

Technological Innovations in the Garhwal Himalayas: The HESCO Case Study

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ABSTRACT The present paper discusses the nature of technological innovation and their implications in the Garhwal Himalayas with specific reference to HESCO, a non-governmental organisation Biofencing, management of common weeds and watermill invention in this area has helped the local inhabitants in solving many of their problems. The approach followed by HESCO includes building on existing structures, use of traditional knowledge, innovation through open forum and need based innovations.

BACKGROUND

The Garhwal Himalayas constitutes five hill districts of Uttar Pradesh. It has become of great significance to nature conservationists because the seeds of eco-conservation movement called CHIPKO were sown here. Garhwal has suffered the onslaught of indiscriminate deforestation for commercial purposes resulting in disasters such as, flood, land slides, soil erosion. In the seventies, when people resisted this practice through Gandhian methods, it was realized that the forests and the wild life needed to be looked at not as mere physical resource but as natural eco-systems on whom is dependent the biosphere of these hills. The Chipko movement developed into an eco-conservation movement where villagers — largely MMDs (Mahila Mangal Dals) and YMDs (Yuvak Mangal Dals)—started organising themselves in eco-camps where eco-restoration tasks such as plantation of socially useful saplings and protect of denuded areas was undertaken.

Besides innumerable community success stories, there are many individual efforts which have been nationally and internationally acclaimed. The Himalayan Environmental Studies and Conservation Organisation (HESCO) is one of the many offshoots of this movement. It was

established in 1979 by the efforts of a young college teacher in cooperation with his students and social workers. What makes HESCO stand far apart from other NGOs in Garhwal is its commitment to develop useful and appropriate technological interventions designed and adapted to local conditions. The present paper attempts to highlight a few of the innovation areas developed by HESCO.

NATURE OF HESCO INNOVATIONS

Most of HESCO innovations are bio-mass based and have grown out of persistent struggle of HESCO scientists in the Garhwal soil. Another significant feature of this group's programme is that its main thrust has been on protection of natural eco-system by converting weed into need fulfillment and income generation. Three examples of such innovations out of many appropriate technological interventions undertaken by this group are presented in this paper.

From Rambans to Ramban – Biofencing Intervention: This intervention was the first to be undertaken. At the time of working on *Rambans* (*Agave centala*) it was held as useless cactus indicative of waste and barren land. As protection of plantations was one of the major problems in the early eighties. It was thought that *Rambans* could very well fit in as a suitable bio-fencing device. Further, as wild animals, such as, wild boars, rabbits, porcupines, monkeys were damping the agricultural and horticultural produce, it was an ideal method in the areas surrounding Kotdwar where HESCO was working in its formative period.

But, when the idea of *Rambans* as bio-fencing strategy was discussed in the village camps, people disliked this idea for the fear that *Rambans* was mainly a cactus which would

decrease the fertility of their soil. As no one was ready to give even the wasteland of the village, a HESCO member volunteered his land for *agave* plantation. The initial experimental plantation was thus tried on this land. In the process however, further uses of *Rambans* was thought up. It was learnt that in Orissa, *Rambans* fibers are extracted and used for making ropes, mats etc. A hand-operated fiber extractor was therefore installed by the group. *Rambans* somehow became an obsession with the group and other uses of *Rambans* started emerging. In an interaction with village women, it was learnt that *Rambans* pulp was used as detergent in past by the villagers. *Rambans* was also found to be an excellent means to check soil erosion due to its deep roots. Under a project supported by the Department of Science and Technology, the riverside land-slide prone area was afforested with the help of *Rambans* fencing.

The real appreciation of *Rambans* by the villagers came to forefront when its income generation potentials through its fiber were established. This income generation programme found great favours with the Mahila Mangal Dals. For this purpose, a technological innovation was introduced which changed the process of fiber extraction from manual to mechanical. With slight modifications, the inconvenience of hand extraction was removed and the process of fiber extraction became more efficient and easier.

By looking at the multiple usages of *Rambans*, more and more villagers started requesting HESCO for bio-fencing and fiber-based activities. The handicraft items such as purses, bags, caps shoes, mats, etc., were marketed by HESCO and the technology was disseminated beyond the confines of the region. Today, the group is imparting training in plantation of *Rambans* and its fiber extraction to a number of NGOs in Garhwal and beyond. "The *Rambans* has turned into a Ramban (the remedy for all hills)" says Mr. Prakash Chander, an agricultural scientist belonging to HOPE, the NGO associate of HESCO group in Kumaon.

Management of Common Weeds: Due to deforestation and altered land-use activities, many areas in the Himalayas are witnessing rapid and colonizing invasion of weeds such as *Lantana camara*, *Euphorbia royleana*, *Carissa carrander*,

Eupatorium hirsutifolium, *Parthenium heterophyllum* etc. These weeds are very hardy and are slowly engulfing the pastures, agricultural and forest lands. The conventional remedy for getting rid of these invasive bio-mass was proving to be ineffective for two basic reasons: (i) the area under the impact of the weeds has become so large that it calls for separate long term programme involving heavy financial inputs and (ii) these weeds are of very hardy nature having the capacity to regenerate even if one removes or burns them. The loss incurred due to these weeds was enormous and therefore, HESCO tried to make intervention in this area. It would be relevant here to mention that the idea of working on invasive weeds emerged in a meeting of HESCO activists with the villagers.

Lantana Camara: It is locally known as *Kurri* belongs to the family Verbenaceae and is considered as one of the worst weeds of the world. This sturdy weed plant has a wide range of adaptability for different regimes. It grows in rich as well as poor soil including gravel and laterite and in low lying areas and on hills upto 1800 meters. The middle and outer Himalayas has faced the invasion of *Lantana* and vast tracks of cultivable and waste land exists in the firm grip of *Lantana*. This plant has very deep roots and once it has established itself, it has almost become impossible to eradicate it. Both agriculture and forest department showed concern at the menace of *Lantana* but their attempt to free the land from its invasion proved futile.

HESCO, on learning about it, initially thought of devising effective ways of removing it. However, in its struggle to find a solution to the problem, it decided to approach the problem from an entirely opposite angle. It started looking for the positive side of *Lantana*.

The group had now some experience in production, networking and marketing activities while working on the *Rambans* fiber. The first activity related to *Lantana* use thus started in income generation. In the initial stages, the technique of *mora* (a traditional easy chair popular in western U.P.) making was learnt and used for *Lantana* sticks. But the final product was not economically viable as it was more labour-intensive. The *mora*, being a cheap product was not compensating labour of the women who joined

this income generation programme. A breakthrough was made when the cane furniture techniques were used to Lantana raw material. Some specific tools were designed by the group for this purpose. The sticks of Lantana were durable and pest resistant. This gave Lantana furniture an advantage over other local raw materials. Thus, HESCO started production of fancy items like tables, chairs, show houses, file trays and fancy buckets which were far more attractive fetching better economic returns than the conventional furniture items.

After successfully implementing and transferring Lantana furniture technology, HESCO decided to work on other uses of the plant. They observed village women burning Lantana leaves near their cowshed. The mosquito repellent qualities of Lantana were scientifically explored. It was discovered that the aroma of burnt Lantana leaves is effective upto 70% on mosquitoes. HESCO prepared cakes which were used as mosquito repellent.

The third area where Lantana was thoughtfully used was energy. As the wood of the Lantana has high calorific value (5,100 cal/gm.), its potentials were explored in power generation. A gassifier, initially developed at the I.I.T., New Delhi, was installed and necessary changes were made in its structure. It was then adapted to use of Lantana's weed which contained high carbon percentage which on partial burning produce coal and other mixture of gases. These gases proved effective replacement of diesel in starting engines.

Finally, another excellent use of the Lantana weed was found to be in the area of charcoal briquetting. The briquetting designs developed so far were very costly and therefore, HESCO worked upon developing easy to built cheap model for charcoal briquetting. They developed a beehive type of simple oven for turning Lantana wood into charcoal. This oven could be easily made by locally available mud and stones. Under HESCO developed process, Lantana is first pyrolysed. Then the charcoal is crushed into fine powder and turned into compact cakes by pressing process called briquetting. This newly developed and locally viable technological innovation has great potential in solving the long standing requirement of fuel in the region without doing any damage to the forested areas.

Watermill Intervention: Watermill is the oldest technology found in the Himalayas. There are nearly 10,000 *gharat* watermills existing at present in Garhwal. But these remarkable mechanical structure which cleverly utilize static energy differences offered by free-flowing water streams for producing shaft power area at the danger of extinction in competition with diesel and electrical watermills. There are two basic reasons for the adoption of diesel /electrical based option:

1. The diesel/electrical machines are easy to operate and have greater efficiency.
2. The diesel/electrical machine can perform multiple functions such as rice de-husking and oil expelling.

The dying traditional technology received attention by HESCO. The group decided to make in suitable improvements in the structure and functioning of the *gharat*. With the help of a civil engineer, D. P. Dobhal, Anil Joshi, the head of HESCO stationed himself in the existing *gharats* of Chamoli situation. It was then decided to systematically bring in minor changes in order to enhance the efficiency and output of the watermill. Following changes were thus introduced in the watermill:

1. The channels bringing water to the mills were cemented to stop water loss by seepage.
2. The wooden flumes were changed by introducing galvanized iron sheets to cover the inner surface of the flume. This intervention resulted in checking the loss of energy by friction and stopped excess turbulence in the water flow.
3. The flat blades of turbine were replaced by curved blades which greatly increased the speed of the wheel and also prevented the flushing of water.
4. Finally, ball bearings were introduced which dramatically increased the efficiency of the water wheel. The enhanced rpm required heavier grinder which increased the falling rate of grain by the hopper.

All these minor modifications led to three-fold increase in the output of the watermill. The enhanced efficiency of the wheel has made this simple water mill capable of performing other tasks like rice de-husking and oil expelling. The *in situ* cost in making these changes was worked out to be a meagre sum of Rs. 1,500 only.

The work on technological intervention on watermill is continuing and HESCO is now on to a very ambitious plan of linking the chain of nearly 10,000 watermills to micro-hydel electricity generation. In order to accomplish this task, the watermill owners have been sensitized by means of an organisation of the watermill owners.

IMPLICATIONS

Garhwal is home to a number of successful non-government organization, most of which have done commendable work in the field of natural eco-systems (in areas like afforestation, forest conservation and management, eco-fencing, alternative sources of energy, etc.). HESCO is just one of them but is radically different in its organisation, approach and methodology than the rests. We will take a look into the structural and functional aspects of HESCO to draw implications.

The Group Dynamics: Although HESCO is a voluntary body, its core members consist of a college teacher and his students. It is around this core that the other members have carved out their respective social space. However, this core teacher-pupil group is not privileged within the organization as far as the information and authority goes. At best, the core group represents the normative standards of behaviour which any newcomer learns when he/she joins the group. In the words of Joshi: "In HESCO, the seniority of a person is always respected. A person will always touch the feet of the seniors". This practice instills a sense of responsibility in the senior and obedience in the junior. Does it restrict the freedom of expression and creativity? Joshi's answer was "No! We always respect and encourage independence and creativity and give full freedom for thoughts as well as actions. Anything new is always given a patient and thorough listening." In this manner, HESCO acts as most conducive platform for innovations.

The group functions as a large family where a person who is senior and experienced works harder in order to facilitate emulation of his behaviour by the newcomers. He is also responsive to even a very minor and mundane problem of his junior. This kind of work ethic ties Hescos in a very deep bond of mutual respect and reciprocity.

Mutual respect, sense of mission, quest for doing something new for the welfare of the villagers and total devotion and dedication to rural development are the hallmark of HESCO. But, the most crucial factor in this group is the charismatic personality of Joshi who has nurtured and developed the group from a classroom situation to national eminence. He can best be described as a marginal man because he was educated in Lucknow and worked on the fringe of Garhwal. It is his commitment, zeal and determination which has made many of his students to throw away lucrative offers. He himself has left his teaching job for the cause of technology improvement. Although, he has played a key role in all the interventions, he is supported by his colleagues (Kiran, Rakesh, Ambarish, Dobhal).

The Approach: HESCO is unique in Garhwal because it decided to work on areas of technological innovations and interventions. Its main task has been to identify snags in the existing technology and offer new/changed alternatives. The approach of the HESCO therefore has following salient features;

1. *Building on Existing Structures :* HESCO has always tried to introduce minor changes in what had already existed in the region whether in the form of a resource or technology. It has never tried to import and transplant new ideas. Its quest for building on what had already existed has always paid rich dividends. Very recently, the group has started making interventions in the field of health. It is doing it by identifying local herbalists and vaidyas through creating Health Banks in the villages where traditional strength is substantiated by outside knowledge and in the process the user gets best of both at an affordable price.
2. *Use of Traditional Knowledge :* HESCO always as a rule gives due recognition to traditional knowledge and wisdom. Its respect to IKS (Indigenous Knowledge System) has given it many ideas which when processed were found to be innovative (e.g. Mosquito Repellent from Lantana or detergent from Rambans). The idea of focussing and developing upon traditional knowhow is also appropriate from the point of view of

acceptability. Anything developed on traditional technology will have inner strength filling in confidence in the user of such technology in the villages. The innovations on traditional watermills are not only changing the outlook of the administrators but also bringing in confidence in the owner and makers of *gharats* who were finding themselves out of place in present times.

3. *Innovation through Open Forum*: The research and development activities of HESCO are truly grassroot endeavors. What is being done and how it is being done is known to everyone including to users. Existing options in use in other areas and institutions are experimented with the field situation in order to identify their respective merits and demerits in the mountain ecosystems. Such as open forum acts as catalyst for cross-fertilization of new ideas or patterns from which the most appropriate, suitable and cost-effective option can be easily picked up and developed into a technology package.
4. *Felt-Need Based Innovations*: Finally, the technological interventions are based on felt needs of the people. A technological package introduced by HESCO is always a refreshing experience for the users because it is known, simple and cost-effective. Within users, HESCO has identified women as its main target group whose bio-mass-based drudgery it wants to reduce by means of making their tasks simple, less time consuming and sustainable. The time saved in collection of fuel and fodder can be properly utilized in income generation activities. It is for this reason that we see that HESCO is receiving invitations for intervention from a large number of Mahila Mangal Dals which are located as far as the Indo-Tibet border.

CONCLUSION

In order to understand the process of innovations and technological interventions, we examined a few of HESCO initiatives from amongst many of its successful breakthroughs. Innovations, communication, change agents, acceptance and people's participation are catch-words

in the phraseology of development interventionists. We have tried various combinations of the above in our family planning (welfare), agriculture extension, joint forest management, watershed management and sundry other programmes. Cliché, like lab to land and science in the backyard have filled the literature of development studies. But, what we witness in the efforts of HESCO goes beyond all this academic space. What makes an innovation success or a failure? What should be the approach in selecting problems for technological interventions?

It appears that there is wide gulf between lab and land. Although, we as a nation, are the third largest technical manpower in the world, there is no effective communication between what we know and what people need. The bullock cart, it is said, runs side by side with a jumbo jet in India. This proverb is true in quite different sense also. We are proud that we are leading in aviation technology but it is also true that we have not tried a meaningful intervention in our bullock cart. All this, in spite of the fact that bullock cart is used by eighty percent of our population.

There seems to be two levels at which India as a country is existing. One is India which is urban, industrial and technologically mighty. The other is Bharat which is rural, stinky and is dependent on age-old technology. Vast expanse of Bharat is condemned to live in darkness. It does not require sophisticated and high-tech science and technology. Even a minor ripple of new knowledge can make enormous difference in the quality of life of rural/tribal folks.

HESCO has tried to bridge the gap between lab and land. It has dared to set up its lab in the village itself. The questions it received than came not from the hearths and homes. It started by understanding problem in its multi-faced dimensions and then decided to work on interventions. Once the question had come from the village, there was never a problem of peoples acceptance, change agents and participations. HESCO presents an example of peoplecentred approach in technological interventions in mountain eco-system. But it is not merely an example. It is also a strategy—a model which needs to be fully appreciated by future innovators of India.