Windmill powered water pump, modified stove, hybrid tractor and others

Bharatbhai Agrawat
Junagadh, Gujarat

Bharatbhai (47) runs agricultural equipments workshop. Despite having studied only till only class tenth, through sheer hard work he has achieved a lot of respect and admiration of people because of his innate creativity. He is a serial innovator who has developed many useful tools, devices and implements. He derives inspiration for his work from his father, Amrutbhai Agrawat, himself a well-respected innovator. His father was a *pujari* in temple and used to do machine repairing in his village. He then started making doors, boxes for granaries and iron gates. Bharat started helping his father in repairing items since he was in 6th standard. He is an environmentalist and understands the need of utilizing natural resources to generate energy in an efficient and eco-friendly way to power different applications or optimally use existing resources.

The early beginning

Bharat first participated in children's fair when he was in 4th standard and displayed a clay cow made with the help of his father. Later he made a rotary chair, sofa which were miniature models made from metal at their own workshop. While in 7th standard he made a modified sprayer pump model with help of his dad using a gas stove used in their kitchen. Bharat was an average student at school with more interest in machines and fabrication than in studies. He was so dedicated that every morning he used to visit the workshop in the morning, open it, do the morning *pooja*, and assign the work to the workers and then leave for school. Even his friends were also very supportive and used to assist him during his late night working hours, a favour which he used to repay by working on their farms.

Working with his father and their discussion around creating sustainable solutions added immense value to Bharat in his earlier working years. It was basically the Aaruni bullock cart (Innovation by his father – Amrutbhai) experience, which helped him develop technical expertise and innovator mindset. In 1986,

drought forced him to look out for work as a welder in a firm for six months, that's where he learnt the art of welding. This work also taught him about modern and heavy machines. He also worked at RCC water tank construction site with a government contractor, who was his friend.

The family as whole has been very supportive of the creative spirit of Bharat and they used to celebrate every time there was a breakthrough or success story for any innovation. Currently, Bharat lives in Keshod in a rented house where he moved 6 years back primarily for children schooling and their bright future.

Windmill powered water pump (1999)

The windmill drives a compressor, which sends a charge of compressed air into the bore well. The air charge is released near the bottom of the shaft, underneath the water pipe. The air charge pushes up the water through the pipe to the surface. He developed a model of water pumping windmill, which was provided to a voluntary organization working on environmental issues in Surendranagar district.

They tried out the windmill and found a water discharge of 50,000 - 60,000 litres in 24 hours. Based on their recommendation, last year, a private salt farm owner purchased and installed a two cylinder windmill. Satisfied with the performance of the windmill, the salt farm owner has ordered for an upgraded four cylinder version to be installed adjacent to the two cylinder model at his site in the Kutch salt farming region.

Rolarmadh (2000)

During sowing in the field, there has always been a problem of harsh soil clots being separated after the first round of tilling. It makes the land surface in the farm uneven and hard and thus, it causes lot of problems for both farmers and bullocks to walk and work smoothly. Bharat developed an instrument 'Rolarmadh" to address this problem. It is a bullock drawn implement and consists of a drum on which several pegs are attached. These pegs are helpful in breaking the hard soil. The drum rests on two wheels for moving the implement to different locations. Using this tool farmers and bullocks can easily do their work in lesser time and with reduced drudgery. The

implement has been used widely in the Saurashtra region of Gujarat.

Lemon Cutter (2001)
Picking lemons manually from the plant has always been problematic because of the sharp stings on stem and branches. Removing the fruits by beating the leaves and fruits with sticks damages the plant and breaks its branches at times. Lemon cutter is a hand held implement, which has a PVC pipe with adjustable length and scissors fitted at the cutting side, which work with the help of lever. When the lever is pulled at far end, it makes the scissors to work and cuts the lemons. This makes plucking lemons easy, safe and less cumbersome.

Modified Wooden Stove (2001)
Traditional wood stoves, by virtue of their design, do not optimally use the heat generated and also emit much smoke and pollutants due to incomplete combustion. Bharatbhai fitted an exhaust chute to a wood stove and noticed that a lot of heat was still coming out, which made him infer that non-utilization of heat was the major fault in existing wood stoves. He decided to solve the problem by facilitating better heat utilization through sufficient air supply and a correct channel for burning. To improve it further, he developed a mechanism for simultaneous heating of multiple vessels using the same heat source. Bharatbhai made the first model of this stove in 1999, then after a few modifications, he came up with this multipurpose stove, which two multilevel burners and a single fuel feeding point.

The stove consists of two chambers, each with a burner for cooking, and a geyser for heating water. Both burners can be used simultaneously, saving time and using the heat effectively. The heating chambers are oriented at different levels in order to be able to completely utilize the heat energy produced connected to a chimney, which provides part of the draft. Inside the main chamber, mud has been used as insulating material to retain the heat. There are air vents on the sides of the first chamber to allow cooling of stove so that it is not too hot to touch for the women/men using it.

Groundnut Seeder

Groundnut seeders are attached to a plough shaft and seeds are fed through a pipe and delivered into the ground while the soil is ploughed so that it covers the seed. The earlier groundnut seeders would get clogged with wet soil and the seed would not be delivered. The innovation is structured in such a way that while the ploughing and seeding takes place, the flow of the soil does not clog up the delivery hole and a lot of time is saved. The device is being sold locally on demand.

Hybrid tractor

Conventional tractors available in the market are built using a 4-wheel chassis and are rear-wheel driven. While a rear wheel design is the norm as a far as the larger HP tractors are concerned (> 35 HP), the same design is also being used by the various manufactures in Saurashtra that are developing small 10 HP tractors.

Bharat has conceptualized the design of a tractor built on a 2-wheel chassis, which essentially forms the front wheel. It can be attached with a 2-wheel frame for fixing farm implements or a 2-wheel trailer, depending upon the purpose for which the tractor is to be used. The tractor, therefore, will essentially be front-wheel driven. Either trolley or santi (digger) attachment having two wheels could be joined to the tractor.

Future plans

NIF has helped set up a community fabrication workshop at Amrutbhai's place for the grassroots innovators' of the region, which Bharat also uses occasionally. He is also working on power generation through the windmill and experimenting with other forms of renewable energy to develop sustainable solutions. In his pursuit of his work, this is what he has to say, "*Jis rah pe chal pada hoon, ussi rah ke kadamo ke nishan kisi kerah ki manzil ban jaye*"