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APPROPRIATE TECHNOLOGY INNOVATION FOR RURAL INDUSTRIALISATION IN LDCs
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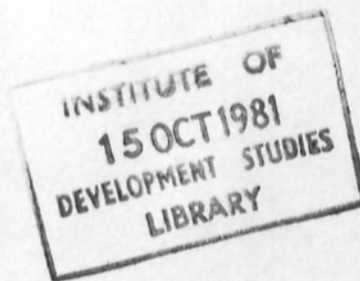
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P.A. Campbell

SUMMARY

Rural industrialisation using intermediate or appropriate technologies is probably the most valid to increasing employment and living standards in LDCs. This involves the design of technologies to suit the very low economic and technical resources of the intended recipients as well as their social environment. Design in this field requires an abnormally wide spectrum of skills drawn from technology and the social sciences. Most of the small amount of work currently being done in the field is product and not market oriented. There appears to be rather too much preoccupation with research instead of development work. It is suggested that some new type of multi-disciplinary organisation with development and not research motivations is required to effect progress.

An investment by the world in large scale rural industrialisation, in LDCs will probably be cheaper in the long run than the financing of the inevitable famines which will result from the settlement of marginal lands by the unskilled undercapitalised surplus populations of these countries.

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Each year Kenya needs about 100,000 new work places. This is around 0.8% of the total population and applying this to Africa as a whole gives a total of around 3 million new places to be found each year. Most of the work seekers have little alternative but to open up new land for agriculture but much of this is marginal and the world can expect an increasing number of famine situations when rainfall is even slightly below normal. Not only is there a need to find other employment possibilities for these work-seekers but it is also desirable, to say the least, to attempt to improve the quality of living of the population.

Apart from family planning which is a very long term solution, rural industrialisation probably offers the most hope for the future. Here one is thinking in terms of simple cheap technologies which can increase employment and production and raise living standards. These have become known as intermediate technologies and as it is often valid to use high level and traditional technologies side by side with intermediate technologies, the problem is one of choosing appropriate technologies. In industrialised countries workers may be capitalised to the tune of \$5000 to 15 000 each but in LDCs there is only a few percent of these amounts available. So one is looking for new technological approaches to create employment opportunities. Such technologies will fail unless they are economically, technically and socially valid and there are few designers with skills covering such a broad spectrum. In industrial countries the mechanisms for innovation are taken for granted; they exist and appear to work. However the industrial structure for innovation scarcely exists in LDCs and this is discussed below.

It is necessary to distinguish between an existing technology and technology innovation. The former requires various facilities if it is to survive and these include markets, supply of skills and materials and a continuance of any necessary organisations required for that technology such as management structure, spare parts etc. These aspects are not without their importance in many LDCs.

Technology innovation means the introduction of new hardware, software or skills. Hardware includes machines, products such as fertilisers etc. Software includes manuals, texts etc. Skills may be introduced through either formal training which requires trained teachers or informally through self-teaching which requires an appropriate amount of existing technical skill by the individual plus new software.

In developed economies most innovation is through new hardware which is designed for the market. Motor cars are designed for those with minimal mechanical skills. A new product which demanded a high degree of new skills from the buyer would need specially designed training courses. Innovation through software requires the presence of authors willing to write and in the technical field, trade associations play a major part in designing and diffusing innovations, mainly in methods of doing or making things. Innovation through training is limited to special short courses as the introduction of new full courses within the educational sector follows a decade or more after their need is established.

In LDCs most innovations are through hardware and salesmen for tractors, fertilisers, tools etc. abound. Whilst there are usually some natural financial constraints to purchasing overmuch hardware, it is not generally realised that many of the purchasers have not the educational background to be able to learn to administer such hardware properly. There is very little software (other than commercial) as there is no profit for authors or publishers (as printing runs would be very short) and there are no trade associations. Nor is there any recognition by national or international organisations that such software is necessary. Students of building learn from English text books. UNESCO has stated that it is not interested in sponsoring books. Skills acquired through self-teaching cannot be developed as the software does not exist, nor is the general level of technical education in rural areas high enough for most people to absorb even simple software, ignoring language problems.

Generally the rural population has not the finance to purchase more than the simplest hardware nor the skills to absorb the software if it existed.

Most of the technologies required would probably fall under the heading of what are commonly called crafts and these are often freely

moved from one country to another. What is ignored is that crafts which involve local materials can seldom be transplanted without modification. An example of this is the generally poor reputation accorded to timber in Kenya. Most of this can be traced back to bad seasoning and subsequent warping and this is because none of the timber trade courses teach the air seasoning of timber because this was not in the syllabuses transferred from Britain some decades ago. The result of this is loose-jointed wooden chairs and a preference for steel furniture. No doubt this will sort itself out in several decades but can we accept change with this sort of time scale? Attempts to change this have been made with limited success and some lessons have been learnt. This is but one example of maltransfer of technology.

Most attempts at innovation in LDCs are through hardware and are naturally product oriented. This approach is also used by most of those concerned with appropriate technology and there are many products in search of markets. There is little or no information on how to select and design a product for a particular technical situation.

Nor is there information on how to design for diffusion. A solar steam cooker to save the cost of charcoal (and preserve trees) might be disseminated through a large manufacturer or through small scale production in villages. The levels of skills and products available would differ and the designs would reflect this. In other words the hardware would have to be designed to suit the means of diffusion.

Perhaps the most neglected area is designing for a particular society. Attempts to introduce fish farming and pedal power have failed through rejection on social grounds. An attempt to improve the milk yields of a herd by the introduction of a grade bull failed because the society was not persuaded to separate the other bulls from the herd. A proposal to introduce a maize meal mill will fail because the men in the society control the money and the women currently grind by hand. As womens lib is somewhat backward in a Muslim village, the technology is invalid.

So it is necessary to consider the structure of the society when selecting technologies. Whether technologies should be designed to suit the society or societies changed so that they can absorb new technologies is more than academic interest. But it is valid to ask.

who will decide? Will it be technologists ignorant of sociology or non-technological sociologists? Whilst technology is oriented towards design, most of the social sciences appear to be observational rather than experimental. Perhaps one should not experiment with people but no one seems to object to technologists building dams and roads and thereby changing societies. Perhaps sociologists and economists should develop design techniques.

Returning to technology innovation, it is of course possible to innovate through formal training. Apart from the time lag mentioned earlier, there is the fact that in LDCs the format of training has been transferred from industrialised countries by an education sector isolated from the industries they serve. Close contact with industry is no aid to the promotion of carpentry or civil engineering teachers. The whole format is oriented towards certificate type courses which invariably require a lot of practical training before the individual is fully qualified. Most of these courses are designed for the most modern part of the industrial sector which is in the towns and this is not of much value to rural areas. The informal education sector (village polytechnics, rural institutes of technology) are under heavy pressure by students and others seduced by the high wages and high status of the modern sector to provide courses similar to those of the formal education sector.

It has been suggested in some quarters that universities should initiate action in developing intermediate technologies. Granted that most of the theoretical skills are available, there is still a deficiency in practical experience. Moreover it is important to recognise that the principle motivation of a university is biological i.e. the reproduction of researchers. So it is unlikely that any staff which did become involved would gain any credit for promotion; it would probably retard their careers.

Through the literature on the problems of LDCs there is frequent comment on the need for appropriate technologies but the only concrete suggestions coming from these documents is that there should be more research. In fact there is less need for research than there is for full scale field experiments. There is in LDCs an almost automatic prescription for more research when things go badly. This has resulted in a plethora of research establishments which bring kudos to donors, research workers and the institutions themselves but are not always of value to

the LDC concerned. They contributed to what Hans Singer has called the "internal brain drain." and many may be described as the unimpeachable in genteel pursuit of the unprofitable. There is a common assumption or rationalisation that "useful" research will in some manner influence the future. To some degree this may be true in developed countries where there are sophisticated private and public sector bodies which have the resources to absorb and convert research to practical usage. But in LDCs where such bodies are rare, the assumption is often invalid and much of the research can only be classified as a luxury.

There is a clear need for some new type of body to design, develop and disseminate appropriate technologies in rural areas. It would have to be multi-disciplinary in nature and probably staffed mainly by applied social scientists and technologists and contain a strong feedback mechanism so that ^{it} does not follow the common pattern of reinforcing failure. The design of such an organisation would be a challenge. To provide adequate career motivation for highly qualified staff, especially local staff, in fields other than research would not be easy. A possible model is one of the more active trade associations in Britain.

It is very doubtful if such a body could operate under an individual ministry; on economic grounds it would probably have to operate on a regional basis. One of its main tasks might be the production of software in the form of manuals, technical news papers etc. to reach what Jolly and Singer have called the "informal employment sector".

What would be the cost of such an organisation? Probably this would be no more than that of one of many existing research bodies set up to add to human knowledge on some narrow topic.

The design and diffusion of appropriate technologies is unusual by current design practice. The present effort in this field is puny and to some degree irrelevant except to focus attention on simple technologies.

Within a time scale of a decade there seems to be no reasonable major alternative to rural industrialisation for absorbing surplus labour and improving food supplies. The growing use of marginal lands

can only increase the probability of future famines. The recurrent costs of these to the world (i.e. the industrialised countries) can only increase. Even if an attempt at large scale rural industrialisation in LDCs, cost the equivalent of a years famine relief and was only 25% successful, is might not be a bad investment.