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Rural development is an integral part and a key part of national development, along with the industrial development. Yet rural development has meant many different things to different groups. In this paper, I will try to link rural development to the practice of Science & Technology (S & T) and discuss mainly the kind of S & T and discuss mainly the kind of S & T projects that need to be tackled by agencies working in or for rural areas. The actual science & Technology involved will not be discussed, but may be raised as a topic for later discussion. As the selection of projects is linked to our criteria and objectives, some basic issue will be discussed first. It is likely that every one may not accept these ideas, but it is important that the basic premises be clear before one takes up the rural development program.

It is my belief that there are certain qualities, viz dedication to work, technical competence, a broad spectrum of experience, an adventurous mind a creative intelligence, patience and perseverance, that are needed as much in rural development as in any other walk of life. There are more things in common between rural and other kinds of development, than there are differences; both activities will complement each other.

**Production of Surplus; Building up Assets:**

All civilization and human progress is based on production of surplus, which is converted into assets or capital. If any activity does not build up assets, it becomes difficult to sustain – it becomes a subsistence activity. Also we need to stress the difference between a linear growth and an exponential growth (simple interest and compound interest) our efforts must earn compound interest. Donations/ Subsidies/ charities produce only linear growth. Activities producing surplus earn "compound interest". Our nation is Fortuna in having a high rate of savings. Unfortunately these savings are frittered away in non-productive or poorly productive ways by individuals and groups.

**Drudgery Vs Employment:**

We have both these as our national objectives, - removal of drudgery and generating employment. Unless we are clear about the boundary between the two, we may be working at cross purposes I would like to define drudgery as non productive or poorly productive employment. Therefore it is productivity that distinguishes drudgery from employment. The same activity could be drudgery if carried out at low productivity and good employment if operated at high productivity. So to eliminate drudgery, we need not eliminate the activity but raise the productivity.

**Productivity:**

Productivity is the ability to increase the assets with given resources. The assets and resources. The assets and resources can be in any form – not necessarily money.

**Capital and Labour intensive Activities:**

The true capital of a nation or an individual is the Human resource (weighted for skill) and time. We always carry the impression of money being the capital. Money is only the token of surplus assets built up in the past by the use of Human resource and time. Other natural resources do add to the capital but are subsidiary to these primary forms of capital – as so well illustrated by the case of Japan.

Therefore the question of labour intensive or capital intensive should be decided on the basis of which produces faster growth of assets with available resources (which will include human resources and all other forms of capital) It is not the immediate growth but the rate of growth that is important. Exponential growth may start slowly but easily overtakes the linear growth pattern.

Luxury Vs. Necessities:

What is a luxury? what is a necessity ? Is bus services a luxury ? Is electricity a luxury ? Something that is luxury today, if it becomes widely available to the population and has a great impact on their life can become a necessity tomorrow. The motor car did that in USA in the first three decades of this century. The electronics industry has done that in the developed nations now and seems likely to do the same in some developing nations also.

In deciding priorities, we should not consider whether a product is considered a luxury or a necessity now, but whether it has the potential of being widely accessible and whether it could make a quantum jump in the life of the population. If it has the potential sooner or later S & T can bring the change.

Problems are opportunities:

A creative mind sees an opportunity in every problem. This is what is meant by "Necessity is the Mother of Invention". A lesser mind runs away. We can't tackle every problem. If we make a balance between the significance of the problem and the probability of solving it in a reasonable period with the given resources, we could have a good project for S & T.

Having clarified some of the basic issues, in the context of the rural situation, let us now look at the types of projects S & T can be applied to

1. Cost Reduction:

Cost reduction is one of the primary application of S & T. Cost reduction extends the availability of an existing services or product to a wider cross section of the people; the benefits from S & T are immediately applied and because the scale of operation is already big the savings are multiplied many times over. Success in such projects also boosts the morale of the people doing the work. There are no extension or marketing problems. This is as important for a government services as for a private enterprise, small or big. A measure of the potential for cost reduction is given by the difference between the final cost of a product or service and the cost of materials that go into it. Another type of cost reduction comes from a radical change in design reduction exercise. Value analysis is a useful technique in cost reduction projects.

2. Improving Productivity:

Improving productivity is another useful activity often allied to the cost reduction objective. But it is much more important than cost reduction itself. Improving productivity usually has an exponential effect. Unfortunately it gets always a low priority in India. When we look for a labour intensive project, we don't need to but we tend to use the labour unproductively. Such programs can be counter productive. Some EGS (Employment Guarantee Scheme In Maharashtra) fall in this category and can spoil the impact of an otherwise pioneering program. When we build bunds, do we need to carry earth and rubble on head loads, instead of using wheel barrows ? If we neglect productivity in labour intensive programs, we are also neglecting it in the Capital intensive Public Sector projects. That is why they don't produce a surplus that could fuel further growth.

We need to look at productivity of simple operations like digging wells, building a bund, even sweeping and cleaning, making pits etc. Productivity cannot be improved unless we first measure it routinely on every job. We must realise that the basis of all S & T is measurement; what we can measure we can improve.

3. Demystification of Science & Technology:

Demystification of S & T is an important area for S & T work. It is not only products that need to be within the reach of all the people. The services also must reach the masses and the knowledge as well. It is possible to make a difficult subject simple, at least to be able to widen the circle of use. But we seem to have a knack of building an aura of mystery around knowledge. I suspect the people who try to mystify science are those who either don't understand it fully and want to hide their ignorance or want to preserve their importance or monopoly. But the if only they become more open they are bound to gain more and not loss as they fear. Knowledge is one commonly that grows when we give away.

The test of true knowledge is in its application and proving in the field. In science Truth always wins. Even if we fail in the beginning, experience is a great teacher and we will build a better science, this way.

#### 4. Product Industries:

While chemical industry is inherently unsuitable for decentralisation, formulated products are suitable for small scale development. There are needs of rural areas which are distinctly different from urban needs. These needs could be met by inventions and formulations for local needs. This should be the way to growth. Plastics and electronics also have good potential for wider spread.

#### 5. Service Industry:

Lastly there are gaps in infrastructure as far as development of rural areas are concerned. All rural population suffer from lack of services. This hinders development. There is therefore immense scope for generating employment by training rural youth in giving these services.

Let us now look at the "Thrust areas, where more effort is needed

#### A. Water

While some parts of the country do have a surplus of rains, the major part has more 250 dry days in a year, and water availability is a problem. We need therefore techniques for development and exploration of water sources, that can be faster, less expensive and more dependable... We also need tests for chemical and microbiological quality of water that could be carried out, if possible in every village. It is not the technology that is to be brought down, but the skills to be upgraded and costs to be reduced. This will enable these services to be extended widely.

#### B. Health and Sanitation Services:

Kits for diagnosis of diseases, based on monoclonal antibodies are becoming available in other countries. They can be used by any technician with a brief training and do not need elaborate laboratory facilities. We should be able to develop and use such kits for tropical diseases. They are potentially low cost services.

Cost reduction in designs of latrines will enable this facility to be extended to more people. Techniques of health services could also be Sanitation in food storage and handling could be improved to improve health standards. In all the above cost reduction would be a major objective.

#### C. Low cost Housing/ construction:

Are we using a double standard for urban and rural areas ? When we talk of rural areas, we sing the virtues of mud bricks, renewable resources local skills and materials. But these are not mentioned in the urban context. Or is this because, this is the only way we can think of for cost reduction.

There is ample evidence that designs and construction techniques have a lot of scope for producing lower cost alternatives. The science & technology of composites

and laminates yet largely unexplored both in the rural and urban contexts. Even facilities like plumbing and sanitation have scope for change, and cost reduction. Productivity also needs to be looked into.

#### D. Agriculture and Animal Husbandry:

The Green revolution has shown what can be done. Techniques for saving water, saving water, effective use of pesticides and fertilisers, identifying bottlenecks in the extension of existing technologies to small and marginal farmers all are awaiting a creative look. Horticulture is poised for a "fruit and vegetable" revolution. Green house cultivation has the potential to be an "industry" within agriculture by virtue of its high productivity, minimal use of pesticides, isolation from ecological constraints etc. This could be for agriculture, what poultry is for animal husbandry.

Forestation including methods for digging pits, protection of plants in early stages, could be crucial subjects for study.

Storage and preservation of food products and perishables (including fruit, milk and eggs) are important economically and we have not gone beyond traditional.

Cost reduction in all these will be possible if S & T is applied.

#### E. Transport, Energy and Engineering services:

This is probably a very fertile field for S & T application in rural areas. Development of services in the countryside is one of the major problems and a golden opportunity for S & T application. It plays a pivotal role in all rural development but has been largely neglected as being the concern of other agencies. Here management techniques, cost reduction (through demystification) and wide technical training will be most important. While industrial infrastructure is always taken care of in development, rural infrastructure is ignored. Beyond starting a state bus services, taking electric poles or cables and now borewells, government planning ignores all infrastructure needs. The quality of these services is very poor and undependable and almost every factor counts against the development of rural areas. It is a vicious circle that needs to be broken.

#### Education:

Education is not at the front of development in our country, but is a follower to fulfill the needs of labour, created by development. Education should lead development, that is the test of good education. Development of teaching/ learning material, tools, kits, techniques all need application of S & T. There is an opportunity to link education directly to development, which will make education relevant and fruitful and which could increase the tempo of development substantially, and save resources.

#### G. Information Storage, Retrieval and dissemination:

This is a key area for all development and with little effort could be developed, but is badly neglected by every agency govt./ or voluntary. Dependable, organised information is a major need for all S & T work as well as development. Crores of rupees and several years of time on big dams have been lost because of faulty data, wrong assumptions. Few agencies have their development work scientifically documented, and even where they are other do not get access to it, quickly. Most people do not realise that information is a valuable product of all development activity, critical for its future pace and direction. Yet we throw it away like rubbish.

#### H Industry:

We need to look for new opportunities for manufacturing industries for rural areas, with their special need in mind. This will depend on the inventive ability of the people.

These are likely to accesssries to agriculture water, housing , trainsport, services, etc. They will lie mostly in the engineering materials (plastics, laminates etc.) and formulation areas. But at present we look only to traditional crafts, ,many of them with uncertain future.

Lastly, we need to know what is the criteria of success, the finish line, for the S & T project. Most tend to stop have they think they have achieved the result, The rest is for extension or marketing people. This is wrong. The project has often to be recast, when a market test shows, the consumer is not happy with it. The S & T project is not complete until the result is proved in the field with the target consumer/ client accepting it repeartedly And the role of the market researcher does not start after the S & T work is over; it starts when the project is being defined.

The final judge of the success of the S & T projectis not the funding agency but the people, who have to use it. It is a slow process, often taking 6-7 years or more. One can mark the milestones on the way to see if one is going the right direction, but there is not simpler easy alternative. This is what the history of all technology has taught us. Rural development is no different.