

Dr. S. S. Kalbag
Pabal, Dist. Pune.

SCIENCE AND RURAL DEVELOPMENT

Development means change for progress; this is what we mean when we say research and development or urban development or National Development. But when we say rural development, there is a connotation about low level technology, voluntary agencies, "sacrifice", - the term rural development, connotes many things but not science or modern technology.

Setting up a factory in a rural area is not generally considered rural development - nor for that matter setting up a farm or a plantation or construction of a dam. But these are major rural development activities. In this background, I will attempt to remove this misconception about rural development and try to show that rural development in the true sense has been a largely unexplored field for our scientists, technologists, and entrepreneurs.

The present kind of rural development is low in technology because most of the agencies and individuals involved are not trained in science and technology but this in no way indicates the relevance or otherwise of the sciences in the rural context.

Working for Rural Development is also in some way associated with 'sacrifice'. I would like to show that there is no sacrifice involved at all. You lose something but you gain something too.

Who were the pioneers, who ventured into the western parts of America, when the settlers first came to the eastern shores of the new continent? They did not "go west" as a sacrifice, they went in search of opportunities and adventure. The people who go to the Himalayas for trekking and mountaineering certainly forego the comforts of a city life, but do they sacrifice? No. They go for excitement, thrill and adventure.

Isn't a good scientist expected to select his project, where he will explore the unknown and feel the thrill and the excitement of discovery?

Our rural areas are unexplored lands, figuratively and a creative scientist/technologist will find it like a gold mine of opportunities, where he can apply the simplest of science and get good results every problem is an opportunity for a creative scientist. It is only a creative person, who sees opportunity in a problem. The lesser persons are blinded by the magnitude of the problems or their persistence. Therefore a creative scientist or engineer will not consider it a sacrifice to tackle the problems of rural India.

Every one knows the difference between discovery and invention. Discoveries push the frontiers of knowledge. Inventions make the tools that make discoveries possible. Both bear testimony to the creativity of the human mind. We owe our debts to the Edison's and the Einstein's of all times.

The question is not whether a creative and adventurous mind should go for invention or discovery or whether one should work for pure science or industrial research or rural development. They will go where they feel the challenge. Louis Pasteur went to help the wine makers of rural France and laid the foundation of microbiology. We commonly start with techniques invented by others and then look for a problem, where to apply it. There must be at least equal thrill in taking up a problem of real life.

and then inventing a technique to tackle it. But we do not do much of this in our laboratories.

Trying to solve a real life problem, a problem that is significant, could unearth new observations that could give new directions or new meaning to existing knowledge.

Maybe the problems of our rural areas are like mopping up operations for an army of scientists, while the real frontiers have been pushed far beyond. There may not be much chance of radical new observation or theories but we cannot say new techniques can not be developed. We cannot still control the tiny mosquito or the pests on our crops.

Sophistication and creativity do not necessarily go hand in hand. A scientist forking with sophisticated Instruments may have more glamour but not necessarily more creativity. Not every one in to-days universities is going to end-up being an award winning scientist or engineer, many of them could get more satisfaction and an outlet for their creativity by solving some of the myriads of problems of the rural area.

Do scientists working for rural development have to stay in the rural areas? There is no doubt that there is a relation between the site of the problem and where the work is done. To observe the problem and sense an-opportunity one has to be "Immersed." in the problem - so one has to be on the site. During the stage of formulation and conceptualization, we need to be a little bit away so that we can look at it from a distance and see it in its perspective. The detail can be worked out anywhere as long as there are constant reminders of the rural environment and its constraints. Finally one has to constantly test it on site.

Keeping in mind that one has to handle many problems in different stages, one has to be close to, if not surrounded by the rural environment. The best solution seems to be to have urban and rural centers and have a close link with work going on in both places. Just as Industrial research and factory development are linked. But the idea that good rural development can be done only if you wear khadi must go.

I suggest senior scientists could spend their weekends or vacations in real, not simulated, rural environments for this would enable them to enjoy the outdoor life. Fresh graduates particularly engineers could spend anywhere from 3 months to 2 years to learn to tackle problems on their own, with guidance only when they need it. What kind of projects should they take up?

Among the most important, are projects for cost reduction that will make the services and products available to a larger percentage of the population in the rural area? Cost reduction does not consist only or even mainly of cost cutting, which has only a limited range. There are opportunities to reduce the cost by radical changes in design, particularly accompanied by value analyses. Henry Ford had a concept that the difference between the cost of the end product and the cost of materials that go into it represents the scope for new technological development. If a motor can cost Rs. 1 lakh and the cost of materials is only Rs. 3,20,000, the difference of Rs. 80,000 indicates the scope for better technology to reduce the prices and increase the market size. The other valuable concept we could take from him is his model T. If you want to reduce the cost and make it available to a larger population, stick to the main function and strip away the decorations. Henry Ford built his empire on the philosophy that an automobile is not a luxury for the rich few, but a tool for nobility for everyone. The growth of the motorcar Industry has many lessons to teach for our rural development.

Another type of project is to improve productivity. Here one has to identify parameters that are controlling the rate and then we can improve productivity. Even a wheelbarrow or handcart can improve productivity in transport, overhead loads. But you hardly see them in our rural areas. On the one hand, we go for labour intensive projects, and avoid machines to save capital. With low labour productivity, the projects cost more. On the other hand, we have capital-intensive projects, where also productivity is low and we don't properly utilize scarce capital. Generally we ignore productivity and slow down progress. Even simple mechanical gadgets like wheelbarrows and winches, could increase productivity in road, bund and well constructions. We don't have technology at the lowest levels.

Yet another series of projects deal with formulations to be evolved to meet a particular need. Usually it is not difficult to make formulations that show initial promise. But few have the patience to keep improving until it becomes a success in the field. The success of small-scale detergent industry in enlarging the detergent market is an example. I believe protective coatings; adhesives, sealants, food products, and many other such products could find wider markets.

Another type, is a project to disseminate knowledge and break the monopoly of a few. This way services/products can be made available to a wider section at lower prices. This involves study of a technique, simplification and wide training.

Lastly many of the current areas of scientific research are going to have their main impact in the rural areas, e.g. tissue culture, genetic manipulations, embryo transfer, diagnostic kits etc. in biotechnology; remote sensing, weather modeling, photovoltaic and perhaps even information technology. To increase their impact, people working on rural problems must understand the significance of these high-tech areas and help in tapping their potential. Otherwise, they tend to pool it as "unemployment generating" "technologies only for the rich" and have a bias against all progressive things.

None of these are essentially different from what any industrial research laboratory does. However, the opportunities are greater because the problems are many and requirements are different.

I shall now list actual specific problems to illustrate the kind of opportunities that traditional rural development worker does not perceive. Somebody with a different background will see another set of projects, but no scientist-technologist with a creative mind will say nothing can be done. There is a lot that needs to be done and can be done.

Water -: Water is the most critical parameter in the whole of India. In most part it is the lack of it and in some, it is the excess. Science can be proud of the accuracy with which the accuracy can be mapped, but here on earth the subsurface geology of our country is known only on a gross basis and all selection of sites for percolation tanks and wells is done on casual geological surveys, if at all. The scarcity and high cost of these geological and geophysical services is the main constraint. Demystification of this knowledge and training at school level will make it widely accessible. All services related to water, microbiological testing, pump installation and repairs, plumbing etc. fall in the same category.

Construction: This is widely recognised, as a priority area for both urban and rural needs. The Operation Blackboard aims at providing just two classrooms of 28 m² for every primary school. But at Rs.25, 000 per classroom, the budget is going to be a major constraint on this program. Yet if you look at the cost break up and the

specifications, there is no reason why the cost could not be halved, Roofing is the most expensive and critical part of the construction but there is not enough being done to explore new composites and new designs.

If sanitation is a high priority, the cost of Rs.1100 per sanitary block, could be reduced to Rs. 250, by dropping the roof and brick walls and opting for reed screens with plaster. Water storage is an important need in the home. A ferrocement tank with a tap is cheaper, and more hygienic than steel barrels but they need to be made locally.

The geodesic dome offers an attractive possibility for a variety of applications, from homes, class rooms, hospitals, green houses, cages for poultry, silos etc. The concept of modular, prefabricated construction has good potential. Standardized RCC columns and panels could provide simple constructions for cowsheds, storage spaces etc. Ready-made trusses could be economical over wooden trusses that are very expensive now. Similarly doors and window frames offer scope for king as standard products.

The workshop services: -This offers very good scope. One cannot expect farmers to use pumps and engines and take the pipes 20 kms away for just cutting and threading or pumps for minor repairs. There is need for a workshop facility within 5 kms of every place. The workshop with welding, drilling, and fitting facility is not just a service. It is an invitation to the lay public to modify and invent. Once the facility is available, people begin to think what else they can do with it. If the skills are also spread, the number of inventors will also multiply. Even if the rupee value of this service is not great, the strategic and economic value is great. When the water tanker has a breakdown or springs a leak, a local repair facility is worth much more to the community, then the cost of repair to the owner.

Energy and transport: - This is one of the most neglected areas of the rural areas. Even when electricity is supplied it is most undependable and voltage surges reduce the life of filament lamps to 1-2 months and tube lights don't switch on when the voltage is low. A small Induction coil for the filament lamp and an oscillator for the tube light are possible solutions that will be cost effective for these applications. Most of the kerosene used in the rural area is for lighting and the hurricane lantern is an inefficient device. Even when all villages are electrified, a large population won't have electricity for lighting - because they are too far from the nearest pole. Battery operated tube lights, even 8 W would be brighter than the lantern and battery recharging by photovoltaic system or windmill could be viable even at today's prices. But the accessibility and services are lacking.

I have already mentioned wheelbarrows for improving productivity -but nobody sells wheelbarrows even in a city like Pune - they are made to order. They could as well be made in the rural workshop. The bicycle is not a mere personal transport but a goods carrier – often carrying 100-200 kg of load. It will surprise many that the maintenance cost of a bicycle comes to about Rs. 10 per month. And so many of them have broken frames etc. and need welding. There is need for designing a stronger vehicle. A motor-assisted bicycle may be an alternative to a moped at less than half the cost and many other advantages. Mopeds and other two wheelers are rapidly increasing in popularity but none of the services are available.

The bullock cart is not an efficient system. If we get rid of the bullocks we will have more fodder for the milch cattle. But today the bullock cart is essential. The pair of wheels of the bullock cart cost Rs. 2000 and more. But the axles are not standardized. Steel wheels for identical size cost half the price, but they are not

widely available and the skill of making a wheel is not as common as the wheel itself. The pneumatic wheeled cart is at par in cost with the conventional, but air and tube services are not common.

Mechanisation of the "bullock" cart is possible and viable but workshop services need to spread fast.

Agriculture: - The pump sets, pesticide spray pumps, tractors, and many other mechanical devices are quite common but suffer from lack of services. Systems like drip irrigation are capable of simplification and wider application. In water scarcity areas, the opportunity cost of water is very high. The economics of intensive green house cultivation of vegetables should be explored.

Protection of farms, forestland is an important need. Fencing is quite expensive. Even live fences are difficult to grow and maintain. Electrical fence controllers need to be explored.

The nursery operations need investigation to improve rate of multiplications. Use of hormones and chemical regulators is not fully exploited. The hybrid seeds also need many services. All these give opportunities for employment generation. There are enough indicators to show the possibilities.

The storage of grains, and packaging of fruits and vegetables needs a lot of attention. The cold storages also need attention to reduce the water requirements.

Animal Husbandry: - The economics of the cross - bred cows is threatened mainly by the fodder cost. The concentrates are the cheapest feed for cows In terms of milk. There is a need for a roughage feed or Increasing fodder production. The other constraint is a source of calves with known pedigree. Nobody breeds cows as they do poultry. Here embryo transfer technique will be most useful.

One of the factors that upset the economics of the dairy industry is the uncertainty of conception after artificial insemination. The calving cycle often exceeds the ideal of 360 days by 60-120 days. Lack of a pregnancy diagnosis test kit creates an uncertainty for about 3 months. Goats have many potential advantages but the technical services are even poorer than in the case of cows. Artificial insemination of goats becomes even more important because of the smaller number of good quality sires and the infrequent coming on heat of the animals. The need for a technique for synchronization of oestrus is also important.

Poultry is a rapidly increasing agro-based industry while breeding is being done by organized sector on scientific basis, the poultry housing, feeders and waters need designs to help the small poultry man. Egg's storage, poultry transport and marketing could be developed as in milk to encourage the small farmer or the landless.

Health and, Home: - Biogas is an energy device and also sanitation and health need. In spite of the subsidy and the effort at propagation, it is growing relatively slowly. One of the reasons might be lack of services. All the Biogas Repair Units are expensive set-ups and the repair cost/unit comes to approximately Rs. 2000 per plant, which is about 30% of the new plant. Nutrition and Health education including education on the effects of tobacco and excessive use of chilli is important - many seem to suffer from ulcers. First aid training needs to be given widely. Scorpion and Insect bites and snakebites, rabies are other dangers in the rural life.

Food preservation - home scale has scope for utilization. Here the use of modern plastic packaging and the pressure cooker should take us beyond pickles, papad, and dehydrated potatoes. Fermentation as a food preservative technique is not fully exploited.

To summarize -

The rural scene provides ample scope for an adventurous and creative mind to apply science and technology. Education could be the main medium for bringing about this change.