Honey Bee Network

Sixth National Grassroots Innovation & Outstanding Traditional Knowledge Awards 2012

National Innovation Foundation - India

6th National Grassroots Innovation Awards
National Innovation Foundation - India
Ahmedabad

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उजालों में स्याह होती, तो दिखती
अंधेरों में हम कभी जाते नहीं

जुगनू तो बहुत हैं जमाने में
हमें क्यूँ नजर आते नहीं...

सत्यमेव जयते

राष्ट्रपति
भारत गणतंत्र
PRESIDENT
REPUBLIC OF INDIA

MESSAGE

I am happy to learn that the National Innovation Foundation (NIF) – India is organising the National Grassroots Award Function and Exhibition of Innovation during March 9-15, 2012 in the President's Estate.

India has made tremendous progress in various fields in the last six decades. However, there are areas where we need to do much more, and innovations and innovative approaches can be useful. To give impetus to our efforts, the current decade has been declared as the Decade of Innovation. I hope that young and old and trained and untrained minds from rural or urban areas, will devote attention to finding practical, sustainable and affordable solutions to everyday problems faced by women in rural areas.

On this occasion, I extend my warm greetings and felicitations to the organisers and the participants and wish their endeavours every success.

Pratibha Patil

(Pratibha Devisingh Patil)

New Delhi
March 6, 2012

R. A. Mashelkar, F.R.S.
Chairperson,
National Innovation Foundation - India
National Research Professor &
Bhatnagar Fellow, National Chemical Laboratory
mashelkar@nifindia.org

Preface

The decade long journey of NIF has brought about transformative changes in the perception about innovative potential of Indian society. Both, the Ignite competition in which children are awarded for creative ideas by the former President of India every year and the biennial award function in which Honourable President of India honours the creative people in informal sector of our country have created new benchmarks for recognition, respect and reward for innovations. In the sixth biennial award function, we once again honour creative people, who have solved societal problems at an extremely affordable cost and with practically no assistance from outside.

This time, we have also recognized some of the innovators whose work so far is really work in progress, though it has achieved some major milestones. In fact, at this stage of intermediate creative process, the recognition and support can make the most difference to sustain their spirit. For technological journeys affecting critical social applications, we will be always looking for such sustained efforts. We have realized another important insight about the grassroots innovations movement in the country. The low hanging fruits, that is, easily searchable innovations have already been picked up. In future, discovering grassroots innovations is going to become harder, and also will require much more longer and strenuous shodhyatras.

I am very happy that in several cases, the validation and value addition support from institutional research and development sector has been very encouraging. I hope similar cooperation will be achieved from private sector. The awards for partnership between formal and informal sector signify our gratitude for such blending of two systems. This way we hope to enrich the innovation eco-systems in the country. Recognition to some of the young students in the national award category is belated recognition of the youthful nation recognizing creative young people and challenging them to address more and more emerging problems of a growing nation.

I congratulate all the awardees but also congratulate those whose contribution made this round worthwhile. Like ever before, the contribution of volunteers of Honey Bee Network is truly exceptional and highly praiseworthy. I sincerely thank them for their service to this cause. I also hope that just as they have done so well in scouting the innovations, they will be equally creative in dissemination of the fruits of innovations.

Let us work together to make India inclusive, innovative and imaginative

Anil K Gupta
Executive Vice Chairperson,
National Innovation Foundation - India
& Professore, Indian Institute of Management
Ahmedabad

Fireflies of Creativity

We have all been fascinated in our childhood by chasing the fireflies in the late evening and night. The fireflies of creativity and innovation are obviously not visible in the day time, though they illuminate their surroundings the same way as they do in the night. Perhaps, the darkness which makes them visible signifies the contrasting eco systems. Over the years, NIF and Honey Bee Ntwork have made them more and more visible nationally and internationally. And yet, the institutional ecosystem still does not recognise their sparks as much as it could. Neither have the text books of children incorporated any lessons based on their life struggles and contributions nor have public media allocated even an hour or week on radio and television regularly. How else can we challenge the mass inertia involving continued adaptation to the high level of drudgery and inefficiency involved in many of the technologies used by women and several other disadvantaged social groups. I hope that very soon we will see the fireflies not only in the night, but will develop an eye to see them around us in the day light of our nurturant sprit and collaborative culture.

The sixth round of unaided grassroots innovation and outstanding traditional knowledge practices was pursued during 2007-08 helping us discover 36,879 ideas, innovations and practices. The contribution of the Honey Bee Network volunteers was as always most significant in scouting new ideas. However, the quality of entries directly received also went up very significantly during this round. On one hand it is a tribute to the awareness the Honey Bee Network and various campaigns of NIF have created in the nooks and corners of the country, on the other, it is also a challenge to the Network. New methods have to be found to look for creative people and support their innovative ideas and outstanding traditional knowledge. One of the experiments being started in the current year is reaching out to all the 6.5 lacs villages through a postal network of 1.5 post offices. We hope that through this Network, we will achieve much greater efficiency in both scouting and disseminating the innovations, ideas and functional and viable traditional knowledge practices.

The shodhyatras pursued in different parts of the country will also have to involve new

pedagogies for reaching out to the unheard and unseen voices of our country. It has taken us much longer for organising the award function this time for various reasons beyond our control but we hope that we will be able to organise the seventh round award function next year.

Some of the lessons from the innovations recognised this time are: [a] the feedback from the formal R&D system in many cases is not only very positive but also conducive to the continuing collaboration between formal and informal sector of innovation, [b] the definition of national innovation system has transformed forever to include the grassroots innovations as a inalienable part of the national polity, [c] the energy technologies, plant varieties and solutions for physically challenged people are the ones which diffused the most followed by herbal technologies, [d] some of the national awards have gone to the young students who earlier received recognition only under the student category. This shows the emerging youthful face of innovative potential, [e] the partnership awards signify the contribution of legal firms, design school, Indian Institute of Technologies, fabricators and small firms. We hope that many more such partnerships will be forged in future to take the innovation movement forward.

This is the first time we are giving national awards for herbal technologies for communities whose knowledge had withstood the test of rigorous scientific scrutiny in an unambiguous manner. It is likely that in future many more technologies will be recognised in this category. It may be worthwhile to mention that for the last eight to ten years, we did not recognise many herbal technologies for animal and human purposes because of the long time it takes for validation. It is a belated recognition of the vibrant and viable traditional knowledge systems of the country.

NIF seeks very active help from designers, fabricators, R&D institutions, mentors and other marketing and media support agencies for giving new wings to the ideas and imagination of the common people. Some of the new initiatives begun by NIF in the last few years are: creating of Technology Acquisition Fund [TAF] for expanding public domain and strengthening open innovation platform; creation of innovation based incubators through setting up of community fabrication workshops at the place of different distinguished grassroots innovators to nurture innovation in their neighbourhood; mobilising CSR resources from international companies such as Alstom for diffusing technologies such as low cost windmill amongst from the poorest people such as salt workers; establishment of Fab Lab with the help of MIT Boston which is slowly and slowly being used by the innovators both young and old; and partnership with not only R&D institutions but also large marketing firms like the Future Group for taking ideas forward through the market channels. The social diffusion of innovations is also receiving much more support than ever before because of augmented resources of NIF after its becoming an institution of Department of Science and Technology, Government of India.

I take this opportunity to thank all the stakeholders including the Directors on the Governing Board [both past and present], Department of Science and Technology, various R&D institutions belonging to CSIR [Council of Scientific and Industrial Research] , ICMR [Indian Council of Medial Research] and ICAR [Indian Council of Agricultural Research] and other universities and colleges, private designers and design institutions, intellectual property firms and large number of Honey Bee Network volunteers. I must

particularly thank all the members of Indian Institute of Management, Ahmedabad without whose support it would have been impossible for NIF to have made so much progress. Everybody including students, staff, faculty and administration has supported all initiatives of NIF wholeheartedly and with a great sense of collegiality.

I hope that more and more entrepreneurs and scientists and public and private companies will come forward to join hands with NIF for making this Decade of Innovation as truly an inclusive one.

I must, however add at the end a small regret for which we have not found any answer. And this is about extreme imbalance between the available resources and the tasks ahead. Even if we stop scouting any further innovations and ideas, at the current rate of the budget, it might take us few centuries to just properly screen, validate and value add in the people's knowledge. The fact is that flow of knowledge will continue may be even at higher rate. If such is the case, then how will we be able to do justice to the aspirations of creative communities and individuals of our country?

I thank all the staff members and volunteers of NIF, SRISTI, GIAN and other partner institutions for their unstinted support to make grassroots innovations movement of our country a global benchmark. I hope that we will be able to make a small difference in the lives of common people by disseminating widely the knowledge, innovations and practices of creative communities and individuals being recognized in the award function.

Lifetime achievement award

National First Awards

National Second Awards

National Third Awards

State Awards

Consolation Awards

Amrutbhai Agrawat
Gujarat

Hailing from Malia in Junagadh district of Gujarat, Amrutbhai Agrawat (68) is not just another serial innovator but is also a great ambassador of the Honey Bee Network. A generous and benevolent soul, Amrutbhai is ever willing to voluntary help anyone needing his time or advice or even innovations.

Multiple agricultural machineries

Lifetime Achievement Award, Scout: Prof Rakesh Basant, IIM Ahmedabad

A Pujari in a local temple, Amrutbhai began his life as a farm worker after discontinuing his studies in fifth class. He set up a small farm machinery workshop at his place and also started making iron doors, boxes for granaries and iron gates. His son, Bharat, a serial innovator himself and an awardee in NIF's Fourth National Biennial Competition (2007) started helping his father since he was in sixth standard and has since, continued his father's legacy. For his pulley with stopper, Amrutbhai won a National Award in NIF's First National Competition (2001) and also Wall Street Journal's Asian Innovation Award in 2005.

A compassionate soul, Amrutbhai Agrawat has learnt to solve problem faced by farmers, women and labourers essentially through his own life experience. Hardship in his early life, created in him a desire to do something about the problems faced by common people. He innovated as many as seven different useful farm implements such as tilting bullock cart, groundnut digger, multipurpose toolbar, wheat sowing box etc.

Janak Santi

Normally from sowing to harvesting of any crop, about 10 – 15 different implements are needed. Keeping this view in consideration, Amurutbhai developed "Janak Santi" way back in the year 1972. This agricultural device, made of cast iron, can be used in all types of crop and soil. In this implement near about 15 subsidiary implements can be attached for carrying out different agricultural operations.

Mini Kaliu **(Groundnut digger, 1980)**

Normally in Saurashtra severe drought condition occurs, due to this the soil of this region has become very hard. Groundnut is an important cash crop of this region, but when the harvesting of groundnut coincides with drought condition it becomes a labourious and time-consuming process. Keeping this in view, Amrutbhai developed the *Mini Kaliu,* which is exclusively used for the harvesting of the groundnut crop under severe drought condition. It is a simple twin bullock drawn implement, which is used to dig out the groundnut in hard soil condition. The implement is made up of cast iron weighing about 30 to 35 kg. The length of beam is 40 inches, which rests on two supporting wheels. These wheels help the attached blade to penetrate in the soil uniformly and easily. The thrusting of blade to a particular depth in the soil can be even adjusted with this implement. Different length blades are available, which can be used accordingly.

This device, which can be used easily by one or two persons, reduces time and labour and improves the harvesting rate. Amurutbhai sold over 250 mini kaliu in the Saurashtra and surrounding region.

The Wheat Sowing Box (1984)

Normally in Saurashtra region, wheat sowing is done by using narrow coulters of 2" - 3.5" width on a harrow. In this method, the plants grow close to each other within the narrow row and the space between the two rows within a furrow remains more or less vacant leading to ineffective absorption of moisture and nutrients. Sometimes sowing is done by hands where the moisture absorption is better but the plants, which grow on other edge of the furrow, tend to lodge on maturity as the seeds did not penetrate deep enough.

To solve these problems, in mid 1990s, Amrutbhai, after many trials, came up with a wheat sowing box for equal and

uniform distribution of wheat seeds in the farms. The farmers liked it, replicated it and benefited from it. Word spread from mouth to mouth and this small device got copied but Amrutbhai did not complain.

Aaruni Bullock Cart: Tilting Cart & Bullocks' Blessing[1] (1995)

Although there is much variation in size, structure and the materials used in the Indian bullock-cart, the basic design has been the same for hundreds of years. The traditional bullock cart has only two wheels. Consequently part of the load is borne by the draft animals on their shoulders/necks. Hence the animals' work consists not only of pulling the cart but also of supporting part of the load. Another shortcoming in the design is the harnessing system, which makes it difficult to negotiate sharp bends or turns in the road. As a result of these limitations, bullocks often develop galls on their necks and suffer silently as they toil for their masters. All this affects not only the efficiency of the animals but also their stamina. For several years, Amrutbhai had been concerned about this "erosion of strength" of draft animals.

A major issue bothering Amrutbhai was the waste of labour, which again stems from the limitations of the existing design. In the Junagadh region, farmers make organic compost from agricultural waste, animal waste and 'tas', a mineral-rich soil excavated from wastelands or common property lands. They transport it to the fields in bullock-carts. The actual application of the compost in the furrows was done usually by the women folk. Since the compost had to be applied in summer before the onset of monsoon, the women had to toil under the scorching sun and distribute the manure with baskets. Amrutbhai often discussed this problem with the farmers who came to his workshop for repair of implements or purchase of new ones. It was through these discussions that he conceived the idea of a bullock-cart which would be similar to a tractor with a hydraulic system for lifting the trolley. In such a system the body of the cart would be tilted gradually so that the compost fell directly into the furrows, in a uniform manner. The new cart would have four wheels and a harness rotating devise which would enable the bullocks to negotiate sharp bends more easily. Although the idea was attractive, developing a prototype was expensive and time consuming.

In the early nineties he decided to start work on the project using his own savings. He built the metal frame on which the cart would be mounted. But further development had to wait for lack of resources. In December 1993, he was invited by SRISTI to participate in its first Advisory Committee Meeting held at Indian Agricultural Research Institute, New Delhi. During that meet he was asked whether he had any new product ideas on which he wished to work on in the near future. Seizing the opportunity, Amrutbhai explained to them the idea of his improved bullock-cart. By that time he had already spent about Rs. 8000 on the project. The Committee members liked the idea and felt it was worth supporting. In due course he submitted a written proposal which was scrutinized by SRISTI and it was agreed that SRISTI would bear half the expense of developing a prototype of the new bullock-cart. If the new design proved successful and economically profitable, Amrutbhai would share part of the profits with SRISTI for a given period of time. This would enable SRISTI to help other innovators. If for some reason the design did not work out, the advance would be treated as a grant. His morale boosted, Amrutbhai discussed the plans for the new project with his sons Bharat and Ashwin, both of whom he had trained in the maintenance and development of farm

implements. Over the years, Amrutbhai had come to rely on them for the day-to-day running of his enterprise.

As a first step towards the redesigning of the bullock cart Amrutbhai purchased a hydraulic jack with an accompanying tank from the nearby city of Rajkot. The tank was too large for the cart and so he procured another one of proper size. After filling it with the oil he applied pressure on it through a pump. The tank burst but fortunately no one was hurt. On probing Amrutbhai discovered that the tank had burst because its outlet was clogged. He realized that this line of thinking was not worth pursuing because, given the nature of their work, the farmers could not be expected to keep the equipment dust-free all the time. The use of such equipment could prove potentially risky for them. Nevertheless, he decided to give the original tank a fair trial. Despite three days of hard work he failed to make the cart lift up. Thereupon he decided to return the hydraulic system to the shop-keeper in Rajkot. The shop-keeper on examining the equipment found some minor defects. He offered to either replace the equipment or to return the money. Greatly relieved, Amrutbhai collected his money and returned home. The net damages were only Rs. 1600 which was the cost of the tank which had burst.

Many of the clients who came to the workshop saw the unfinished cart gathering dust. To some it seemed like an idea that had failed. But Amrutbhai strengthened his resolve to complete the project. He decided to work on it only in the peace and quiet of the night, when he could think and work undisturbed and test his new ideas without distraction. One night while at work he wondered if using a horizontal gear as a lifting device would solve his problem. Such a system was being used to lower an engine into a bore well. He decided to try it out and found that it was indeed effective in lifting the cart but not in lowering it. The failure of this experiment cost him another two thousand rupees. Not losing heart, he decided to try out vertical gears. At first he mounted two gears and found them successful. He then increased the number of gears to four, and then to six and finally to eight. It was the morning of New Year (2052 as per Hindu calendar) that he finally arrived at a satisfactory solution using eight gears. He named the new cart "Aaruni", after the son of an Indian sage. Aaruni is well known in folk-lore for his example in checking the erosion of soil. By analogy, the new product would prove useful in checking the "erosion of the bullock's strength".

Pulley with stopper (1997)

In the villages, water is drawn from the wells, primarily for domestic purpose by the women folk. The originally designed rudimentary pulley system, which is also very physically demanding, is still in use for this purpose. Highly erratic rainfall, installation of submersible pumps and borings in arid areas, has lowered the water table further. This has compounded to the problems of drawing water from wells by means of a pulley. The problem despite being very real and dangerous was never taken up due to the apathy of the officials towards the affected group namely women and children. Realizing the importance of pulley in the daily routine of average rural women, Society for Research and Initiatives in Sustainable Technologies and Institutions (SRISTI) organized a workshop of artisans with proven capabilities to think scientifically and entrusted them with the responsibility to redesign the pulley to suit the women folk.

At the brainstorming session, Amrutbhai came up with a creative solution to this problem called pulley with a stopper His innovation ensured a safe method of drawing water from wells reducing injury and stress on the womenfolk. He called his pulleys the Ganga,

the Yamuna and the Saraswati pulleys. Presence of a rachet on the pulleys prevents the movement of rope of these pulleys towards the well. In the Ganga, a ratchet type pulley, there is no loss of the rope and bucket. The Saraswati is a detachable pulley, which can be used at various locations where a beam is present. The Yamuna is a roller type pulley. Each costing under Rs 500, these pulleys are also economical to use. These pulleys were installed in several villages of Gujarat on an experimental basis and received good response from individuals and NGO's, though their diffusion somehow remained limited. Amrutbhai also got Gujarat Government's Sardar Krishi Puruskar for this innovation. He has declared this technology as an open source technology for anyone to copy and make use of.

Passing on the genes

Amrutbhai has mentored his son, Bharat Agrawat (46) and fueled his spirit of innovation. Bharat has come up with a number of innovations like a lemon cutter, innovative windmill for lifting water from wells, 5 HP power tiller cum tractor, which can be rotated at 360^0 angles and many more equipments besides the modified stove. His multipurpose stove has two burners at different elevations to maximize usage of heat and can efficiently run using both, wood and coal as fuel. He first made an innovative windmill, which included weight balancing gearbox system, designed to pump water out of the well at a rate of 2000-2200 litres/hour and continues to come up with one thing or the other.

The Network Ambassador

Amrutbhai has been part of the Honey Bee Network almost since its inception and by far has contributed the most to sustain and nurture the spirit of the network. He has served the Board of SRISTI and contributed to its growth and expansion.

He has been instrumental in voluntarily organizing twenty Shodh Sankals in the Saurashtra region. To strengthen lateral learning among the grassroots innovators, the concept of Shodh Sankal-a chain of experimenting farmers, was initiated in mid 1990's by SRISTI. This platform provides scope for lateral learning among those who solve the problem and not only those who merely articulate them. Shodh Sankals make use of a solution augmenting approach rather a simple problem solving one. Meetings are organised in different talukas where the farmers participate in large numbers. The meetings, whose main focus is discussion on organic farming experimentation, are now being organised by the farmers themselves at their own cost. Information on herbal agricultural products based on people's knowledge is also disseminated during such meetings. These meetings have been a melting pot of innovative ideas from farmers and mechanics of the region resulting in a lot of knowledge exchange and problem solving.

A sizeable network of such people has been developed regionally by Amrutbhai, who accompany him to every Shodh Yatra (walk in search of local ingenuity), twice a year in different parts of the country. Amrutbai has participated in twenty six Shodh Yatras organised till date over last fourteen years missing only two of them.

Not satisfied being just an innovator, Amrutbhai is also on a perpetual hunt for people like him, who have come up with creative ideas. All these years he has scouted about

ninety six entries including engineering and herbal from his region and discovered about fifty innovators, farmers or traditional knowledge holders. Recently, NIF supported him for a workshop to continue his untiring work on innovations. An inclusive innovator, he has agreed to help and mentor any other innovator willing to make use of this facility. He has come up with the model of a small tractor within a few months of the support and is presently working the windmill with his son Bharat.

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[1] *Honey Bee, 6(4): 3-4, 1995; the cases studies/reports of SRISTI & GIAN West are gratefully acknowledged for developing this profile.*

Gurmail Singh Dhonshi
Rajasthan

A fabricator cum mechanic par excellence, Gurmail Singh Dhonsi (53), has developed a number of agricultural and heavy earth moving machineries. Two of his very useful machines are the tractor mounted rapid compost aerator which can aerate, humidify and mix bio waste, and a tractor mounted tree pruner for the dressing of avenue or other tree plantations

Compost aerator & Tree pruner

National First, Agricultural Machinery, Scout: Direct

His father wanted him to study but somehow, he was interested in becoming a mechanic. His father, thus showed him different workshops in the nearby town, but he was not satisfied. Somehow he kept on insisting that he wanted to see a 'workshop'. His notion of workshop, a word he heard from his uncle a few times, at that age was a place with lot of machines and repair work going on. He was surprised to see all kinds of small and big mechanic shops like scooter repairing, watch repairing, welding etc., being called as 'workshop'. He refused to work at any of these places and selected a tractor repairing workshop to start his learning at the young age of 13. His father told a tea shop nearby to give him tea and snacks whenever he wanted. Slowly he learned the work and started impressing his employer with his ingenuity. Much later, he was joined by his father as well and both worked there for the several years. Thereafter, they set up their own fabrication workshop at Sri Karanpur and continued working there till 1984 before they shifted to their present place, Ganganagar.

His tryst with innovation started in the year 1972 when he was able to repair the genset of a military vehicle, which broke down while passing through his village. He proudly recalls that he did not charge for the same as he has great admiration for the *jawans*. Later, he also repaired a German tractor, lying useless, by modifying and using parts of local Kirloskar engine. Not satisfied with his daily routine of repairing, he kept himself

engaged in creative pursuits. In 1976, he modified a petrol bike to make it run on kerosene. He converted the engine into a petrol start kerosene run engine. He recalls having modified about 30 such bikes then, which gave an average of 80 km/l.

Agricultural machine repairs

Sri Ganganagar district is situated at the point where the Satluj River enters Rajasthan. Known as the 'food basket of Rajasthan[1]', the district also boasts of many cotton ginning and pressing factories, mustard oil and sugar mills, and spinning and textile factories. The district is also one of the largest automobile markets in India. He often used to get threshers and harvesters for repairing. Many times farmers shared their other technical problems as well with him. Sometime about 1984-86, while working on threshers, he was able to modify the then prevalent design suitable for wheat and similar crops, to suit mustard crop as well. This he achieved by developing a reduction gear for reducing the speed of threshing drum and by adding a blower/aspirator fan. He then modified a combine harvester originally suitable for wheat and paddy to suit mustard crop, a task given to him as a challenge. Changing the settings of the combine and retrofitting a small kit to make the combine suitable for mustard, Gurmail could modify any combine harvester. He continued this work till 1997 but his technique got copied gradually, lost interest and moved over to other things. Continuing his work, he developed a mini combine (1990) for harvesting and threshing wheat, soybean, mustard, paddy, etc., costing a mere Rs. 70,000. Though he sold many units of the machine and earned well but could not save much due to his habit of reinvestment in his own research and development.

Sometime in 1998-99, he got into an agreement with a company in Punjab to develop a thresher cum straw windrower. He was assured of a 50 per cent margin and his name on the machine. However, he got cheated and could receive the royalty for only three machines though the company continued with the production. Undeterred, he continued and churned up improved agricultural products one after another. In 2000, he modified a thresher to make it safe in feeding the crop, reducing the load on tractor and facilitating storage of grains as well. The machine also had the provision of re-feeding the un-threshed crops and blowing out the husk. He sold about hundred of these modified threshers during 2000 to 2008 when the margin got reduced. He then also developed a hydraulic powered grabber to pick the heavy stones, wooden blocks, sugarcane loader, chaff cutter, hole digger, wood chipper and many such useful devices.

Visualization of design

Gurmail Singh mentions that all the drawings originate in his mind clearly, which he reproduces on paper. Thereafter the task of converting those ideas on paper into reality starts. Passionate about his work, he claims to have spent over Rs twenty two lakhs over the last few years in research and development. Many times his source of funds was open market from where he took money on interest. But thankfully due to his adeptness, he could develop and market his machines properly and was thus able to settle all the outstanding balance. Apart from his workshop where he likes to spend most of his time,

Gurmail Singh also owns some irrigated agricultural land in his native village where cotton, millet, wheat, *guwar* etc., is cultivated. This is taken care of by his brothers.

His family includes his wife Ranjeet Kaur, two married sons and three grand children. Both his sons, Palvinder and Guruvinder dropped out of school to help in his workshop. His wife, while taking the responsibility of the entire family, allows him sufficient space to work on his new ideas and machines.

An idea from an earthworm

In October 2006, a farm owner from Firozpur, Surendra Kumar Jakhad invited him to show vermicompost being made from cattle dung. Jakhad wanted a machine to convert waste fruits of his farm into compost. Dhonsi was given 15 days to work upon. He returned back and started studying the vermicompost process himself. He observed the earthworms breaking down the waste by eating and excreting. He thought of developing a machine to simulate the work done by the earthworms. Working day and night for three months (January 2007), he finally came up with a machine, which could process about 1-1/15 ton or waste per day, at the cost of about Rs 1,60, 000. Happy with Dhonsi's work, Surendra Jakhad honored him and sent a video CD recommending his machine to a company Axle Crop Care Ltd, which later purchased six machines.

The Rapid Compost Aerator

The innovation is a tractor driven machine, consisting a rotor shaft at which number of straight blades made of carbon steel are fixed to cut and thoroughly mix the bio-wastes while adding moisture as well.
In this machine, Gurmail Singh has mechanized the process of turning the compost. The machine can be attached to any make and model of tractor of size 50 hp or above. The rotor, which is 16" in diameter, is nine feet long. Its 9"blades are helpful for breaking,

chopping into small pieces, mixing and lining the biomass. A hydraulic jack has been provided to facilitate the up and down movement of the rotor. At the side of the tractor, a water tank with 1500 liter capacity has been provided. This water is used to moisten the compost while the rotor blades are turning the heap of biomass. A weight box has been provided next to the water tank to maintain balance during movement.

While the rotor rotates and the blades cut the biomass, moisture is also added to the mixture. To cover the entire heap of biomass, the tractor is slowly moved from one end of the heap to the other. This operation is repeated four to five times at an interval of about five days in summer and interval of seven days in winter. As a result the total time for converting biomass into manure reduces to 25 -40 days, as against 120-150 days using conventional methods. The machine can cover a row of wastes disbursed by 100 trailers of size 11 ft x 6.5 ft x 2.5 ft (i.e. about 400 ton) in one hour consuming fuel about 3.5-4.0 liter per hour.

The technologies for thoroughly mixing compost for rapid composting mechanically are available abroad, although no such domestic product is available. Moreover, the provision of providing moisture while turning biomass does not appear in art and accordingly, a patent (1717/ DEL/2008) for this machine was filed by NIF in the name of the Gurmail Singh.

The compost has been tested by soil testing laboratory, ARS Durgapura, Jaipur. The percentage of N, P, and K was found to be 1.87, 1.79, 2.26% respectively as compared to 0.4-1.5, 0.3-0.9, 03.-1.9 % respectively, in the conventional farm yard manure. This compost was found to be even better than vermicompost (N, P, K at 1.6, 0.7, 0.8%). Similar results have also been reported by Chambal Fertilizers & Chemicals Ltd. The user feedback is also in favour of its cost effectiveness and ease of operation. A few buyers have mentioned that the aerator has provided them option to add sugarcane waste, using which was not possible in the traditional method.

Costing over Rs 3, 00,000 this machine is claimed to have low operational cost at about only Rs 0.45 per ton. For commercialization of this machine, Dhonsi was supported under the Micro Venture Innovation Fund scheme of NIF. He has been to sell about 25-30 pieces in Maharashtra, Uttar Pradesh, Gujarat, Rajasthan, Punjab and Haryana. Of these, five machines have been sold after NIF mobilized the support.

The next challenge

While he was working on improving the compost maker, Surendra Jakhad, realizing his ability, gave him another challenge to develop a tree pruner. Due to the shortage of labour, regular pruning of trees had become a huge problem. Gurmail Singh was offered a financial assistance of Rs. 1, 00,000 with the risk of failure being covered by Jakhad. Exploring different possibilities, Dhonsi thought of using the hydraulic power to rotate the blades, but where to derive this power from, he got stuck. He discussed with Surendra, who agreed to part with his tractor for a few months. He brought the tractor at his workshop and started working on ideas to optimally use the hydraulic system to develop the tree pruner.

The Tree Pruner

Gurmail's tree pruner is a tractor mounted device, which makes use of its hydraulic system to move and operate cutters for the pruning of trees.

Trees and horticultural plants are generally pruned for better growth, for using the parts (stem, branches, leaves, etc) for different purposes or simply giving the tree a proper shape. This task is generally done manually, which is very tiresome and time consuming process. The tree pruner, which can be attached to any tractor of size 40hp and above, has specially been designed for pruning of trees in big orchards and horticultural gardens. Using this machine, trees up to the height of 20 ft can be pruned by keeping blades in vertical plane. Top dressing can also be done on the trees up to the height of 12-15 ft by keeping the blades in horizontal plane. Trees within 10 ft diameter can be covered by the stationary tractor at a place. About 200 plants on both side of a 2000 feet long row can be pruned in an hour consuming only 3.5 litres of the fuel and needing just one person to operate.

The detailed prior art search did not disclose any tractor operated tree pruner however, oen does find information about tree trimming cutters, pruning devices and similar such devices with blades. The difference in this particular technology and others is in the arrangement of cutters. NIF has filed a patent (662/DEL/2011) in Dhonsi's name. He has sold two pieces of the tree pruner at the price of Rs. 4, 50,000.

The journey forward

Gurmail Singh Dhonsi has received recognition from Government departments, Ministries and other local bodies. His work has also been covered by Doordarshan and All India Radio station and profiled in the leading news papers of Punjab and Rajasthan. NIF facilitated his participation at the Second Innovation's Exhibition at the President House in March 2011 and at the Expo organized on the sidelines of the meeting of Science & Technology Ministers of African countries in Delhi on 1-2 March 2012 at Vigyan Bhavan. Awards and accolades do not seem to have distracted Gurmail and he continues to work in his farm as hard as ever. He is thankful to his family, his wife especially who has supported him always to go ahead with anything good that comes to his mind.

[1] *www.ganganagar.nic.in*

Mohammad Mehtar Hussain
Mushtaq Ahmad
Assam

While looking for a low-cost alternative to pump water in their field for winter crops, Mohammad Mehtar Hussain (38) and his younger brother, Mushtaq Ahmad (34) developed a simple windmill made up of bamboo and tin sheets. Their effort was recognized by National Innovation Foundation – India (NIF) in its Fourth National Biennial Award, 2007[1]. Their windmill later found applicability in the salt farming regions of Gujarat for pumping up underground brine.

Mehtar and Mushtaq both completed their higher secondary and got involved in agriculture. The family owns two acres of land, which the brothers jointly look after. NIF provided them monetary support to start a workshop facility to enable them continue their work on innovations and also help fellow innovators undertake specific work for their own innovations at the facility.

The bamboo windmill at Assam

Mehtar and his brother while growing paddy in winter season (also called *bodo* paddy), needed irrigation from the well. Continuous pumping by hand involves a lot of effort and drudgery. At the same time, pumping out water by using diesel sets was a big drain on their resources. He pondered over the problem and looked around for possible options. Seeing wind as a viable source of energy, he thought if he could develop a large wheel, which could run on wind power, and connect this wheel (turbine) to the handle of the hand pump, he might pump out water continuously as the turbine rotates.

Both of them then started building a windmill unit, using locally available materials such as bamboo, wood, strips of old tyres, pieces of iron, *etc*. The first prototype became functional in only four days with the help of a local carpenter. Their windmill actuated bore-well pumping unit consists of a tall tower structure made of two parallel bamboo posts supported by two inclined bamboo posts each. An iron shaft is mounted on bearings near the top of the tower, ends of which rest on the parallel bamboo posts on either side. At the centre of the shaft, a wind turbine with four blades is mounted. The shaft is connected to the tube well handle on the ground through mechanical linkages (crank lever mechanism). As the turbine rotates, due to motion of the wind, the shaft also rotates. Through the mechanical linkages, rotary motion of shaft is converted to reciprocating motion of the lever of the hand pump, which in turn pumps water from the tube well continuously. Since the supporting framework is made of bamboo, hence, the final product costs only Rs 4500, which is very low as compared to commercially available windmills, which cost over Rs. 60,000.

Salt farming in Gujarat

India is the third largest salt producing country in the world with an average annual production of about 157 lakh tonnes. The state of Gujarat contributes around 70% of it. The Little Rann of Kutch (LRK) produces 21 per cent of total salt production of India. It is estimated that 54,000 salt workers (*Agarias*) are engaged in the salt making in the state and more than 10,000 *Agaria* families are involved in inland salt farming in the LRK during the salt season.

Salt workers are some of the poorest people in the state who have been using some of the oldest technologies for lifting saline water and performing other operations for salt making. The use of counterpoise, a thousand year old technology to lift water, has not undergone practically any improvement. It requires two people, one for lowering or lifting the counterpoise and the other for straining the water to the right channel. Many *agarias* now also use diesel gensets to pump up brine. In a coastal region with saline ground water and saline winds, working under the sun for stirring the water in the salt panes is hard work. Furthermore, long term exposure to salt can be extremely harmful to the health of the salt farmer, often resulting in ailments of the feet and arms and distress during old age. Given the ecological and economic hardships, it is not surprising that they are extremely vulnerable in various economic and social exchanges.

The salt panning work starts somewhere in October-November and continues for five to six months. For the first two months water is required twenty four hours for the next two-three months, water is required only during the day. Depending upon the quality and quantity of saline ground water available at various places, it is decided by the farmers to go for the two types of available harvesting in the region- *wadaguru*-one time salt harvesting per season or *karkash*-three times salt harvesting per season. For *karkash* type of harvesting, the availability of water and salinity should be more than the *wadaguru* type. The crystals of salt obtained in *wadaguru* type are bigger and clear, as the precipitation is done over a longer period of time whereas the salt crystals obtained in *karkash* type are smaller and brighter. Either of the two crops is done by the farmer per season. The price range for the procurement of salt by the companies varies between Rs 80 - Rs. 125 per tonne with the average being Rs 100 per tonne. The *karkash* salt gives additional Rs 5 - Rs 10 per tonne to the farmer than the *wadaguru* salt. *Zipta* herb is used to precipitate the salt from the standing water and is procured from the border areas. Herb of nearly Rs 1500 is required per pan (100′ x 250′).

The average land holding of the *agarias* working in the LRK region is about 10-15 pans of size 100′ x 110′ approximately. The diesel pumps used by the farmers commonly come between the price ranges of Rs. 15000 for local brands to Rs. 25000 for the branded ones. Under the operating conditions, these pumps work typically for three to four years with annual maintenance expenditure ranging between Rs 3000-4000 excluding labour cost as the farmers themselves are adept in repairing these. These pumps use crude oil costing between Rs. 6000 and Rs. 7000 for a barrel of 200 litres.

From East to West: The Windmill travels

With a view to improve the lives of the salt farmers and reduce drudgery (where manual labour is involved) and emission (where diesel pumps are used), Gujarat Grassroots Innovations Augmentation Network- West (GIAN W) with support from National Innovation Foundation – India (NIF) undertook initiative to diffuse low cost windmills in salt farming areas.

The salt farmers showed a lot of interest in the windmill and subsequently an experimental demonstration was made near Dhangadhra, Little Rann of Kutchh, in association with VIKAS & SAVE, Ahmedabad based NGOs working for empowerment

of salt farmers in Gujarat, in January 2008. Based on the feedback received, GIAN W got the design improved and developed a multi-directional model, which it got installed at Little Rann of Kutchh with the help of VIKAS and at Sasan Gir through AKRASP for pumping water from tube well for irrigation in April 2008. With the help of an innovator, Banjibhai Mathukia, a static wind mill was also installed in the village Kalawad, Junagad district of Gujarat for trial by GIAN W in July 2008. Many windmills were installed at LRK during the period 2008-2010 for demonstration and trial basis, which found encouraging results. These demonstrations and long duration trials of wind mills at various locations helped GIAN W to study the basic performance of wind mill design developed by innovators Mehtar and Mustaq. The results from these trials were used to further improve the design of the windmills in consultation with the innovators. The IPR of the innovators has been protected (1367/KOL/2008) and the benefits go back to them in a fair manner.

Looking at the different needs to make the wind mill more efficient and adaptable by the farmers and to adopt large scale trials GIAN W and Alstom Foundation, France joined hands. With support of Alstom Foundation, GIAN W carried out major modifications in design and developed a robust design of windmill suitable for pumping water after consultation with experts at Alstom Wind. GIAN tied up with M/s Chaudhary Designers & Fabricators, a reputed manufacturing firm of Ahmedabad involved in precision fabrication of engineering items for the last 30 years. GIAN entered into agreement with Chaudhary Designers & fabricators for manufacturing and installation of 50 wind mills under project. 25 of these have already been installed at Kathivadar and Kadiali villages located nearer to Pipavav Port in Amreli district by GIAN W.

GIAN W also involved EQDC (Electronics and Quality Development Centre), a Government authorized testing agency, and IIT Gandhinagar to carry out the scientific testing of the wind mill. In one of their test reports, EQDC have reported an average discharge of 1476 litre / hr @ 14.36 km/hr wind velocity for these windmills.

Economic and social benefits

The use of an alternate method of pumping water, i.e. windmill, freed at least one person in the family. Typically the women to attend to the other household and livelihood related matters. It saves about Rs 50,000 worth of diesel in a season of six months in case diesel engine was used. Using the wind mill, now the salt workers do not have to rely on labour much and can thus make a saving of an average Rs.28000/- season per person. Similarly, saving per acre of land per season comes to be Rs. 30,000/- . The use of windmill results in eliminating drudgery as well in cases where manually water was pumped.

Economics of a windmill powered hand pump used for pumping brine water is overwhelming as farmers can easily recover their investment amount in less than eight months (one single season of salt farming from September to May) is important as this will as this will prevent spilling over of high interest debt over non-productive seasons of the salt farmer (June –August). More importantly, installing a windmill based pump is akin to buying an insurance against losses and this would considerably reduce risks and therefore vulnerability of the salt farmer.

Apart from working like a profit linked insurance scheme for the salt farmer, the innovation should result in the reduction of 5 tonnes of carbon emissions for every 100 tonnes of salt produced. On an average every windmill powered hand pump should generate 5 Carbon Emission Reductions (CERs) certificates worth Rs 3750 (US$75).

Following the success of the low cost windmill for pumping underground saline water, GIAN W is also experimenting with a windmill for generating power. In June 2011, it also installed one power generating windmill at village Kadiyali. The windmill has been installed near to the small hut so that batteries, inverters and other instruments can be kept safely. Multi blade rotor has been used for power generating windmill as the rpm and initial torque achieved is quite good.

In the next phase, GIAN W plans to install another 25 windmills in other areas of Gujarat. Seeing the success of the windmills, Department of science and Technology, Govt. of India has also suggested diffusing them on a mass scale in the coastal regions of the country.

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[1] *4th National Biennial Award Book, National Innovation Foundation – India, pages 79-80*

The reports of GIAN West on their windmill project have been gratefully drawn upon to build this profile. The source of all figures and data has been these reports/records based on primary fieldwork and secondary data.

Balwan Singh
Haryana

Balwan Singh (50) is an innovative and progressive farmer from Bhiwani, Haryana. He has developed a high yield improved variety of onion with good keeping quality.

Balwan *Pyaj* – an improved variety of onion

National First Award– Plant Variety, Scout: Kamaljeet Miglani, Sristi Gyan Kendra

Born in a family of farmers, Balwan Singh was a naughty child and fond of playing "kabaddi" and "pilla khudra", a local game similar to hockey. Though his parents wanted him to lend a helping hand in their work rather than going to the school, little Balwan had certain inclination towards studies. He used to run away frequently to the village school, to be with his favourite teacher Bhim Singh. His simplicity and the ease with which taught appealed to Balwan most. Science was his favourite subject but somehow due to precarious financial conditions, he could not continue his studies beyond class tenth. His parents also wished to help them in their chores.

Soon after, he landed up a job in Jindal Steels but did not continue beyond a few months. He also got selected in Police and Army, but as luck would have it, never joined them to remain an agriculturist. Left with only an acre of land after the partition of the family property, Balwan rented fields to cultivate and occasionally worked as farm labourer too. Picking up bits and pieces from every where he worked, his interest in farming kept on growing. Research on different plant varieties and its analysis is something, which he really enjoys. An advocate for organic farming, he has developed a mixture of neem leaves & fruits, cow dung, cow urine to spray in his fields. He maintains that weeding and irrigation are two very important activities for plants' growth. Water being scarce,

he irrigates alternate rows. "Water table is at 60 ft depth in the region and the water is salty which increases the ph. Hence, irrigation is mostly done through canal irrigation and only after sunset" informs Balwan. Apart from agriculture, he has another very interesting preoccupation, genealogy and tracing of family history. He claims to have traced back his family history by over 200 years.

Genesis:

A mismatch between the quality of seeds supplied by different companies and the expectations of the farmers, let Balwan to think about developing some variety of his own. After a careful look at the market, he found onion crop to be the most suitable for his experiments.

Sometime about 1984, his brother bought some onions from a neighbouring village. Balwan observed large and well shaped bulb, red colour, thick and tight skinned characters in these onions. Being an experienced farmer, he knew that good quality plants yield good fruits hence he started grading and breeding through selection considering parameters such as the health of the plant, tight skin, large size and well shaped red coloured bulb. Year after year, he repeated the same process to purify the variety and stabilise the characters. After the painstaking efforts of seventeen years, finally he was able to stabilize the characters of his onion variety. It took him long but he persevered with the support of his family. The family also maintained the year wise performance data for the crop, which exhibited good performance. All this while, he was ably supported by wife who many times had to take care of both the field and household all by her, when Balwan used to travel in connection with work. She always stood by his side in his failures in experiments and episodes of sickness or depressions.

The *Balwan Pyaj*

This Onion variety is a high yielding variety with very good keeping quality due to its tightly attached skin.

Its yield is about 350 q/ha and good thickness of rings, tolerance to stemphylium blight and moderate pungency are the other features, which have been noticed. Its dark red coloured globular shaped bulb about 5 cm diameter, neck thickness of 0.8 cm and 50-60 g weight appears more attractive than the conventional ones with firm, bright red coloured, mild pungent bulb with average yield 200 (q/ha).

NIF facilitated that the testing of variety at Vegetable Research Farm, Department of Vegetable Science in CCS HAU Hisar, Haryana during Rabi season, 2010-11. As per the results, the onion variety showed significantly higher yield (368.1 q/ha) of bulb, average bulb weight and bulb diameter than the check variety Hisar-2. Other features, which distinguish this variety, are dark red colour of bulb dry skin and dark green colour of foliage.

Though Balwan Singh has small land holding, and limited access to new technologies, he has been able to develop a variety whose performance is high as compared to other farmers' varieties. He has distributed the seed of his variety to about a thousand farmers

of Haryana and around. Balwan Pyaj is well known in Hisar, Bhiwani and adjoining areas.

Recognising the efforts

Balwan Singh, due to his pleasing disposition and the experimental streak enjoys a very respectful place in the village, community and local administration. He specially recognises the support of the officials of the Haryana Agriculture University who guided him from time to time and helped him with technological updates. NIF also provided his an opportunity to display his variety at the Innovations' Exhibition at the President House in 2011. He has been participating in different agricultural exhibitions of agricultural products and winning prizes as well. His work has been covered in local as well as national media. Being a generous person, he does not mind sharing his knowledge and seeds with others for prosperity.

"Mere bijon se gar ho kisi ka bhala, to fir kyu rahe mujhko koi gila"

(If some gets benefitted by my seeds, why should I complain?)

Fazlul Hoque
Asom

Based at Moriabari, Fazlul Hoque (50) is a mechanic who has developed a whole stalk paddy thresher capable of threshing moist crop as well.

Low Cost Paddy Threshing Machine

National Second Award – Farm Machinery, Scout: NIF Asom Cell

Fazlul was born to a goldsmith father and though good in studies, could study only up to 7th standard due to his father's ill health. After his death, he set up his cycle repair shop. Later over the years, he kept switching over from one kind of a work to another trying his hands at shutter and grill work, making water filters, washing powder, gates, small agricultural machineries etc. Being the sole bread earner of his family comprising his wife and six children, he had to face a lot of problems and financial constraints. In order to stay afloat, while he tried his hands at different kinds of tasks, he briefly engaged himself in the collection and sales of scraps. It was during this time that he got a chance to look into various machine's interior mechanism.

Building upon the knowledge gained, he later started a fabrication unit where he started manufacturing small agro machineries along with spare machinery parts. Presently, he is exclusively manufacturing paddy threshers and has engaged eight people in the fabrication unit. His sons also lend a helping hand in his unit.

Genesis of Haque paddy threshing machine:

Moirabari, the native place of Fazlul is about 30 km away from the district head quarter Morigaon and about 150 km from Guwahati. It is a major rice producing district in Assam and located adjacent to Nagaon district, which is known as the rice bowl of Assam. An estimated 70 per cent of the households in the area are involved in agriculture with rice being one of the main crops. For threshing paddy, farmers here mainly depend on cattle even though it is time consuming and not very efficient. Threshers though available are beyond the reach of the most due to their cost. Few years back, Assam Government provided some manual paddy threshers to farmers in the region. These threshers had a lot of maintenance issues and needed regular upkeep, for which farmers visited Hoque's workshop from time to time. While working on these threshers, he realised the problems associated with them and started thinking about making one such thresher himself, which was devoid of such issues. He identified the need to have low cost efficient threshers, which can be an alternative to manual threshing by hands or through cattle. Fazlul purchased four such threshers in scrap and started his experiments. HE carefully noted down the demerits in the existing machines and then began to think about ways to solve the technical issues. This was sometime in 2003-04. It took him another two years of hard work and persistence to come up with a satisfactorily working model in 2006-07. Fighting moments of doubts and periods of financial uncertainty, he prevailed to develop the thresher after undergoing a number of iterations of building and dismantling.

NIF Asom cell came to know about the thresher from a newspaper report and got in touch with Fazlul.

The paddy thresher

Fazlul's thresher is a low cost motorized machine for threshing paddy without breaking the straw and capable of threshing moist crop as well.

The body of the machine is made of high quality steel to withstand maximum wear and tear. The feeding system is chute type and the power is transmitted from the prime mover to threshing cylinder though belt and pulleys. The machine runs on 5 Hp power and can

be operated with electric motor or diesel engine. The sieves in conventional threshers have been replaced by a blower to reduce costs. Paddy is fed from the rear and led to the threshing cylinder, where the spikes act upon each straw and separate the husk from the grain. Under the impact of the blower, the straws eject out through the outlet in front while grains heap up on the ground underneath the machine through a slot provided.

The average feed rate of the machine is 600 kg/h, which can go upto 900 kg/h in case of masuri variety of paddy, quite common in Asom. The following values of performance were obtained by NEFMTTI, Sonitpur while testing the machine viz. threshing efficiency (96.56%), cleaning efficiency (89.06%), broken grain proportion (0.632%), spilled grain proportion (0.283%), blown grain proportion (0.395) and un – threshed grain proportion (1.627%).

Though prior art search revealed different kinds of paddy threshers but attempts to obtain performance or efficiency data from manufacturers for benchmarking purpose did not yield any fruits. The thresher has been selling well and the users have appreciated its performance considering lower investment and running cost.

Advantages of the thresher

Needing just a person to operate, it can thresh paddy ten times faster than four draft animals. It can also be used to thresh moist crop. Another feature of the thresher is that it retains the complete straw and does not chop it. This straw can then be used as gap filers in packaging and manufacturing of earthen houses etc. The paddy thresher is easily reparable and can be used for both commercial and domestic purposes.

The diffusion

NIF, which filed a patent (508/KOL/2011) in his name, also supported him under the Micro Venture Scheme for commercialization of his thresher. The support to Hoque was facilitated through NIF Asom cell. Fazlul Hoque has been able to sell more than 75 units in different districts of Assam and West Bengal. This innovation has enabled him to improve his financial status. One of his machines was purchased by another innovator Biren Singh in Bishnupur, Manipur. To suit his own requirement, Biren has done some incremental changes to the thresher like putting wheels for easy transportation, incorporation of additional fans to blow away the husk and other minor changes.

Presently, Fazlul is preoccupied with his orders for threshers and has little time to think beyond. He has certain other ideas as well but is waiting to consolidate his growth before undertaking anything else forward. He believes in engaging one's mind constructively and advices the following to everyone to follow in life.

Moy aagloy unnoti koraar cheshta moy kareechu. Homay thoo bekar kaamot kharach noy karoo
(I am trying to improve for the future and will not waste my valuable time in unproductive work)

V. Jayaprakash
Kerala

V. Jayaprakash (42), a chulha maker from Kerala has improvised the portable stove by incorporating a secondary combustion chamber for burning the un-burnt bio mass and hydrocarbons. As a result, the thermal efficiency of the stove has improved while the pollution has reduced.

Portable stove with high efficiency

National Second Award – Energy, Scout: Peermade Development Society

Coming from a lower middle class background, V Jayaprakash was a very good student. Since his childhood, he had keen interest in science and innovations. He used to participate regularly in science exhibitions and represent his school. Some of his early projects included using pulley to lift load to a certain height and a small toy motor boat, which could go up to a certain distance and come back automatically.

His childhood was spent among a lot of constraints and he had to face a lot of financial problems. He recalls that one of the incentives to attend the school was the mid day meal scheme. Though he passed SSLC with a first class, he could not secure admission in intermediate in the science stream. Then due to high fees, he could not enrol in aeronautic diploma course as well. After passing class twelve, he went to his fathers' work place in Coimbatore and started to earn his living as a daily wage labourer. The idea was to make some money and continue studies. However, he lost all his certificates in an unfortunate incident, which jeopardised his chances of securing an admission. A year later in 1989, he returned to his home town and started a small fruit business.

Genesis

While he was trying to settle in his new business, he heard about *Kerala Shastra Sahitya Parishad* (KSSP- a local forum for science literature and awareness) and the low cost *smokeless chulha* popularised by it. The term 'smokeless' somehow caught his fascination and he discovered a new interest. He got in touch with ANERT (Agency for Non Conventional Energy and Rural Technology- a Kerala government organisation working in the field of non conventional energy) to learn about the smokeless *chulhas*. With time, he got sufficient knowledge and confidence to switch over to the business of making *chulhas*.

Once he made a community *chulha* for a hospital and installed it at its premises. While inspecting it one day, he noticed a sudden spur of flame near the chimney after about 10 minutes of operation. He was surprised and reported the same to the experts from ANERT. They explained him that the observed flame was the result of the complete combustion of the carbon particles, which came in contact with oxygen near the top of the chimney. This triggered his innovative mind and he started thinking of a stove model where burning can take place at two levels. He tried over and over again for many months, making and breaking numerous stoves in the process trying different passages for air movement.

Persistence paid off finally. One fine morning, his attempts bore results and he became successful in burning the firewood at two levels with complete combustion and without smoke. He happened to attend a workshop organized by *Kerala Shastra Sahitya Parishad* who tested his stove and found its efficiency to be more than 30 per cent as against less than 20 per cent of the smokeless chulhas. He improved the model further and started selling the new product.

The stove

Jayprakash's innovative stove is a double chambered efficient portable stove, used primarily for community cooking. It can use coconut shell or wood as a fuel.

This portable stove is made of bricks, cement, clay, cast iron and can cook food upto 100 kg. The base of the bottom chamber is made of iron grill on which the fuel is kept. Below the grill is an air chamber. When the fuel burns, smoke mixed with unburnt hydrocarbons reaches the upper chamber, which has been provided with air inlet holes. Complete combustion takes place here and the combined heat gets available to the cooking vessel above the second chamber. The fuel opening has been provided at the front of the device and can be regulated using shutter, which in turn controls the flow of air. The air which flows through the opening during combustion causes an updraft when the fuel is burnt. This triggers secondary combustion as the carbon particles, which were left unburned will now get burned due to the additional air.

Apart from its efficiency, lower cost and portability are also significant features of this stove. The combustion efficiency is in the range of 37.67% when wood is used as a fuel and 29.48% when coconut shell is used (Test report by Integrated Rural Technology Centre, Mandur, Palakkad). IIT Guwahati also tested the same and observed the thermal

efficiency of 29.28%. ANERT team has informed that Hotel in Calicut, using this stove, needs only 75 coconut shells costing about Rs. 30 for cooking 40 kg rice. This is in contrast to LPG operated system, which needs 10 kg fuel costing about Rs. 400 for cooking the rice of same quantity. Considering the efficiency, cost effectiveness, portability and unique design, NIF applied patent (1582/CHE/2011) for this portable wooden stove in the innovator's name.

Nif supported the innovator under the Micro Venture Innovation Fund for the commercialisation of the stove. Jayaprakash has sold over hundred stoves in the last two years and has been getting a lot of orders from colleges, hospitals, and municipalities. He has orders for over 500 stoves pending with him presently. In order to scale up his business, he wants to set up a production unit and is also looking for entrepreneurs interested to licence the technology so that he can spend more time in research and development. User feedback is of much importance to him as he believes that consumers can provide valuable advices for the innovators. He informed that many of his women customers have given him important insights from their experience of using this stove. One of them even asked him to make a two burner version.

Besides the portable wooden stove, he also manufactures and sells smokeless and community chulhas. License and certificate for the same has been issued from ANERT. He has sold more than 4000 smokeless *chulha* and around 700 community chulha's.

Apart from his business, he also goes to community gatherings and shares his experiences with other people as well. In 2009, he demonstrated the design development and evaluation of improved biomass stove and its community use in Rural Innovators Meet organized by Kerala State Council for Science Technology and Environment (KSCSTE) at Thiruvanathapuram, Kerala. He also received Kerala State Energy Conservation Award 2008 in appreciation of the commendable achievements towards energy conservation and management. NIF invited him at the Innovations Exhibition at the President House in March 2011, which he considers as the most memorable day of his life.

T.T. Thomas
Kerala

T.T. Thomas (71), a farmer from Idukki, Kerala is known for developing "Pepper Thekken", a high yield variety of pepper which gives a yield of more than 1000 pepper balls in one pepper bunch. The specialty of this variety is that its spikes are fully branched while other pepper varieties are single spiked without branches.

"Pepper Thekken" - an improved high yielding variety of Pepper

National Second Award- Plant Variety; Scout: Peermade Development Society, Idukki

Originally hailing from Kottayam, Thomas is a farmer with deep interest and wide knowledge in agriculture research. His family includes his wife, a son and a daughter. Both of them are married. Both his wife and son have been assisting him in his agriculture activities and are a source of great moral support. Born in an agricultural family, Thomas had keen interest in agriculture since childhood, which was nurtured by his mother, who was a great inspiration for him. The family had eight acres of land. Before going to and after coming from school he used to go to the field for cutting and collecting grass and fodders for cows. Though his father was very strict, mother was always supportive and motivated him to know and learn all agricultural activities. An average student, Thomas discontinued studies after class 8 as high school was far from his home. He then got fully involved in agriculture at the age of fifteen.

Migration to the high ranges was a trend among the farmers in his village at that time. This was mainly because of the availability of cultivable forest land at cheap rate. In 1962 soon after him discontinuing education, his family also migrated to high ranges of Kattapana, Idukki District. Facing hardships initially managing wild animals, difficult terrain and extreme climate, the family managed to obtain land on lease from forest department for cultivation. Forest land after cutting the trees was available for cultivation for a limited period and farmers had to bid for the land. They cultivated paddy, cassava, yam, cardamom etc in the forest land.

A chanced observation during a walk in the forest

The higher ranges were known for cardamom cultivation. But Thomas's family did not have sufficient knowledge about cardamom cultivation. Frequent failure of the crop forced them to shift to pepper cultivation, which was another spice cultivated in the area. He and his friends used to visit nearby forests to observe wild varieties of vegetables and crops such as pepper, nutmeg, cardamom etc. Sometimes, he used to collect these and plant them in his field.

About twenty five years back while walking through a forest he noticed a different and unique type of pepper plant with branched spikes. He brought this plant from the forest and grew it in his farm. Amazed by the unique branching of spike, he started taking care of it, observing the plant closely. The plant responded well to the care given. In the forest though the plant grew in shade, but he planted it in the sunlight and gave organic manures and bone meal. He noticed that the roots of this pepper plant could grow in water also, which was not possible in normal cases. The plant showed vigorous growth and thereafter, he started multiplying his plant in his farm and gave his house's name to the variety.

Pepper Thekken variety was developed by grafting the pepper plant obtained from the forest on the root stick of *Pepper Colubrinum*, a disease tolerant wild pepper from Brazil. Now he has mass multiplied the grafted *thekkan pepper* plants through stem cuttings. It has to be specially mentioned here that grafting of pepper is not commonly used for commercial purposes but Thomas has been successful in practicing this.

***Pepper thekken*: an improved pepper variety**

The variety is an improved high yielding pepper variety with highly branched spikes resistant to quick wilt disease.

Pepper Thekken is noted for its highly branched spikes, which result in high yield. Eight hundred to thousand berries can found in a single spike of this variety against 60 to 80 berries in locally popular variety. The berries are present on both main and branched spikes. Increased Lateral branches with more nodes and inter nodes, resistance to insects and diseases particularly quick wilt, thin epidermis, negligible air cavity etc are other distinguishing features of *Thekken*. The negligible air cavity leads to the enhanced dry weight. About 8600 kg dry pepper can be produced from one hectare. Since the pepper is produced in bunches, harvesting is also easy. Having bearing period of three years, the variety is found to be pest and disease resistant and tolerant to adverse climatic

conditions. Thomas has been cultivating this variety for the last twenty five years using only organic manure, cow dung, vermin compost etc.

Ninety per cent of the pepper in the area is affected by the quick wilt disease (locally known as vattam), which is a fungal disease caused by the phytophthora (Palmivara var. piperis). This disease affects the roots of the pepper plant during the monsoon season. Thomas shared that *Thekken* is not affected by this disease as it is grafted on *Pepper Colubrinum*, a wilt tolerant pepper variety. He further informed that grafting is done at a height of 50cm to prevent pepper strings from touching the soil directly.

Indian Institute of Spice Research (IISR), Calicut has recognized this variety as a unique high yielding variety and remarked that this variety has a characteristic branching of spike, which is rare feature in black pepper.

Thomas has sold more than 5000 grafts in Kerala itself, mainly in Idukki, Aleppy, Pathanamthitta and Wayanad districts. He has also been able to sell more than 1000 grafts outside Kerala, mainly in Goa and Karnataka. Recently, a Tata group company from Assam also placed an order for this variety.

Recognising the effort

Considering his vast experience, Thomas has been invited in many meetings, trainings, workshops and seminars organised by Agriculture department and Farmer groups. He has always attended these meetings with great interest and shared his experiences with others. For his *Thekken* variety, he was also invited by ICAR for an exhibition in Mysore. He has also been honoured by Krishi Vigyan Kendra, Kannur. He also talked about his "Pepper Thekken" in Farmer's Science Congress.

Earlier, Thomas had got a consolation award in NIF's First National Competition for developing a herbal formulation from tulsi (basil) leaves for preventing insect attack, especially from green worms and thrips in Cardamom. Peermade Development Society supported him for developing a nursery of *Thekkan.* In 2006, he was honoured during the Shodhyatra organized by SRISTI and Peermade Development Society in Idukki. NIF also invited him to participate in the Innovations' exhibition at the President House in 2011, which he considers as the most precious moment of his life. His works have extensively been covered by media, which has helped him get more sales from different parts of the country.

His farm boasts of a variety of crops such as strawberry, tomato, Italian malta, brinjal grafted in chunda, jack fruit without latex and different types of medicinal plants. He has maintained his passion for agriculture even at this age and is now working on improving productivity in ginger. Thomas mentions that agriculture is a form of art just like music and believes that only talented, interested and perseverant can be successful.

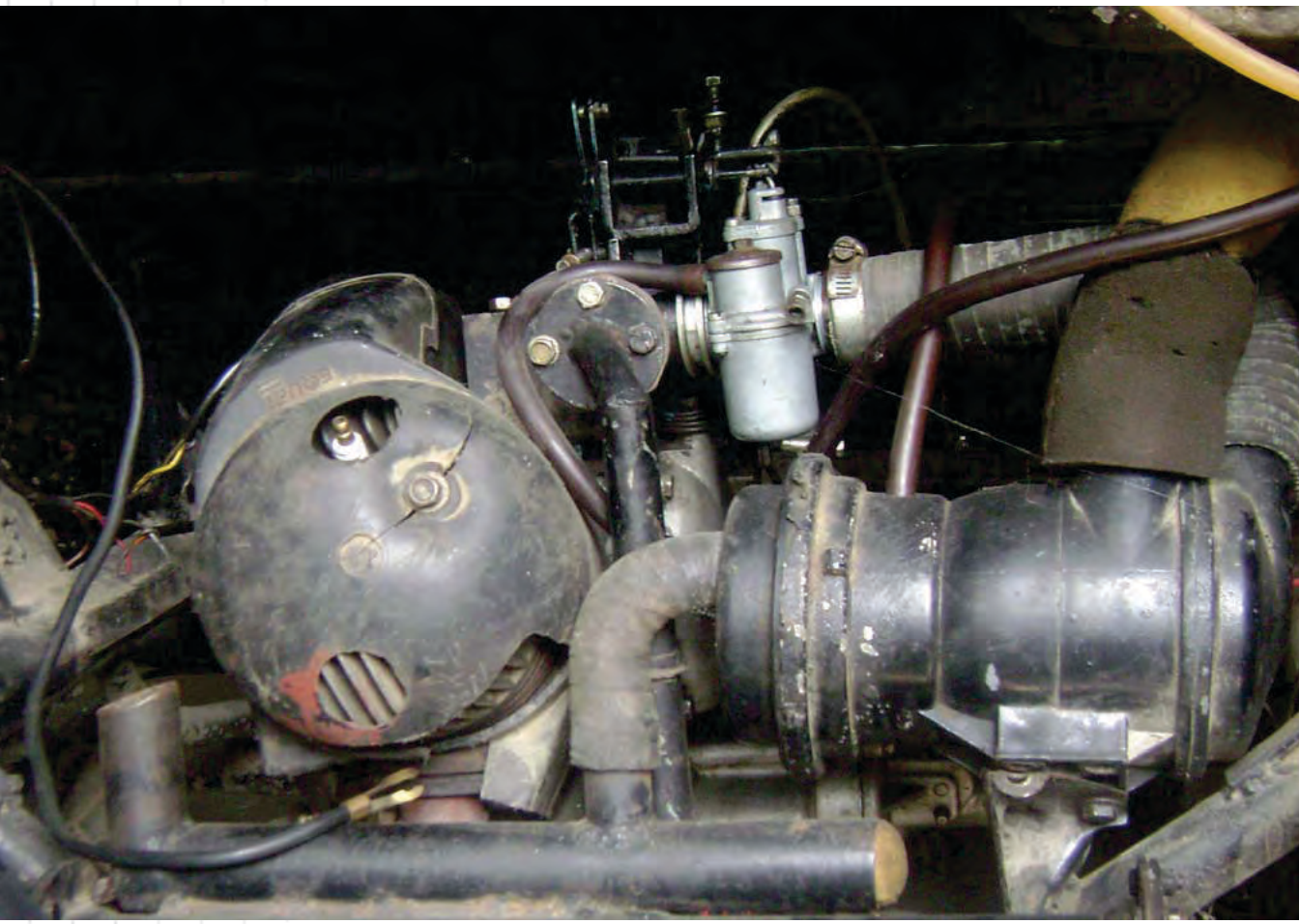
"Oru anweshakan eppoyum velluvilikale neridan theyarakanam. Thudakathil prathisanthikal neeridendi vanallum vijayam anthimam aayirikkum"

(The innovator should take risk. Though he may face some temporary setback, in the long run he will eventually succeed)

Sib Sankar Mandal

Asom

Sib Sankar Mandal (35), a mechanic from Kokrajhar, has modified the auto engine incorporating a process to pre-heat the incoming air for complete combustion of the fuel. This has resulted in significant improvement in the mileage.



Modification in auto-engine for increasing mileage

National Third Award – Transport; Scout: NIF Asom Cell

Sib Sankar, fondly called "Narayan" is an exceptionally gifted mechanic. Originally hailing from Bangladesh, His family migrated years before the partition. His grandfather was a carpenter but his father took to the repairing of musical instruments. His family comprises his parents, two elder brothers and a younger sister. Ardent followers of the *Brahmakumaris* sect, the family is highly spiritual and has a *ardhnareeshwar* temple in their courtyard where his father worships the deity ceremoniously every morning. They also have a big meditation hall in their house where other devotees from their neighbourhood gather every evening and morning for prayers.

As a child, Sib Sankar had good interest in both studies and creative model making. Making various models like wind turbine, water pump, motorcycle etc., he used to participate in science exhibitions and win prizes. Somehow he could not continue his

studies beyond class ten due to the poor financial conditions at home. But he continued to work on the science models and took up odd jobs in workshops including electric wiring works, water system work etc. Later he started his own workshop along with his brother, taking some minor repairing work orders initially. Meanwhile he continued to make models, which were exhibited at "Bodo Sahitya Sabha exhibition", "Krishi Vibhag Pradarshini" etc among others. His Hitachi crane model in an exhibition impressed an engineer so much that he offered him a job at the site of GAMMON in Arunachal Pradesh, but he did not join as it was too far from his home. But he is now willing to explore an opportunity outside Kokrajhar. Apart from his interest in models and mechanics, Sib Sankar has a creative side to his personality as well. He enjoys playing harmonium and singing as well. Watching Discovery Channel is another of his favourite activities.

Genesis

Since childhood Sib Sankar Mandal wanted to make bike that could run for long on minimal fuel and maintenance. He worked hard to make such a bike in the late 1990s but its performance was not even par with the existing ones, which disappointed him a lot. It was just passion that was driving him and lack of sufficient technical knowledge was a hindrance. The experiments were many times erratic and sometimes he had to redo everything all over again. He started visiting garages where dismantled bikes could be found. While studying the working models of bike engines in garages, he identified gaps, which reduced efficiency. After many rounds of changes, he was able to modify the valve system and the heat chamber, which resulted in increasing the mileage to about 65 km/l. While he was working on the engine, he came to know that pre-heated fuel results in better combustion.

One day, he read news about the phasing out of two-stroke engines. He also learnt in one of the television shows that auto-rickshaws were the most cost-efficient mode of transport. That is how the idea to incorporate his system in auto-rickshaws came to his mind. He worked continuous for many months and did umpteen numbers of trials. Finally he was able to make the desired changes and achieve about 30% increase in mileage. This auto-rickshaw has been running efficiently for the last three years. Moreover, the knocking problem of the auto rickshaw has also been resolved.

Reflecting on his life and work Sib Sankar shares, "*Sometimes I felt low especially when I required lathe machine or tools for cutting and so on but could not make an arrangement. I felt frustrated and stopped working. But again something inside motivated me to continue the work. Still sometimes a sinking feeling comes that even after trying so hard I have not been able to achieve much in life.*" He takes solace in the fact that his family has been by his side all this while and strongly supported him in every decision of his. He does not have many friends as he believes people do not relate properly to what he thinks or does and hence, he likes to be on his own. Apart from the family, he appreciates the support provided by NIF Assam Cell at IIT Guwahati.

The modified auto engine

The innovation is a modification of an auto rickshaw engine assembly. In the modified system, a part of the exhaust gas is utilized to heat the incoming air while the remaining

part is utilized to heat the mixture containing both the air and fuel before the entry to the engine. This is to ensure the complete combustion of the fuel, which results in increased fuel efficiency.

The heat from exhaust gas is utilized to warm the intake air by means of a heat exchanger having surface contact with the silencer pipe. Some exhaust gas is channelized to the carburettor section, which is used to heat the air fuel mixture using another heat exchanger. Besides the cylinder valve has also been modified in a manifold way so as to ensure that the air fuel mixture does not move out from the cylinder.

Using this system, lesser harmful pollutants are released in the environment due to improved fuel combustion. Also, the temperature of the exhaust gas is less, ensuring that heat does dissipate in the environment. The system was tested at IIT Guwahati, which reported that the fuel efficiency increased by 35 per cent using this system in comparison to other conventional engines. It was also mentioned that preheating both the intake air as well as the charge using exhaust gas was a new concept which is possible for other three wheelers as well. With the support of NIF, an improved prototype is also being made and further tested by the IIT Guwahati experts.

Prior art search has disclosed preheating methods of intake air (for cold start) for small period of time. But none of the system showed the capacity to perform two levels of preheating and the alternatives available are only super charging and turbo charging where increased intake of the exhaust pressure is allowed to enter in the combustion chamber for better combustion. Hence considering the novelty of the system, NIF filed the Patent (1811/KOL/2008) in the name of Sib Sankar Mandal.

At present Sib Sankar Mandal is using this system in his auto rickshaw and is satisfied with the performance. Earlier, NIF had facilitated Mandal's visit TATA motors at Mumbai and Lucknow where he explained his concept. NIF also extended financial support to him for the development of prototype followed by facilitation at IT Guwahati for testing.

Looking forward

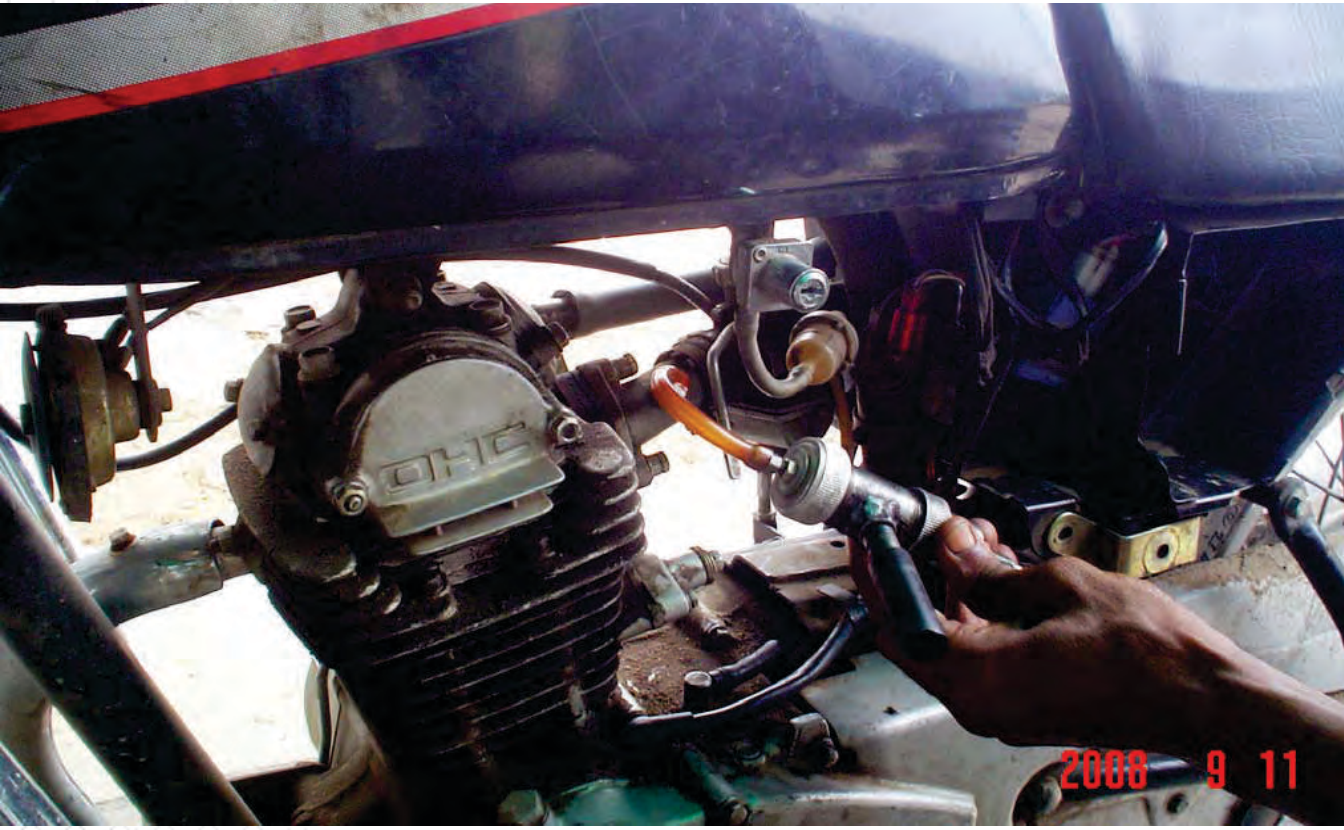
Since child hood Sib Sankar dreamt to work in the research department of some good automobile company. While he acknowledges the limitations of his education and professional training, he is keen to work in the automobile sector. Presently he is developing a sports car and trying to improve the fuel efficiency of the four stroke old Maruti engine.

Sib Sankar Mandal has a great piece of advice for other fellow innovators. He mentions that innovators may work hard with great zeal to do something new but even hundred per cent efforts may also not yield results sometimes. This does not mean that the world has come to an end, one should take things in their stride and move ahead. There are many other duties to perform as well.

Amra jitaar upor research kari sheyer upor amra 100% confidence neeye boshe thaktey pari na
(We cannot have 100 per cent confidence about the success of our work)

Hari Narayan Prajapat
Rajasthan

Hari Narayan (38), an automobile mechanic, has developed a small kit comprising a piston and calibrated nozzle, which can be fitted in the fuel line between the carburetor and the entry to the cylinder head. The attachment introduces additional air before the charge (mixture of air and atomized fuel) is compressed. This results in increased combustion efficiency and thereby the mileage of vehicle. It has been tried in four stroke engines.



Kit to increase mileage in vehicles

National Third Award – Transport, Scout: GIAN North, Jaipur

Son of a mason, Hari Narayan took liking to machines as a child. He liked them so much that he used to work in a garage along with studies to know more about vehicles. Dropping out of school after class eight, he started doing petty tasks mainly related to automobile repair. Later he opened his own workshop where he now repairs two wheelers. He lives with his family comprising his wife, four daughters and son. His younger brother, who is studying, also stays with him.

While working in his repairing shop, he came across so many people who had problems with the fuel efficiency of their vehicles and asked him if there a solution. He slowly began to think in this direction and conceived an idea to develop a motorcycle that would work on compressed air. Starting in 2005, he spent many years, making prototypes and trying the unsuccessfully. However, he tasted success after many failed attempts. His compressed air vehicle had an air tank where compressed air was stored. This was used to drive the motor cycle for which certain changes in the engine were also done. This was not too successful though proved the concept. He was felicitated along with other grassroots innovators, who had developed similar compressed air engines, during

the NIF's Fifth National Biennial Award Function in 2009. He also displayed his innovation at the Innovations' Exhibition at the President House in 2010. There after he did not do much in this regard as had to attend to certain family obligations.

The petrol prices kept on increasing and he kept on thinking what he could do next. He realised that if he could do something, which would not require any change in the vehicle except some minor modification or attachment, it would be of great help to the people. He worked on the idea and developed a kit, which could be easily attached to the fuel line of the vehicle.

The kit for improving mileage

This kit is an easily attachable device for 4 stroke engines, fitted in the inlet manifold line and has a small piston inside a cylinder. This small device introduces extra air ahead of fresh charge at the beginning of suction stroke, which forms a heterogeneous air fuel mixture in the cylinder. The upper charge (near the spark plug) is normal air-fuel mixture and charge at the lower end is lean. Combustion starts normally and flame propagates at normal pace towards the end fuel to produce sufficient power. Due to proper combustion the losses during scavenging are reduced and mileage increases to the tune of 12-15 per cent.

Prior Art discloses a number of techniques in art and market for increasing mileage but most methods seem to result in knocking. Some methods like magnetizing gives positive effect only for a few hours of running. The device has been tested at MNIT Jaipur and about 23 per cent increase in mileage at the speed of 35 km/h has been reported. Due to proper combustion of the fuel, reduction in CO, HC, CO2 and NOx to the tune of 53%, 48%, 42%, 25% respectively, has also been noted. NIF has extended support for trial marketing under its MVIF scheme. The trial results have shown promise and Hari Narayan Prajapat has sold over 1200 pieces of this device (Pat App No: 1410/DEL/2009) over the last few months.

Abhishek Bhagat

Delhi

Abhishek Bhagat (19) is a young student from Bihar who has developed a machine, which can cook food automatically and like one's mother would do. Sounds interesting, read on!

Automatic Food Making Machine

National Third Award – Utility; Scout: Direct

Hailing from Bhagalpur district of Bihar, Abhishekh Bhagat was born in a middle class family. His father is a businessman and runs a general merchant shop. His elder brother is presently pursuing C.A after his graduation in commerce while Abhishekh has enrolled himself for a course in animation. While the going has been tough, his father has managed to take care of the educational needs of both of his sons to the best of his ability. In studies, Abhishekh was an average student primarily because he believed in doing things on his own and not just follow what has been told. Physics has been his all time favorite subject and painting his favorite pastime. While in class 9, he received the First prize in the state in a painting competition on jointly organized by Indian Oil, Bharat Petroleum, Hindustan Petroleum and Indo-Burma Petroleum Company limited. His first innovation, when he was just twelve years old, was a timer operated explosive device, which scared his parents so much that they packed him off to a boarding school. But this did not deter him even slightly.

The taste of mother's recipe

Every day he used to see his mother cooking food for the family and spending many hours in the kitchen. Once it so happened that due to his mother's illness, he had to cook food instead of her.. He then realized how tedious the job was for ladies to do every single day throughout the year. This motivated him to develop a machine for his mother, which could cook food automatically and save her the pains. With just a burning desire and little technical knowledge, he set about designing this machine. While he was thinking of different ideas to develop this machine, it happened so he was in his hostel having his dinner, which did not taste good. A thought came to his mind to incorporate the cooking style of his mother in his to-be-developed machine. Perhaps, this way he would be able to have his food, which tasted as if his mother had cooked, anywhere and anytime.

He conceived a rough idea about a machine, which would have boxes to hold different ingredients of a particular recipe. The machine would be operated using a recipe card, which will be programmed as per the cooking style of the person for that particular dish. Abhishek wrote to NIF, which linked him to ISM, Dhanbad. The machine could be made but how to make the card, which will make it operate, became the biggest problem there. After spending some time there, Abhishek came back and pondered over the problem. He took help of his Physics books and using a normal watch, he designed a card, which could be programmed. The first version of this machine made successfully in 2009 could make tea and *kheer* (kind of rice pudding). This innovation won him the first prize in the Ignite 2009 (national competition of students' ideas and innovations) competition. He received the prize at the hands of Dr APJ Abdul Kalam at IIM Ahmedabad, who appreciated his machine very much. NIF also filed a patent (729/KOL/2010) in his name.

Later NIF supported him to develop an improved prototype with eight boxes for different ingredients and some other technological refinements. A Delhi based designer has also been engaged to further develop the prototype and make it into a marketable product. Abhishek also participated in the Innovations' Exhibition at the President House in March 2011 and was the INK Fellow in 2011.

The automatic food making machine

This machine is an electrically operated automatic food making machine where only ingredients are loaded in boxes and the cooking is completed according to the recipe card being used.

The machine has eight boxes and a central container. The boxes house the different ingredients, which fall into the central cooking container as per the predefined timing in the recipe card. This recipe card is pre programmed. Once the recipe card gets inserted,

the display on the machine shows the information about the different ingredients that need to be put in the respective boxes. Once this is done, the user may sit back and relax. The machine will automatically sound an alarm once the recipe gets made. The machine can also be used as a mild mixer. Prior art search did not find any previous reference of this machine in art or market.

While he was making this machine, he had to struggle a lot with finances first and then with the limitations of his knowledge. After he completed the machine 'Kitchen King' successfully tested it once, he invited his relatives to see its working. However, when he tried to start it before them, there was a short circuit, which destroyed some components. His was teased a lot by them for this. However, determined, he went ahead and completed it successfully.

During the course of the development of this machine, his mother provided strong support to him, helping him cope up with bouts of depression and setbacks. She, along with his cousin sister, helped him develop the recipe modules based on which the recipe cards were designed. This machine, undergoing value addition right now, would be very helpful for the old, bachelors and people with various disabilities as it will do away with the requirement of supervising the whole cooking process. Moreover, the person would be able to taste homemade food anywhere away from the home.

The innovation streak

Abhishek was invited by NIF to be the innovator-in-residence for a period of two months to work on his innovation of the automatic food making machine. Not only did he work on his previous innovations, he also developed a new one, which is the scissor with a measuring tape. It simply means that while you cut a cloth with your scissor, you can see how much inches/feet of the cloth you have cut. So now no need to mark on the cloth, just keep on cutting till you get the right reading on the scissor!

Observing that the sunflower turns its head towards the direction of the sun, Abhishek has also thought a solar light and solar cooker based on the same idea. The solar panels on these would automatically detect the motion of the sun and move accordingly. Thus, they will always be facing the sun and obtaining maximum energy. Another of his concept is the smart watch, which can be programmed for twelve hours to do general household work like switching on bulbs and other appliances. He has many more other ideas to his credit. The list is never ending and his mind is always buzzing with something or the other. Being enrolled in an animation course now, he is discovering the artistic side of his persona now. We hope to soon see how he combines both of his abilities, technological and artistic to come up with something new. After all he says,

"Sirf study karna and exam me pass hona hi study nahi hota. Padh karna study hota hai"

Study is not only about reading and passing exams. To use wha something new is the real study.

Jahangir Ahmad

Jammu & Kashmir

Jahangir (19), a young student, from Anantnag has developed an electric painting brush, which is an automatic gadget for painting walls without having the need to dip the brush in the paint bucket.

Electric Painting Brush

National Third Award – Utility, Scout: Direct Entry

Jahangir's father is a carpenter while his mother is a house wife. His two younger siblings are students. He has been a brilliant student since childhood, known among his friends for his hard work and practical bent of mind. Jahangir, an eager fellow, is always on the lookout for different kinds of problems, which could challenge him. Many times his friends also approach him for solutions to their problems. Some even believe that being so sharp, he does not need a formal education. A sort of non-conformist, he is never ready to believe what does not appeal to his mind, even some accepted theories of science. He mentions that such theories can never be final; they need to evolve with the increase in scientific knowledge and should be evaluated accordingly.

His father mentions that he has been a good and patient observer and that they have always provided him full support and freedom. Though not being sound financially has prevented them from allowing him to spend on his ideas most of the times. But the family still remains a great pillar of strength and has provided emotional support. Finances have been managed frugally from here and there somehow! Reflecting on his poor financial conditions, Jahagir quotes Wali Dakhni, a famous Urdu poet of the 18th century,

"*Muflisi sub bahaar khoti hai, Mard ka aitibaar khoti hai*" (Poverty snatches away every moment of spring. It snatches away the trust of man.)

Besides studies, Jahangir also has interest in painting and poetry, mostly in Urdu and English. He has a good collection of poetry written by himself, which he doesn't want to show any one until it gets published. He also has written an autobiography of himself as he believes an autobiography helps a man to alienate himself and enables him to look at one's self objectively. He also has a good collection of self made toys. He has even carved Isaac Newton's statue out of wood and has painted portraits of many great scientists like Galileo Galilei, Stephen Hawking, and Einstein.

Making the electric brush

While painting one needs to dip the brush into the paint bucket from time to time. This makes the process tedious and cumbersome. Some paint also gets wasted as well as spillover. In order to support the family financially and also partly fund his own work, Jahangir used to work while also studying. One day he noticed some workers painting a high wall of a house near his home. There was little space to keep the paint bucket and the workers were struggling to hold on tight to the ladder, dip the brush in the bucket periodically and paint the wall properly. Paint had also splashed over their clothes and body. He sympathized with the workers and started to think what he could do to reduce their effort. He thus got the idea of making the electric painting brush.

The Electric Painting Brush

Jahangir's innovation is an automatic painting device facilitating the user to control the flow of the paint through the brush.

The electric painting system consists of a pump operated by one hp motor, which pumps the paint into the brush through tubes, a specially designed brush with a distributer to spread the paint properly in the bristles, paint bucket with inlet & outlet connected to the pump and an operator belt which is worn by the user while painting.

The paint from the bucket flows into the pump, which pushes it up to the brush, through the flexible pipes. An actuating lever has been provided to start/stop the flow of the paint into the bristles. The paint comes out at the base of the bristles at four places via the distributer. Jahangir has developed a working prototype with the financial support from NIF through GIAN Cell-JK, University of Kashmir and technical support from USIC, University of Kashmir. Prior art search did not disclose any similar product in the market. NIF filed a patent (1949/DEL/2011) in the name of Jahangir. This brush has the potential for wide application and has good commercial potential.

Other than the electric painting brush, Jahangir has developed other innovations as well, which are described briefly. Electric tester to check the flow of current over an insulated wire itself without cutting the insulation, pedal sewing machine for physically challenged, which has a pedal attached to a wheel, a dish washing machine, a mason helper, vapor releasing fan, which is a light weight mobile cooling device and a wind power generator among many others.

Presently, Jahangir is keeping himself busy in studying celestial theories and has written about them and submitted to different universities including the University of Kashmir. His dream is to establish a scientific lab after working with reputed organizations like the Royal Society, NASA, and BARC etc. He is hoping for a meaningful future and has this to share

"boo chus yachchan bunyadi kathaou nishe zainyab gazun. mei pazi tei karun yami khatra raban ba paida karus"
(I am interested in fundamental research. I should do what nature has sent me for)

K.J. Benny

Kerala

"Elarajan"-an improved high yielding variety of Cardamom

National Third Award – Plant Variety, Scout: Peermade Development Society

Originally hailing from Kottayam from an agricultural family, K J Benny (45) grows cash crops like pepper and cardamom. As a child, every day in the morning and evening, he joined his father and brother while they worked in their fields. Being an average performing student, he decided to involve himself fully in agriculture after higher secondary. His family includes his wife who is a teacher in a secondary school and two sons. His wife also finds time to help him in his agricultural works and supports him wholeheartedly. Both his sons, though quite young, also show keen interest in agriculture. He believes agriculture to be the best livelihood option where hard work is a must. Benny's mantra for successful life is '*Success lies in hard work*'. All his achievements and innovations are the products of this belief and attitude.

Genesis of the Innovation:

The *Vazhukka* variety of cardamom has been widely grown in the region where Benny lives. Sebastian, a cardamom grower from the same village developed an improved variety named *Njallani* and received a National award from NIF in 2001. His achievement was widely covered by the media. This made Benny realise the possibility of developing new improved variety of cardamom himself. The seeds of *Vazhukka* variety were collected from his field for plantation. When the plants were about 1 feet high, they were transplanted to a polythene bag and later to soil when they became 2 feet high. Out of the 500 seedlings he prepared, he noticed five plants with vigorous growth bearing bold cardamom capsules. He further observed and selected one plant and propagated through suckers. He planted them nearby his kitchen so that the growth could be closely observed. They also showed the same characteristics. Lengthy panicles with bold seeds (9mm capsules) having more than 70 tillers were noticed as the unique features. After 5 years of efforts, in 2007 Benny could stabilize the characteristics of this high yielding cardamom variety . He named it as *Elarajan* meaning the king of cardamom. When shared with his father and brother they were also amazed seeing the bold seeds and high productivity.

Elarajan: the improved cardamom variety

Elarajan is a vazhukka type of cardamom having uniform bold capsules of 8-9 mm with high yield. Short plant height, bright green colour capsule, uniform bold shape, moderate resistance to pests and the comparatively higher dry yield per plant than its parents or other local varieties characterize *Elarajan*.

On an average, the variety takes 80 days for maturing after flowering.The number of capsules per panicle is very high totaling up to 1400 capsules. Seeds per capsules are 23 to 26 and provide the yield of about 12500 kg green and 2500 kg dry capsules per hectare. *Njallani* variety provides an average yield of 800-1300 kg/ hectare and the other local varities provide 1500-2150 kg / hectare. Besides, the stem is also fibrous which resists the attack of stem borer. The dry recovery ratio is 1:5 per green cardamom, which is considered as a good ratio as per the experts. Most significant feature of this variety is its bold capsules, which helps it fetch high market price for the farmers, about 10-20 per cent higher than that of the other local varieties.

The testing and validation of the variety was done with the help of Indian Institute of Spice Research, Calicut and Indian Cardamom Research Institute, Idukki. Both the institutions certified that about 80- 90 per cent of the capsules grade from 8-9 mm (80-90 %) with high yield. The variety is moderately resistant to disease and pests as well. The price of cardamom is based on its grade. The cardamom available in the market belongs to the grade 5mm-6mm. Sometimes very rarely 7mm grade cardamoms are also available.

The *Elarajan* cardamom is bold and a good percentage of capsules grade from 8mm-10mm, hence fetching more market price.

Diffusion efforts

In 2007, his father K.J. Baby got a National Award for his white flowered cardamom variety in the Fourth National Competition of NIF. His father is a respectable social worker and was also the then President of Cardamom Growers Association, which had about 2000 farmer members. Lot of farmers came to visit his farm when they heard about the features of the variety, local channels also covered the news and the demand increased. He started selling the suckers and his brother started a nursery. Till date, they have sold more than 60,000 suckers. But Benny wants to concentrate on cultivation only rather than raising a nursery as he believes that the cultivation of cardamom is more profitable than raising the nursery. This variety has now diffused to nearby Karnataka and Tamil Nadu as well. Recently, a leading plantation company has placed an order for 25000 suckers.

Benny's experiments are not confined to cultivation and nursery raising only. Besides cultivation, cardamom processing is also one of his interested areas of research. He has designed and developed a new model of cardamom processing machine. In this model, it is claimed that at a time about 450 kg of cardamom can be processed in 26 hours with less firewood than the conventional driers. The experiments continue as he plans to bring down the drying time to 20 hours.

In March 2011, Benny was selected by NIF for participating in the Innovations' Exhibition at the President House, New Delhi, which he considers as one of the most prestigious moments of his life. '*This is a lifetime achievement for an ordinary person like me*', exclaims Benny. He advises his fellow innovators to concentrate on their work solely and adds that fame will come in its own time if we do our work well, and that there is no need to chase name and fame.

T.P. Joseph

Kerala

T.P. Joseph, a well known farmer for his innovative experiment in cardamom and pepper, has developed "Thiruthali", an improved variety of cardamom. This variety is a prolific yielder with the dry yield being 4-6kg per plant. The capsules are parrot green coloured which fetch good market price. This variety is also resistant to root grub, stem borer and instance of decaying.

"Thiruthali" - An Improved Variety of Cardamom

National Third Award – Plant Variety, Scout: Peermade Development Society, Idukki

For Joseph agriculture has been a passion since childhood. Though he was good in studies, poor economic condition of his family forced him to discontinue studies after secondary education. He recalls some of his school friends, who continued their studies, went on to become famous doctors. Nevertheless, he is content of the life he has lived and appreciation he has received for his experiments in agriculture. He believes that observation, hard work and determination are the most important qualities of an innovator. The life of seventy four year old Joseph underlines these values.

Hailing from Kottayam originally, their traditional agricultural family migrated to Mariapuram in the hilly terrain of Idukki in 1964. Initially they were into the cultivation

of paddy, tapioca and pepper. But later after purchasing few acres of land, they started cardamom cultivation in Peethothy area of Idukki district. Like any other farmer family in Idukki, they also struggled a lot to ward off attacks from wild animals and to get acclimatised. In 1980 he decided to only focus on pepper and cardamom cultivation. But the pepper cultivation got destroyed fully by quick wilt and this forced him to confine his interest to cardamom cultivation alone. He started cultivating most popular variety *Njallani* and other local varieties.

His family includes his wife, three sons and a daughter. The two elder sons are helping him in agriculture while the youngest one is a practicing advocate in a distant city. Joseph, who stays with his second son, mentions that his wife and children are behind all his achievements.

Genesis:

The area where Joseph lives gets covered with heavy mist particularly during rainy and winter seasons. Joseph observed that even *Njallani*, the most popular variety of cardamom was not performing well in his place. He then tried many other varieties but without success. He also realised that many high yielding cardamom varieties were highly prone to diseases and pests, which drastically reduced the yield at times. This prompted him to think about developing a variety, which would suit local conditions.

In 2000 he selected the high yielding variety *Njallani* and other two varities named *Vazhukka* and *Vulga* (Malabar Variety). Though low in yield, both *Vulga* and *Vazhukka* were known for less maintenance as well as high resistance to pest and disease. These three varieties were planted in a pit with an isolation distance of 5m to reduce the chances for cross pollination. After two years capsules were harvested from these plants and 600 seedlings were raised through seed propagation. These seedlings were then transplanted in an acre of land.

When the plants grew, he noticed a special plant with profuse flowering and long panicles (6 feet long) with an average of 4 pinnacles per tiller. It displayed resistance to disease and pests as well. From this mother plant, 30 seedlings were developed and planted. Another 20 seedlings were then developed from each plant. Of these 600 plants, 500 are still growing well in his field in their twelfth year. High yield, good resistance to pests and diseases are the particular features of this variety. It took him six years to stabilize the yield characters of this variety. Presently, he receives a minimum of about 4-6kg of dried cardamom per plant. He says this yield is unique and high among the existing popular varieties. He has been multiplying the variety by vegetative propagation. This has been widely adopted by other cardamom cultivators as well.

Thiruthali- the improved cardamom variety

Thiruthali variety, named after his family house, is a high yielding disease resistant variety possessing bold parrot green coloured capsules.

It is a Malabar type variety with a dry yield of 4-6kg per plant and is highly suitable to Santhampara area of Idukki district, Kerala. It gives good yield even under rain fed condition and is mostly suited for areas with less shade (<40%). The medium bold and parrot green coloured capsules fetch good market price. In this variety about 60 - 80 productive tillers per clump, 50- 60 racemes per panicle and 15- 20 capsules per racemes can be observed. Due to the higher number of panicles per tiller, the yield level in the first bearing itself is two to four times higher in comparison with other popular and released varieties. The plant has fibrous stem and is resistant to stem borers, root grubs and incidence of decaying. The management efforts as well as the pesticide and fertilizer requirements are also less than other locally popular varieties.

Indian Institute of Spices Research, Calicut and Indian Cardamom Research Institute, Idukki have both observed that this variety has a higher yield than other locally popular and released varieties. IISR, Calicut, while claiming it to be an innovation, recommended recognition for the farmer. Bapooji Krishi Vigyan Kendra Santhanpara, Idukki describes this variety to have a yield potential of 2000-3000 kg/acre (dry weight) with 22% curing weight.

Diffusing it far

Joseph maintains a nursery of the plants for sale/distribution to other farmers. This variety has slowly spread to many districts of Kerala and neighbouring states of Karnataka and Tamil Nadu. The farmers mention that this variety gives good yield and performs well even under adverse conditions while reducing the overall cost of production by 40 per cent. He claims to have sold more than 2 lakh seedlings to about 1000 farmers in over 2000 acres of land. Joseph mentions that mostly small and medium farmers cultivate his cardamom variety because it requires little inputs. He adds that most of such farmers actually grow cardamom because of this particular variety; else they may have switched over to some other crop. Apart from economic benefit, which he may obtain through the sales, Joseph is happy to see the change in the lives of small farmers. *Cherukida karshakarude jeevithathil ee vilavu kondu vanna matta kanumbol njan valareyathikam santhoshavananu*, says Joseph. (I am satisfied by seeing the success of small and medium farmers cultivating this variety which has brought change in their life).

Thiruthali variety was recognized in First Farmer Science Congress at Kannur Krishi Vignan Kendra some time back. Joseph also received a certificate of honour from All India Radio for adopting the modern agricultural techniques and Prasar Bharati award from Doordarshan in 2009. A documentary on his variety was also aired in *Krishi Darshan* programme by Doordarshan Kendra. He also bagged Bapooji Krishi Vigyan Kendra's best farmer award of Idukki district in 2009-10. "*Cardamom landrace Thiruthali is an innovation of high esteems for consideration by any institution for a moderate farmer*" mentions the KVK.

Moving ahead

Joseph, still experimenting, is working on developing another variety – the 'super *Thiruthali*' with bold capsules, high productivity and adaption to local conditions. Though he is largely satisfied with what he has achieved in his life, there is a worry that troubles him a lot. While he wants to transfer all his accumulated knowledge to the next generation, not many are interest to receive any. He is sad about the fact that while the whole world is dependent on agriculture yet farmers and agriculture are not getting the attention that is due to them. He wishes for a time when farmers' contribution would be recognised. Joseph opines that agriculture needs to be included in school curriculum so that students get sensitised to it and may get interested to take it up as a career later.

Arkhiben Mithabhai Vanakar

Gujarat

(Community Reprsesentative)

Farmers in different areas of Gujarat have developed their own herbal solutions for controlling pests in crops. Their individual practices have been pooled together by SRISTI to develop a product more efficient than individual practices. Arkhiben Vankar is the selected community representative.

Herbal formulation for controlling aphid, white fly and heliothis

National Third Award – Plant Protection; Scout: Ramanbhai Sutariya and others

(Community Practice)

In absence of available options to ensure sustainability of crops, innovation becomes imperative for a farmer. Soil types vary, crops vary, ground water levels vary, irrigation patterns vary and micro climate varies but the efforts of farmers in any region, are directed to only one end and that is to make sure that their lands give them enough for sustenance. In this process a lot of experiments are attempted by them, some succeed while some do not. The Honey Bee Network has been documenting stories of these ingenious singular or community efforts from different parts of the country. Similar accounts of farmer developed herbal formulations for pest control were also documented by SRISTI from different areas of Gujarat and shared with NIF. These practices were subject to scrutiny at NIF & SRISTI, subsequent to which it was found out that there were communities spread in patches in different parts of the state, which were using these plants for pest control. An experiment was tried to see if these individual practices could be pooled to produce a more effective and broad spectrum formulation for herbal pest control.

Tests at Sadbhav SRISTI Natural Products Laboratory, Dantewada Agricultural University and in the fields proved the efficacy and superiority of the formulation over individual practices. SRISTI Drop, a herbal product for the control of pests, was thus developed on the basis of community knowledge. The product is being promoted by SRISTI Innovations and the benefits are being shared with the communities.
Mithabhai Vanakar (90), widely known as the pesticide lady, was chosen as the community representative. She is a walking encyclopedia on the uses of different herbs for agricultural and veterinary diseases and has a vast repertoire of knowledge. Arkhiben had learnt the use of a local herb for pest control from her mother-in-law, which gave about 70-80 per cent control. As her husband was a priest and people from different villages came to him for conducting religious ceremonies, this practice got diffused due to interactions with them.

Ramaji Bhemaji Parmar

Gujarat

(Community Reprsesentative)

Ramaji Bhemaji Parmar (49) is well renowned in his area for his expertise in many human and veterinary health related herbal practices. He represents local community which has knowledge about the use of the herb for the fever.

Herbal medication for skin diseases

National Third Award – Human, Scout: Narsinhbhai Parmar, SRISTI

His father late Bhemajibhai, who expired at the age of 110 years, was an admired herbal healer for animal and human ailments like cyst, kidney stones, bloat, fever, malaria etc. People from nearby villages used to visit him looking for cure and getting medicines. Being surrounded by different kinds of herbs and talks about diseases every day, Ramaji gradually developed interest in these activities and started assisting him. While on their trips to the forest to collect various herbs, his father taught him to identify and differentiate different medicinal plants. An avid learner, Ramaji visited nearby forest for collection of herbs, leaves, barks and plants and showed them to his father who explained him their uses. After the sad demise of his father, he took the responsibility to carrying the task forward in the service of the society. He also holds two acres of land in his village and has a wife and four children in his family.

Though illiterate, Ramaji's repertoire of herbal formulations, both for human and veterinary health, comprises over 500 traditional herbal practices for curing various ailments/diseases. He laments the fact that human activity is destroying the forests, which are necessary for sustenance. Also, many of the plants, which he uses in his formulations, are not available now because of the destruction of their habitats. This has posed difficulty for him to prepare his formulations as he has to look for an alternative for the plant(s) used in the formulation, which are not available now. But being a person with never-say-die attitude, Ramaji decided to do something about it rather than waiting for something to happen.

He thought about developing a garden with rare medical plants and went about making his dream a reality. In considerable time but with patience, he has been able to grow about 3,000 plants in an acre. He uses these plants from his botanical garden for treatment and aims to preserve bio-diversity of the surrounding area as well. This garden also boasts of a tube well for watering plants, the water of which is available to the village folk for consumption. Due to his pleasing personality, and herbal knowledge, he is visited by almost 40-50 people daily from his village and nearby areas. He freely shares his knowledge with people for their benefit and also sensitizes them about the need to conserve bio-diversity for human welfare. He also organizes periodic visits of school children to his garden to sensitise them about their environment and its diversity.

One of the herbal practices, Ramaji shared with SRISTI was related to a skin disease. He used a particular plant (name withheld for IPR reasons) which was found to be novel after doing prior art search. While pursuing research at Sadbhav SRISTI Sanshodhan Laboratory, it was found that adding certain other common ingredients increased the efficacy of the formulation. Suitable base was used for the formulation to prepare an ointment for topical use. The toxicological tests were conducted at Indian Institute of Toxicology Research (IITR), where it was found to be non-toxic. Limited user trials were initiated. The results of the trials were very encouraging and a product, 'Zematic' was commercially launched by SRISTI. The benefits so obtained are shared with Ramajibhai and his community.

Naval Kishore Singh
Bihar

(Community Reprsesentative)

Naval Kishore Singh (59) is a farmer by profession. He is also a traditional knowledge holder and administers a very effective herbal medicine for curing ephemeral fever in animals. He represents local community which has knowledge about the use of the herb for the fever.

Herbal medication for treating ephemeral fever

National Third Award – Veterinary, Scout: Mukesh Kumar Singh
(Community Practice)

Late Kailash Singh, father of Naval Kishore Singh was a well known traditional knowledge holder and a farmer. People from many nearby villages used to come to him to get medications for their cattle. Exposure to herbs and their uses thus came early to Naval Kishore. He obtained primary education from his village and later went to Varsaligunj for higher education but failed to pass matriculation. Soon after he got married and started helping his father in various household activities.

The first six children of the couple were girls. There was a lot of family pressure on him to get married again. But as he loved his wife much, he resisted all the pressures, trying to explain to the people that whatever happens is for the best. His wife later gave birth to two boys, both of whom are studying right now. After the death of his father in 1990, he had to take over the complete responsibility of his farm and his father's small in-house '*dispensary*'. With limited source of earning and over half a dozen persons to feed, their financial condition has not been well all these years.

It is very commendable that despite all financial hardships, Naval Kishore has never charged any money for his services from anyone, sometimes helping them even at the expense of his own work and time. His helpful nature has made him quite popular in the area. On inquiring about the hardships he had faced in his life, he calmly says, "*Jo hota hain sab ishwar ki marzi se hota hain*"- whatever happens is all God's will. His wife, Jaywanti Devi, describes him as a soft spoken, jovial and friendly person who loves to meet and interact with people. He is good at heart, a bit extravagant and lives life his own way. She adds that he does what he feels like doing even if that brings loss to him.

Naval Kishore has a lot of herbal formulations for treating various diseases in both animals and humans. One of the herbal practices, Naval Kishore shared with NIF was related to a veterinary disease. He used a particular plant (name withheld for IPR reasons) for treating ephemeral fever, which was found to be novel after doing prior art search. NIF filed a patent (2243/CHE/2008) in his name. Clinical trials were undertaken and the results clearly indicated that major liver enzymes were not affected by the administration of the herbal formulation and that the protein metabolism was normal and liver was in healthy condition. The therapeutic efficacy was confirmed for alleviating the ailment by reducing the lameness and pain in the limbs of animal. A product named Ephelixin - 3D, an oral herbal medication has been developed based on this practice. NIF is looking for entrepreneur/companies to transfer the technology of this very useful drug for ephemeral fever.

The ever positive, Naval Kishore with the help of the community, is planning to open a small veterinary hospital for the treatment of animals if some funds could come their way.

Biren Kalita

Assam

Biren Kalita (60) is a farmer cum herbal healer and has developed a herbal medication to cure retention of placenta (ROP) using local herbs.

Herbal medication to cure retention of placenta in animals

State Award – Assam; Scout: NIF Assam Cell

Kalita's village is about 70 km from Guwahati and lies on the fertile banks of the Brahmaputra river, meandered by one of its tributaries. Agriculture is the primary occupation of the people with paddy being the main crop. Biren Kalita comes from a very poor background. Though their primary engagement is agriculture but annual floods cause so much havoc that sustainability itself becomes an issue every year. Hence, his son has started a small grocery shop to supplement whatever meager income is there from agriculture on their 10 bighas of land.

His father was a milk man and had good knowledge of symptoms and diseases of animals. He had also acquired familiarity with herbs through interactions with different people. Gradually this interest turned into a hobby and people from nearby villages started to come to his father for medications. Biren's induction in herbal healing started from this point and she started learning observing and hearing his father. Gradually as his expertise grew, he started modifying his father's herbal practices by altering the ingredients and/or proportions. This particular practice of Biren is for Retention of Placenta, which is a condition where all or part of the placenta (organ that connects the developing foetus to the uterine wall to allow gaseous, nutrient and faecal matter exchange) is left behind in the uterus after the calves birth. The ROP has many associated medical problems hence its earliest cure is recommended.

Biren Kalita is a very reserved person and as per his wife, does not even talk unnecessarily with his family members. In return for his services, he never takes any money except tamul-pan (areca nut and betel). If somebody persists with the request to take money, he politely declines and asks him/her to donate to the Namghar (temple).

Natubhai R Wadher
Gujarat

Cotton boll picking machine

State Award – Gujarat; Scout: SRISTI

Dry land cotton is well adapted in certain parts of Gujarat. But cotton bolls do not open in certain varieties and hence cotton cannot be picked up directly. Extracting the cotton seeds and picking the cotton bolls is a tedious job and requires a lot of labour supply. Natubhai, a forty year old farmer from Erawada (Surendranagar district, Gujarat) brought a sustainable solution to this with his tractor drawn mobile cotton boll picking machine which takes the drive from tractor PTO. This machine not only plucks the cotton bolls but also separate the cotton from the bolls.

Natubhai Ratubhai Vader family's comprises mother, wife and two children. Youngest of the six children, Natubhai was pampered a lot by his parents and siblings. As a child he was very curious to know how different machines worked and in the process had spoiled many. It is this fascination along with the understanding of inner working of machineries made him invent the cotton boll picking machine.

The custom of child marriage is prevalent in the Naroda Rajput community like many other communities in India and accordingly Natubhai was married to Puspaben when he was in his early teens. After one year he was sent to a boarding school at Kadi,

Mehsana district where his son Dharmendra is studying now. Meanwhile his elder brothers got job and shifted out from the village. The elder one is a contractor and running a business in Ahmedabad while the younger one is a primary school teacher in Dasada. After they moved out, it became difficult for his father to manage farming activities on his own. He then asked Natubhai to join him and the obedient son complied and discontinued his education. His father believed that the sole intention of education was not to get an employment rather it is a value addition to an individual. Natubhai believes the same. Ratubhai, father of Natubhai was a respected person in the village and had a land holding of more than 150 acres. "*Because of his good rapport, the labourers were loyal to him and thus some worked with him throughout their life*", says Natubhai. For him, agriculture is more profitable than other employment and this was another reason why he took farming as a livelihood option. Natubhai shares that he is earning much better than his brother who is a teacher. The ancestral land was divided among the brothers when his father passed away and Natubhai received 60 acres of land. He also works as a real estate broker. After the farming season, majority of the villagers sit in the *Ram* temple and talk over the various issues. Often they discuss on the crop patterns of the year. Natubhai shares this as a good platform for social exchange.

Genesis of the Cotton boll picking machine

Cotton is one of the main crops grown in the Surendranagar, Ahmedabad and Randhanpur districts of central Gujarat. Due to the water scarcity and other geographic features prevailing in the area, local variety of cotton named Kalyan-V-797 also called as Shankar is widely grown in the belt. Erwada, Natubhai's village, too follows the same pattern. The crop is rainfed and takes about nine to ten months to grow. The seeds are sown during monsoon and the harvesting is done around March to April. Once the crop is ready, labourers are to be employed to pluck the cotton from the fields. This is a very labour intensive activity and often farmers and their families also join the labourers to pluck cotton from the fields. Since harvest time in the entire region falls at the same time the demand for labourers during this season is also increasing. It is very difficult to get labourers in the village and if cotton is not plucked in time, the crop gets wasted. Workers often demand more wages and are not ready to work for a smaller duration of time. Now day's industries started establishing in this area and because of the better salaries labourers preferred to work there rather than in the cotton picking farms. Farmers having small or medium sized land holdings often find it difficult to pay higher wages and bring labourers from outside. Since this is a onetime earning for the farmers during the year they have to get the cotton plucked by some or other means.

Natubhai's father had eighty acres of land. It was difficult for him to employ labourers for the entire farm and hence Natubhai used to support the labourers in plucking cotton from the fields. He noticed the labour shortage during the cotton picking season despite having a big team of sincere and committed labourers. Once while doing his work, the idea of making a machine to do the job crossed his mind. Natubhai says, "*I could not bear to see the problems of my father and other villagers. A lot of cotton use to get wasted. A machine would certainly make the job easier.*"

While Natubhai was conceptualizing his design, he lost his wife in an accident. This caused him tremendous agony. Later his family got him married to Nabuben, a widow

from the same community. She took care of Natubhai and young Dharmendra and after a few years, Ravina was born to the couple.

Meanwhile Natubhai heard the news of *Chetak* - the automated cotton stripping machine made by Mansukh Patel, an innovator (supported earlier by Honey Bee Network through GIAN) from a nearby village which had revolutionalized the cotton industry in the region. His success made Natubhai's conviction stronger that his machine will pick the pods one day. He recalls, '*mara biswas drad thai gayo ki mhari machine kaala bins'* (This made my conviction stronger that my machine could pick cotton bolls). When he invested his savings year after year on designing this machine and not getting good results, his wife started complaining. Natubhai spent almost 10-12 lakh of Rupees in research and because of this he was not able to pay any attention to his family's needs. When the first model failed to perform, his wife objected and advised him not to invest further. She wanted him to think about education and future of his children. Natubhai recalls, "*Sometimes, I start from the house saying that I am going out to grocery shop for purchasing oil. However, I would return bringing some iron parts for the machine*." But this could not last for long. He had already invested more than ten lakh rupees and there was no guarantee that he would succeed. Tired of family's criticism, he stopped working on this machine for about three years. In 2004, SRISTI decided to fund his endeavour which refuelled his ambition. Subsequently NIF/GIAN increased the grant to Rs 1,50, 000. He upgraded this machine subsequently.

Natubhai did not have the technical knowledge to design a machine. However he was very determined and believed in learning by doing. "*I believed in the fact that if one wishes to do something sincerely, then he surely finds the ways to learn it. For hours together, I would sit in the field and think about what kind of force can segregate cotton boll from its stalk. Later, when the idea became clear in my mind, I prepared the drawings. I brought some cuttings, drilling tools etc and started working on the design*" shared Natubhai. While working on the field he realized that a vibration action would be needed to make the bolls drop of the stalk. To test his hypothesis, he tried various ways of hitting the plant and finally concluded that a set of vibrating sticks would perhaps serve the purpose. Gradually, he started getting the equipments that he needed to make the machine and opened a private workshop. He has created most of the machine parts in his workshop only. He adds, "*Since I do not have all the equipments in my workshop, I got certain parts fabricated in GIDC cluster. I instructed the workmen there and gave them my requirements*."

Natubhai also took an assistant for contract to help him which he calls him on the need basis. "*It is good to have someone with you as it keeps one going. Whenever I get stuck up, I can discuss the problem with him*" says Natubhai. He also got suggestions and help from his friend Yashinbhai. It took him two years to improvise the machine substantially.

The Cotton boll picking machine

The cotton boll picking machine is a self propelled one in the form of big chamber that removes cotton bolls from the plants. This was developed to suit the varieties of cotton generally grown in country which does not ripen at same time and is available at the affordable cost.

This tractor mounted machine takes the drive from tractor PTO and can be raised or lowered to a desired height from ground level through hydraulic system. It can be easily attached to a tractor and taken to the field and comprised of four parts namely the vibrator, conveyer tray, suction pump and storage cabin. Every time that the vibrator discs revolves, it gives a strong jolt to the plant and the cotton bolls dropped on the conveyer which collected them and drew to it to the back of machine from where the suction pump sucked these for storage in the storage box. When the tractor moves forward, the cotton plant comes in between the guides which forward the plants towards the plucking unit. The cotton bolls are plucked by rotating the star wheels (3-4 on each shaft) mounted on inclined shaft. Rolling rubber belts are provided on both side of the row beneath the plucking mechanism to carry the bolls towards Suction pipes on both sides. In addition aspirators are also there to suck the cotton bolls through suction pipes. The performance of the machine is found satisfactory.

The machine can be operated with diesel and the fuel requirement for one *Bigha* is one liter. For the operation purpose, the machine does not require any additional power. It can be attached to the tractor. Natubhai says, "Generally tractor requires about 10k HP power after joining this machine an additional 5HP power is required which can be managed with the fuel used for operating the tractor."

Functioning of this machine has been tested by the department of Agriculture and food, IIT Kharagpur and presently the work is in progress on the recommendations. Prior art search reveals that the Cotton boll picking machine developed by Natubhai is different in its concept from those available in market and believed to suit the local conditions. Patent is filed by NIF in the name of Natubhai.

The present model is cost effective in comparison with the existing models. While discussing about this Natubhai says that by attaching this to the tractor he can pick cotton from 3 *bigha* in an hour with one liter of diesel costing about Rs 40 i.e. he can pick approximately 600 kg of cotton bolls whereas, manually a man can pick 100 kg of bolls in a day costing about Rs 30-40 per 20 kg. Hence this machine claims to reduce the cost of harvesting in terms of time and money. Natubhai says that the attachment can be made with Rs 60000-70000 per piece and it should be a fair deal for the farmers. Affluent farmers can have a personal one, others can share or hire as in the case of tractors. He thinks that with a little modification it can harvest Bt cotton also. He says, "*Dimag main to hai, karna padega*".

Support and Recognition

Natubhai and his cotton boll picker gained attention among media, government officials as well as the public. In 2005 he was felicitated by *Uttar Gujarat Naroda Rajput Samaj* recognizing his efforts to make the machine. In 2006, he received *Sardar Patel Krushi Award* for being the most progressive farmer in the district. In 2007 he received SRISTI *Samman* for his innovations. He also participated in *Baisakh suth teej* where a programme was arranged before the rains for the farmers to meet, interact and learn from each other. He also had a meeting with *Dilip Sanghani*, representative from the Gujarat Chief minister's office where some scientists were also present. They assured him the provision of subsidy from the state government on the successful manufacturing of the machine.

During the time when Natubhai's work was stopped because of the financial crisis SRISTI, an organization working for grassroots innovations in Gujarat came forward to support him. In addition he was also supported technically and financially by GIAN/ NIF. After the grant was approved, he has upgraded the machine by introducing two

way hydraulic gear system. Natubhai says that most of the grant money has utilized in up gradation of the machine.

People from the nearby villages are aware of the cotton boll picking machine innovated by Natubhai. His community members recognized his contribution and felicitated him with various laurels and awards. Since Natubhai was facing financial difficulties his community members offered him help. He wants to keep his respect and dignity intact and hence has politely refused the financial help from his community. As the news about his innovation spread in the region many expressed their interest in buying the machine. One of the community member of the village said "*Picking cotton is one of the main issues of the farmers here and we have to spend a large amount of money on labourers. We will purchase it even if the machine is bit expensive it as it will save our money over the period of time*." An elderly members of his village remarked "*Making the machine is a very difficult task and it requires a lot of dedication and application of mind. In the entire village only Natubhai has the talent to create such a machine*." While discussing about the feedback on the machine, Madebhai Vadher, another senior from the village shared "*mehnat bau kareche, thai ja se*" (If one puts in a lot of efforts, the work is completed). He further added when machine for reaping, drilling, cotton stripping etc has come, why won't cotton boll picking? It has no reason not to succeed and everyone will come to him asking for the machine as the demand is high. In a way Natubhai was creating market for his 'virtual machine' which is yet another step ahead.

Prakashbhai K Dodhiya, the dealer and supplier of Fergusson tractors in the whole district informed us that people are willing to pay around 1.5 lakh or more for the machine. He said that the when farmers can pay 1.25 lakh for a thresher then for this they can pay anything around 2-2.5 lakhs because it will be a dream machine for them. The cost will be recovered from the saving on the labour cost.

Way Ahead

Once the machine design is complete, Natubhai has plans to start a manufacturing unit at his village. Since he has a lot of land and electricity is not a problem he finds it convenient to start the unit in his village. He is also thinking of adding a cotton storage area in the same machine. He also aspires to make a vehicle runs by magnets, which Natubhai assures will be done soon.

Yenkhom Mangi Singh
Manipur

Yenkhom Mangi Singh, from Kakching, Thoubal District of Manipur pioneered Kakching mat weaving machine which is the first of its kind in India. The innovation is a small weaving machine for making the mats of water reed locally known as Kouna in Manipur. The Machine works like a shuttle loom. The leg treadle in shuttle loom is replaced by a hand lever which lifts the warp threads. The machine increases the productivity 3-4 times in comparison to the conventional weaving process.

Kakching Mat Weaving Machine

State Award – Manipur; Scout: NIF Manipur Cell

Life has been a struggle for Mangi Singh since childhood. He had to discontinue studies after class 3, since he was affected by polio. His wife Mypakpi (52) is illiterate. He has three sons, the elder son has studied upto X Standard, second upto IX Standard. Mangi Singh's youngest son is differently abled. Other than Mangi Singh, his second son also supports the family; he is a hawker.

Mangi Singh, though not formally educated is very well skilled in the Manipur language. Being specialized in Manipuri, he is a well known tutor for Manipuri language in the area. He gives tuitions to the school students in his neighbourhood for Manipuri subject. His students show extra ordinary performance. His daily routine starts with the early morning tuition for the small kids and after that he starts mat weaving. In between he does other small works as and when he gets the demand. He manages to earn about Rs 3000 by way of tuitions and *Kouna* mat making. Mangi does a wide variety of jobs to earn a living. Because of his interest in learning new things, he was able to attain mastery in a wide variety of jobs. Apart from being a craftsman by profession, his other face includes that of an electrician (mechanic) cycle repairer, barber and blacksmith.

The only driving force has been his inquisitive mind and will to fight and this helped him so far for learning and solving many local problems while earning for livelihood. If there is a person who is equally hardworking and struggling to survive in the locality, that will be only Mangi. He is a brave man! "Bring any kind of problem I will give solution for that" claims Mangi Singh proudly.

Being creative in nature, Mangi is always busy making something or other. But he started making products from zinc like buckets, water sprayer, *meiphu* (a type of *chulah*) etc. and mat from locally available weed, as a source of main income 15 years back. He made the mat manually for two years. But as the raw material was the widely available weed (*Kouna*), the product cost was only Rs 100-200/- per mat and 10-15 days are required for making the same. After sometime he found difficult to run his family with an income of only Rs 100-200 in 10-15 days, thus, stopped making the same.

Then he started thinking day and night for about a couple of months, how to shorten the days required for making the same. Ultimately, he could develop a mat making machine and took ten days to develop a complete machine, with the help of a carpenter, as he is not physically fit to assemble all the parts required. Now, after a gap of 6-7 years, he is making the mat again in his machine, from another locally available weed (*Chungthang*). The advantage of the machine is that two mats can be made in one day and each cost Rs 230-300/-, he could get a profit of Rs 200/- per machine. Deputy Director of Development commissioner for Handicraft, Ministry of Textile NE, Guwahati visited and approved the machine.

Genesis of Kakching Mat Weaving Machine:

Mangi Singh, the innovator of the Kakching mat weaving machine has been able to provide the much needed impetus on the traditional *Kouna* (water reed) mat weaving industry in Manipur. Water reed known locally as *Kouna* (*Scripus lacustries* Linn.) is a firm stemmed water or marsh plant used for weaving and is grown generally in places where paddy is not suited at all. This plant is synonymous with the exotic craft tradition of Manipur and the unique feature is that Manipur is the only place where *Kouna* is grown and extensively used in local crafts. More than 4 lakh people in the unorganized sector are engaged in the state crafts industry of Manipur and more than 180 items are made using *Kouna*. Kakching (Thoubal district), where the innovator lives, is also one of the places in Manipur where the *Kouna* grows abundantly.

As a craftsman, he learned the traditional mat weaving art some 30 years back and tried to earn a living from that. The traditional method for weaving is labour intensive in which a weaver has to work on a squatting position for hours and this brought him a lot of physical strain and illness. In spite of all the difficulties he continued weaving. This

back-breaking experience triggered his inquisitive mind and thought of developing a machine which would simplify the weaving process. About 25 years back, he started working on the machine which could relieve his physical discomfort and pain while weaving. He spent years on the experiments related to the development of the machine. First prototype allowed the weaver to operate sitting on the ground. But he gave up this model experiencing the strain on neck while working for long hours and started working on an improvised model. After five years of trial and error, he came up with the first workable machine in 1993. Mangi Singh shares that he even kept awake for three days without rest, while working on the machine. It is observed that the life of Mangi Singh is passing through a new horizon with the launch of *Kouna* mat weaving machine.

***Kakching* Mat Making Machine as a solution to sustainable livelihood**

Making mats of local reed/grass called '*Kouna*' is a popular practice in Kakching and surrounding areas in Manipur. The traditional manual mat making is a tedious, slow and physically challenging work. Moreover, it is not a profitable occupation as well. The tradition survives mainly because that it is being done by the elderly and others who have no other means of earning. Mat weavers perceive it as a tedious work. Since the traditional weaving is done on the floor, one has to continuously squat for hours and needs total concentration. It takes about four days to complete a single mat in the traditional mat making process costing about Rs 300. After deducting the costs of raw materials and other expenses which comes about Rs 140, becomes a completely hopeless profession. This makes the occupation highly unproductive and uneconomical. Hence it is undertaken by only those who have no other alternatives. The major constraint in large scale production of *Kouna* products especially the mats and cushions is the lack of mechanization process which restricts the production capacity. A revolution has brought in this tendency with the weaving machine innovated by Mangi Singh who is physically handicapped and the one who has undergone this toiling process for years. The significance of the machine lies with the fact that it reduces the toils and physical strains of women, elderly people and physically challenged individuals.

The *Kouna* Mat Weaving Machine is a small size loom and works like a shuttle loom. However, there is no shuttle in the machine and the leg treadle in shuttle loom is replaced by a hand lever, which lifts the warp threads and here lies the main innovation. It has a wooden frame of about 4 ft high, 4 ft in breadth and 4 ft in length. The lever is either pulled up or pulled down to lift the warp threads and restores in its normal position once the lever moves back to the original place. Each of the two harnesses/shafts has a set of heddles through which the wrap threads (small plastic rob) are threaded. The warp plastic threads are rolled into a wooden beam on the front end of the machine and on the other end; the plastic threads are tied to a collection beam which lies below the weaving area. Using gears and sprockets, the two beams can be rolled simultaneously.

The open ended weft '*Kounas*' are rolled by hand into a designed frill which just takes about 4-5 hours to complete frill rolling of a single mate (6.5ft long). Once the weaving is done, the woven mat is cut into desired length using a cutting knife.

This is the first effort for mechanizing the '*Kouna*' mat weaving in Manipur and '*Kouna*' mat being made only in Manipur; the machine appears to be the only one of its kind. The modification of treadle into a hand lever, hand lever running on an arch wire, adjustable heddle shaft holder, wooden comb etc emphasize the innovation done by Mangi Singh and the experts verified that these processes along with the machine is a new concept in the weaving process.

The weaving machine brought a solution to many livelihood concerns. At first it introduced a new weaving practice and thus it is ensuring that the tradition of weaving is sustained. Earlier it was considered as a male domain and now even the females can weave with the support of this machine. The demand of physical efforts for weaving was a concern in the traditional method and it created more stress to physically handicap. Mangi Singh, the innovator was also handicapped and he found it difficult for him to weave because of the pain while squatting. Presently he is working with this machine and found that the physical stress and the pain is not at all a concern as it provides comfort to weavers. Also the productivity has increased three to four times with this machine. A skilled traditional mat weaver can make only one mat in four days where as the present machine can weave one mat per day including the frill tying. It just takes 8-ten hours. Prior Art Search found no handloom kind of machine's availability for making mats from the grass or local reeds without the support of an external motive power (engine/motor).Taking this into consideration NIF has filed a patent in the name of innovator (148/KOL/2011)

Diffusing the technology to the unknown:

Efforts for diffusion were undertaken so as to assure the reach of the technology to the local weavers. As the part of this, collaborations were made with the State and the Central ministries of the department of the Industries and Handicrafts along with many other organizations. With the support of NIF, a *training-cum-production centre* was established at Mangi Singh's house. The formal inauguration of the same along with a demonstration cum training programme of machine was arranged on July 7, 2011 with the leadership of Alliance for Development Alternatives Manipur (ADAM) . About 100 women participated in the event and out of this 50 were the young girls who registered for the training. The training of 30 girls was financially supported by Nehru Yuva Kendra. Representatives from the Crafts Council of India attended the programme and assured the linking up of the trainees under Crafts programme and also the provision of assistance for the procurement of the machine. Others who attended the programme

include the representatives from the Department of Commerce and Industries, Women Income Generation Centre (WIGC), Manipur etc. Besides this training, Mangi Singh has trained about six women at his own initiative and out of this 4 is working regularly in his production centre. Depending on the mat variety they are paid for weaving and selling as well.

The machine costs about Rs.15000/- and has region specific potential. It may be good for making mats of other similar grasses too. There is no any remarkable sale of the machine apart from the sale of one machine to WIGC for which the team is highly satisfied on the performance. But more than 100 pieces of mats which was manufactured with the new weaving machine is sold.

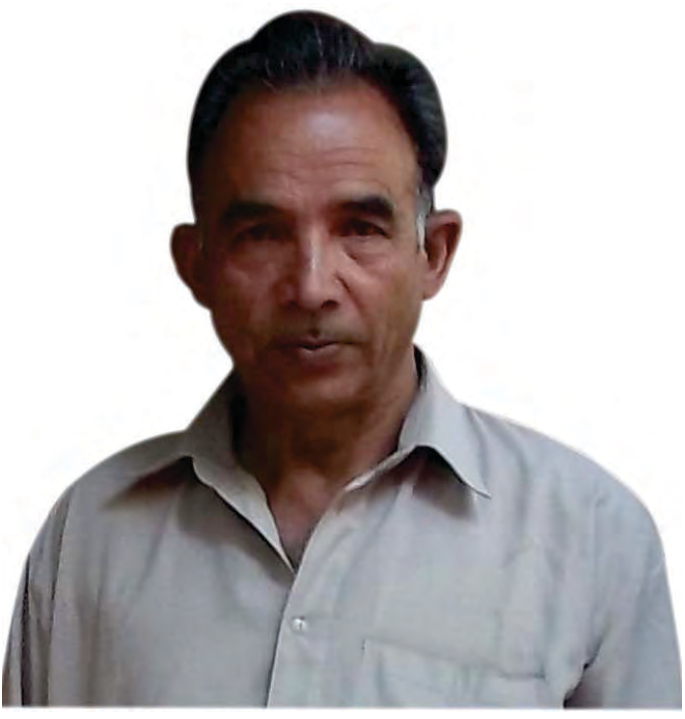
Support and Recognition

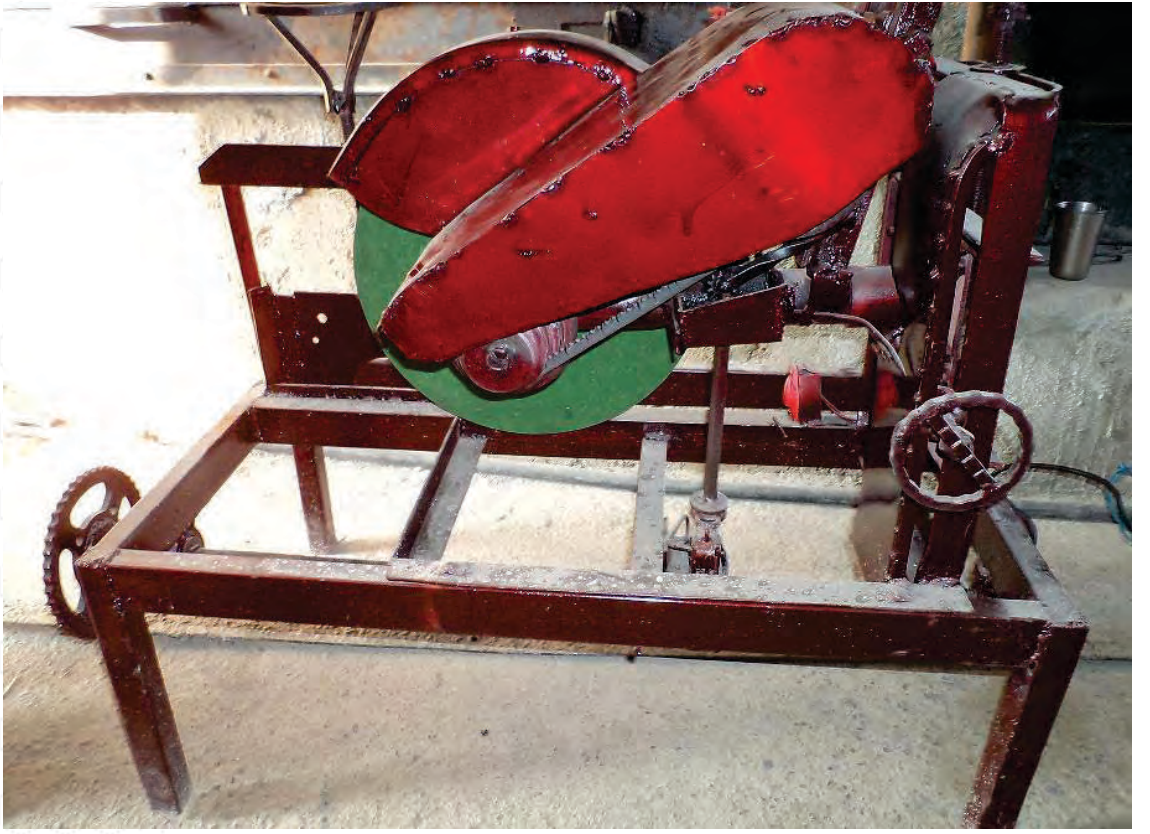
Mangi Singh was supported financially by NIF for the development of the prototype. Apart from this, the value addition of the machine is being undertaken with the financial support of NIF and the technical support from CMERI Durgapur and IIT, Guwahati. As a result the machine is improvised to such a stage that it can be used in all season where as previously it was not possible to use this machine in the rainy season. Also the mat can be stretched so that it does not gather at one place. Besides the support for the establishment of training cum production unit, NIF also gave him a fellowship of three months recognizing his contribution to sustain the Kouna mat weaving tradition in Manipur through his machine. Seeing the potential of the machine for enabling many more weavers to continue the practice so as to promote the traditional kouna mat weaving as a good livelihood alternative, NIF endorsed Mangi Singh the business development support for trail marketing. A total of Rs.150000/- is sanctioned for this out of Rs.130000/- is dispersed to him as of January, 2012. Besides he also received the continuous mentoring support from ADAM throughout the product development and also in the business development. As the part of the Business development initiative for the machine, NIF and ADAM took lead to collaborate with various leading government and non government institutions. Some leading institutes include Department of Industries and Handicrafts, Nehru Yuva Kendra, Department of Commerce and Industries, Women Income Generation Centre. Etc.

Mangi Singh was selected by NIF for participating in Grass root Innovations Exhibition held on March 2011 in Mughal Garden, Rashtrapati Bhavan. Followed by this a reception cum interaction programme was arranged by Nehru Yuva Kendra, Thoubal in his locality to facilitate the knowledge exchange. During this period a good number of local and national media covered Mangi Singh's innovation which includes Indian express, Assam tribune, rediff.com and many other local news papers. He was also interviewed by Doordarshan Kendra of Imphal, North East TV etc.

Abdul Rahman Sheikh
Jammu & Kashmir

Abdul Rahman Sheikh, 50, a mechanic, has developed an iron cutter capable of performing four kinds of motions and cutting iron precisely from different angles. Its cutting range varies between one inch to eight inch (pipe, guarder etc) and it can cut flat sheets of any length.





Improved Iron Cutter

State Award – Jammu & Kashmir; Scout: Shodh Yatra

Son of a bricklayer, Abdul Rahman Sheikh has studied up to class 8th and owns an automobile repair workshop. He has four sons and two daughters in his family. Two of his sons work with him in the workshop while others keep themselves engaged in other sundry activities.

Sheikh has been quite a creative person since his childhood. He liked making and displaying toys of iron and tin, and displaying them. Once, in a convention at Dooru, the then Chief Minister of J&K saw his toys. Impressed with his creativity and technical skills, he offered him the option to undergo any technical training. Rahman Sheikh, thus, enrolled himself for the plumber training for a year at Bagh –e- Dilawar Khan. He got excellent grades in the course and got posted in the Transport Department. But the engagement was quiet brief and he had to return to his family due to certain problems. Subsequently, he set up this present workshop with the help of his brother. He started making grill gates, different iron structures for household use along with the motor repairing work, learning everything through sheer hard work. For setting up the workshop, a bank employee also helped him obtain the loan. The workshop provided

apprenticeship to his brother as well as his two sons who now assist him aptly. It is not surprising that he named his workshop as 'Shahbaaz Steel Hard Works', a name which intrigued the shodhyatris and drew them into his workshop.

Genesis

With time and improvement in the quality of work, his reputation increased and also increased his work load. Getting labour at reasonable rates was getting very difficult for him but the work also had to be finished on time. He pondered over the problem and came to the conclusion that if he had a machine, which could reduce dependence on labour, his problem would be solved.

Once he started making the machine, he knew what he wanted to make and how, so there was no technical problem in developing the machine. However, finances were limited and sourcing money for components and items he did not have was difficult for him. The machine thus took some time in developing. Many a times, he had to say no to his children for some things they desired. But his family was (and still is, as Sheikh points out) very understanding and took his refusal in stride. They were always there to provide him emotional and moral support. His wife's contribution is foremost as she discussed with him the problems and gave suggestions to the best of her knowledge and experience. He fondly recalls an incident that once when his iron cutter was being photographed, he joked with his wife that tomorrow the iron cutter would be displayed somewhere and he would be invited there. Then he would get married there itself. To this his wife just smiled and said that she would be with him wherever he may be. She died soon after said Rahman with watery eyes.

The iron cutter

Rahman's iron is a useful cutter, which can incisively cut iron multi-directionally. Iron materials such as pipe, rods, sheet etc can be cut with his iron cutter.

Needing just a person to operate, four kinds of motion can be obtained from this cutter viz. forward and backward, up and down, right and left, and for cutting at an angle the cutter can be rotated on its vertical axis. The cutting range varies from one inch to eight inch; flat sheets of iron of any length can be cut using this cutter. This iron cutter is similar to angle cutting band sawing machine. Hacksaw has been replaced by toothed cutter and can rotate about its vertical axis, which is perpendicular to the plane of the ground.

Prior art search discloses different types of iron cutters using hacksaw blade. The present iron cutter can cut in any angle from 0 to 180 degree while the available cutters can cut

only from 0 to 45, 0 to 60 and 0 to 90 degree. Though NIF is processing the patent filing application of the cutter, Rahman Sheikh has no objection in declaring this open source or anybody else adding value to it but with due acknowledgement. NIF has also engaged an Ahmedabad based design firm to improve the cutter. Besides the iron cutter, Sheikh has also made a grass burning machine on a request from one of his acquaintance.

Promoting creativity in young

Rahman Sheikh feels that in the mindscape of people, Kashmir is not imagined to be a place rich in technology or innovation, which is not true in totality. He feels that a change in the education system is imperative so that marks should not only define the ability of a child. There could be many other things, a child may be good at. Teachers should also inculcate the spirit of originality among children. Such children who come up with something new and useful may be provided possible financial, technical and psychological support. Sheikh is willing to train any child in his workshop who sincerely desires to learn something. He adds that sometimes, weakness in academics may be ignored in favour of creativity and innovation.

"saun nizam gachchi teuth aasun yath manz akh bache gode paithay panas andar chupith gun izhar heki karith, baiye gachci bache senzan zehni salahiyatan qadar karne yenn te poochar dene yun"
(our system should be such that it allows a child to build upon his inherent strengths, their innovative inclination should be respected and promoted)

Vikas Shinde
Maharashtra

Vikas Shinde (30), a farmer cum welder from Jalgaon is a prolific innovator who has close to two dozen ideas and innovations to his credit. His foot operated drill is fitted with a drill bit, used for drilling holes in various materials. The drill bit is gripped by a chuck at one end and rotated while cycling the device. The plate is attached with a handle for raising or lowering the position of a job. He has made this device by using old gear and spare iron parts. It is used to drill larger pieces of material made of metal, wood, PVC etc. It could be very useful in those areas where electricity is irregular or insufficient.

Pedal Operated Drilling Machine and others

State Award – Maharashtra; Scout: Pravin Patil

He stays with his wife and mother and has a welding workshop. He also owns half a hectare land where he cultivates cotton. Most agricultural activities are mostly taken care of by his wife. About his childhood, his mother fondly recalls that he was very notorious but very creative. He liked opening up things and then reassembling them. His favorite pastime was playing his bicycle. Though good at studies, he did not show much inclination towards it and studied upto only class ninth. He wanted to become a businessman but developing the liking for machine as he grew up. Vikas says, "I got interested in tools and machines because of my father. My father was a self-learner. Although he could not go to school, he learnt reading and writing on his own and retired as a senior technician in a government factory". He recalls that once his father had told him that nothing was impossible if one was willing to work hard for it.

Vikas is a self-motivated and ambitious person. His motivation comes from the drive to excel in his life and is ready to walk an extra mile to achieve his goal. Family and friends are of great support to him. They are proud of his achievements. Some of the innovations such as the grass cutting device, waste collectors, radio torch etc have been used by his neighbors and friends.

Genesis

Vikas decided to start farming after dropping out of school. Every day he used to ride a bicycle to his farm. On the way, if his bicycle got punctured, he used to sit down in a corner and repair it. Many people who saw him doing this approached him when they needed similar tasks to be done. Slowly the whole village came to know of his skills. He opened a shop and continued with his work. He happened to visit his uncle once where he saw an iron bed with no welding, which surprised him quite a bit. He tried his hand at it and did it to perfection. Thereafter he received many orders for the same. With the increasing volume, he felt the necessity of a drilling machine. Some of the options, which were available, were either not suitable for him or not affordable. Hence he decided to go ahead and make one himself.

The pedal operated drill:

This is a foot pedal operated manual drilling machine suitable for drilling larger pieces of materials made of metal, wood, PVC etc. This is useful especially in those areas where electricity is irregular or insufficient.

In this machine, the power is transmitted from the pedal to the drill through different transmission gears. It can also be operated by a motor by connecting the device pulley to the motor pulley. Using this machine, an average human being can produce 150 rpm of drill bit.

Though drilling machines are available in the market, the pedal operated ones are not found. Most available are electric operated semi-automatic or automatic. Costing about Rs 2000/-, this machine is very helpful for small scale workers and fabricators. The value addition of this product is under process with the financial support from National Innovation Foundation (NIF). Patent (1016/MUM/2011) has been filed by NIF in his name. Vikas and his wife were also invited for the Innovations Exhibition at the President House in 2010.

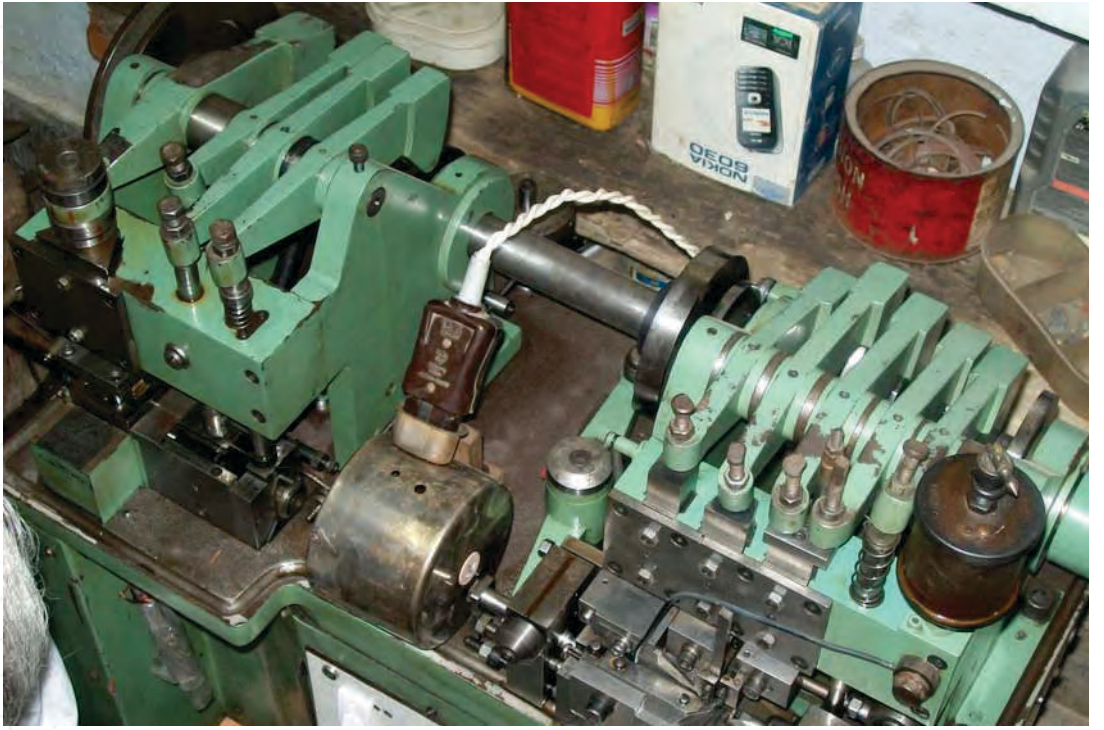
Besides the pedal operated drilling machine, Vikas Shinde has innovated many other simple but effective machineries. He receives the inspiration for his innovations from daily needs. The main point to note in all his works is that these are simple and utilize

junk, scrap and waste materials. Among many others, some of them are: Motor cycle operated pump: Facing electricity problem in his field, he developed this water pump, which drew power from his motor cycle's engine to lift underground water; Multipurpose Farm Machine: Using spare parts of a motorcycle, he developed an agricultural machine, which can be useful to cut grass, plough soil and make markings; *Jhoola* washing machine: He has also developed a washing machine, which can be attached to any swing. It enables the user to wash his/her clothes while enjoying the *jhoola* ride.

Vikas is passionate about innovating devices, which are energy efficient, cost effective and can be used by many. He wants to improve on some of his current innovations particularly the water pump and farm work vehicle as currently not many people are able to use it. He intends to standardize a few parts, so that operating these machines becomes easy. Vikas says 'when I made these equipments my only intention was to make them work and hence I did not paid much attention to these aspects however now I would like to standardize them and work on their appearance as well.' Incremental innovations in the waiting!

Madan Mohan Verma
Delhi

The goldsmiths usually put the gold sheet in dyes, heat and then beat it manually for making gold chains. In 1970s, Madan Mohan Verma, a goldsmith from Delhi thought of an alternative to this practice and developed a machine, which could make chains automatically. It was the first effort of such a kind in the country to mechanize the chain making process. His machine was developed during such a period where no other indigenous machines were available for the purpose.



Jewellery (Chain) Making Machine: Recognition coming late

State Award – Delhi; Scout: Direct entry

Madan Mohan Verma's father Chandu Lal Verma was a goldsmith and died when he was just eight. His elder brother and mother took care of him and his three younger sisters and a younger brother. Because of the poor financial conditions, after school hours he started working in a factory manufacturing plastic toys. It became his regular habit to gather some toy parts from the waste/scrap and assemble them into something meaningful. Once while going to the school, he found some toy parts on the railway track and developed railway signaling system. This gained the attention of many and he received a lot of appreciation. At the age of 12, he left studies after class five and joined a goldsmith as an apprentice. He was promoted as a trained worker because of his fast learning ability. After a year he got married. Later in 1957 he was forced to leave the job because of certain issues at the work place. He started the business of making gold ornaments with the little savings available with him, briefly learning the art of goldsmithery from Baroda.

In 1968 he learnt dye manufacturing (used with gold chains) at Chinchin near Mumbai. After returning to Delhi he purchased a drill and started manufacturing dyes for different

designs of chains. In 1995, he handed over the workshop to his son to focus on the unfinished dyes. Presently, he is training other goldsmiths and guiding some research students. So fond is he of technology that even at this age, he dismantles anything found dysfunctional and tries to mend it. His family includes his wife, four married daughters and a married son.

Genesis of the innovation

To make chains, generally the goldsmith applies the dyes on the gold sheet followed by the manual heating and beating. This requires a good amount of skilled labour with limited productivity. Chain making machines were imported and beyond the reach of an ordinary goldsmith. In 1969, he happened to see a chain making machine in the first Asian International Trade Fair at *Pragati Maidan*, New Delhi. Even though he wanted the machine, at Rs 1.75 lakh, it was beyond his purchasing capacity. This made him to think about developing a similar but affordable model. He analyzed, "*jo kam hath se hota hai usko hi to machine kar rahi hai, hath ki movement ko dhyan se dekh kar is tarh ki machine ke banana ki jaroorat hai*" (a machine is doing what a hand would do, let me closely observe hand movements and design a machine accordingly). In the process of developing the chain making machine, from time to time, he required several small machines and tools, like surface grinder, which he had to develop himself due to the lack of funds. He started his work making a wooden frame but due to illness got bedridden for a year. This distressed him a lot and he even thought of discontinuing the development of the machine. But with his family's and specially his brother's support, he decided to go ahead. He restarted working on the machine by making sketches and finally after relentless efforts of eight months, he developed the machine. He used this machine till he handed over the shop to his son in 1995. He spent about Rs 1.60 lakh, which included the development of basic infrastructure for fabrication. He also started guiding young students in developing projects and doing research on machines.

The jewellery making machine

This is an electricity operated automatic machine capable of making jewellery chains and rings.

The machine has been tailor made to imitate human action sequentially and is very simple in operation. It consists of array of dyes, punch for shaping the gold, conveying rollers, oil bath heater, 0.5 hp single phase motor, gear box for speed reduction, cranking mechanism, temperature sensing coil, etc. Wires which are abundantly available in general can be filled in the machine and the dyes of particular size and shape are fitted thereafter. There are sets of different dyes according to the weight and design of chains

ranging from 4-30 g. The dyes are made of steel imported from Poland and one cannot find even a single stain even after prolonged use.

Consuming the power about 230 volts, the machine gives good melting speed and can produce about 250- 300 links. Most importantly, the machine can smoothen gold sheets as per requirement without putting much manual efforts.

The machine is made of stainless steel, which does not rust and is easy to handle due to its small size. The wire size is of 0.8-2.0 mm and the dyes weigh between the range of 4 – 30 g according to the weight and design requirement of the chains.

Some of his other innovations include ear ring making machine, transformer winding machine, drilling machine etc are some other innovations on machineries used in jewellery designing.

Madan Mohan Verma used it only for his own work. He did not make any other piece primarily he did not have extra funds and also because of the fear of copying. The machine proved its worth earlier, however as Madan Verma puts it, the use is quite limited now because the patterns change every day and making dyes so frequently is different. Moreover, many advance machines have come in the market. He says, *"ajj har roz pattern change hota hai, nayi design aati hain, aap kitni dyes banavoge; is machine ka zamana ab chala gaya hai. Bahut mushkil hai isme sudhar karna, ab iski mang 5% tak hi ho sakti hai."*

It is worthy to mention here that the machine can be used for mass producing chains for fixed patterns, for which dyes are needed. Also using some features of CNC machine the present machine can be improved to make varying patterns as per the design requirements of the manufacturer. Hence the present machine can find a market in traditional jewellery centers or smaller towns, where a pattern is used for a longer periods.

Masha Nazeem
Tamil Nadu

Masha Nazeem, a young student, is a serial innovator and has developed eight very interesting projects including the flameless seal maker, which won her an award in the IGNITE 2009 competition of NIF.

Flameless Seal Maker and others

State Award – Tamil Nadu; Scout: Direct entry

Hailing from *Kanyakumari* in Tamil Nadu, Masha is a very soft spoken girl and the favourite of her friends and teachers. Her passion in life is to do things differently and strongly believes in the proverb, "Take the path less travelled and the world will follow you". Presently she is doing her II year B.E in Electrical and Electronics from SSN College of Engineering (NIF received her entries when she was still in school). Masha, passionate towards science, started designing science models from the age of 9. She is also a very talented dancer and an artist.

Her father, N. Kaja Nazeemudeen is a government servant and her mother, M.Sumaya Begam is a house wife. Insha Nazeem is her younger sister studying in VI standard. Family has been a strong support for Masha. Her parents never bothered about the expenses on her projects and her travels to different places for competitions, though it was a considerable portion of their income.

Besides the prize money and sponsorship, their parents have spent close to Rs 5 lakhs from their pockets till now to bring her up to this stage.

The journey of innovations

Masha has been quite creative since her childhood. Different kinds of projects have been made by her starting in class fourth and are described below.

Burglar Alarm & VIP Security System: The alarm was a simple electro-mechanical device to alert about a burglary. She developed it for her science project when she was in class IV at the age of 9 years. Later she improved the project, comprehensively adding more features to develop the VIP Security System in Class VI.

Conveyor Belt System: Out of concern for the safety of her friends who had to cross a national highway every day for school, she thought the idea about a conveyor belt system in a sub way. Students can off load their heavy school bags on the conveyer belt on one side of the road and cross over to the other side through the over head foot bridge. They can collect their bags on the other side using a cycle pedalling system, which moves the conveyer belts.

HI – Tech Train Toilet System: This is a useful system for Indian railways to avoid the soiling of railway track at stations. In this proposed system, the toilet waste is stored in a horizontal and cylindrical storage tank fixed under each toilet of the train. This tank can be connected to an underground drainage system through pipes and can be emptied when the train stops at a station. Masha was in class seven when she conceived this idea. This project helped her to get the first prize in the Southern India Science Fair, two National awards & one International Award (World Toilet Organization, Singapore). She was also invited by the then President of India at Rashtrapati Bhawan. She also demonstrated the project before the Railway Boarding Meeting at Rail Bhawan, Delhi in the presence of the then Railway Minister.

Modified Fuel Dispenser: It is a very simple system to prevent accidental spill over of petrol/diesel while dispensing at the fuel station. A small roller ball has been inserted between the grip and the dispensing lever in the hand held dispenser. Thus only when the fuel nozzle is inside the tank of the vehicle, the ball will roll forward and downwards enabling the lever to be pressed. As soon the position changes to upright, the ball rolls back, and thus the

dispensing lever cannot be pressed as the ball comes in between the lever and the grip.

Transparent Test Tool Kit (3TK box): It is a completely transparent box, which can safely keep all of the requirements of a student for an exam including exam ticket, pens, pencils etc. As it is completely transparent, students cannot hide anything inside it. She has demonstrated this 3TK box, an exclusive exam tool kit and its advantages with the Governor of Tamil Nadu, the Governor of Kerala, higher officials of the Education Department of Tamil Nadu, Minister for School Education and got appreciations.

Flameless Seal Maker: Sealing different confidential or legal documents of the government is a mandatory requirement. While returning from her school, Masha often used to visit her father's office (sub treasury) where she noticed him sealing official documents. Sometimes, he also used to get burned from the candle while sealing. She wondered if there was an alternative way to do this and questioned her father who jokingly asked her to find a way. Taking this as a challenge, after a lot of hits and trials with different materials, she was finally able to develop the flameless seal maker.

Masha's electricity operated flameless seal maker is made in hylam and polypropylene material, which is very light and handy. The user can load the lac pieces from the upper top. Using a small piston, the flow of the molten lac can be regulated. Temperature also can be controlled by thermostat control fitted inside the device. Using this seal maker, about 100 seals can be applied safely within 10 minutes. This seal maker is simple, handy, hassle free and device. Masha herself filed a patent for this device.

The possibility of using it by different government departments and by the Election Commission is being explored. This seal maker has been tested in two election booths in *Kanya Kumari* during the recent elections. This was the first time in India that an authoritative seal as affixed for government purpose without using naked flames was used. Otherwise his practice has been going on since the regime of Mughal emperor Jahangir. She won an award at the hands of Dr APJ Abdul Kalam in the Ignite 2009 award function organised by NIF.

Mechanical porter: Masha observed the problems women and old people face while moving luggage or any other heavy object at home from one place

to the other. Hence she developed this small mechanical porter where luggage can be loaded and it can be then raised to the required height using a jack like mechanism by hand or foot. Masha also got an award for this porter in Ignite 2010 competition of NIF.

Recognitions

Masha has been rewarded by the various international and prestigious institutions. So far she received 2 international awards, (World Toilet Organization, Singapore and Anna university, Chennai) and 5 national awards which includes the awards at 97th Indian Science Congress, National Innovation Foundation and National Council for Education Research and Training. Besides this, Viswesariaya Industrial and Technological Museum Bangalore awarded her the Southern India Award where as the Science City Chennai has given the state award for Tamil Nadu. Masha was also short listed for the prestigious TR35 young innovator award by the Technology Review Magazine, the world's oldest science magazine of the MIT, USA.

Masha has made presentations of her innovations in several institutes including Indian Institute of Space Science and Technology, Trivandrum and Indian Institute of Science, Bangalore where she received National Science Research Fellowship. She was also awarded KVPY research fellowship. She claims to have travelled more than 62000 kilometers across the length and breadth of the country and met over 11 lakh people for the cause of promotion of science. She has also visited Japan as a guest invitee of the Government of Japan (deputed by the ministry of HRD/ Government of India) and UAE as an invitee of the Indian residents in Dubai.

Masha values a lot the love and support given by everyone. She acknowledges the moral and financial support provided to her by various institutions and officials, which she considers as a great facilitator for her growth. She specially remembers the encouraging words of the Chief Election Commissioner Dr. Quraishi during the one hour presentation on the flameless seal maker at the Election Commission, "*You take up the task of manufacturing and supply of seal Maker to Election Commission of your own and become the youngest inventor cum entrepreneur of India. The Election Commission will provide all help including arranging loans from Banks*."

Young Masha aspires for a research career in engineering. Besides, she aims to continue the development of useful and unique products and wishes to become an entrepreneur one day.

Consolation Award

Modification in hadamba thresher for threshing castor crop

Jagmal Singh
Haryana

Scout: Kamaljeet Miglani, Sristi Gyan Kendra

Jagmal Singh (44), farmer cum mechanic, from Bhiwani district of Haryana has improvised a multi-crop thresher enabling it for threshing castor crop.

He also owns eleven acres of land where he grows wheat, mustard and sorghum. Few years ago, there was huge production of castor in nearby area of Loharu, his tehsil head quarter. At that time most of the farmers were using hadamba thresher (multi-crop thresher) for threshing various crops. Due to the non-availability of castor specific threshers, normal threshers were used to thresh castor crop. This resulted in the breakage of seeds and the farmers could not get proper value for their crops. This forced Jagmal Singh to think and to modify the thresher so as to suit it for threshing castor efficiently. In 2005, he successfully modified the hadamba thresher by making suitable alterations in concave and the feeding system and reducing the speed of the beater. Compared to conventional multi-crop threshers, the present innovation works at quite low speed (150 rpm against 500) to ensure least breakage. When operated using tractor PTO the present machine, which has the threshing capacity of 17q/h consumes about 2 litres of diesel per hour. The concept is known in art but Jagmal Singh developed this much earlier when the farmers of that region did not have any better alternative. NIF has filed patent (2964/DEL/2011) in his name. Besides this modification done in a multi-crop thresher, he has also developed a manual weeder.

Consolation Award

Parboiled paddy spreader

Ranjeet Ghorai
West Bengal

Scout: Shodh Yatra

A farmer from Bankura, Ranjeet Ghorai (35) has developed a parboiled paddy spreader, which is manual and easy to operate.

For sun drying, the spreading of parboiled rice (paddy) is conventionally done manually using a tray. The parboiled paddy is very hot and labourers get burned and blister many a times. In order to solve this problem, Ranjeet has developed a simple but an effective par-boiled paddy spreading machine. It is a trolley having a sluice gate kind of opening at the bottom where the size of the opening can be adjusted. While carrying the par-boiled rice to a different site for drying, the opening is kept closed. It can spread about 800 kg par-boiled paddy in five minutes. This machine can also be used for spreading cow dung, compost etc in the farm field and there is no need of hiring any labour for this purpose.

Prior art discloses that sun drying is very common and oldest method of drying the parboiled paddy, crops and seeds before processing/storage. The interaction with users revealed that even today the task of spreading is done manually using scoops or spades in the region. This is a very time consuming and laborious task. A similar innovation found in NIF database is a parboiled paddy and oil spreader developed by R. Ravi from Erode, Tamil Nadu, which is described elsewhere in the book.

Consolation Award

Parboiled paddy and oil seed spreader

R. Ravi
Tamil Nadu

Scout: SEVA

R. Ravi (37), a mechanic from Erode has developed an engine operated paddy spreader for fast and efficient spread of paddy. This machine can also be used to spread oil seeds, millets, coriander etc. Studying only up to class eight, Ravi worked as an electrician for five years and then as a mechanic and labourer for about a year in a local firm. Thereafter he started his own workshop. While visiting mills for supplying products and repairing machines, Ravi observed the difficulty in spreading hot parboiled grains (seeds) and also the labour requirement. Paddy is generally spread on the floor and exposed to sun for drying. A large number of workers are needed frequently (7-8 times a day) for turning the paddy rapidly for proper and uniform drying. For best results, the thickness of paddy layer should be about 2.5 cm. At this thickness, an acre of drying floor can handle 60 tons of paddy. To solve this problem, Ravi devised this machine and gave it to the labourers for their feedback, which was used subsequently to make improvements.

His spreader is a tricycle having a 50 cc petrol engine, which powers rotary members made of rubber and mounted on a shaft. These rotary members turn the grains (seeds) without damaging. As an innovative solution for sun-drying the paddy and oil grains, the machine appears to be very useful for farmers and small scale industries. Spreading 10 tons of paddy using this machine just needs two labourers for which otherwise 15 labourers are needed. The machine costs Rs 30,000/- and Ravi has sold about 200 machines in Tamil Nadu. In 2008-09 after about 3 years of sales, he stopped developing this machine further due to the funding problems. Many tried to copy this machine but somehow could not succeed.

Consolation Award

Sago rice roasting machine

V. Krishnan
Tamil Nadu

Scout: SEVA

V. Krishnan (54), a farmer from Salem has developed a machine for sago rice roasting, which saves time, works efficiently and solves labour problems as well.

The innovator lives in the tapioca belt of South India and Sago rice is derived from tapioca (cassava). Tapioca root is the basic raw material for sago and starch. Conventionally the TAWA or pressure cookers are used for roasting/cooking the sago rice, which is a time consuming and tedious process. Hygiene and quality issues are also there. Krishnan has developed a cauldron (kettle) shaped roasting pan with oscillating arms for turning /churning the sago rice. The pan is coated with Teflon material to avoid the sticking of sago rice. The processed and sized sago rice balls are roasted in this device. The arms ensure that the roasted rice is moved to the basket from where it can be packaged.

Krishnan developed this machine for his own use at the cost of Rs. 5.5 lakh INR. Prior art search did not disclose any method except roasting on hot plates at about 100 degree Celsius for about 6 to 8 minutes. NIF has filed patent (2091/CHE/2011) in his name for the machine.

Consolation Award

Coconut tree climber

D. N. Venkat (D. Renganathan alias)

Tamil Nadu

Scout: SEVA

D. Renganathan alias D.N. Venkat (49), an agriculturist from Coimbatore, Tamil Nadu has developed a coconut tree climber with a sitting arrangement, locking system and a safety belt. After trying his hand at many things, from being a daily wager in a khadi spinning unit, selling spare parts of pumps, to being a mechanic, Venkat finally settled down with agriculture. It was here that he noticed the problems in climbing coconut/ palm trees. He planned to address all the issues and design a simple low cost tree climber. The tree climber has a seating provision and has two frames. The upper frame is operated by hand while the lower one is operated by leg. The user sits comfortably on the seat and by the up and down movement of upper and lower frame, can climb the tree. A locking system has been provided, which enables the climber to work without fear at any height. To avoid the possibility of a fall, a four lock pin can be fixed at any height. One can climb up to 40 ft in 5 minutes (this includes time needed in fixing, climbing up-down and removal of device from tree). One of the major advantages of this machine is that it is useful for trees with different girth. University of Agricultural Sciences, GVK, Bangalore has tested the device as part of an all India coordinated research project on Post Harvest Technology and found it useful for climbing coconut palms. The team also gave a special mention of its in-built safety feature.

Prior art has discloses similar devices used by hunters but about the girth of the trees on which these can be used is unclear. Having a good demand majorly in South India, Venkat is selling the device at Rs. 7000/-. So far he has sold about 200 units in Tamil Nadu. Recently few units were exported to other South Asian countries as well.

Consolation Award

Stencil cutting device for hand embroidery design

Shaikh Mohammad Nazim

Gujarat

Conventionally, stencils are prepared by punching papers using needles, which is a very cumbersome and tedious task. Shaikh Mohammad Nazim (31), a lock and key repairer has made a stencil cutting device for hand embroidery design.

Nazim has been very creative since his childhood and has completed his studies upto class 12. Presently, he is pursuing model making training at National Institute of Design, Ahmedabad. Majority of his friends are engaged in making manual designs on sarees and dresses. While visiting them frequently, he noticed that the manual punching of design on butter paper was a time consuming and labour intensive process requiring the participation of the entire family. Motivated to find a solution for this, he came up with the idea of a pen having a reciprocating needle to simplify the work. The stencil cutter has a needle operated by a motor, whose speed can be controlled. Using the up and down motion of the needle, stencil for imprinting the desired design on the cloth can be easily made on the butter paper. This may reduce the time spent by nearly 100 times.

Though the prior art disclosed a number of stencil cutters, they were not similar to the present model. NIF has applied patent in the name of innovator (676/MUM/2011) and has also supported him for the commercialisation of the product. The user feedback has been encouraging. They mentioned that the device not only speeds up the stencil design making process but also increases the accuracy of the holes to be punched. Considering the huge number of women handicraft workers, efforts for commercialisation through women groups and other occupational communities engaged in similar work are on. Apart from the stencil cutting device, Nazim has also made a solar cooker, emergency charger for mobile phones, goggles to see 2D& 3D pictures and is also working on a 3D webcam.

Consolation Award

Pennao

N Jilatombi Singh, Kennedy Singh, Bhagat Singh

Manipur

Scout: NIF Manipur Cell

Jilatombi Singh, Kennedy Singh and Bhagat Singh, three music lovers from Imphal have improvised the traditional instrument "pena" into *pennao* by changing the number of bundle strings and modifying the bridge arrangement. This arrangement allows the *Pennao* to play a wide range of musical notes, without losing the original and distinctive sound of the traditional *Pena*.

Jilatombi Singh (55) is a craftsman, singer and a musician; Bhagat Singh (34) is a musician cum theatre artist while Kennedy Singh (45) is a small contractor. The common factor that keeps all of them together is their dedication to music. The three friends have a common vision to establish a *Pena* Music School at Imphal. *Pena* is one of the most popular musical instruments of the Meitei community and is used in a variety of social and cultural events. The uniqueness of *Pena* lies in its distinctive sound, which is quite different from any other fiddle and string instruments. Jilathombi, Kennedy and Bhagat have worked together to improve the *pena* to enable it to play classic and modern music also. To increase the range, they tried to introduce two to three strings. Cow's hide/ cow's skin was used to make the belly of *pena* and to keep the identity of the sound, they kept the skin same as before. *Pennao*, the modernized version of "*Pena*" has three strings and can produce lower octave, middle octave and upper octave. It can be used as a folk musical instrument, classic and modern musical instrument. Further it can also be used in the orchestral music as violin and it can also be mentioned that it can be easily tuned to required scale by using new technology. *Pennao* is also an advantage for a modern or classical soloist in exploring talents and skills through it. NIF has filed patent (Pat app no 1332/KOL/2011) in the name of innovators.

Consolation Award

Pedal operated/manual drilling machine

Ghonakanta Gogoi

Assam

Scout: Banudhar Kakoti/NIF Assam Cell

Small carpentry workshops have difficulty in purchasing and using multiple machines due to high initial costs, space constraints and maintenance considerations. Ghonakanta Gogoi, a carpenter from Dhemaji, has developed a pedal operated wood turning/wood carving machine.

This multipurpose machine with minimal footprint, is built to address all major workshop needs, allowing completing the sequence of wood-working operations in one place, and facilitating better finishing of the product. Ghonakonta's father was an expert carpenter himself and specialised in making innovative designs out of wood including gears. Due to poor financial conditions, Ghonakonta had to drop out of BA Third year to take up the family tradition of carpentry. Those days' local carpenters had to visit the nearby district, Lakhimpur for wood carving, which was done by the electrically operated machines. Understand the need to have a solution to this, he worked hard for two years and developed the pedal operated manual wood carving machine.

This portable machine is very easy to operate and only one person can handle it. The working speed of the machine can be varied as per the requirements with minimal wastage of wood. NIF supported him for the product development and trial marketing of the same under which additional features for drilling bamboo, wood as well as iron along with the sanding of bamboo facilities were incorporated. Apart from wood curving machine, he also made a new model of latrine which has been approved by DRDA for supply to poor people.

Consolation Award

Modified Kerosene Stove

Ghulam Mohammad Sheikh

Jammu & Kashmir

Scout: Shodh Yatra

Ghulam Mohammad Sheikh (47) has designed a modified kerosene stove using pipes, arranged in such a way that there is no need of an additional fuel tank. It is believed that the stove has higher thermal efficiency due to preheating of kerosene (stored in the pipes) and less chances of explosion due to the distribution of pressure in large area.

Son of a labourer, Sheikh spent his childhood in extreme poverty and the financial condition has only marginally improved since then. While being unable to purchase a stove due to its cost, the idea to make it himself came to his mind. This low cost stove (Pat. App. No. 207/DEL/2012) is designed in a manner that the need for an additional fuel tank has been done away with as the pipes double up as the stand and the tank. As the kerosene is stored n the pipes, it is believed that the stove has a higher thermal efficiency due to preheating of kerosene. The chances of explosion are also less due to the distribution of pressure over large area.

Prior art search did not yield the description of any similar stove. However, the concept of preheating of kerosene before ignition has been tried by Niranjan Prasad Sharma from Uttar Pradesh. The development of an improved version of the stove was supported by NIF through GIAN cell (J&K), which also facilitated its testing at NIT, Srinagar. Apart from this modified stove, Ghulam Mohammad Sheikh is presently working on a motor bicycle, which can be used to ride over snow.

Consolation Award

Pounded chilly sorter

Nazeer Ahmad

Andhra Pradesh

Scout: Palle Srujuna, Andhra Pradesh

Nazeer (50) runs a small chilli powder making unit at his home. In order to provide chilli of good quality, he and his wife used to sieve it manually. This is a cumbersome job resulting in burning sensation, sneezing caused by the pungent smell and pain in the hands. To overcome this drudgery, he developed the chilly sorter.

He thought of making a self sieving mechanism for which he needed a motor, which he could not afford. He pondered over for some time and came up with an idea of utilizing his existing machine to do so. For the welding and fabrication work, he took help of some mechanics. It took him four to five iterations to get the idea he had, translated into reality.

His machine is an extension of the mechanism of the already existing motor operated chilli pounder for giving oscillating motion to sieves from the camshaft. The pounded chilli is filled in the sorter in batches of 1.5-2 kg and can be sieved with the efficiency of 95-98% without much human intervention. Apart from reduction in drudgery, this machine reduces physical contact with the chilli and thus, the associate health risks like skin irritation, allergies, etc. Prior art discloses a few simila use only.

Consolation Award

Key with light, shaving brush and razor with light and other innovations

Ashish R. Sadiya
Gujarat

Scout: Direct

Ashish (24) has develop many small, simple but practical gadgets, which include a key with a light so that one can see lock's hole while unlocking it at night and a 'brush and razor with light', to help a person shave in dark. He has numerous other ideas to his credit as well.

He is a serial innovator from Gujarat. After class ten, he took admission in a diploma course in electronics and communication but could not complete it due to financial problems. He also enrolled briefly in a one year certificate course in automobile engineering but left it to join as an assistant in a medical store. Later, he started working in a car showroom. Ashish's mind is continuously buzzing with new ideas. Some of his interesting innovations are mentioned below.

Key with light: He has provided a key with a LED, battery and a switch to facilitate locating lock's hole at night. Prior art search discloses similar keys with light but abroad, hence this is considered to have potential in Indian market. Shaving razor and brush with light: Like in the key, here shaving razor and brush have been provided LEDs so that in absence of light, a person can shave while looking in the mirror. Prior art search discloses LED lights/blub attachment with razor but brushes with lights are not available in market. Apart from these he has also developed locators for common articles, PCB circuit cleaners, easy keyboard cleaner among many others. NIF filed a patent (584/MUM/2012) for his light enabled utility items.

Consolation Award

NMS-2- An improved and high yielding variety of paddy

MK Shankara Guru

Karnataka

Shankara Guru (63), an innovative farmer from Mysore, has been growing an improved and high yielding variety of paddy 'NMS-2' developed through simple selection from local heterogeneous landrace varieties. Suitability for low external input cultivation, high tolerance to biotic and abiotic stress, absence of shattering, quality fodder, fine rice quality with brick red colour are the distinctive features of this variety.

Belonging to a traditional agricultural family, his inclination was naturally towards farming. In 1992, he started collecting and conserving traditional seeds. Shankara Guru developed the improved variety 'NMS-2' through simple selection method. He noticed a plant in his field with different height and growth between the plants of a traditional variety 'Salem Sanna'. He collected and separately cultivated the seeds and found the plant to perform well in terms of yield, robustness of stem and tolerance to biotic and abiotic stress. The process was continued for seven years during which he could stabilise the characters.

NMS-2 is fine rice of brick red colour and high yield (80 q/ha) than the conventional locally popular variety (65q/ha) along with the good quality fodder. It also does not shatter and is suitable for low external input cultivation. As a variety, well adapted to the local conditions, it is highly tolerant to biotic and abiotic stress. The field trials of the variety were conducted at UAS Bangalore where the results were very positive. In order to diffuse the variety widely, Shankar Guru distributed the varieties to farmers in Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra. In an Akashvani function in Mysore, the variety was distributed to thousands of farmers. The feedback on the variety was good and many are taking yield up to 30-32 quintals/acre. Along with NMS 2, Shankara Guru also conserves the *Ratnachudi* variety obtained from a relative. This is a medicinal rice variety, which is consumed by pregnant women and also lactating mothers after mixing with ghee, pepper and salt. Another variety with him is *Jeeraga sanna,* which is a scented variety.

Consolation Award

Pest control in crops using *Anethum spp*

Bhikhabhai Becharbhai Suthariya
Ahmadbhai Daudbhai Ganchi

Gujarat

Scout: Ramesh Patel & Vijaysinh Chauhan

Farmers by profession, Bhikhabhai Becharbhai Suthariya from Bhavnagar and Ahmadbhai Daudbhai Ganchi from Bharuch have been using non-expensive solution for pest control in crops using *suva*, a winter crop having insect repelling odour.

Owning about eight *bighas* of land, Bhikabhai mostly grows cotton in his field. On being asked the reason for developing a cost effective method of pest control in cotton he remarked, "*Mari passe dimag hattu, pan abhyas na hatto*" (I have good knowledge but not practice).

In 2006, he sowed Bt cotton with some space between the two consecutive rows. To make optimum use of the space, he decided to sow *suva* in between the cotton rows. The same year he observed the incidence of sucking pests in other farmers' fields while his own field was free from the pest. Since then he has been using this practice to protect his crop from sucking pest. Given the results about a quarter of the farmers of his village have started using this practice, which reduces the dependence on chemical pesticides.

Ahmadbhai owns four acres where he grows castor, cotton, millets and wheat. His family comprises of his wife, two sons and a daughter. The whole family believes in using low cost herbal formulations for agricultural use. In the practice used by Ahmadbhai, seeds of *suva* are incorporated with sorghum seeds approximately 3 to 4 kg/ha at the time of sowing to avoid the emergence of striga. *Suva* has very slow growth. Its growth is suppressed at later stages due to shortage of light, water and nutrients. Hence there is no detrimental effect on the growth of sorghum.

Consolation Award

Use Control of insect pest in agricultural crops

Rahul Kumar Patel
Bihar

Along with the studies, Rahul used to take care of the fields in absence of his father. While working in the field, he used to see different types of insects which damage the crops. He experimented with different kinds of herbs and stumbled upon this particular practice (Pat app no 1606/KOL/2008). For verification, field experiment was facilitated by NIF at Regional Research Station (ICAR) Madhopur, West Champaran and in vitro experiments were conducted at National Center for Integrated pest Management (ICAR) New Delhi, both of which have given encouraging results. RRS-ICAR recorded 30 per cent higher yield during their trials.

Consolation Award

T Shirts with Movement Based Animation

Shailendra Rakhecha
West Bengal

Scout: Direct

Shailendra (26) has conceptualised a system in t-shirts wherein a part of the cartoon/ illustration on the front/back can be animated while walking using the movements of the hands. He grew up working with his father and trying his hands at something or the other. One fine day, while watching the movie 'Paheli' where he saw a puppet, the idea to make such a T shirt came to his mind. He thought if kids had a friend they could play with on their T shirt itself, it would remove their loneliness. Thinking about various options, he decided to keep it simple and affordable, something which could be manufactured at a large scale.

Experimenting with different materials and methods for months, trying his hand at sewing, and making hundreds of prototypes, Shailendra succeeded in making his animating T-shirt. He achieved this by making the cartoons/illustrations in two parts as per the requirement and not stitching the part to be moved completely with the t shirt. This part was connected from inside through a thick thread with the arm of the t- shirt. The to and fro movement of the arms while walking pulls the thread, which in turn moves that part of the cartoon to which the thread is attached, thereby achieving animation in the object. This system can be combined in a variety of ways for various illustrations.

In his endeavour, though he faced financial problems, his mother kept on egging him to think more and come up with the solution. Once done, all the family members really liked the idea. The patent (634/KOL/2011) for Shailendra's T shirts was filed by NIF in his name. He was also invited by NIF at the Innovations' Exhibition at the President House in 2011. Shailendra has many other ideas as well and urges fellow innovators to

"Don't just think, think out of the box. Remember 'ideas are like switches.....they click'".

Consolation Award

Herbal medicines for treating fracture in animals

Mogjibhai Manjibhai Damor
Gujarat

Scout: Pravinbhai Rohit, SRISTI

"Even at odd hours in midnight, if someone knocks my door, I can sense what intensity of pain would have led him to me and hence I never mind to help and render my service to cure him"

Addhi ratre koi maro darwajo khakhdave, to hu samji saku chu ke amne ketlu asahay dard che ke addhi ratre mane jagade che, tyare hu kai pan kari ne amne madad karvani faraj bajavis.

Popularly known as "*Sadhu Vedic*" in neighbouring villages for his herbal knowledge, Mogjibhai Manjibhai Damor (54) has developed various herbal formulations for curing diseases in animals and human beings, of particular mention being the medicine for treating fracture in animals.

Mogjibhai is an illiterate farmer possessing two acres of land from which he earns the living for his family of seven. Along with farming, he is also engaged in providing his services to cure animals and humans from diseases without any selfish motive. His wife is also illiterate, but she has closely observed her husband and learnt many things from her. So much so that if Mogjibhai is not around, she can provide a suitable remedy for certain ailments. Mogjibhai has developed a number of formulations for animals, human and plants like for bloat, fracture, diarrhoea in animals, for pest control in plants and diarrhoea in human beings. He has been serving the community of nearby fifteen villages for over twenty five years now with all his knowledge.

Consolation Award

Herbal medication for curing bacterial mastitis in animals

Boya Pedda Rajanna
Andhra Pradesh

Scout: Dr. Subramanium, Y. Assistant Project Officer, DRDA, Anantapur

Hailing from a small village in Anantpur district, Pedda Rajanna (58) is a healer expert in treating animal diseases using herbs. He has developed a herbal formulation using a local herb to treat mastitis effectively.

Owning ten acres of land, Pedda Rajanna is primarily an agriculturist. However, the knowledge of the usage of herbs for treating animal diseases has been passed on over generations in his family. He has five members in his family, his wife, son and three daughters. His family members help him in farming as well preparation of herbal formulations and drug administration as well. Though he knows a number of good herbal practices, the practice for the treatment of mastitis needs special mention. This practice was documented during a workshop organised with the support of the District Administration, Anantapur. Pedda Rajanna was felicitated also in the workshop. The data was processed by NIF and plant sample verified. After literature review, it was found that the practice was unique, accordingly a patent (1013/CHE/2011) was filed in the name of Pedda Rajanna for this practice.

Mastitis is an infection of the tissue of the breast that causes pain, swelling, redness, and increased temperature of the breast. The primary cause of mastitis in cattle, goats and sheep are well-recognized groups of microorganisms, Streptococcus sp., Staphylococcus sp., Pasteurella sp. and coliforms, Escherichia coli, Enterobacter sp., and Klebsiella sp. Sometimes due to the infection visibly abnormal milk (eg, color, fibrin clots) is also produced. As the degree of the swelling increases, changes in the udder (swelling, heat, pain, redness) may also be evident. Apart from giving pain to the animal, it also affects the quality and quantity of milk.

The test results of this formulation against bacterial mastitis were very promising. Further work is also going on to refine the technology further and make it more efficient.

Consolation Award

Improved wood stove

C Senthil Kumar
Tamil Nadu

Scout: SEVA, Madurai

C Senthil Kumar (45) is the owner of Kumar Industries specializing in making wood fuel based stoves and heaters. He has developed cooking stoves whose walls have been insulated by brick made from special clay, which reduces heat loss. This stove has been well accepted by the users.

Senthil's father started an agriculture equipment making unit in 1969. Seeing different kinds of agricultural implements being made around him since childhood, his could never focus properly in studies. Discontinuing his studies after class 12, he joined his father's business with the aim to provide farmers the best qualities of equipments. In 2000 he started his second unit, Kumar industries, which manufactured non–electric fire wood heaters and kitchen equipments. He stays with his wife and daughter. His wife is quite supportive of him and in his absence, handles the business as well.

He first made the brick insulated stove in 2000 and subsequently developed many versions of it for both domestic and industrial use. He claims to have sold over 5000 pieces of the different variants till date primarily in Tamil Nadu state. Wood stoves are available in art but they don't have insulation bricks between the walls. It has grills for better aeration and thus resulting better combustion. Users have also given feedback that the running cost is less as compared to other conventional stoves. He also claims that in this stove any kind of waste wood can be used as a fuel. Senthil wishes to now export his product as people from other countries have been showing interest in these stoves. He plans to launch the stove in an agri fare in Sri-Lanka soon. However, he says that first he would supply as much as needed by his countrymen and then gradually expand to foreign shores.

Diffusion Award

Walking stick to assist visually challenged

Wazeer Hayath
Karnataka

Scout: Direct entry

Wazeer (52) has developed a walking stick with audio alarm to assist visually challenged persons. There has been good demand of his sticks due to their functionality and low cost, in India and abroad.

Son of a poor farmer, Wazeer had to discontinue studies early to support his family. He started his career as a bore well mechanic and then moved to electronics repair and opened a shop 'Waz technology'. One day while working in his shop, on the opposite side of the road, he saw a blind man slip and fall down in a slushy pothole. As he was quite far, he could not help him, which made him feel bad. He thought of doing something so that such an incident may be prevented. Using his electronics knowledge, he thought of developing a stick, which would assist a blind person and facilitate his movement.

He then started working on this stick and gradually developed three variants of the same namely talking folding stick, sensor based folding automatic sticks and double sensor based talking folding stick. These sticks, operating on chargeable batteries, have a voice recorded system, which gives alerts to the user about an obstruction ahead or water. As soon as the sensor detects water, the signal gets transmitted to the controller, which actuates the audio alert. In crowded places, the user can give a voice alert "Excuse Me Side Please" just by the simple press of a button. Having an inbuilt sensor system and alert facility, this walking stick reduces the chances of accidents of the visually challenged to a considerable degree.

The device was tested with the help of Blind Men's Association, Ahmedabad and feedback of about fifteen visually challenged persons recorded. The users appreciated the voice alert facility and also suggested to have a vibration mode for the same. Additionally, they requested incorporation of a proximity sensor.

Prior Art Search disclosed similar sticks but without multi functionality like this one offers and at a higher cost. NIF filed a patent (2244/CHE/2008) in Wazeer's name.

Earlier, NIF had awarded two students, Sanket and Prashant in its 3rd National Competition in 2005 for making proof of concept of a similar stick.

NIF also supported Wazeer under its Micro Venture Innovation Fund scheme for the commercialization of the sticks. The innovator has sold over 1000 pieces of different variants in India and many have been exported to other countries as well. The distinguishing feature of his stick over others is the availability of three different variants each at a cost (Rs 900- Rs 2400) lesser than its market competition (> Rs 3500).

Idea

Windmill having different design of the blades

T Bhoomaiah Chary
Andhra Pradesh

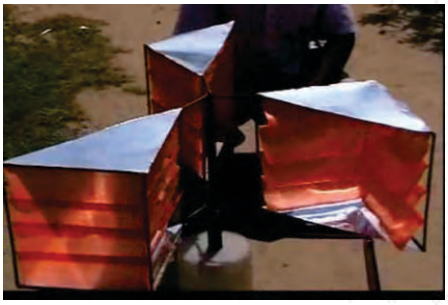
Scout: Direct entry

T. Bhoomaiah Chary (44), a goldsmith by profession, is a prolific innovator. He has conceived an idea of developing a wind mill having blades in the shape of hollow prism and made of flexible tiers/flaps. He has also built a small model.

Only class 10th pass, Bhoomaiah Chary has filed over one and a half dozen patent applications for several of his innovations. Concerned with the ever growing energy crisis, he thought of making a low cost windmill to address the issue. He envisioned the windmill having blades in the shape of hollow prism. The prism would have flexible angled tiers/flaps, which may become straight vertically due to the pressure of air and help in fetching maximum energy from the air. The blades would be connected to a shaft attached to an alternator/dynamo through a set of gears.

Prior Art Search discloses different designs of blades unlike that thought of by Bhoomaiah Chary. Only comparable alternatives available are conventional horizontal axis or vertical axis windmills. But this design is different from both of them and seems to utilize the air pressure more efficiently. Patent has been filed by National Innovation Foundation (NIF) in Bhoomaiah Chary's name (1137/CHE/2011).

Even though only proof of concept has developed till date, it seems to have great potential for electricity generation (community/ individual model) and water lifting and may be worth trying with the cost of failure being so low and the stakes high. Bhoomaiah Chary is a very passionate man and dreams to make an air filter, which would help in breathing healthy.



Appreciation

Digital Starch Measuring Scale for Cassava

S. Rajamani

Tamil Nadu

Scout: Direct

S. Rajamani (47), a tapioca farmer, has incorporated a digital scale to obtain the correct weight of tapioca under water, increasing accuracy and minimising errors.

Tapioca is the major crop of his region. The price of the tapioca crop is dependent on its starch content. Traditionally, starch is measured in a manually operated machine, which gives an opportunity to the merchants to cheat the farmers by manipulating the machine. The farmers then get paid less for their produce. To ensure a fair system, Rajamani felt the need to develop a machine, which could help farmers obtain the correct price of their produce.

In the conventional manual measuring process, developed originally in Thailand, tapioca is put in a bucket and the weight on the pan is balanced together with a locked scale. The tuber is then immersed in water and the lower point scale is adjusted until the balance is re-established. Rajamani converted conventional method of balancing of weight to digital scale. The prototype development was supported by National Innovation Foundation.

Rajamani developed this device in 2007 and has been using since then. He claims to have observed a difference of about 1.5 -2 per cent in the readings obtained on his device and that obtained using the traditional manual method. Officials from SAGOSERVE, Salem have also observed a difference in reading between the two. Prior art search did not yield any such machine for the purpose and accordingly, NIF filed a patent (1128/CHE/2011) in his name.

Appreciation

Amphibious Car

P. S. Vinod
Kerala

Scout: K T Alex

P. S. Vinod (32), a car mechanic cum electronic operator from Kerala has modified a Maruti 800 car and adapted it to move on land as well as water.

Perturbed by the heavy flooding every rainy season, Vinod thought of modifying an existing car to make it an amphibious vehicle. Starting with a 1985 Maruti 800 model as the base, he went about modifying it to make it amphibious. It has two engines, regular petrol engine of the car and kerosene boat engine. His amphibious vehicle uses the front located petrol engine of car for moving on the road while for floating on water, it uses an outboard engine mounted in the rear. A boat like floating structure is fixed above the tyres. The vehicle is completely water proof and can only accommodate two passengers. It can travel at the maximum speed of 140 km/h on road and 20 km/h in water. Just a matriculate by education, Vinod could successfully complete his amphibious vehicle in 2003.

This vehicle may have applications in defence, aqua tourism, water sports, hunting and fishing and may find relevance during rescue and relief operations during floods.

Student Award

Rain Protector, automatic side stand retracting system and other ideas

Harkesh Kataria
Haryana

Scout: Direct

Harkesh Kataria (21), a student from Gurgaon has deviced a rain protector, which withdraws the clothesline to prevent clothes hung for drying from getting wet in rain. He is studying for the final year B.A and part time working in the PCB design department of ASTI Electronic India Pvt Ltd for the last six months. He was still a student when he submitted his entry for NIF's competition.

One has to always run to collect clothes hung out for drying during monsoons if it rains. Harkesh's idea was to devise a system through which this could be done automatically. This is a motor driven and moisture sensor based system (Pat app. No 158/del/2012) which withdraws the clothesline into shade when it starts to rain, thereby preventing the clothes from getting wet..

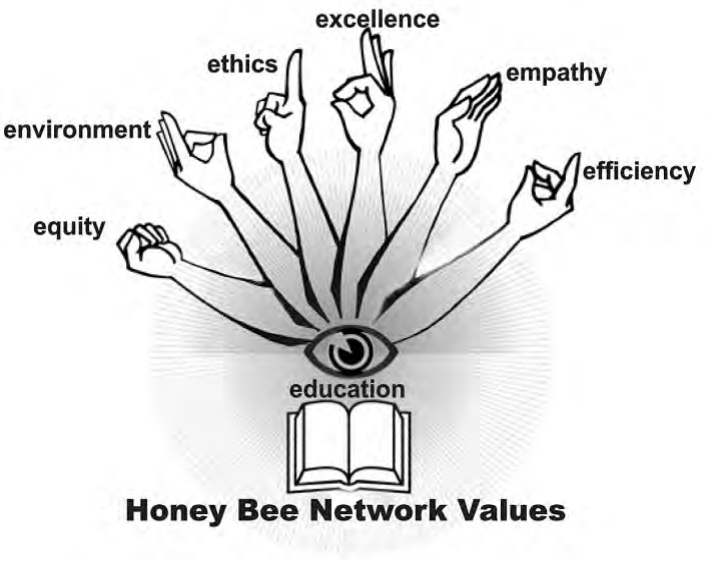
Prior Art search disclosed those Automatic retractable clotheslines are commonly available, mostly in abroad. These technologies described in art are manual in operation and need a constant attention thereto. But present invention is a simple sensor based line traveling system which automatically senses humidity and triggers the clothesline withdrawal. Hence the device is of good potential for diffusion in homes, offices, hotels, restaurants and hospitals. Piyush Agarwal, Hazaribagh, Jharkhand also submitted a similar idea later during NIF's Ignite 2009 competition.

Apart from the rain protector, he also made more than a dozen of technological innovations and ideas. The list includes mobile operated home lighting system, sensor system in any vehicle, sensor alarm, clap switch, water engine, dancing car, musical fountain, day night switch, sensor gun, water over-flow controller, and electric crane.

6th National Biennial Competition
Scouting and Documentation Data

State	Practices Count (from 366 districts)
Andhra Pradesh	286
Arunachal Pradesh	417
Assam	1781
Bihar	5315
Chandigarh	2
Chhattisgarh	28
Daman & Diu	1
Delhi	21
Goa	1
Gujarat	7994
Haryana	99
Himachal Pradesh	217
Jammu & Kashmir	1234
Jharkhand	6186
Karnataka	227
Kerala	412
Madhya Pradesh	104
Maharashtra	170
Manipur	1323
Meghalaya	79
Mizoram	10
Nagaland	2
Orissa	393
Puducherry	29
Punjab	20
Rajasthan	1579
Sikkim	16
Tamil Nadu	5965
Tripura	81
Uttar Pradesh	1011
Uttaranchal	316
West Bengal	1560
Total	**36879**

Category	Count
Agriculture	1318
Animal science	4676
Artisans	6
Energy	163
Engineering	1090
Forestry	4
House hold innovation	389
Human health practices	28729
Ideas	248
Others	256
Total	**36879**



www.honeybee.org

National Innovation Foundation - India
Department of Science and Technology, Govt. of India
Satellite Complex, Prem Chand Nagar Road, Satellite
Ahmedabad 380015 Gujarat, India
Tel +91-79-2673 2456/2095 Fax +91-79-2673 1903, +91-11-43851803
Web www.nif.org.in Email info@nifindia.org