ISSUES FOR DEBATE

Lessons from Astra's Experience of Technologies for Rural Development

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A personal introduction : After almost two decades in the field of electrochernistry, I felt that, like most of the work in advanced institutions of education, science and technology, my own work was largely irrelevant to India's poor, the majority of whom live in villages. I also felt that I should reorient my efforts towards technologies for rural development. Such as viewpoint found sympathy from many other colleagues at the Indian Institute of Science. This shared vision led in 1974 to the formulating and implementation of the ASTRA programme through which it was hoped that the application of science and technology would be a weapon (or *asthra* in Sanskrit) in the interests of the poor.

However, the attempt at working in rural areas quickly revealed my serious shortcomings. I was born and raised in a city and therefore knew virtually nothing about life in villages; I had received a western type of education and therefore found it difficult to understand traditional attitudes and approaches; and I came from the family of a professional, a member of the elite, and therefore found it very difficult to see the world through the eyes of the poor.

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All this meant that I had to undergo a great deal of unlearning (in addition to learning) to be able to function in rural areas. Thus far, my learning experience has spanned 14 years of which the first nine were as the Convenor of ASTRA, and the remaining years have involved its community biogas plant project at Pura village, Kunigal Taluk, Tumkur District, Karnataka.

Many lessons have emerged from this experience. Since these lessons may be of some use to others wishing to make similar efforts, they are set down below.

Lesson 1. *Rural people may be poor and illiterate, but they are not irrational. I*n fact, the poorer they are, the more their survival depends upon their rationality, i.e., upon a proper evaluation of costs and benefits. And, in the attitude to returns and risks, they invariably take the “worst case scenario” more seriously than the "best case scenario” because the former can lead to total ruin whereas the latter only means marginal improvement. For example, their choice of traditional seed varieties in preference to high-yielding varieties is often dictated by the fact that the latter can give lower yields than the former if the inputs are not in the optimum range - as the nursery rhyme goes: 'when she was good, she was very good, but when she was bad, she was horrid.'

Lesson 2: We must therefore proceed with the assumption that, given the options within the range of awareness Of the people, *the technological choices of the people are rational.* For example, the draught animals in many parts of the country are fed well only during the ploughing season because most of their traditional year-round functions-water- lifting, oil extraction, cane crushing, etc. have been usurped by pumpsets, oil mills, cane crushers, etc. Another example is the fact that the load-bearing capacity of bullock carts is kept low because the average payload is only about 250-300 kgs.

Lesson 3. We *must understand rural rationality if we want our technological suggestions/recommendations to be accepted.* For example, if smoke from their wood-stoves (chulas) is essential to control termite attack on thatched roofs, then it is unlikely that smokeless stoves will be accepted unless they are accompanied by a solution to the termite problem, for instance, a termite-proof roof.

Lesson 4: *We must first be students if we want to be successful teachers. Information must flow both ways - from the people to the rural technologists, and from the rural technologists to the people.*

There are **several** important **steps** in this information flow process.

step 1 - *Scientific study of the lives of the people:* This step is crucial because most rural technologists know more about London **or** New York than about villages 20 krns from their institutions. Hence, there is no option other than starting from zero.

Step 2 - *Identification of felt needs, rather than perceived needs.* For instance, villagers are completely aware of the fact that thatched roofs (a) leak, (b) catch fire, (c) are attacked by termites, (d) harbour insects and rodents, and (c) need constant maintenance. If asked (for instance, through a questionnaire), they may express their perceived need for a tiled or RCC roof because those are the only alternatives that they have seen and are aware of. But, their felt need is really for an improved roof that does not have the defects of thatched roofs. An understanding of felt needs is essential therefore for working out the design criteria for improved technologies.

Step 3 - *Presentation of options to the people.* Before a major effort **is** launched on the development of new technologies, it is vital that the various technological options are presented to the people and their preferences elicited.

Step 4 - *Technology Selection.* If the intention is ultimately to spread the technology and to ensure that it does not remain a museum piece, it is imperative that the final decision on the selection of technology is made by the people and not by the technologists.

Step 5 - *Technology generation.* The arduous task of R & D has to be taken up at this stage.

Step 6 – *Technology testing.* This important step consists of testing out the technology in the field and getting the reactions of the potential users.

Step 7 - *Technology finalization.* The feed-back from the **field** is used to improve/modify the product/process before the technology is finalized for diffusion.

Step 8 - *Technology Dissemination. The process of disseminating the technology has to be a multi-institutional effort* involving rural users, development agencies, technologists, financial and/or credit institutions, etc.

Lesson 5: *Start with the people, and end with the people!* Unfortunately, it is possible for scientists and engineers to get so involved with Steps 5 and 7, i.e., technology generation and technology finalization, that they forget all the other steps in which the people (who are the prospective rural users of the technology) have a crucial role to play. This process of by-passing the people is even more easy when the technology dissemination consists of simply transporting a device/equipment
(for example, a photovoltaic module or a biomass-fuelled engine-cum-generator) and installing/erecting it in a village. What these blinkered scientists and engineers disseminate may be rural technology, but it will certainly not be technology for rural development. For, there cannot be development without the involvement of people. It is wise therefore to keep on asking: “Where are the people?'

Lesson 6: *Women are often the best agents of disseminating technologies for rural development.* Even where technologists work with the people, the tendency is to restrict popular involvement to the men. This gender bias is often difficult to avoid because most scientists and engineers are men, their technologies are often male-oriented, there are social taboos discouraging direct interactions with women, rural women do not come forward to articulate their views in the presence of their men, etc. But, with many, many technologies, once the women are seized with it, the dissemination takes off. Thus, once the women began to have a vested interest in the delivery of dung to the Pura community biogas plant, the operation of dung collection and delivery has been running smoothly.

Lesson 7: ***The** steps involved in the two-way information flow of lesson 4 are quite similar to those involved in satisfying the demands of urban middle-and upper-class consumers,* but the terminology is usually different. In the case of the generation and dissemination of technologies for the middle and upper-classes, the following steps are usually distinguished: Market Survey E Consumer Preferences ('the customer is always right!') E Identification of Market Demand E R&-D E Test Marketing, E Productionizing E Manufacturing E Marketing.

Lesson 8: All this, which is considered so self-evident in the case of affluent customers, is completely ignored in the case of the poor. This bias is perhaps because the poor do not have the purchasing power to articulate their demands through the market mechanism and be rated as 'consumers'. *But, because people are poor, we must not ignore their likes, tastes, preferences and needs.* For example, janata houses for the poorest sections tend to ignore the way in which the spaces in traditional houses are used by villagers.

Lesson 9. *We must curb our marked tendency to develop technologies in response to imaginary and imagined needs identified in remote and alien settings.* For example, a number of 'modern' designs of bullock-carts were developed with the capacity to carry 1000-2000 kgs of load even though such high loads do not arise frequently in typical rural situations except, for instance, in the 'catchment area' of a sugar factory.

Lesson *10:* *Traditional technologies are optimal solutions for the challenges of the past and therefore they must not be ignored as sources of innovation* - they have evolved through a long process of the natural selection of innovations. For example, computer analysis has shown that the geometry of traditional bullock carts represents a optimum solution.

Lesson 11*:* *rough traditional technologies were optimal solutions in the past, almost **all** of them are sub-optimal and inadequate today* because of changed expectations, resource availability, materials and circumstances. For instance, in the past when the country was heavily forested, teakwood **may** have been an optimum material for constructing the highly stressed wheels of bullock-carts, but today teak has become such a scarce material that it is a costly and therefore sub-optimal solution.

Lesson 12: On the other hand, *the so-called "modern" 'technologies, which are only bad xerox copies of western technologies, **are** invariably inaccessible **to** the poor.* For example, the poor cannot afford a modern roofing technology such as reinforced cement concrete (RCC).

Lesson 13: It is therefore a Hobson's choice for the poor – on the other hand, traditional technologies are inadequate, and on the other hand, modern technologies are inaccessible. To permit the poor to escape from this dilemma, scientists and technologists must generate new options, each more effective than the traditional, and more accessible than the modern. Ideally, the options should constitute a hierarchy of technologies with upward compatibility. Then, with rising incomes, the poor can climb from a cheaper less cost-effective option to a costlier more cost-effective option. Only in such situation will the people have genuine choices. Thus, the role of rural technologists is to be option-generators and choice-wideners. For example, in the matter of cooking fuels and stoves, rural technologists can widen the options of villagers so that they can also choose improved (smokeless and fuel-efficient) wood stoves or biogas cooking.

Lesson 1*4:* *But, the ultimate choice of technology must be made by the people, because technology choice is too important to be left to technologists and other 'experts'.* These "experts" have made monumental errors even in the industrialized countries (cf. the Concorde supersonic passenger plane or the US breeder reactor). And, our countryside is littered with the blunders in the choice of technology. Rural technologists, like all technologists with careers, fortunes and fame linked with technologies, have clear-cut vested interests in the technologies that they push - they are neither as unbiased nor objective as they claim or as they are portrayed.

Lesson I5: In generating technological options, there are three approaches for technologists:

1. cheapen western technology,
2. develop ab initio an alternative technology,
3. transform traditional technology.

For example, in the case of low-cost building technologies, the approach of cheapening western technologies may consist of developing fibre-reinforced materials, that of *ab initio* alternative technologies, geodesic domes, and that of transforming traditional technologies, compacted unfired mudblocks.

Lesson 16: Even though it is a hitherto untapped source, *the transformation of traditional technologies is* ***a*** *rich source of, and promising route for, technologies appropriate for rural development.* The transformation of traditional technologies involves an understanding of the scientific basis of traditional technologies, followed by qualitative changes achieved through marginal improvements.

Lessons 17: As a consequence of the whole process that has been out-lined above, *the technologies that are developed are likely to be region-specific, location-specific and culture-specific.* And, the local culture may have many surprises. This is probably why Gandhiji is reported to have advised one of the most creative architects in India, Laurie Baker, 'When you design for the poor, restrict yourself to materials that are available within a radius of 10 miles!"

Lesson *18:* *Any foot can make a thing complicated, it takes* ***a*** *genius to make it simple.* The end-product may have to be, or may turn out to be, simple, but the thinking that goes or went into its development can be quite sophisticated. In fact, there is a desperate need for wise ideas and ingenious solutions. Rural technologies are neither trivial nor second-class because they invariably pose the extremely tough challenge of having to be 'zero-cost'.

Lesson *19:* In the case of most rural technologies (stove, windmills, biogas plants, wood gasifiers etc.) there is a marked difference between the first generation of unsuccessful devices (which were often the result of the enthusiasm of unqualified amateurs) and the second generation of successful devices (which emerged from the creative efforts of qualified professionals.

Lesson 20: *Thus, the penetration of the countryside* ***with*** *rural technologies involves* ***a*** *learning curve* - in the initial part of the curve there **is** a very slow penetration of the potential 'market', then a rapid climb, and finally a saturation. Unfortunately, most plans of development agencies forget this learning curve and prescribe linearly increasing targets.

Lesson 21: During the initial part of the learning curve, *there has to be intense back-and-forth interaction between the lab and the field.* The feed-back from users in the field must lead to modifications and improvements of the product/process, and the modified/improved product/process needs further 'test marketing' in the field. As a result of this interplay between technology generation and dissemination, and between technologists and potential consumers of the technology, the penetration of the 'market' is necessarily very slow during this phase.

All these points are generally ignored when technology dissemination is planned and implemented. In fact, there **is a** general tendency for technology generation and technology dissemination to be thought of as two distinct non-overlapping sequential stages with **the** generation ending when the dissemination begins, and the generators 'washing their hands off' the technology dissemination process.

Lesson 22: *here **are** four main mechanisms for the dissemination of rural technologies involving*

1. the market,
2. the top-down approach,
3. the bottom-up approach, and
4. the franchising approach,

and it is very important that the appropriate mechanism is chosen.

Each of these has its advantages and disadvantages. The market is an excellent allocator of resources, but it ignores three extremely important aspects: equity, the environment and the long-term. In particular, the rural poor are by and large outside the market because they do not have the requisite purchasing power to articulate their demands via the market.

The top-down approach - favoured so much by bureaucracies - seems the obvious route when there is clarity at the top, but under- rates the central role of popular participation in technology selection and finalization and of the strengthening of self-reliance.

The bottom-up approach starts with popular participation, but may suffer from the inadequacy of technical expertise.

The franchising approach in which a centralized technology- generating-cum-development agency franchises local groups/ entrepreneurs, may be able to combine the advantages of the large and the small, the public and private initiatives and the technologists and the grass-roots workers.

Lesson 23: *Of various technologies contending for dissemination, those technologies succeed in spreading (i.e., penetrating the "market") that simultaneously solve several problems.* Charles Berg who enunciated this "theorem" illustrated it by stressing that energy-efficiency improvements were introduced into the US steel industry during a period of declining energy prices because those improvements were accompanied by other useful characteristics. The Berg "theorem" is very relevant to rural technologies too. Thus, of the various designs that have been successful (for example, the ASTRA OLE) have been those that simultaneously eliminated smoke, cut down cooking time and reduced fuel consumption.

Lesson 25: *If the designer cannot meet all the user's objectives simultaneously, but only in stages, then it is inoperative that the designer's sequence must be in the same order of the user's priorities - otherwise, the implementation may run into problems.* This is what happened to ASTRA's community biogas plant at Pura - the villagers wanted the biogas to lift and pipe drinking water, generate electricity for lighting homes and provide cooking fuel. But, they did not stress that order of priorities, and the Astra workers did not pick up the signals - they sought to provide cooking fuel first. The villagers went along with this effort out of solidarity, but the dung availability could not provide biogas even for one complete meal (let alone two meals) and the biogas plant had to be stopped for some time. Then, the plant was restarted at the request of the villagers, but this time, drinking water was taken up as the first priority - as desired by the villagers - and the project has taken off again.

Lesson 26. Notwithstanding any successes with the generation and dissemination of rural *technologies, technology alone cannot remove poverty, redress injustices, prove a panacea and solve development problems.* Technology is only a sub-system of society, and the development of society hinges, not only on technology, but also on the other crucial subsystems. Technology is only an instrument for the development of society. Like all instruments, it must be specifically chosen and/or designed to fulfill is intended function. But, the will to use the instrument, and the skill to wield it effectively, do not depend so much on the instrument as or, the users of the instrument. Thus, technologies are a necessary condition for rural development, but not a sufficient condition. It is also essential that the political structure and the socio-economic framework are both committed to development goals. Rural technological missions will succeed only when they are part of successful societal missions. *Rural technology has therefore both power and limits - it is an essential requisite for development, but it cannot be a substitute for economic, social and political change.*

Lesson 27: However idealistic and romantic it may appear, it must be stressed that *technologists must approach rural work with empathy and affection for the people.* Otherwise, they tend to be afraid of the people and hide behind the walls of their rural centres. Then, the poor tend to conclude that their poverty is being used as **a** resource for professional gain. Even if the people do not get something back in return **from** the interaction, the feelings with which technologists make efforts are extremely important in the eyes of the people. Given the right attitude, the people are far more understanding of technical failures (which are the usual precursors of success) than the so-called educated who cheer when the satellite goes into orbit and jeer when it falls into the sea.

Science and technology too stand to gain from these feelings of empathy and affection. The forging of an emotional bond with the people may result in the catharsis, redemption and the resurrection of science and technology which have become **so** amoral, immoral and violent. At that stage, the poor shall inherit science and technology and therefore the earth.

Lesson 28: The perspective **guiding** rural technology is also vital. Rural technology **is** not merely a matter of expediency, a transitory measure and a tactical device to cope with the current predicament of the poor in the countryside. *Rural technology **is a** path to **a** new society. It is an instrument for development.* And development must be seen as a socio-economic process directed primarily towards the satisfaction of basic human needs starting from the needs of the neediest particularly in the locations of development projects. In addition, development must involve the strengthening of an endogenous self-reliance based on social participation and control. Finally, if this development is to be sustainable over the long term, it must be in harmony with the environment.