST and other levies

Demand Driven Technology: This project was done in association with NGO Amboulim Nagrik Samiti, Goa. Downer cow syndrome is a common disease in which the animals suffer from weak leg muscles thus making it difficult for the animal to get up (from sitting position) or stand or walk. All existing instruments used to assist the animal were designed for use in the veterinary hospital and therefore were fixed in one position (not portable). A portable instrument was needed for supporting the animal during treatment in the field or in cow shed.

Collaborating NGO: Amboulim Nagrik Samiti, Goa

Major Drawbacks of Existing Method of Lifting a Cow

- Fixed in one position (Not portable)
- Bulky and difficult to operate
- Around 4-5 persons were needed to assist the animal
- Comfort of animal was not given high priority while lifting the animal

Current status

- One prototype given at the site of NGO Amboulim Nagrik Samiti, Goa
- One prototype given at the site of NGO Paoolwaat, Pune

Feedback from the user
"This portable device is very helpful in supporting a downer cow during treatment"
Dr. Mahendra Bale, Amboulim Nagrik Samiti Goa

Relevant Research Publications

- Prashant P. Tak, Tanmay K. Bhandakkar and Rupali S. Khanolkar (2018). Designing a cow lift for downer cow: Experience of working on a rural technology – presented during 1st International conference of RuTAG, Rural technology development and delivery (RTDD) held during 9-11 March, 2018 at IIT Delhi.

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15

Tricycle for the Mobility Disabled

RuTAG IIT Madras/2012-13/Tricycle for Mobility Disabled

Tricycle for Mobility Disabled

In the rural areas, the challenges are even more severe because of the poor road conditions. The three-wheeler therefore must be comfortable and safe during ride, be able to withstand rough road and environmental conditions while requiring little and easy maintenance, and costing less.

Salient Features of Mobility Tricycle
Suspensions for shock absorption
Modified brake design for prompt and safe braking
Small turning radius
Smaller driver sprocket
Modular assembly
Adjustable footrest, chair height, seat and backrest inclination, crank assembly location, and wheel base

Dissemination Potential
For use by mobility disabled especially in rugged terrains

Tentative Cost: Under ₹ 10,000

Demand Driven Technology: There is a huge need for a powered vehicle in India for the mobility-disabled people (MDP). Vehicles specifically for the MDP are almost absent in India and it appears that only very few indigenous efforts have been made to address this need. The contemporary means for traveling/commuting for the MDP are antiquated. Most of them use hand-driven tricycles that require a lot of effort and consequently have a reduced range. Other classes of vehicles are converted from two wheelers (which are designed for able-bodied users) by adding two wheels on the sides.
Collaborated NGO: Sukriti Foundation

Major Drawbacks of Existing Mobility Tricycle
Handle is too long
Larger turning radius
Excessive leg space
The rear has too many tubes
No space to keep many crutches
Parking brakes do not function desirably

Impact of the Improved Technology

- Improved comfort and ease in mobility for the mobility-disabled.
- Modular features customizable depending on extent of disability and requirement of user.

Relevant Research Publications

- Soni A., Ramanathan M. and Bandyopadhyay S. (2012), An improved design for the manually operated tricycle for the physically challenged Indian Patent Application No. 613/CHE/2012

Feedback from the user
Climbing in and out is Good and Riding uphill and downhill is Fair

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DRAUGHT ANIMAL POWER (3 TECHNOLOGIES)

DRAUGHT ANIMAL POWER

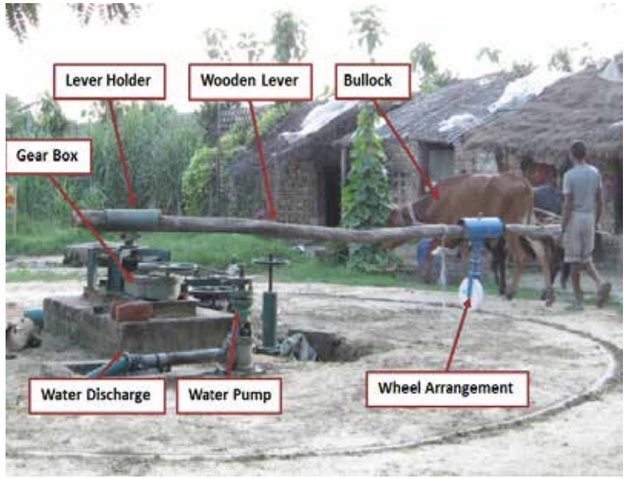
16

Animal Driven Gear Box

RuTAG IIT Delhi/2012-14/ADGB

Animal Driven Gear Box (ADGB)

This speed enhancing gear box is operated by animal power for various rural applications such as for running the flour mill (atta chakki), chaff cutter, grain thresher, water pump and other small rural gadgets.



Salient Features of ADGB

- Standardized gear box with efficient power transmission
- Wheel arrangement for lever support is provided to reduce load on bullocks
- Can be used for multiple rural applications

Dissemination Potential

Harnessing animal power for various rural applications viz. Screw pump, Chaff cutter, Atta chakki and Paddy thresher

Tentative cost of the prototype excluding freight, installation, GST and other levies:
Gear box ₹ 45,000; Screw Pump ₹ 45,000; Power Transmission System ₹ 22,000; Chaff-Cutter ₹ 14,000; Atta-Chakki ₹ 14,000; Paddy Thresher ₹ 8,000

Demand Driven Technology: Upon demand from the farmers, RuTAG IIT Delhi took an initiative to standardize the Animal Driven Gear Box (ADGB) and power transmission system developed by M/S Panchal Pumps & Systems, Kanpur for multiple rural applications such as Screw Pump, Chaff-Cutter, Atta-Chakki, and Paddy Thresher. The modified ADGB and its various applications were very much appreciated by small farmers who use bullocks for farming.
Collaborated NGO: M/s. Panchal Pumps & Systems, Kanpur, U.P.

Major Drawbacks of Old ADGB

- ADGB and its power transmission were not standardized
- Gearbox was heavy, bigger in size and expensive
- Excessive load on bullocks due to absence of lever support
- It was used only for pumping water

Impact of the Improved ADGB

- Nearly 40 devices have been sold by the vendor
- Efficient harnessing of animal power and environment friendly
- Currently being used in Uttar Pradesh, Maharashtra, Madhya Pradesh, Karnataka, Jharkhand, and Assam

Feedback from the user

Very useful ADGB for both sprinkler and drip irrigation around 25 acres-Mr. Jay Dwivedi, Biowed Research &Communication Centre, Allahabad, U.P.

Relevant Research Publications

- Ashish Singh Bhandari, Vamsi Aluru, Saurabh Sahu, Subir Kumar Saha, and Raj Kumar Gupta, 2014, "Design Evaluation of an Animal Driven Prime Mover 11th National conference on "Industrial Problem on Machines and Mechanisms" at ITS Engineering College, Noida.
- Davinder Pal Singh, Raj Kumar Gupta, Mangal Sharma, Sabyasachi Chatterjee, Subir Kumar Saha, 2014, on "Technology Upgradation and Entrepreneurial Diffusion through Rural Technology Action Group (RuTAG) of IIT Delhi", 3rd National Rural Management Symposium on "Rural Entrepreneurship and Enterprise for Inclusive Growth" at KIIT School of Rural Management, KIIT University, Bhubaneswar, Odisha.

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17

Enhancing Life of Horse Shoes

RuTAG IIT Kanpur/Horse Shoe

Enhancing Life of Horse Shoes

The horses are put on shoes to protect their hooves from wear and tear. Made out of saria, Life of horse shoes is quite short (nearly 5-12 days); frequent nailing causes injuries and lameness. Increased the life to 3 to 4 weeks.

Salient Features of Horse Shoe Technology

The technology developed uses medium Carbon steel (commercial grade EN9) and uses new process route by introducing new reheating step and a faster cooling

Life of horse shoes using the new technology increased to 23 – 26 days

Cost has gone up marginally; the benefit to be shared between horse owners, farriers and shoe makers

Patent Granted

Technology Dissemination
A technology dissemination programme is on in which shoe makers and farriers of 25 districts in Uttar Pradesh are being trained by RuTAG IIT Kanpur

NGO Partner: Shramik Bharti

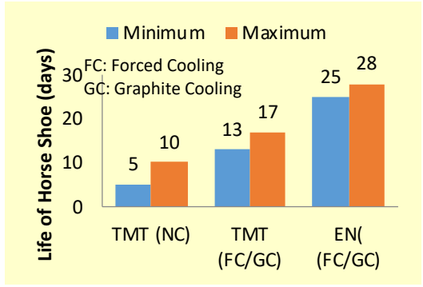
Dissemination partner: Brooke India

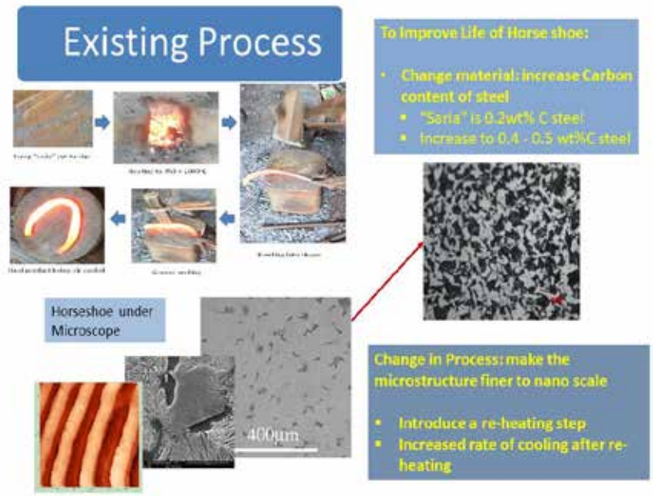
Tentative cost of the prototype: ₹ 150 for four shoes

Easy Manufacturing **Marginal Increase in Cost**

Flexibility **Highly Durable**

Increased Longevity





Team:
1. Prof Sandeep Sangal, Dept of MSE, IIT Kanpur
2. Dr. K .C. Chandrashekhar, Dept of Metallurgical and Materials Engineering, IIT Roorkee

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18

Ergonomically Designed Bullock Driven Tractor

RuTAG IIT Delhi/2013-17/BDT

Bullock Driven Tractor (BDT)

Bullock Driven Tractors use draught power of bullocks, and are suitable to the needs of the farmers with small land holdings. BDTs are capable of performing multiple tasks of agricultural operations such as ploughing, harrowing, sowing, planting, and harvesting.

Salient Features of Ergonomically Designed BDT
Steel rope and winch mechanism for lifting attachments such as harrow, cultivator, seed drill, etc.
Better sitting posture
Easier in turning the tractor
Provides comfort to the tiller

Dissemination Potential

Draught animal power for agricultural operations viz. ploughing, sowing, harrowing, planting and harvesting

Tentative cost of the prototype: ₹ 25,000 which excludes freight, installation, GST and other levies

Demand Driven Technology: Existing BDTs performed inefficiently with issues in lifting attachments while turning and lacked ergonomic design. As per the demand, RuTAG IIT Delhi took the initiative for finding out solutions to these issues. A better and efficient BDT have been designed, developed and distributed. Modifications have been appreciated by the farmers in Dahina village in Haryana, and villages near Balaghat and Tamia in Madhya Pradesh.

Collaborated NGOs: Social Centre for Rural Initiative and Advancement, Khori, Rewari, Haryana; Madhya Pradesh Vigyan Sabha, Bhopal, M.P.; Wainganga Samudaik Vikas Kendra, Balaghat, M.P.

Major Drawbacks of Old BDT
No mechanism for lifting the attachments while turning
Difficulty in turning the BDT due to heavy attachment and large size of lever
Iron chair was used which was discomfort to the famer
Caused fatigue and stress on the bullocks

Impact of the Improved BDT

- Nearly 3 BDTs have been distributed (by RuTAG IIT Delhi)
- One BDT was sold through Innovative Products Delivery of FITT-IIT Delhi
- One BDT has been purchased by Shantidhara Dugdh Yojna, Binaji Barah, Sagar, M.P.
- Efficient harnessing of animal power
- Most suitable to farmers of small land holdings
- Relief to farmers from increasing price of the fossil fuel and electricity, and environment friendly
- Currently, it is being used in M. P. and Haryana

Feedback from the user

Increased comfort to the farmer and animal- Farmers, Dahina village, Rewari, Haryana

Relevant Research Publications

- Davinder Pal Singh, Ajit Kumar, Raj Kumar Gupta, Mangal Sharma, 2018, "Improving the Design of Bullock Driven Tractor (BDT) to Make it User-Friendly."A paper presented on 1st International Conference of Rural Technology Action Group (RuTAG), IIT Delhi, New Delhi.

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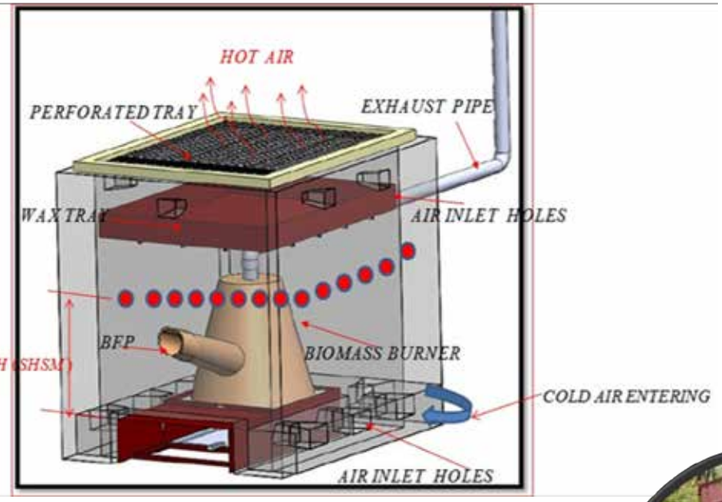
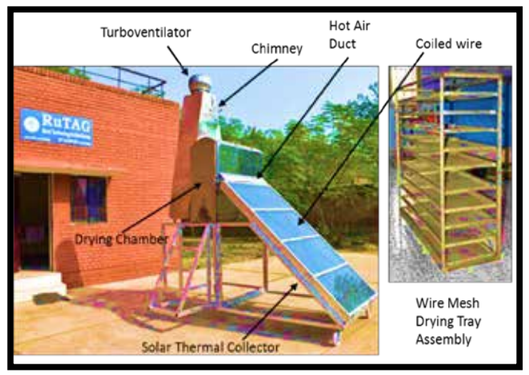
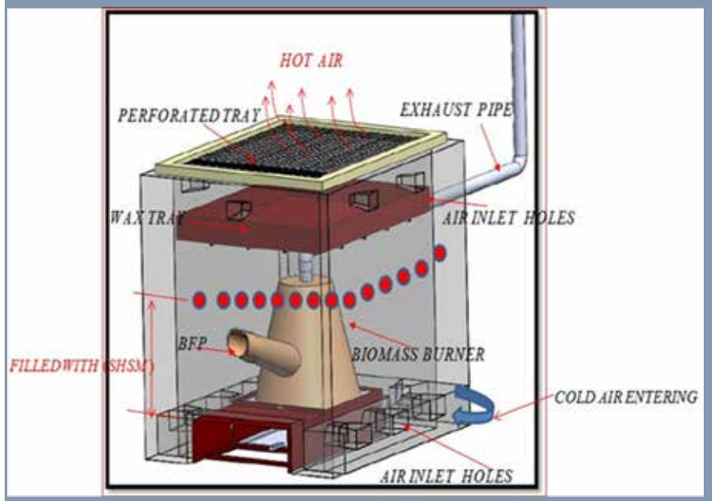
ENERGY (4 TECHNOLOGIES)





ENERGY



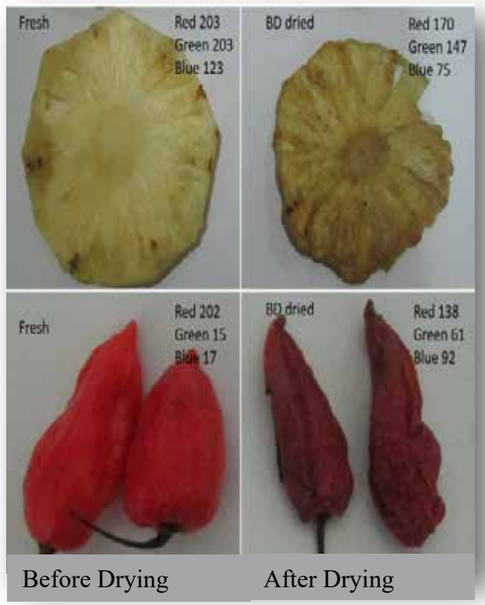
19

Biomass Dryer

RuTAG NE IIT Guwahati/Biomass Dryer

Biomass Dryer

It is an indirect heating type natural convection drier for drying agro-horticultural and herbal products. In this dryer, the heat required for drying is supplied by firing biomass in a conical shape burner. The flue gas from the combustion chamber melts the wax plate before leaving through chimney. The fresh air passes through and over the wax layer, temperature increases, then passes through the drying tray. While passing through the products, its takes away moisture and the products get dried.



Salient Features of Biomass Dryer

- Can be customized for drying different products
- Can also be customized for different sizes
- Negligible maintenance is required
- The Dryer was tested for paddy, king chilly, pineapple, ginger etc.

Dissemination Potential
Food Processing

Tentative cost of the prototype: ₹ 35,000

Demand Driven Technology: Traditional process of drying includes drying under the heat gained from the sun, but has quality problems such as contamination with dust, rotten colour, requires longer time duration etc. Although electrical dryers are easily available and have good quality control capacity, but electricity is one major problem in rural areas. Dr. Gunaviram Khanikar, approached RuTAG-NE to develop a drier. RuTAG-NE has developed an indirect heating type natural convection drier under thorough technical guidance of Prof. P. Mahanta, for drying agro-horticultural and herbal products.

Major Drawbacks of Existing Dryers

- Other dryers can only dry a specific item
- Traditional drying i.e. sun dried process involves with many contamination issues. Moreover, drying duration is much longer
- Constant monitoring is required to control temperature
- Electrical dryers are not suitable for rural areas

Impact of the Improved Technology

- STINER programme has decided to disseminate 200 nos. of dryer across NE region
- People from Nagaland working under GIZ, are ready to adapt the technology
- Currently some training programmes are going on regarding the dryer in collaboration with Mizoram and Sikkim ministries

Feedback from the user

- People dealing with dry products from Nagaland are very much satisfied with the technology.
- People from various suburb areas of Assam are interested in adapting the technology.

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20

Household Oil Expeller

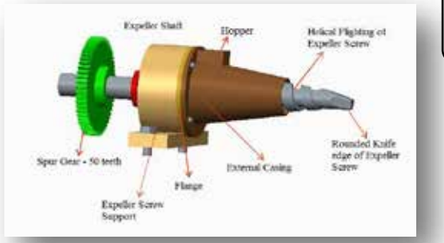
RuTAG IIT Madras/2015-16/Oil Expeller

Oil Expeller

The oil expeller consists of a screw in a sealed chamber having inlet and outlet for seeds and oil cake respectively. When there is pre-heating of seeds for better oil yield, the oil obtained is known as hot-pressed oil. Oil obtained by mechanical crushing without increase in temperature of oil is known as cold-pressed oil.

Salient Features of Household Oil Expeller

- 30% yield of cold pressed oil
- Seeds are crushed in single run
- Groundnut, sesame and dry coconut have been tried
- Special tapered screw designed for maximum compression



Dissemination Potential

Additional source of income for farmers, Tabletop device for urban health-conscious segment

Tentative cost of the prototype: ₹ 30,000

Demand Driven Technology : The objective is to design and fabricate a small motorized Oil Expeller machine, meant for household (or small farmer's use). The intention is to improve upon a previous design made by Gandhigram Rural Institute and to rectify its deficiencies, i.e., (a) lack of robustness, (b) occasional seizing or blocking of the screw from the oil cake, (c) difficulty of cleaning the oil cake blockage (lack of modular design for quick disassembly).

Collaborated NGO: Gandhigram Trust, Dindugal, Tamilnadu

Major Drawbacks of Existing Oil Expeller

- Hot press method
- Decrease of nutritive content of both oil and oil cake products
- Requirement of multiple crushing to obtain good yield
- Opening up of device in case of seeds getting stuck during crushing
- Slow feeding time of larger seeds

Impact of the Improved Technology

- There is an untapped opportunity of building a supply chain linkage for the cold-pressed oil for farmers and women Self Help Groups, thus connecting rural and urban areas.
- Rural and urban enterprises can include this as an item in their basket of food products, similar to sale of freshly ground flour/ batter.
- Use of fresh, cold-pressed oil will have a positive impact on health of users.
- Urban individual users may want a table-top unit for fresh oil.

Relevant Research Publications

- Sandhya Seetharaman: Review of Science and Technology Interventions developed by Rural Technology Action Group, IIT Madras. Paper presented in 1st International Conference on Rural Technology Development and Delivery, Indian Institute of Technology Delhi, March 9-11, 2018.
- Akash, Shankar, K.: Design of household mini oil expeller. B.Tech thesis submitted to Indian Institute of Technology Madras (2016).

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21

Kiln for Making Charcoal from *Prosopis juliflora*

RuTAG IIT Madras/2012-16/Charcoal Kiln

Charcoal Kiln

Acting upon a request from ODAM, RuTAG has designed and fabricated a 100 kg prototype of a charcoal kiln for efficient production of charcoal from the abundantly available fuel wood tree *Prosopis juliflora* (Seemai karuvelam in Tamil). Five trials were undertaken along with temperature readings using thermocouples in order to draw up an easy-to-use protocol for operation in rural areas.

Salient Features of Charcoal Kiln

- 0.5 to 1 ton capacity
- Insulated steel drum
- Ability to control airflow in the inlet and outlet
- Use volatiles from wood in heating
- Faster turnaround time (1 to 2 days)
- Lesser pollution
- Complete elimination of water consumption
- Higher yield

Dissemination Potential

Can be used as a livelihood option of 'portable kiln' in areas where invasive wood species such as Prosopis juliflora are available in plenty.

Tentative cost of the prototype: ₹ 80,000 for 150 kgs capacity (input)

Demand Driven Technology: The current practice of charcoal production from *Prosopis juliflora* (Seemai Karuvelam in Tamil) in the southern districts of Tamil Nadu using earth kiln is a process that is resource-intensive in terms of time, efforts, labour and water and also involves risk to workers. The process is also very polluting due to release of volatiles and particulates during the pyrolysis. In baseline surveys done in Virudhunagar district, the need for an S&T intervention that reduces both the resource consumption and the need for constant supervision was expressed by the charcoal producer community.

Collaborated NGO: Organization of Development Action and Maintenance (ODAM), Virudhunagar

Major Drawbacks of Traditional Earth Mound Kiln

- Takes 3-4 days to stack wood and total production process takes 10-15 days
- Labour intensive and lot of drudgery involved
- Lot of particulates and gaseous emissions released in process
- Mud residues stuck to charcoal product
- Requires 1 tanker load of water to stop production process

Impact of the Improved Technology

- Reduction in drudgery and risk of accidents in charcoal production as constant supervision through nights is reduced
- Water requirement for the production is almost nil
- The charcoal producers may get a better value for their products due to better quality
- New livelihood option of charcoal kiln rental
- Soil deterioration due to burning is prevented due to use of portable kiln

Relevant Research Publications

- Indala, V. S. S.: Studies on Pyrolysis of *Prosopis juliflora*. Master of Technology thesis in Chemical Engineering submitted to Indian Institute of Technology Madras (2012)

Feedback from the user

The quality of charcoal obtained in RuTAG kiln is very good as it does not contain mud residues or much unburnt wood.

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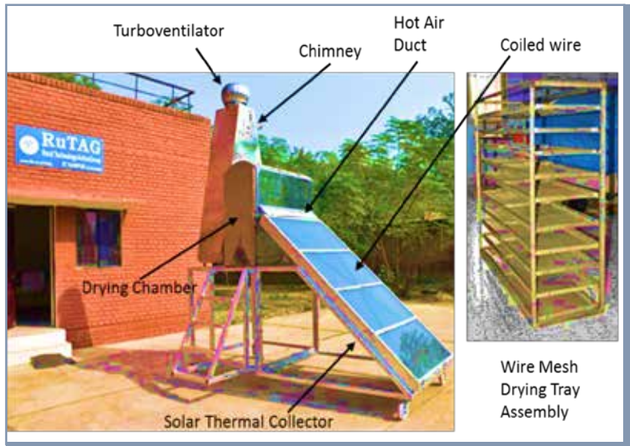

22

Solar Thermal Drier

RuTAG IIT Kanpur/2017/Solar Thermal Drier

Solar Dryer for Food Processing

A low cost zero energy solar thermal dryer is developed to obtain temperatures in the range 45° to 65°C. The target is rural based small size food processing units particularly those engaged with amla and bael processing, and vegetable drying. The solar dryer is capable of drying in a closed chamber so that the green matter is not exposed to the direct sun. It has the capacity of holding 20 kg green load of amla candy.

Salient Features of Solar Drier

- Thermal Collector – Flat Bed Aluminium based
- Drying Chamber with easy loading-unloading trays
- Chimney with Turbo-Ventilator
- Runs without electricity
- Zero Maintenance

Project Investigators

- Prof. Sandeep Sangal, Dept. of MSE, IIT Kanpur
- Prof. Kallol Mondal, Dept. of MSE, IIT Kanpur
- Prof. Naveen Tiwari, Dept. of CHE, IIT Kanpur

Dissemination Potential
Amla processing cluster of Pratapgarh, Varanasi, Jaipur, Ahmedabad, Pune, etc.

Tentative cost: ₹ 1,00,000

Thermal Collector

- A flat bed aluminium based collector covered with glass designed & exposed to the sun which acts as a collector of solar energy.
- Easy replacement of glass.

Drying Chamber

- A well insulated box with stacks of trays on which the green load is placed.
- Dehydration takes place as the hot air passes from the collector over the green load.
- Easy loading & unloading of the trays.
- Dryer dimensions: 51cm X 128cm X 112cm
  Number of trays: 9

Chimney with a Turbo Ventilator

- A chimney with a turbo ventilator fitted at the top.
- Chimney sucks the moisture laden air out of the dryer due to natural convection.
- Turboventilator operates without electricity and rotates using the wind energy.

Results

- Temperature achieved is 45-65 degree C
- No decoloration of dehydrated product
- Satisfactory Rehydration Ratio

Partners

Fabricator - Frontier Alloy Steels Limited, Kanpur

NGO Partners -

- Shramik Bharti, Kanpur
- Pushpanjali Gramodyog, Pratapgarh

Technical Partner - Indian Institute of Vegetable Research, Varanasi

Demonstration in Pratapgarh

Feedback from the user
Saves time, No decolouration of dehydrated product, Satisfactory rehydration ratio

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ENVIRONMENT/WATER (4 TECHNOLOGIES)

ENVIRONMENT/WATER

23

Air Quality Measurement System Using Low Cost Sensors

RuTAG IIT Madras/2017-18/Air Quality Measurement System

Air Quality Measurement System Using Low Cost Sensors

In India, air quality is being monitored at more than 573 fixed stations across the country through manual or automatic measurements. The current fixed monitoring stations use sophisticated instrumentation to measure the ambient air quality. The operation and maintenance of these fixed stations are expensive. Further, the data captured by these fixed stations may not reflect spatial variation of urban air quality. In this context, there is a need for cost effective, real time air quality monitoring system.

Salient Features of Air Quality Measurement System

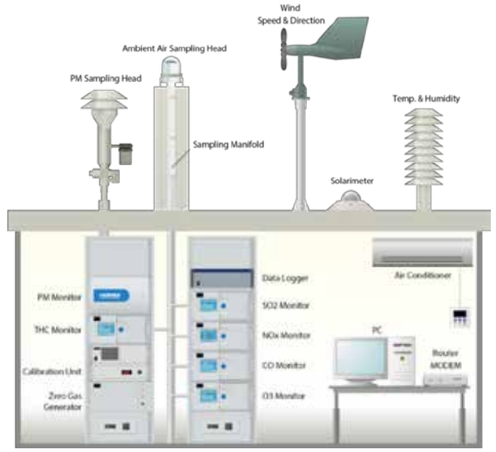
- Semiconductor sensors for CO_2, CO, particulates, temperature, and humidity
- Calibrated and validated using electrochemical sensors
- Data transmission through GSM/ WiFi/ LAN and IoT
- Cost effective and easy to maintain
- Low-cost and easily available sensors
- Portable

Dissemination Potential

Air quality monitoring even in remote areas at much lower costs

Tentative Cost: ₹ 50,000

Demand Driven Technology: The costs to set up fixed site monitoring stations using sophisticated instrumentation is substantial. Operation of monitoring stations is also constrained by the crucial requirement of infrastructure, i.e., secured enclosures, power supply, location etc. Therefore, there is an immediate requirement to complement existing air quality monitoring network with flexible and affordable alternative technologies to improve spatial and temporal resolution of air quality data for both scientific and public awareness purposes.
Collaborated NGO: Green Rameswaram, Vivekananda Kendra, Kanyakumari



http://static.horiba.com/en_en/products/detail/action/show/Product/aqms-1560/

Major Drawbacks of Existing Air Quality Measurement System

- Capital-intensive sophisticated equipment
- Expensive operation and maintenance
- Fixed stations may not reflect spatial variation of air quality
- Data may not be available visually

Impact of the Improved Technology

- Empowering people in terms of air quality measurement and monitoring, especially in places adjoining industrial areas
- Improved public awareness on air quality

Feedback from the user

'We want to display air quality data in prominent public places in Rameswaram as part of our Green Rameswaram initiative'
-Green Rameswaram team

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24

Ergonomically Designed Treadle Pump

RuTAG IIT Delhi/2012-17/Treadle Pump

Treadle Pump

Treadle pump is a mechanical device which uses human power to draw water from the ground. It is a twin-cylinder reciprocating water pump presently being used by small/marginal farmers in various parts of eastern U.P, Bihar, Orissa and other places for irrigation purposes. These are particularly popular in areas where water level is not too low (around 10 m or less).

Salient Features of Ergonomically Deigned Treadle Pump

- Portable
- Easy to assemble and operate
- Made using hand pumps and plumbing parts
- Save electricity and environment friendly
- Pedals can be adjusted according to the weight of the operator
- Discharge rate: 3500-4000 litre per hour
- Projected life span: 10 to 15 years

Dissemination Potential
Irrigation, lifting water from wells, bore holes, and ponds

Tentative cost of the prototype: ₹ 10,000 which excludes freight, installation, GST and other levies

Demand Driven Technology: Though treadle pumps have been used extensively, farmers expressed the need for improving their ergonomic design to make its operation less cumbersome. Further, the problem of rapid wearing out of the piston washers was also reported. As per the demand and requirements, more efficient and user friendly treadle pumps was developed by RuTAG IIT Delhi.
Collaborated NGOs: Gramodaya Rachnatmak Vikas Sansthan, Deoria, U. P.; Madhya Pradesh Vigyan Sabha, Bhopal, M.P.; Wainganga Samudaik Vikas Kendra, Balaghat, M.P.

Major Drawbacks of Existing Treadle Pump

- Not standardized
- Difficult to operate, and caused stress on knee and calf muscles
- Cylinder was made using M.S. sheets, and lacked cylindricity
- Rapid wearing of piston washer due to friction
- Discharge rate: 2500-3000 litre per hour
- Projected life span: 1 to 1.5 years

Impact of the Improved Technology

- A total of about 19 pumps were sold (8 by vendors and 11 by RuTAG IIT Delhi)
- Two treadle pumps were sold through Innovative Products Delivery of FITT-IIT Delhi
- Useful for farmers with small land holdings
- Treadle pumps are installed in Orissa, Uttar Pradesh, Bihar, Madhya Pradesh, Karnataka, and West Bengal successfully

Feedback from the user
Very useful device for pumping water from ponds without electricity
-Residents, Ambalipura, Banglore

Relevant Research Publications

- Pawan Tiwari, S.N. Singh, Subir Kumar Saha and Davinder Pal Singh, 2016, "Treadle pump operation with rotary motion", International conference on advanced technologies for societal applications, Pandharpur, Maharashtra
- Airin Dutta, Dynamic analysis and design of solar operated treadle pump, M.Tech Thesis, IIT Delhi, 2017
- Best poster award, the poster on 'Dynamic Analysis and Design of a Solar-operated Treadle Pump' by Airin Dutta, iNaCoMM, 2017, Mumbai

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25

Ground Water Level Measuring Device

RuTAG IIT Delhi/2012-17/GWLMD

Ground Water Level Measuring Device (GWLMD)

This device is used to measure ground water table in the monitoring well. It is an electric switch-type device, with electrodes having open ends attached to a wire, which is further connected to a battery beeper and LED. When electrodes encounter conductive fluid, the circuit is completed and buzzing starts and depth is measured from the marked cable.

Salient Features of GWMD
Portable
Complies with IS 15896:2011
Probe is an assemblage of plumb bob, perforated tubular body, high pressure cord holding gland, a sensor, and stainless steel material
High operational stability
Accurate measurement

Dissemination Potential

Estimation of ground water resources, In-situ water measurement for various sectors like irrigation, domestic and industries

Tentative cost of the prototype: ₹ 10,000 which excludes freight, installation, GST and other levies

Demand Driven Technology: Old ground water level measuring device was very expensive and could not accurately measure and interpret the depth of groundwater in an observation well. It used to get affected by the presence of moisture in the well and eventually gave false reading. Moreover, the device often got stuck in between the rivets joining the socket and the well casing leading to breakage and damage. Hence, due to the consistent demand from the field agencies/ NGOs for the low cost and robust ground water measuring device, RuTAG IIT Delhi took the initiative to design and develop a low cost ground water level measuring device.

Collaborated NGO: Ram Krishna Jaidayal Dalmia Seva Sansthan, Chirawa, Rajasthan

Major Drawbacks of Old Device
Made using plastic pipe in a non-professional way
Low quality cord
The overall structure lacked robustness to hold cord reel effectively
Inaccurate measurement

Impact of the Improved Technology

- Nearly 3 devices have been sold/distributed (by RuTAG IIT Delhi)
- Used by Central Ground Water Board, Ministry of Water Resources, Govt. of India
- A new company at IIT Delhiextended the product to a contactless device, http://www.aquasense.tech/#products

Feedback from the user

Easy and accurate ground water level measurement

-Ram Krishna Jaidayal Dalmia Seva Sansthan, Chirawa, Rajasthan

Relevant Research Publications/Commercial Product

- Davinder Pal Singh, A. K. Gosain, 2018, "Development of a Low-Cost Ground Water Level Measuring Device", A paper presented on 1st International Conference of Rural Technology Action Group (RuTAG), IIT Delhi, New Delhi.

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26

Pump Used as Turbine for Pico Hydro

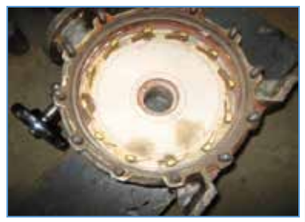
RuTAG IIT Roorkee/2015-17/PAT

Pump Used as Turbine for Pico Hydro

The problems associated with micro hydro power exploitation are primarily economical. In general, each proposed site requires turbine with specific design parameters to suit head and discharge conditions unique to the site. Among various options, commercially available water pumps can be highly economical substitute for expensive turbines. Centrifugal pumps are efficient when used for small power generation and specific discharge conditions. However, these pumps are not fitted with mechanism to regulate quantity of water discharge. It adversely affects efficiency in part flow conditions.

Modified yet low cost centrifugal pumps fitted with flow control mechanism to regulate flow of water while maintaining high efficiency has been developed. These modified pumps will be useful in efficient generation of power throughout the year even when discharge in the stream varies significantly.

Pump used as Turbine



Casing with Guide vane

Salient Features of Pump Used as Turbine

- The availability of pumps and their spare parts are easy to assemble and operate
- Investment cost of PAT is lesser than of a comparable turbine
- More cost effective and efficient for small power generation
- Standard pumps are simple and sturdy, and do not require highly qualified mechanic for maintenance

Dissemination Potential

Electricity generation in remote areas of hilly regions, for small scale local industries especially energising cold storage units and other food processing units etc.

Tentative cost of the prototype: The estimated cost of PAT is about ₹ 60,000 for 5kW of power generation whereas the cost of complete hydro power generating unit is nearly ₹ 1.25 lakh/kW.

Demand Driven Technology: Pico-hydro power units can be used for electricity generation in remote areas of hilly regions. The electricity generated by such machines can be utilised to operate small scale local industries. There are lot of potential sites for pico hydro in hilly regions. The problem associated with exploitation of these potential basically is non availability of turbines for each sites as turbines are site specific. RuTAG IIT Roorkee has modified centrifugal pumps to be used as turbine, fitted with flow control mechanism for wider range of operating parameters at given sites and maintaining high efficiency.

Collaborated NGO: Jansamarth, Tehri, Uttarakhand

Casing of Pump

Major Drawbacks of Existing Pump as Turbine (PAT)

- Absence of flow control mechanism in existing Pump.
- Part load efficiency is poor.

Impact of the Improved Technology

- Pump which can be used as pico turbine is more cost effective and efficient in hilly areas
- Power generated from pico-power units can be used for energising cold storage units and to operate small scale local industries
- Useful for states like Uttarakhand and Himachal Pradesh, and other states such as J&K, North Eastern states and Western Ghats where pico-hydro potential is available
- Efficient for small power generation under variable discharge conditions

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HANDICRAFTS (13 TECHNOLOGIES)












HANDICRAFTS

27

Automatic Potter's Wheel

RuTAG IIT Madras/2010-12/Automatic Potter's Wheel

Automatic Potter's Wheel

Moulding of pots has usually been done on a potter's wheel with the potter manually adjusting the speed as required. The speed obtained thus is not stable, constant and often require manual intervention. The rotation of wheel consumes time and human energy thus reducing production. Different potters have different styles of working such as standing up/ sitting down. Also, different products have different speed requirements during moulding.

Salient Features of Potter's Wheel

- 3 different speeds- 720, 960 and 1440 rpm
- Single phase induction motor
- No electronic components
- Low maintenance
- Pulley and belt drive to transfer motor power to shaft of wheel

Dissemination Potential
For use by potters requiring different speeds for moulding of different products

Tentative Cost: ₹ 10, 000

Demand Driven Technology: Though there are many variations of potter's wheels available in the market, a need for a wheel that has different speeds, yet is rugged was expressed. The need for electronic components was eliminated by introducing three windings in the motor for obtaining 3 different speeds. Since no inverter or auto transformer is used, the systems has lesser components and requires low maintenance.
Collaborated NGO: Centre for Social Development, Nagercoil, Tamil Nadu

https://timesofindia.indiatimes.com/travel/destinations/himachals-pot-secret-its-not-what-you-think/as22754730.cms

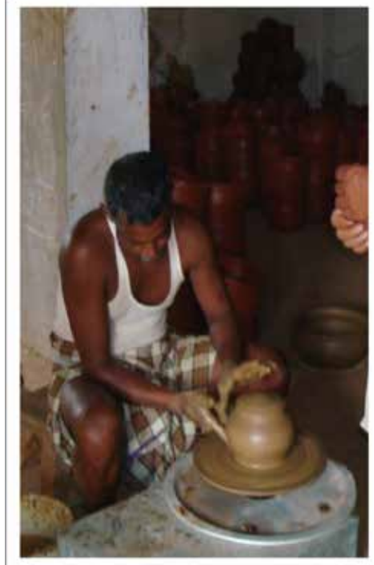
Major Drawbacks of Existing Potter's Wheel

- Manual is laborious and time intensive
- Motorized- Only one speed possible
- Automatic using autotransformer- speed changes are not feasible. System is bulkier. Higher cost
- Automatic using rectifier and inverter- Expensive; Many electronic components- hence higher maintenance

Impact of the Improved Technology
- Moulding different products using different speed modes
- Lesser maintenance costs for users

Feedback from the user
'Convenient to use in all speeds'
- Potter, Thalakulam, Nagercoil

Relevant Research Publications:
- Sandhya Seetharaman: Review of Science and Technology Interventions developed by Rural Technology Action Group, IIT Madras. Paper presented in 1st International Conference on Rural Technology Development and Delivery, Indian Institute of Technology Delhi, March 9-11, 2018.



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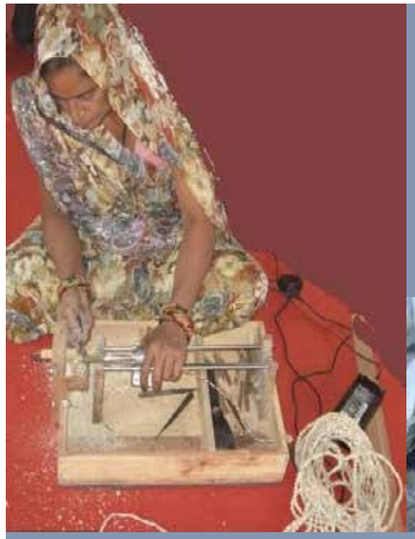


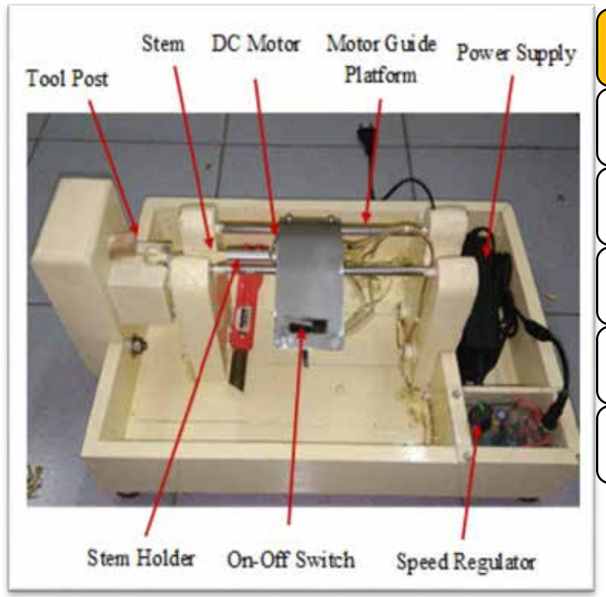
28

Ergonomically Designed Bead Making Device

RuTAG IIT Delhi/2012-13/Bead Making Device

Bead Making Device

The device is employed to make beads (size range 3 -14 mm) from various stems (size range 6-16mm) by performing turning, drilling and cutting of each bead. These beads are mainly used for making of malas, rosaries, and other decorative purposes. Currently it has been used in the rural areas of Rajasthan, Kerala, Karnataka, Uttarakhand, Gujarat, Himachal Pradesh, Odisha, Madhya Pradesh and Maharashtra.



Salient Features of Ergonomically Designed Bead Making Device

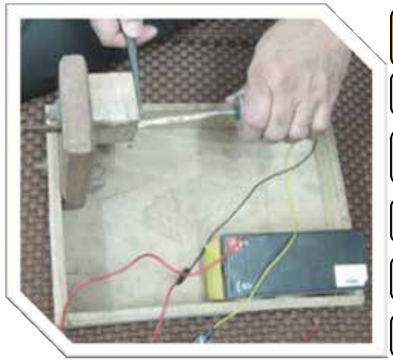
- Portable
- Better sitting posture
- Speed regulator to control the exercise
- ₹ 1200-1400 earning per day
- Consistent finish of beads

Dissemination Potential
Suitable for women and rural livelihood

Tentative cost of the prototype: ₹ 5,000 which excludes freight, installation, GST and other levies

Demand Driven Technology: Various shapes of beads are made from the stems of Holy Basil (Tulsi), Neem, Sandal wood etc. in many villages of India as there is a good demand and consumption of malas throughout the year. Though artisans had devised their own conventional arrangements for turning, drilling, polishing and cutting of beads from the stem, the process was cumbersome which resulted in low productivity and inconsistent quality of beads. As per the need and demand for developing a low cost device to carry out the effective operations with high productivity and consistent quality of the beads, an ergonomically designed bead making device was developed at RuTAG IIT Delhi. It has been reported that the artisans are satisfied working on the improved device.

Collaborated NGO: Lupin Human Welfare & Research Foundation, Bharatpur, Rajasthan.



Major Drawbacks of Existing Bead Making Device

- No speed control
- Motor was lacked support and held on hand to perform the exercise
- Irritation and pain in arms and fingers
- Stem holder got detached very often
- ₹ 300-500 earnings per day

Impact of the Improved Technology

- Nearly 120 devices are in the field (113 by vendors and 7 by RuTAG IIT Delhi)
- Five bead making devices were sold through Innovative Products Delivery of FITT-IIT Delhi
- Adapted by AMMACHI Labs, Amritapuri, Kerala for improvement of women's livelihood

Feedback from the user
Enhanced productivity and income by thrice
-Ms. Omwati Devi, Nadwai Village, Bharatpur, Rajasthan

Relevant Research Publications

1. Raj Kumar Gupta, Mangal Sharma, Davinder Pal Singh, Bhivraj Suthar, Subir Kumar Saha, 2015, "Women Empowerment by Technology supported manufacturing of beads from Holy Basil", Current Science Journal under special section of Design for well-being, Vol. 109, No. 9.
2. Raj Kumar Gupta, Mangal Sharma, Davinder Pal Singh, Bhivraj Suthar, Subir Kumar Saha, 2014, "Technical Interventions for the Empowerment of Rural Women: A Case Study of the Manufacturing of Beads from Holy Basil (Tulsi)", Design for sustainable well-being and empowerment, Indo-Dutch international conference, IISc Bangalore.

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29

Improved Furnace for Jointless Glass Bangles

RuTAG IIT Delhi/2013-17/Furnace for Jointless Glass Bangles

Furnace for Jointless Glass Bangles
This furnace is used for making jointless glass bangles which are considered very auspicious for weddings across the state of Rajasthan.

Salient Features of Improved Furnace

- Improved the working environment by reducing the pollution level and temperature around the furnace with the help of commercial ceramic fiber insulation and a chimney-damper arrangement
- New furnace uses the same fuel (husk) as its traditional counterpart
- Attains a temperature of 1000°C within 10 minutes of firing
- The percentage reduction in fuel consumption in the complete operation (for 8 hours) was found to be about 74% compared to that of the traditional furnace

Dissemination Potential
Production of various artistic products

Tentative cost of the prototype: ₹ 70,000 which excludes freight, installation, GST and other levies

Demand Driven Technology: Glass bangles are manufactured by skilled artisans in several clusters in Northern India. Bharatpur in Rajasthan has several artisans engaged in this activity. The bangles are intended to be made jointless. This makes the crafting process different from their counterparts of Firozabad where jointed bangles are produced. In Bharatpur, 14 of these bangle-making furnaces are operated on loose biomass. The artisans in Bharatpur had faced several difficulties in the use of traditional furnace and tools. In the village of Unch in Nadbai block of Bharatpur district, Lupin Human Welfare and Reearch Founation, an NGO, has been working for the betterment of the artisans. As per their request, Rural Technology Action Group (RuTAG) IIT Delhi took the initiative for finding solutions to the problems faced by the artisans engaged in the manufacturing of glass bangles.
NGO Collaborator: Lupin Human Welfare and Research Foundation, Bharatpur, Rajasthan

Major Drawbacks of the Traditional Furnace

- The smoky working environment led to respiratory disorders
- The high temperature made the working environment very difficult particularly during summer
- Low furnace efficiency led to high fuel consumption

Impact of the Improved Technology

- Two clusters in villages of U.P. have expressed interest in the improved furnace
- Substantial improvement in the working environment

Feedback from the user
New furnace is smokeless and efficient which saves a lot of fuel

Relevant Research Publications

- Davinder Pal Singh, Shrey Gulati, Subir Kumar Saha, M. R. Ravi, Sangeeta Kohli, Presented a paper on "Design of an Efficient and Ergonomic Bangle-Making Furnace and Tools", 3rd International Conference on "Creativity and Innovations at Grassroots" at Indian Institute of Management Ahmedabad held during January 19-22, 2015.
- Davinder Pal Singh, Sangeeta Kohli, M. R. Ravi, S.K. Saha, Mangal Sharma, Raj Kumar Gupta. Presented a paper on "Developments to Overcome Problems in Traditional Process of Making Glass Bangles", An International Conference on Rural Technology Development and Delivery: RuTAG and its Synergy with other Initiatives", Indian Institute of Technology Delhi, New Delhi, India March 9-11, 2018.

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Improved Up Draught Pottery Kiln

RuTAG-IIT Delhi/2017-2019 /Pottery Kiln

Improved Up Draught Pottery Kiln

Pottery making is a traditional craft in villages for making clay utensils and various artifacts. These furnaces are highly polluting and inefficient. The improved design of the pottery kiln is more efficient and less polluting.

Dissemination Potential
Production of various artistic products

Salient Features of Improved Furnace

The improved kiln incorporates a grate to provide primary air for combustion, thus minimizing smoke emissions during firing

Air-gaps are introduced through rat-trap type of wall construction which act as a low-cost insulating medium that minimizes heat absorption by the wall or heat loss to the environment

Floor of the furnace, on which the firing actually happens, is insulated from the ground by channels of bricks, providing an air gap between the floor and the ground

When the energy absorbed by the floor of the furnace and the wall is minimized, and more heat is retained in the kiln volume, thus increasing ware temperatures during firing, with no additional fuel input

In different sites, fuel savings of 40-60% have been achieved with such modifications in the kiln

New kiln design uses up to 10% fewer bricks than the traditional kiln. This offsets the additional construction cost of providing a grate below the firing area. Thus the new kiln is cheaper than or at most of the same cost as the traditional kiln

Estimated cost as per the yearly scheduled rate: ₹ 30,000 including excavation, brick masonry and labour charges

Demand Driven Technology: The pottery kilns in the village are updraft kilns, cylindrical in section, typically 5 feet in diameter and 5 feet deep. The ware is placed on a grate, along with pieces of dried cow dung cakes which are a source of heat for firing. The ware is then covered with broken pottery pieces to improve the retention of heat in the kiln. The firing is done by burning light, low density biomass typically comprising of agro waste such as crop stalks and husk, which is painstakingly gathered and stored by the families of the potters during the harvest season. Sometimes they also purchase the fuel for use in firing. Since the firing is done by burning low density biomass, it burns off fast, and so it needs rapid feeding of fresh fuel. Since the kilns are not scientifically designed for adequate air supply, rapid feeding results in smoky combustion of the fuel. In addition, since this heat is used to ignite the cow dung cakes stacked above the grate, it is even smokier: the pyrolysis of the cow dung cakes releases more smoke, making the process even more polluting.
NGO Collaborator: Saathi Samajsewi Sanstha, Kondagaon, Bastar, Chattisgarh

Major Drawbacks of the Traditional Furnace

The smoky working environment leads to objection from neighborhood to activities of potters

Low firing temperatures lead to poor ware strength, coloration and quality, leading to low prices for the products and thus less income

Low furnace efficiency leads to high fuel consumption

Impact of the Improved Technology

- Nearly 15 kilns were constructed by Saathi Samajsewi Sanstha of Kondagaon in Chattisgarh during 2004-2008, at sites across the country.
- Fuel savings reported 40-60% at various sites.
- Uniformity of ware temperatures ensured by best practices in arranging wares for firing.
- Less smoky combustion of fuel during firing.
- Potential for enhanced productivity and income.

Feedback from the user
New furnace is much less smoky and more efficient, saving nearly half the fuel. Ware quality in the new kiln is also superior

Relevant Research Publications
Ravi, M.R., Dhar, P.L. and Kohli, S., (2007) Energy Audit and Improvement of an Updraught Pottery Kiln, SESI Journal, Vol. 17, Nos. 1 and 2, June and December 2007, pp 70-86.

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Microwaveable Pottery from Red Clays

RuTAG-IIT Madras/2013-14/Microwaveable pottery

Microwaveable pottery from local red clays

Large numbers of traditional potters are engaged in making pottery products. Most of the potter families are economically very poor and they are living below poverty line. To increase the earning of the artisans, modern machineries are to be introduced which will improve not only the productivity but also the wages of the artisans. Besides the introduction of modern machineries, additional skill and product trainings will also improve their economical status.

Salient Features of Microwaveable Pottery

- Clay body formulation using local common red burning clays and suitable admixtures
- Glaze preparation suited to clay body to enable reuse of clayware
- Precise high temperature baking to obtain uniform high quality products
- Water absorption value of 0.58% and porosity of 1.36%

Dissemination Potential

Ad-mixtures can be customized as per local clay characterization in traditional pottery clusters

Tentative Cost: ₹ 25 per litre capacity

Demand Driven Technology: Pottery industry is declining due to low returns from the production activity and hence potters are leaving the industry, opting for alternate employment. Limited innovation has been undertaken in this sector. This industry is not meeting the current market requirements of the people. In order to upgrade the market acceptability, consumer-oriented higher value products have to be introduced.

Collaborated NGO: Centre for Social Development, Nagercoil, Tamil Nadu

Major Drawbacks of Existing Technology

- Not thermal resistant for use in microwave ovens
- Higher porosity- absorbs liquids
- Non-uniform temperature baking leading to higher breakage

Impact of the Improved Technology

- Three-to-four fold increase in income
- Products are four times more than the market value of traditional pottery items
- Immense market opportunity for these products

Feedback from the user

'I have set up my own unit that produces microwaveable pottery under PMEGP scheme using this technology'
-Hari, Entrepreneur, Nagercoil

Relevant Research Publications:

- Sandhya Seetharaman: Review of Science and Technology Interventions developed by Rural Technology Action Group, IIT Madras. Paper presented in 1st International Conference on Rural Technology Development and Delivery, Indian Institute of Technology Delhi, March 9-11, 2018.

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Modified Potter's Wheel

RuTAG NE IIT Guwahati/Modified Potter's Wheel

Potter's Wheel

It is a reciprocating paddle driven potter's wheel which uses the mechanism of sewing machine. The machine is capable of making small decorative items as well as big earthen vessels. The design is suitable for women in rural areas of Assam as well as other parts of NER.

Salient Features of Potter's Wheel

- The design is very user friendly, specially among the women artisans.
- Drudgery in pottery has been reduced to its maximum extent.
- Any normal chair can be used according to the height of the operator while using the machine.
- Suitable for making both small and big earthen vessels. Decorative items can also be crafted.
- The production rate has been increased by 2-2.5 times.

Tentative cost of the prototype: ₹ 35,000

Demand Driven Technology: Pottery making is an age old occupation of human civilization. Though the industry has been playing an important role in the economy of Assam but due to lack of proper S&T interventions the industry is facing its downfall. The earlier version of modified potter's wheel designed by IIT Kharagpur is further modified by RuTAG-NE based on the feedbacks received from local artisans of North East during demonstration and training programmes conducted at different potters clusters of North-East India. Ergonomic and anthropological considerations result an improved machine.

Major Drawbacks of Existing Potter Wheel

Anthropological and ergonomic problems, as earlier design was made by keeping in mind with the anthropological data of West Bengal people

Women cannot balance hand and leg movement simultaneously by wearing Mekhela/Sari

Feedback from the user

•Users are very much delighted using the technology.

•As it is designed keeping ergonomic values of user in mind, it has made the labour associated with the work less easy.

Impact of the Improved Technology

- 5 nos. of machines have been employed to NEHHDC under STINER programme in 2018.
- Nearly 9 nos. of machines were disseminated to various places of Assam viz., Nalbari, Bezera, Chapor etc.
- This technology is proven to be very much helpful for small and medium pottery clusters.
- Not only the pottery clusters but also the young entrepreneurs who fabricate the machines for RuTAG-NE are also benefitted by it.

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Motorized Coir Ratt

RuTAG IIT Madras/2006-2008/Motorized Coir Ratt

Coir Ratt

Manufacture of coir fiber, yarn and coir-based products are important traditional industries of Kerala. The industry employs around 7 lakh workers from mostly economically backward sections, 70% of which are women. The existing processes in the coir rope-making industry are outdated and labour-intensive, resulting in inconsistency in quality of the rope. Most women spinners often walk long distances to the place of work to manually spin the yarn into ropes.

Salient Features of Modernized Coir Ratt

- Motorized operation
- Low maintenance due to lesser contact parts and components
- Different varieties of yarn (Twist, runnage, score) can be produced
- No physical strain
- Evenness in twist and thickness
- No restriction on length of rope

Dissemination Potential

Coir spinning clusters

Tentative cost of the prototype: The cost of making a machine was ₹ 13,000, which can be further reduced with large-scale production and economy of scale.

Demand Driven Technology: There is huge scope for modernization of this industry, which will revolutionize the whole manufacturing process, enhancing chances for increment in production including quality to meet the demands and to compete with others in global market. The coir ratt machine can be situated in home and the rope made conveniently as a home industry. Thus, efforts were made in the direction of designing a machine which could make popular Vaikom type of rope. It may be noted that there are various types of ropes commercially produced by manual methods in Alleppey.

Collaborated NGO : Small Industries Services Institute, Thrissur, Kerala

Major Drawbacks of Existing Coir Ratt

- Walking 12-15 km per day due to nature of operation
- Bleeding aberrations in palm and fingers resulting in scars in hand
- laborious drudgery of work and uneven twist
- Sore foot and bleeding, painful itches and cracks in foot
- Machine vibration because of powerful motor
- The speeds of input twisters are very high and there is no provision to change the speed of twisters

Impact of the Improved Technology

- Reduce drudgery of women spinners
- Improved productivity
- Uniformity of ropes produced

Feedback from the user

Tested with positive feedback from Indian Coir Spinners Association (Alappuzha)

Relevant Research Publications:

- Sandhya Seetharaman: Review of Science and Technology Interventions developed by Rural Technology Action Group, IIT Madras. Paper presented in 1st International Conference on Rural Technology Development and Delivery, Indian Institute of Technology Delhi, March 9-11, 2018.
- Anand, R.K.C., Shankar, K.: Modernisation of Coir Spinning Ratt. B.Tech thesis submitted to Indian Institute of Technology Madras (2006).
- Shankar, K, Ashok Kumar, S.: Design and Manufacture of Prototype of Modernized Coir Ratt. Technical project report submitted to RuTAG, Indian Institute of Technology Madras (2008).

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Motorized Dhoop Stick Making Machine

RuTAG IIT Kharagpur/Motorized Dhoop Stick Making Machine

Dhoop Stick Making Machine

The bamboo pieces of specific size are kept in a closed lid box shelf and cut to a constant size and shape. Again, the obtained bamboo slivers are placed in the machine to form Dhoop sticks. The obtained Dhoop sticks are then placed to the polisher for polishing to get a unique round shape ideal for Dhoop stick (Incense stick).

Salient Features of the Technology

- Compact and Portable
- Can be operated by a single person
- Simultaneous cutting and rounding can be done
- Productivity of around 400 sticks per hour (cutting)
- Capacity of Polisher is 1800 sticks per hour

Dissemination Potential
Handicrafts

Tentative cost of the prototype: ₹ 40,000 to 50,000 per pair (Stick maker + Polisher) (subject to prevailing market forces)

Impact of the Improved Technology

- Better livelihood option for the local artisans
- Strengthened and Empowered women SHGs

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Motorized Single Twist Sutli Making Machine

RuTAG IIT Kharagpur/Motorized Single Twist Sutli Making Machine

Motorized Single Twist Sutli Making Machine

Majority Sutli rope productions are done by Jute Mills with fully mechanized method. For small and marginal rope manufactures maximum work is done manually only like twisting of jute fiber to rope by hand. This is a very laborious job with less productivity. With this new machine, it is possible to twist the jute fiber rope mechanically using an induction motor.

Salient Features of the Technology

- Cheap, Compact and Portable
- Productivity increased 2-3 times compared to foot operated machine
- Finished product (single twisted jute rope) is superior in quality
- Production capacity goes up to 400-500 gm/h

Dissemination Potential
Handicrafts

Tentative cost of the prototype: ₹ 5,000 to 6,000 per unit (subject to prevailing market forces)

Impact of the Improved Technology

- Better livelihood option for the local artisans
- Strengthened and Empowered women SHGs
- Two units installed in Tripura and in Barasaat

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Pedal – Driven Potter's Wheel

RuTAG IIT Kharagpur/Pedal Driven Potter's Wheel

Potter's Wheel

The wheel is based on a revolutionary concept using the bicycle pedal as the source of owner; it enables the potter in a comfortable sitting position with little strain on the back.

Salient Features of Potter's Wheel
Circular turntable rotating at 250-300 rpm
Less effort in pedaling
Bicycle pedal operated turn table with easy and comfortable seat
Molding of pot and driving of wheel done simultaneously

Dissemination Potential
Handicrafts

Tentative cost of the prototype: ₹ 10,000 per unit (subject to prevailing market prices)

Impact of Technology

- The income of the potters have increased from petty ₹ 50 to ₹ 250/day
- Less drudgery and better quality of products
- Strengthened and empowered potter communities
- Better livelihood option for local artisans
- Five units installed at pottery clusters of Bamanmura village, Lodhasuli Jhargram

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Pottery Item Dyeing Chamber

RuTAG NE IIT Guwahati/Pottery Item Dyeing Chamber

Pottery Item Dyeing Chamber
This technology is developed under RuTAG-NE to provide a safe and hygienic working environment to the artisans while colouring pottery items.

Salient Features of the Improved Technology

The fabricated parts used to manufacture the dye container are easily available

All parts are flexible and bolted joints are adopted for easy removable

Light in weight and easily portable

Dissemination Potential
Pottery sector

Tentative cost of the prototype ₹ 10,000

Demand Driven Technology: A group of pottery artisans from Meghalaya is interested in the Dyeing Chamber which is developed by RuTAG-NE (Rural Technology Action Group- North East) to replace the traditional method of dyeing pottery items. The traditional method for dyeing of pottery items is hazardous to the skin of those artisans during the time of operation. Initially, the pottery items were burnt in an open fire place by the artisans to increase the hardness property. After a sufficient time of burning the hot items were then handled with tongs and they were directly dipped inside the vessel containing natural dye from a very short distance. This traditional process of dyeing was hazardous because when hot pottery items were dipped in the vessel containing dye, the instant formation of hot bubbles on the surface of the dye burst out on the artisan's hands and other parts over the skin. Moreover, hot gases and fumes coming out of the hot dye make the working environment hazardous too. So, a science and technology intervention is very much necessary in this traditional method to minimize the problems in order to provide a safe and hygienic working environment to the artisans. Considering the problem faced by the artisans, RuTAG-NE team has developed a small prototype of dye chamber that can be used for dyeing purpose of pottery items in a safer way and non hazardous to body.

Traditional method of dyeing pottery items

Major Drawbacks of Existing Dyeing Chamber

Hot gases and fumes coming out of the hot dye make the working environment hazardous

Hazardous to the skin of those artisans during the time of operation

Impact of the Improved Technology
- Artisans from West Jayantiya Hill, Mehalaya are willing to adapt the technology
- Currently they have asked RuTAG-NE, for 7 nos. of this technology under technology transfer programme

Feedback from the user
- The artisans find the dye container to be useful and easy to operate with the same time they find it hazard free.
- This new method of dyeing will also make the process faster than the traditional one.
- The operating principle is also very easy.

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Sabai Grass Rope Making Machine

RuTAG IIT Kharagpur/Grass Rope Making Machine

Sabai Grass Rope Machine

This machine helps in reducing menial work involved and provides good working conditions. The working situation is ergonomically safer resulting in higher levels of productivity.

Salient Features of Grass Rope Making Machine

- Less gear mechanism with 0.5 hp motor
- Leg driven; operation and grass feeding can be done simultaneously
- Easy maintenance by artisans themselves

Dissemination Potential
Handicrafts

Tentative cost of the prototype ₹25,000 per unit (subject to prevailing market prices)

Impact of Technology

- Better livelihood option for the local artisans
- Strengthened and empowered women SHGs
- Upliftment of artisans in Jungle Mahol of Paschim Medinipur
- Two units have been installed at DHAN foundation NGO, Betnoti, Odisha and SHGs of Nayagram in Paschim Medinipur district

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Sisal Fiber Extractor (Pedal Operated and Motorized)

RuTAG IIT Kharagpur/Sisal Fiber Extractor

Sisal Fiber Extractor

These are pedal and motor operated dual fiber extractor machine, suitable for extracting fiber from ramie as well as from sisal leaves. The foot operated mechanism is very convenient for the operator as compared to the traditional hand held devices, and the motorized is even more convenient and hassle free.

Salient Features of the Technology

- Cheap, Compact and Portable
- Easy construction and maintenance
- Can process around 12-14 kg of leaves per hour
- Produces 1-1.5 kg fiber per hour (wet fiber)

Dissemination Potential
Handicrafts

Tentative cost of the prototype: ₹ 15,000 to 20,000 per unit (subject to prevailing market forces)

Impact of the Improved Technology

- Better livelihood option for the local artisans
- Strengthened and empowered women SHGs
- Three units installed at North 24 Parganas and 1 unit given to Manav Kalyan NGO at Dantan

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TEXTILE (13 TECHNOLOGIES)













TEXTILE

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Charka: Foot-Driven Ambar Charka

RuTAG IIT Kharagpur/Foot Driven Amber Charka

Amber Charka

Charkha is a traditional device which involves manually driven 'Spinning Jenny' used to spin cotton and silk yarn using human energy. We transformed the driving and power transfer mechanisms where the driving handle is eliminated and a new pedal drive system is introduced with the help of an angular treadle.

Salient Features of Amber Charka

Operation shifted from single hand to double legs

Uniform speed thus less breakage of thread

Dissemination Potential
Textile

Tentative cost of the prototype: ₹ 2,000 + the existing cost of charkha (subject to prevailing market prices)

Impact of Technology

- Better livelihood option for the local artisan and spinners
- Strengthened and empowered women SHGs and NGOs under KVIC
- Earning twice as that of hand-driven charkha
- Productivity increased from 16-18 to 32-34 spindles per day
- Field Tested and installed at KVIC Centres: Jhargram, Jagannathpur, Gopiballavpur in Paschim Medinipur district

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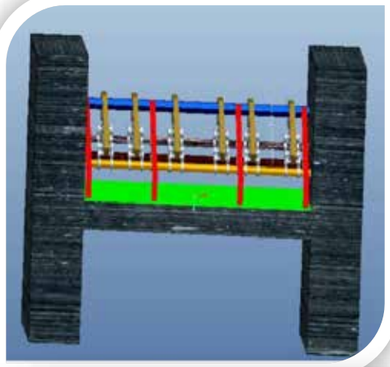
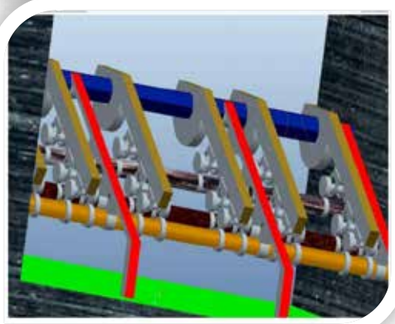
Charka: New Model

RuTAG IIT Delhi/2018/New Model Charka

Improved New Model Charkha

New Model charkha (NMC) is very popular across India for producing coarse to fine count cotton, blended and worsted yarns. This micro size machine consisting of six to eight spindles (production positions) is turned by hand in a sitting posture by the village women. The NMC has been redesigned to eradicate drudgery and improve productivity.





Salient Features of Improved New Model Charkha

- User friendly
- Bicycle pedal driven mechanism with option to operate by hand
- Number of spindles increased from 8 to 10
- Reduced number of gears and spindles makes it lighter to operate
- Hands-free operation
- Adjustable operator seat
- Twin spindle drive

Dissemination Potential

Handicrafts and Khadi Institutions

Tentative cost of the prototype: ₹ 30,000 which excludes freight, installation, GST and other levies

Demand Driven Technology

Over 12 lakh people are involved in the Khadi sector in India, and a vast majority of them are women. Khadi sector faces many challenges such as counterfeit products, lack of sale and distribution network, low wages and inefficient equipment. The need to improve the existing New Model Charkha was identified after users reported problems such as drudgery, muscle pain and productivity issues.

Collaborated Agency: Khadi and Village Industries Commission (KVIC), Mumbai, Maharastra

Major Drawbacks of Existing NMC

- Improper sitting posture leading to stress on spine and back
- Spindles restricted to eight only
- Heavy to operate
- Jerky motion of the ring rail while changing direction of traverse

Impact of the Improved Technology

- Technology being used in Jhargram, West Bengal; Coimbatore, Tamil Nadu; Kanpur, Uttar Pradesh and Gondal, Gujarat
- Improved ergonomics and reduced drudgery

Feedback from the user

More productivity, convenient

Relevant Research Publications

- R. Chattopadhyay, S. K. Saha and Ankit Fatnani (2018). Redesigning the humble NMC (New Model Charkha)- presented during the 1st International conference of RuTAG, Rural technology development and delivery (RTDD) held during 9-11 March, 2018 at IIT Delhi
- Suman Sahu, Design Analysis and Simulation of a New Model Charka, M. Tech Project, 2018-19, Mechanical engineering Department, IIT Delhi

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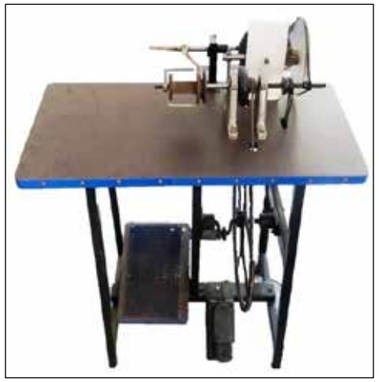
Charka: Modified Bageshwari Wool Charka

RuTAG IIT Roorkee/2010-16/Modified Bageshwari Wool Charka

Bageshwari Wool Charkha

Spinning of locally grown wool using drop spindle and foot operated charkha is a traditional occupation of people of Himalayas. Since 1926, Bageshwari Wool Charkha is commonly used in Uttarakhand for spin wool. The manual operated charkha has been motorized with speed control mechanism while its foot-paddle operation has been retained, and a reciprocating mechanism has been introduced for uniform filling of the bobbin.



Salient Features of Modified Bageshwari Wool Charkha

- Operate manual as well as electrically
- Ease in operation of modified motorized charkha for spinning
- Introduced foot operated speed controller while its foot-paddle mechanism retained
- Portable and lightweight structure
- Only 80 Watt power is required and speed can go upto 2000 rpm
- High quality yarn produced using the modified charkha
- It is capable to spin different types of wool.

Dissemination Potential

Improvement in local livelihood of artisans and spinner communities in hill states, Textile handicrafts industry

Tentative cost of the prototype: ₹ 15,000

Demand Driven Technology:
Traditional Bageshwari Charkha is being used to spin wool in hilly states. However, this manually operated charkha faces the problem of low productivity, non-uniform filling of bobbin, non-uniform thickness of yarn. In order to eliminate these limitations of traditional charkha, an attempt has been made to modify by introducing foot operated electrical motor, speed controller, modified flyer and a crank for lateral motion of bobbin and light weight steel pipe instead of wooden frame.

Collaborated NGO: Himalaya Trust, Bageshwar, Uttarakhand.

Major Drawbacks of Traditional Bageshwari Wool Charkha

- Manual operated and low productivity
- Hand spinning of wool is laborious and time consuming
- Non-uniform filling of bobbin
- Non-uniform thickness of yarn

Impact of the Improved technology

- Utilized local wool-Tibetan and Tibetan-56 for spinning
- The modified charkha is efficient for the production of yarn for local wool
- Improvement in local livelihoods as spinning wool is highly remunerative
- NGOs–Himalaya Trust Bageshwar, Johar Mahila Janjati Samiti, Dehradun and Badrish Himalya Janjati Sewa Samiti, Badrinth have adopted this technology for the local use

Feedback from the user

Yarn produced by motorized charkha is stronger compared to the manually operated charkha. Yarn is more uniform and quality of yarn is better and smooth-Shri Sadan Mishra, Himalaya Trust Bageshwar

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Charkha: Switch-at-Will Dual Drive

RuTAG IIT Madras/2016-17/Switch-at-Will Dual Drive Charkha

Dual Drive Charkha

Charkha is used in Khadi centres to spin thread. Currently, most women spinners use their hand to operate the drive. In some centres in Kerala, a dual drive charkha is used where the women use both foot and hand to operate the drive. The spun thread is used in further dyeing and sizing processes, followed by weaving.

Salient Features of Switch-at-Will Dual Drive Charkha
Pedal-operated charkha procured from RuTAG, IIT Kharagpur and modified
Smooth rotary motion using cycle pedal with chain drive
Easy switching between pedal and hand drives
Improvement in reach of wrap reel for the operator
Special ergonomic stool
Hand support bar for better grip and lesser strain on operator during the switching of drives
Crank shaft made of durable stainless steel

Dissemination Potential

For use by spinners in Khadi production centres across the conutry

Tentative Cost: ₹ 15,000

Demand Driven Technology: Most women spinners operate the charkha by hand. It involves continuous rotation of drive for extended duration of up to 6-8 hours in a day. They get paid as per number of hanks spun. As foot operations have higher power, there would be a rise in productivity if women had an option to use pedal to run the drive. There is continued interest to improve productivity by increasing number of spindles and make it more operator-friendly.

Collaborated organization: Kerala Khadi and Village Industries Board

Major Drawbacks of Existing Charkha
Laborious to use only hand for spinning
Uncomfortable seating
In dual drive version- have to stop production for switching between hand and foot
Frequent breaking of main shaft

Impact of the Improved Technology

- Improvement in productivity of up to 50% (from 16 to 24 hank in Nm33 count)
- Lesser fatigue for spinner
- Comfortable ergonomic seating
- Lesser wear and tear of parts
- Better quality of thread

Feedback from the user

'I used to spin maximum of 20 hank by hand. In this charkha, I can weave up to 25 hank and thus earn more. It is also smooth to operate and gives tighter spinning.'
-Asma Beevi, Spinner, Nedumkunnam, Kerala

Relevant Research Publications:

- Sandhya Seetharaman: Review of Science and Technology Interventions developed by Rural Technology Action Group, IIT Madras. Paper presented in 1st International Conference on Rural Technology Development and Delivery, Indian Institute of Technology Delhi, March 9-11, 2018.

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Electronic Jacquard Handloom with Design Software for Fine *Korai* Grass Designer Mat Weaving

RuTAG IIT Madras/2014-16/Electronic Jacquard Handloom

Electronic Jacquard Handloom for Fine Korai Mat Weaving

Pathamadai, Tirunelveli district, Tamil Nadu produces the famous hand-made Pathamadai fine mats (which have a GI status) and other value added products from Korai grass. These mats with names of bride and groom are an auspicious gift for marriages. The mats are woven in coarse, fine and superfine variations. Coarse mats are being woven using power looms nowadays. There is a kora grass mat weaving culture in Kerala as well, where they are famously known as Killimangalam mats.

Salient Features of Electronic Jacquard Handloom with Software

- 192 hook electronic jacquard in wooden frame handloom for picking of threads as per loaded design
- Automatic *korai* take-up and let-off motion in loom
- Specially designed Naming carpet software for easy weaving of names on marriage mats
- Ergonomically convenient
- No restriction on length of mats that can be woven
- Ease of storage and retrieval of designs from electronic jacquard

Dissemination Potential

Reviving intricate designs in traditional grass mats with profitability. The number of hooks can be customized as per requirement of other traditionally woven grass mats

Tentative Cost: ₹ 1,50,000

Demand Driven Technology: . The traditional women weavers weave for 6 hours per day on a floor loom with their leg at a slight upward inclined position to provide tension for the warp. Weavers have stopped weaving intricate motifs as they are unable to sell for profitable price in market due to higher labour hours required for intricate design mats. The Govt. of TN has declared this craft as a languishing handicraft that requires interventions for revival.

Collaborated organizations: Jeenath Self Help Group, Pathamadai, Tirunelveli, TN; Killimangalam Kora Grass Mats Weavers Cooperative Society, Thrissur, Kerala

Major drawbacks of existing floor loom

- Ergonomically painful for women weavers
- Intricate designs take long man-hours
- Limitation on length of mat that can be woven
- Younger generation unwilling to take up weaving as a profession

Impact of the Improved Technology

- 300% rise in productivity for design mats (Mats taking 6-9 days now take 2-3 days)
- Weavers can get creative and weave any level of intricate designs with basic weaving skills
- Profession made lucrative to younger weavers due to comfort and value-addition for mats

Feedback from the user

'I have chosen designs from the internet and woven them on mats using the EJH. I find using the loom more convenient and faster. I can now take up many orders '
-Ahmada, Weaver, Pathamadai

Relevant Research Publications:

- Ganesan, S and Badari Nath, K: Design and Development of Mechanical and Electronic Jacquard Handloom for Fine-Korai-Mat Weaving . Paper presented in 1st International Conference on Rural Technology Development and Delivery, Indian Institute of Technology Delhi, March 9-11, 2018.

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Eri Cocoon Opener

RuTAG NE IIT Guwahati/Eri Cocoon Opener

Eri Cocoon Opener

Eri silk produced by the silkworm Samia ricini, Denovan, is an excellent natural silk due to its softness, thermal and dye absorption properties. It is obtained by adopting the following pre-spinning and post-spinning techniques, (i) Degumming (ii) Opening and (iii) spinning. Eri cocoon openers were developed at several stages by RuTAG-NE and the final version of the cocoon opener has enhanced the Eri silk spinning fibre productivity

Salient Features of Eri Cocoon Opener

In this opener a 0.5hp motor is used for rotating a 22 cm spike roller for extracting yearns from the cocoons

The machine is portable and can easily be movable

With this machine yarn can be produced in a single step

Dissemination Potential
Textile industry

Tentative cost of the prototype: ₹ 25,000

Demand Driven Technology: The cocoons are either spun in any one of three devices namely, Takli, Spinning wheel, Motorized spinning machine or Amber Charkha. The yarn spun in Amber Charkha is more uniform, has higher tpi (twist per inch), and thus it ensures superior quality. It consists of six different implements, namely (i) Cocoon opener, (ii) Fine fillet drum, (iii) Tap drawing belni, (iv) Roving belni, (v) Fibre cutting, and (vi) Six spindle amber charkha. The carding machine used in Amber Charkha is actually designed for cotton, and the spikes used in the fine fillet machine, are made of Iron and they tend to rust in the humid condition. The fiber cutting machine is presently manually operated. The fillet in Amber Charkha is very costly, and requires frequent replacement due to wear and tear, and further, the operational hazard is also like to be too frequent. The problem of Eri silk spinning was brought to RuTAG-NE's notice by Late Rabindra Nath Upadhaya, the then Chief Executive of Tamulpur Anchalik Gramdan Samiti (TAGS) in the year 2006. Therefore, there was a need for S&T intervention. After studying the problem, Eri cocoon openers were developed at several stages by RuTAG-NE and these were field tested not only in TAGS but also in other clusters like Sualkuchi and Palashbari.

Major Drawbacks of Existing Cocoon Opener

Existing machines are costly

Easily exposed to wear and tear

Operation is hazardous

Impact of the Improved Technology

- STINER programme has decided to disseminate 56 nos. of this technology across NE region.
- Many artisans who were already migrated from Eri Silk sector to Mulberry or Muga Silk sector have returned to their original trade.

Feedback from the user

- The technology was field tested in TAGS and they have adapted it.
- Clusters like Sualkuchi and Palashbari are also benefitted by the technology.
- The resultant impact is that the artisans involved in the trade now earn about ₹ 400-500/- per day.

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Hank to Bobbin Machine

RuTAG NE IIT Guwahati/Hank to Bobbin Machine

Hank to Bobbin Machine
It is a winding machine used in weaving industry with winding capacity of 10 bobbins at a time.

Salient Features of the Technology

In this machine, 10 bobbins can be loaded at a single time

Winding capacity is 8 kg per day

Runs on 0.5 hp motor

Dissemination Potential
Textile Industry, *Weaving Sector*

Tentative cost of the prototype: ₹ 55,000

Demand Driven Technology: Assam has the largest number of weavers in the country. Many industries have come up in the State, but they don't come even close to the demand created by the handmade textiles in the global market. The 'Silk village', Sualkushi is near Guwahati where more than 5000 looms are engaged in weaving silk fabrics. This village is often called the Manchester of the North East. What is striking is that the entire populations of the village are weavers. Development of a low cost Hank to Bobbin Winding Machine was one of the requirements of the weavers of Sualkushi. Earlier this machine was procured from either Coimbatore or from other parts of South India. It was costlier and involved more expenditure on transportation. A Hank to Bobbin Winding machine was designed by RuTAG-NE. An entrepreneur from the village, who has a knack for innovation, was trained and the machine was fabricated with locally available material at reasonably low cost.

Traditional Method of winding using “charkha”

Impact of the Improved Technology

- STINER programme has decided to disseminate 120 nos. of this technology across NE region
- At Sualkuchi, many entrepreneurs have come across for further modification of the machine

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Mechanized Roller for Making Handcrafted Woolen Felt

RuTAG IIT Roorkee /2015-17/Mechanized Roller for Felt Making

Mechanized Roller for Making Handcrafted Woolen Felt

Namda felt craft is based on wet felting of wool which requires matting, rolling, and pressing woolen fibres. Manual wet felting enables craftsman to embed designs and decorate it exquisitely. Manual felt requires excessive physical labour and strength. There is a strenuous pressure on leg joints and muscles while rolling namda felt. The developed mechanized rolling device saves a lot of labour and reduces physical strain of the artisans. It has a set of two rollers, which would be pulled and pushed over a distance. The smaller roller would have wool rolled over it on canvass sheet as commonly practiced. The second roller (larger one) is used for energizing a small beater or weight drop on wool and also to add rolling support to the main rolling cylinder.

Final product made by mechanized roller

Salient Features of Mechanized Roller for Making Namda (Felt)

- Easy to roll and far less strenuous operations
- Limited shrinkage in felt size while rolling
- Easy to carry and move
- Substantial reduction in physical labour
- Higher production and better quality of products
- Allows production of 6-7 excellent quality felt sheets per day

Dissemination Potential

Local Weaver Service Centre, Textile Handicrafts Industry, Improvement in local livelihoods and employment

Tentative cost of the prototype: The cost of equipment is about ₹ 5,000- ₹ 20,000 depending upon the size of felt

Demand Driven Technology:

Large numbers of families are engaged in making felt using strenuous leg movement for floor covering, tent material and decorative items. Traditional rolling of felt needs intensive labour while using feet and applying physical pressure on felt under making. Also, remunerations for the work are far from adequate. RuTAG IIT Roorkee has received request from group of namda makers of Uttarakhand, Himachal Pradesh, Rajasthan and Jammu & Kashmir for introduction of equipment which can save a lot of labor and reduce physical stress. In view of demand, RuTAG center at IIT Roorkee has developed 3 sets of rolling devices for making ornamental handcrafted felt (Namda) of different sizes (2ft×6ft to 2ft×8ft, 3ft×6ft to 3ft×8ft and 4ft×6ft to 4ft×8ft).

Collaborated NGO: Jansamarth, Tehri, Uttarakhand and Prayavaran Avem Gram Vikas Sansthan (PGVS), Karsog, Himachal Pradesh.

Major Drawbacks in Traditional Felt Making

- Traditional rolling requires excessive physical labour and strength
- Rolling is much laborious
- Traditional rolling requires highly skilled craftsman
- Less production capacity as manual felt requires excessive physical labour and strength
- Allows production of 3-4 inferior quality felt sheets by conventional method

Impact of the Improved Technology

- Trained 15 men and women who will be able to make felt
- Utilized local wool for felting application
- Exploring possibilities of local manufacturing of felt roller
- Improvement in local livelihoods and employment
- One unit of this roller machine adopted and procured by NGO-Prayavaran Avem Gram Vikas Sansthan (PGVS) to popularize the technology on cluster level in the state of Himachal Pradesh

Feedback from the user

NGO- Prayavaran Avem Gram Vikas Sansthan (PGVS) Karsog and other trainees have shown keen interest in rolling device and found very useful for Namda (Felt) making

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Pirn Winding Machine

RuTAG NE IIT Guwahati/Pirn Winding Machine

Pirn Winding Machine
Pirn winding is an essential process for handloom and power loom.

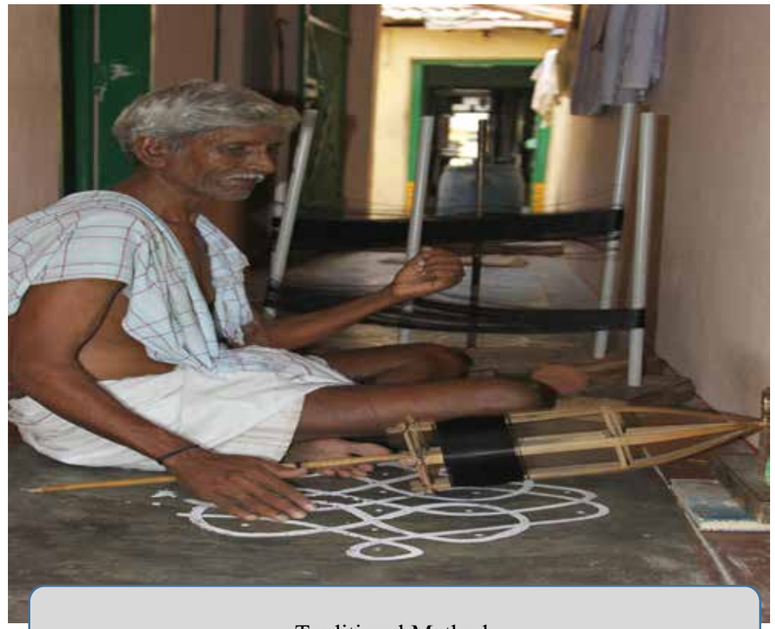
Salient Features of the Technology

- Machinery parts are made by locally available materials
- Winding capacity is 60 numbers of bobbins per hour
- Dual operation facility (Paddle or motorized)
- Winding in 6 pirn at a time
- Winding capacity is 60 numbers of bobbins per hour

Dissemination Potential
Textile Industry, Weaving Sector

Tentative cost of the prototype: ₹ 45,000

Demand Driven Technology: A Pirn Winding Machine with 6 bobbins with length counter developed under the guidance of Prof. S. K. Kakoty, Professor Mechanical Engineering Department, IIT Guwahati, was also fabricated locally at Sualkuchi. Traditional method is very inefficient and time consuming. So this machine is developed under RuTAG-NE.



Traditional Method.

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Power Loom for Muga Silk

RuTAG NE IIT Guwahati/ Power Loom for Muga Silk

Power Loom for Muga Silk

For manufacturing plain Muga fabric this power loom is used. This is a patented technology of Er. Dulal Chowdhury. A joint initiative of RuTAG-NE and North Eastern Development Finance Corporation Ltd (NEDFi), at the instance of His Excellency Lt. General Ajay Sing, then Governor of Assam, made it possible and paved the way for the first time in the muga industry for manufacturing plain Muga fabric in power looms.

Lt. Janaki Ballav Patnaik, then Governor of Assam in the inauguration of power loom.

Salient Features of the Power Loom

- Capacity of weaving has been increased to 5 meters per day per loom against 1 meter in traditional loom.
- Drudgery and health hazard of weaver has been reduced.
- Throughout uniform quality of cloth.
- Runs on 2 hp motor.

Dissemination Potential
Weaving Sector

Tentative cost of the prototype: ₹ 8,00,000 which excludes freight, installation, GST and other levies

Demand Driven Technology: The golden yellow a fabric of Muga silk, considered to be the supreme among all varieties of silk, is the prerogative of Assam valley. It is the toughest of all silks. "Muga" is derived from the Assamese word 'Muga' meaning yellowish. Apart from its use in normal dressings, it is also used in furnishing and decoration stuff. Muga Silk is supposed to be one of the costliest fabrics in the world. It is produced from cocoons of 'Antheraea Assamensis', which is available only in Assam. It received the Registration as a Geographical Identity (GI) in 2007 due to its endemic nature to Assam. It is the artistic creativity of the weavers in different corners of Assam which add more to the natural golden glow of Muga. The weavers embroide beautiful designs to the Muga wearing. It has high demand in the national market. The sophisticated attires made from Muga have very good international market as well. Traditional Muga fabrics are woven in handlooms. Quality of hand woven fabrics is high, but at the same time labour intensive. The international market for plain fabrics is expanding rapidly. So for mechanization of plain muga weaving this technology is designed.

Accessory Machines For Handloom And Power Loom

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Sectional Warping Machine

RuTAG NE IIT Guwahati/Sectional Warping Machine

Sectional Warping Machine

Sectional warping is an essential process for handloom and power loom. The time consuming traditional method is replaced by the operation of this machine.

Salient Features of the Technology

- The machine is electrically operated
- Runs on 1 hp motor
- Facilitate in house production
- Dual operation facility is available
- Nuts and bolted joints make ease in transporting

Dissemination Potential
Textile Industry, Weaving Sector

Tentative cost of the prototype: ₹ 55,000

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Semi-automatic Pirn Winding Machine

RuTAG IIT Madras/2016-17/Semi-automatic Pirn Winding Machine

Semi-automatic Pirn Winding Machine

In weft preparatory processes for Khadi/ handloom, the spun thread has to be wound on a hank for dyeing and sizing. Following dyeing and sizing, the thread has to wound from the hank to the cone and then from cone to the pirn. The pirns are used in shuttle in loom as weft in weaving. The winding process has been traditionally done manually using a wheel.

Salient Features of Semi-automatic Pirn Winding Machine

- Automatic build of thread on pirn
- Good tension of wound thread obtained
- Reduced breaks in thread lead to better quality of fabric during weaving
- Semi automation saves time and reduces drudgery while retaining employment
- Version with slow start clutch drive available to reduce breaks in thread

Dissemination Potential
For use in weft preparation in Khadi production centres across the conutry

Tentative Cost: ₹ 10- 20,000 depending on number of spindles and slow start version or normal version

Demand Driven Technology: Winding the thread from hank to cone and then to pirn is time-consuming and labour-intensive when done manually using a wheel. Moreover, any breaks produced in this winding affects the quality of fabric woven later. Thus, weft preparatory processes are extremely important. Automation of this process helps in process and product improvement.
Collaborated organization: Kerala Khadi and Village Industries Board and Tamil Nadu's Co-Optex

Major Drawbacks of Existing Manual Winding Process

- Laborious to wind using a wheel
- Time consuming process
- Non-uniform build
- Tension may vary

Impact of the Improved Technology

- Better quality of pirns leading to better quality of woven fabric
- Reduction in drudgery of women
- Reduction in time required for winding process

Feedback from the user
'We use it every day to wind our pirns. We have stopped doing it manually.'
- Jessy, Weaver, Pambadi, Kerala

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Sheep Hair Shearing Machine

RuTAG IIT Delhi/2014-19/Sheep Hair Shearing Machine

Sheep Hair Shearing Machine

Sheep Hair Shearing Machine is a mechanized way to remove the woolen fleece of the sheep. By machine shearing, the wool can be cut from the roots which results in good quality yarn. It also help a shepherd to get good price for the wool. This device is light weight and cost effective which makes it easy to operate and affordable by the shepherd community.

Salient Features of Sheep Hair Shearing Machine

- Indigenously developed
- Portable, easy to assemble and operate
- The depth of penetration is more which increases the staple length of sheared wool
- Environment friendly
- Reduced shearing time
- Long life of components

Dissemination Potential
Wool /Textile Industries, Sheep breeding farm

Tentative cost of the machine: ₹ 75,000 which excludes freight, installation, GST and other levies

Demand Driven Technology: Presently 80% of the sheep population is shorn by hand scissors in India. With hand scissors, the staple length is not appropriate as per requirement and affects the quality of yarn produced by this wool. However, mechanized device can cut the woolen fleece much closer to skin giving maximum staple length of the wool which results in good quality yarn. Therefore, IIT Delhi took an initiative to develop the device indigenously. IIT Delhi developed a low cost indigenous device to boost the livelihood of the shepherds in the region of Himachal Pradesh, Uttarakhand, Rajasthan, Gujrat, and Karnataka.

Collaborated NGO/ Field Agency: Jansamarth, Tehri, Garhwal, Uttarakhand, Central Wool Development Board (CWDB Jodhpur), and Himachal Pradesh Wool Federation (HPWF Palampur).

Major Drawbacks of Existing Technology

- Not standardized
- Pain in hands of the shearer while using the scissors for a long time
- Hand shorn wool's length was not much to produce good quality yarn
- The imported device was not affordable by the shearers/organization
- Long shearing time

Impact of the Improved Technology

- Good staple length improved the quality of yarn and shepherds can get good price by selling this wool in the market
- It gives boost to MAKE-IN-INDIA propaganda
- It promotes Indian manufacturers to compete in international market

Feedback from the user
Very efficient and cost effective device for our shepherd community
-Mr. Malbar, Shearer, Palampur, H.P.

Relevant Research Publications

- Sinha S.S., Saha S.K. (2019) Dynamic Modeling of a Sheep Hair Shearing Device Using RecurDyn and Its Verification. In: Zahariev E., Cuadrado J. (eds) IUTAM Symposium on Intelligent Multibody Systems – Dynamics, Control, Simulation. IUTAM Bookseries, vol 33. Springer, Cham
- Vashista, V., Jere, A., Rane, S., Grover, V., and Saha, S. K., Synthesis and Analysis of a New Mechanism for Sheep Shearing Machine, 13th National Conference on Mechanisms and Machines (NaCoMM07), IISc, Bangalore, India, December 12-13, 2007

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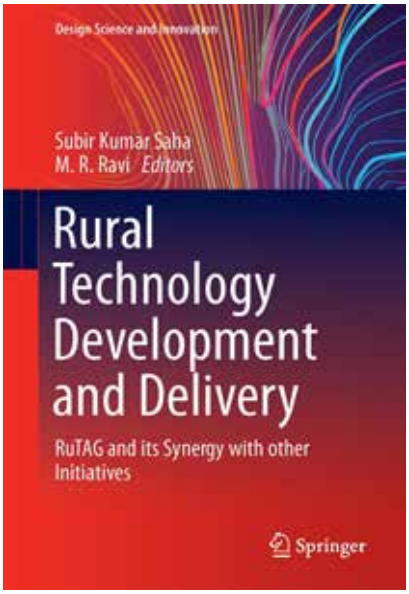

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Rural Technology Development and Delivery

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This book comprises the proceedings of a rural technologies conference organised by the Rural Technology Action Group (RuTAG), which was conceptualized and initiated by Principal Scientific Adviser (PSA) to the Government of India R. Chidambaram in 2003–04. The book highlights case studies and research into providing science and technology interventions for the development of rural areas. Covering various aspects of research carried out in the area of rural technologies, it offers a valuable resource for researchers, professionals, and policymakers alike.

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