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Distr.
LIMITED
ID/WG. 282/101
17 October 1978
ENGLISH

08576

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

INTERNATIONAL FORUM ON APPROPRIATE INDUSTRIAL TECHNOLOGY

New Delhi/Anand, India 20–30 November 1978

WORKING GROUP ON CONCEPTUAL AND POLICY FRAMEWORK FOR APPROPRIATE INDUSTRIAL TECHNOLOGY

AN APPROACH TO THE DEVELOPMENT OF APPROPRIATE TECHNOLOGY,
~~Background Paper~~

id. 78-7125

AN APPROACH TO THE DEVELOPMENT OF APPROPRIATE TECHNOLOGY

by

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Acceptance of an appropriate technology is now widespread. As a result, a large number of new organisations have sprung up both in developing as well as developed countries. It is unfortunate that there is a wide divergence as to what alternative technology should be and as a result there is confusion and lack of direction. The sum total of achievement is too small to have had much impact in the real world of production. This divergence is apparent from the various terminologies used, i.e. intermediate, low cost, need based, labour intensive and appropriate. Many other criteria are added, such as, "socially acceptable", "based on local raw materials" and "producing for the local market". The same divergence is apparent in application as well as theory. The organisational aspects are often called "soft ware" and can be classified as follows:

(i) Documentation and information services

(ii) Economic analyses

(iii) Policy and planning

Activities in the field are called "hard ware" and are limited to:

(i) Training and demonstration of techniques

(ii) Finding the technical solution of the local problems and making it work

In a new movement there is always some divergence. Initially it is helpful to take the movement further, but there is a limit to the usefulness of semantic debate. The stage has been reached where if this divergence is not resolved and a positive direction and methodology is not evolved, there will be a danger of the Appropriate Technology Movement sinking in its own wake.

The concept of appropriate technology arose mostly in the context of the developing countries. The application of the proven, large scale, mechanised technology in these countries over the last three decades has often created more problems than it solved. The increasing incongruity between high cost inputs and inability to create new jobs has created grave doubts as to the appropriateness of large scale technology. Technological skills, capital resources and social and economic conditions differ widely from one developing country to another. One reason for the divergence in the definition of a new approach to technology is related to the different experiences of the various developing countries. This divergence could be resolved

if the basic imbalances created by present day technology both in developed and developing countries is taken into consideration. A totality of approach is possible for the development of appropriate technology with universal application.

The basic imbalance of the present day technology is its inherent largeness, i.e. being only viable at higher and higher levels and skills of production. The levels continue to rise due to constant massive expenditure on research and development. A rough computation will indicate that scales of production during the last 75 years have increased 10-20 times.

On the social plane, the effect of this is what is commonly called "the rich getting richer and the poor getting poorer". The input requirements to practise such technologies, financial, managerial and technological, are within reach of a few who get the major benefit and thus become more affluent. The employment created, though at higher wage levels, is at the expense of throwing many more out of employment. The other effect is concentration of jobs into urban areas which keep on growing into bigger and bigger complexes, wherein the common man loses his identity and personality and has to accept a sort of economic slavery.

At the regional level, the effect of largeness is to concentrate productive activities into a few locations because of the lack of infra-structure outside. These locations grow bigger and bigger, from urban to metropolitan, maybe reaching the megalopolis stage within the near future. These areas amass most of the wealth of the country, putting out of business any small and indigenous industries in the rural areas. To meet the cost of infra-structure, fiscal policies are so maintained as to draw the savings and earnings of the people outside the towns. The green revolution, for example, has increased the productivity of the farmer in rural areas and his income has gone up, but all the basic inputs have to be imported from cities. Local production of these inputs, like agricultural implements, has been put out of business; thus the rural area not only has to pay back the higher capital costs of the green revolution, but it loses the income from local industrial activity.

On the international plane, the effect of largeness is similar to what is suggested above for the urban and rural areas within the country. There are two divisions - "developed" and "developing" countries. The first group, constituting about 20% of the world population, is very affluent and its standard of living, even for the common man, is much higher than the rest of the group, which constitutes 80%. The other effect of this largeness of the technology is that it must continue to grow vertically - it cannot remain static. If its growth slows, employment levels go down and social instability is created through continued efforts to utilise surplus capacity. These efforts are channelled into three directions: (i) exploitation of other countries by creating markets in those countries; (ii) increasing the amount of service and maintenance production; and (iii) increasing the production of war materials. Higher imports by a country of the

goods from another country always imbalance the economy at the expense of the common man in these countries. Large scale industry can use quite large parts of its own production to maintain both its machinery and services. The amount of production for the replacement and maintenance of the industrial complex is estimated to be about 20-30% of total production. The amount required both in terms of transportation and other services consumes another 30-40% of production. This consumption appears to be necessary in this content, but it has no capital formation value and it survives by adding to the cost of production by industry and from heavy taxation by the government. So, this parasitic component of about 60% of the total production could be avoided and inflationary trends would diminish.

For these reasons, there is always a tendency to stock-pile war materials, even though they are not needed; they can be consumed much more quickly than any other commodity, even in a war of short duration. The practitioners of such present day technology therefore try to build up a high component of the "defense expenditure" in the industrial complex. When the consumer goods do not have a market, the production of war material is increased, which involves the creation of tensions and war-like situations which increase sales further. Other effects of the largeness of the present technology are well known in the shape of pollution of the atmosphere and rapid consumption of non-renewable resources.

It is obvious from the above that an alternative or appropriate solution has to confront the scale of present day technology and to keep it on a lower level, giving it no particular reason to expand. If this criterion could be met, the resultant industrial units could be widely dispersed even in remote rural areas. They would create employment, increase capital formation, lead to higher standards of living and mitigate factors causing migration to urban areas. Experience shows that such small units are more labour intensive, requiring comparatively less capital investment through, for example, selective mechanication, i.e. the degree of automation is less and many of the processes are carried out by labour in place of machines. Moreover, the wastes and effluents occur in lesser quantity over a longer period and thus nature gets a chance to redress the balance. The pollution hazards and ecological imbalances would be automatically reduced without requiring huge capital investments for cleaning or removing the discharges. The dispersion of rural industries in many small units offers promise of a greater utilisation of renewable alternative energy resources, such as solar, wind, hydro, wood and bio-gas, which also tend to be dispersed and are of low intensity.

It is obvious that almost all the criteria laid down for appropriate technology in the preceding paragraphs can be met by inculcating the idea of smallness in industrial production in place of largeness, and by developing technically feasible and economically viable small units.

Would it be possible to reduce the scales of production yet keep both quality and cost in line with that of large scale technology? The economist will usually reply in the negative; the technologist may disagree.

Man is a tool-using animal. Right from the dawn of history he has been trying to improve the efficiency of his tools until the advent of the industrial revolution, which meant the introduction of mechanical energy into productive activities. The power behind a tool is muscular only; it cannot suffice for larger scale productive activity, but mechanical energy has no such limitations and a very large concentration of power can be achieved. Wherever engineers have designed tools for larger units, efficient tools for a smaller concentration of power have also evolved. Large scale technology during its growth has thrown up such processes many times. The vertical shaft cement kiln is one such example which can be as efficient and economical as the rotary kiln for cement manufacture. Yet on many occasions, work done for evolving lower power processes has not found acceptance when used under actual field conditions.

A technology programme has to take account of three facts:-

(i) Product preference: it must be possible to manufacture the types of articles which are acceptable to the society. There should also be flexibility to adapt to changing needs and tastes.

(ii) Technique: i.e. plant, machinery and processes capable of organising the manufacture and production on as small a scale as possible yet keeping the product quality and cost competitive with large scale production.

(iii) Organisational pattern: which means ownership, financing and marketing organised in such a way that the surplus formed by this activity may be available at the lowest level and thus be instrumental in further development in the immediate locality.

Unless the above three aspects are well integrated, the chances of success of the programme are slight. To illustrate this point, one may have an appropriate technology for producing cloth, but unless the quality of the cloth is acceptable to the society, the technology will not be adopted because it does not serve the purpose. Or, even if these two factors are harmonised, the technology may still not be workable if the proper types of entrepreneurs and organisations to own and work it are not available in a particular situation. ACRA has evolved a pilot project approach for an integrated package which takes into account the following factors: (i) proper product selection; (ii) specification of the technically feasible and economically viable production processes; and (iii) identification of the right type of organisation for ownership and operation.

Our methodology for developing such technology is as follows:-

Stage I : Survey and Analytical Studies

The objective of the surveys and studies are to identify the areas in which integrated packages of appropriate technology could be developed by a pilot project approach. The studies consist of:

(a) Exploring the potential of the technology.

(b) Definiting its present status in the country

(i) as a large scale modern industry

(ii) as an indigenous, local or artisan type of industry.

(c) Improvements and developments carried out to scale up artisan or indigenous units or to scale down the large scale units.

(d) Isolating technological gaps and other problems to be overcome.

(e) Identifying factors which make it possible for a smaller unit to be successful.

The studies will reveal the state of art in the technology in question. The data and information collected will also prove useful for other research workers even if it is not encouraging enough for a pilot project. Such studies are being published by the Association.

Stage II : The Pilot Project

A. On the basis of the survey and analytical studies, a pilot project is prepared covering the following points:

(a) Background need

(b) Objectives

(c) Product specification

(d) Organisational pattern

(e) Technology

(i) Sources of availability and operational advice
(ii) Process details
(iii) Machinery specifications
(iv) Manpower needs
(v) Capital cost structure and total funds required
(vi) Operational details

(f) Timing and extension methodology.

B. The pilot project proposals are published and circulated to get collaboration and funding response from interested agencies and organisations, leading to:

(a) Initiation of the erection, installation and operation of the pilot unit either on its own or in collaboration with other agencies.

(b) Erection, installation and operation of the pilot unit under realistic field conditions.

Stage III : Working of Integrated Package

Depending on the results of the pilot project, steps may be taken:

(a) To build up integrated package plant with complete design specifications and technical literature.

(b) To offer it to entrepreneurs by guaranteeing technical know-how and technical help for installation, erection and operation advice.

(c) To initiate machinery manufacture by making available drawings and designs to technical personnel and machinery manufacturers.

(d) To disseminate the knowledge of the technology by publishing technical and operational literature and by holding seminars and arranging technical training programmes, etc.

The result of the development work carried out is published as case studies.

Stage IV : Research Programme

Large scale industry is supported by extensive research and development efforts aimed at maintaining the pace of progress. If appropriate technologies are to remain competitive, they also require that constant research and development be undertaken. The Association therefore seeks to establish the means by which appropriate technology research and development continues with an inherent momentum and dynamism of its own. The objectives of the fourth stage are:

(a) To initiate and organise the development of higher efficiencies in the integrated package plants, in collaboration with the owners, on a cost sharing basis.

(b) To refer problems of a more fundamental or long term nature to universities and research institutes for solution.

(c) To organise and build up institutions which can carry on the research and development work in future without the technical help and guidance of the ATDA.

By these means, the Association tries to ensure that small scale technologies continue to evolve and remain competitive in the face of advances by large scale industry.

The areas for development are of three types:

A. Industrial activities to increase the money flow in the area where it is limited. Some of the possibilities are:

(a) Cement making
(b) Paper making
(c) Cotton spinning
(d) Jute spinning and weaving
(e) Wool spinning
(f) Chemical fertilizer manufacture
(g) Improving the efficiencies in existing mini sugar technology
  (i) Manufacture of liquid sugar from molasses
  (ii) Plate evaporation
  (iii) Screw press for higher extraction

B. Industries which can be owned and operated by a small man at a much lower level:

(a) Handloom weaving
(b) Blacksmithy
(c) Carpentry
(d) Extraction of vegetable oil
(e) Village pottery, both red clay and white ware
(f) Village tanning and shoe making
(g) Rice milling

C. Technologies which provide inputs both for industry and home needs:

(a) Village power pool

(b) Village sewage disposal system and environmental sanitation

(c) Village transport

(d) Bio-gas

(e) Solar cookers

(f) Animal husbandry

(g) Social forestry and forest based industries

(h) Improving tractive efficiency of small tractors

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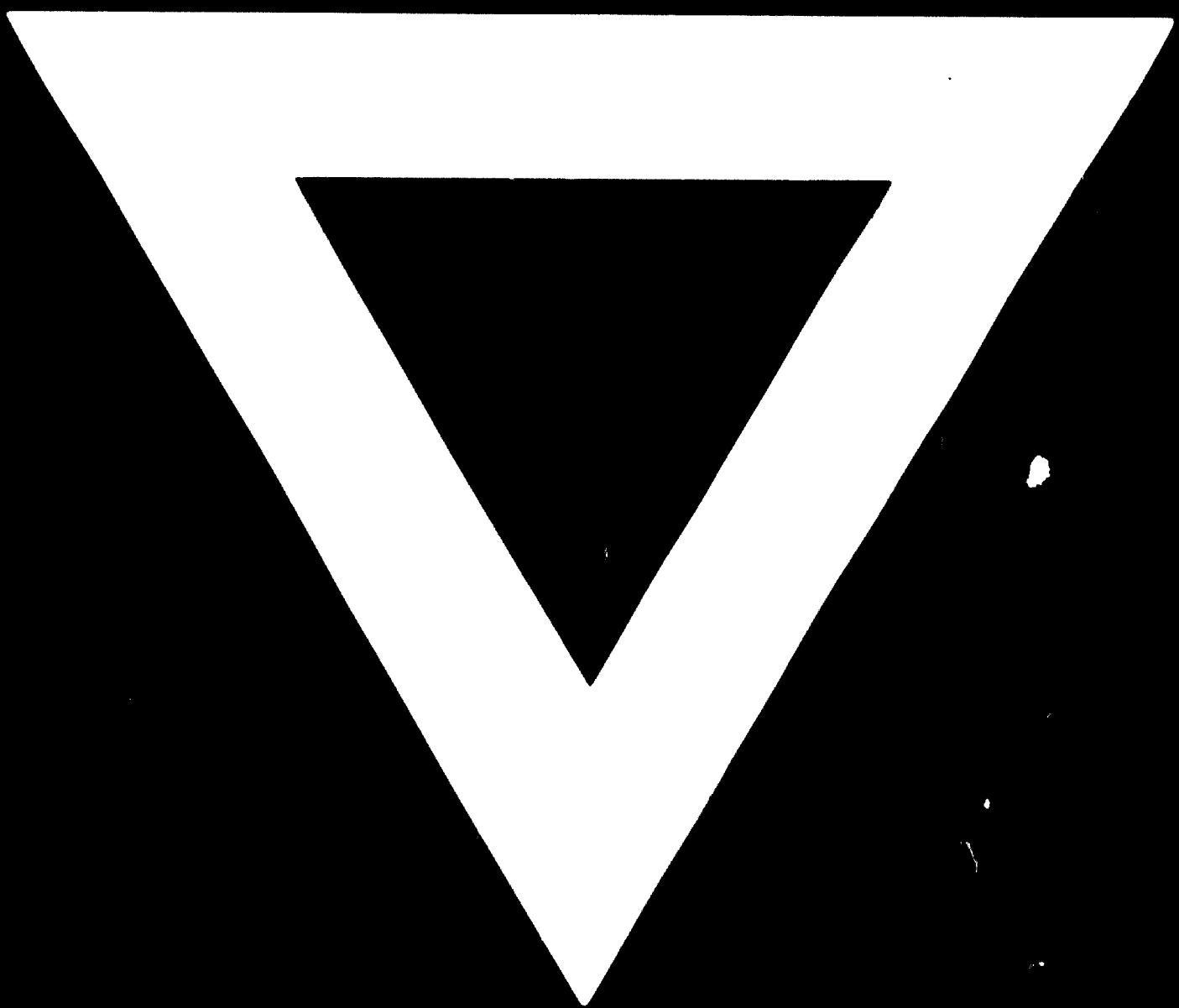

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