APPENDIX 'C'

SOME EXAMPLES OF PROMOTION OF "APPROPRIATE TECHNOLOGY"

IN THE CERAMIC FIELD (SISI, NEW DELHI)

1. Two pattern down-draught kilns of 10 ft. dia. were got constructed, one in the premises of the Central Research Institute and the other at the Porcelain Appliances Corp. Ltd., Rohtak Road, New Delhi. The cost of the construction of both the kilns was pretty low. On enquiry from the C.R.R.I., it has been observed that the cost of such kilns with flue and chimney comes to Rs.9,000/-, whereas other constructions cost about Rs.13,000 to Rs.14,000. This kiln was constructed for making Reactive Surkhi, which is just a Pozolana cement. As the temperature was not to go beyond 1000° C, the walls of the kiln were kept about 2', whereas in other such kilns the walls are 3'. The C.R.R.I. authorities have very much appreciated this construction. As this is a prototype of the kiln, the C.R.R.I. people have advised all the entrepreneurs for making of Surkhi to approach SISI, New Delhi, who are receiving a lot of enquiries and supplying blue-prints of different types of down-draught kilns to various parties throughout India.

2. Messrs. Abrol Engineering Works, Kapurthala, had approached SISI, New Delhi, as well as the Ludhiana Institute for the services of a ceramic expert in order to guide them in the manufacture of electrical porcelain.
The party had been given a number of technical advice and most of them they have implemented. Previously, the party was purchasing glaze from a commercial glaze manufacturing concern at Rs.35 per maund. They were given a suitable composition for the glaze which would cost them Rs.13 per maund. The party had experimented and got satisfactory results. In the past, their saggers did not last even one firing and got bent or broken during the first firing operation. They had been given a suitable composition for the sagger composition and now their saggers last for 7 to 8 firings. The breakages of saggers had been considerably reduced in this unit and it is estimated that the firm has been very much benefited by introducing new type of glass and the new saggers.

3. Messrs. Bimal Brothers are manufacturers of vacuum formed plastic articles. In the past, they were using metallic dies for making such articles. As the clays were very costly, they were suggested to use plaster of paris moulds and dies; and the Institute helped them in making such moulds. Now the party informed that the plaster of paris moulds for wash-basin, which were made for them, work very satisfactorily and the initial cost on the dies and moulds making is very negligible. The results were also very satisfactory.
4. Messrs. Palam Potteries, Palam, are manufacturers of crockeries and electrical porcelains. In the past, they were using some costly clays like Ahmedabad and Delhi clay. SISI, New Delhi, suggested them to use Torda clay in conjunction with other clays. Tor da clay is very cheap, burns white and can be used as such without washing. The cost of production in this factory was considerably reduced.

5. Messrs. Sham Ceramic & General Industries, Faridabad, were helped in starting a new ceramic unit and they have installed an oil-fired kiln instead of a coal-fired one. It is expected that this kiln will be more economical and efficient than the coal-fired one. Time oil-fired kilns can be fired during a month and thus the production will be more in one kiln.

6. Messrs. Dayal Potteries, Berdarpur, were given a design for making a low-cost furnace for testing their firebricks, before supplying the same to various government departments. This furnace was constructed under the guidance of SISI, New Delhi, and is now working very satisfactorily. The party tests their products before they are supplied to Railways and other government departments, at one-third of the rate it had to previously pay the Test Houses; and the party has not to run after the test houses for testing products.
7. Messrs. Delhi Plaster Industries, Palam, are manufacturers of plaster of paris. In the past they were firing plaster of paris with wood, and a different type of furnace was made by them. The officers of SISI, New Delhi, had helped them in constructing a new type of calcination furnace, which is meant for plaster of paris and now the party reports that their calcination operation is quicker and better than the old one and is at half the rate, they would have to, otherwise bear.
RECOMMENDED ACTION PLAN

There are several existing agencies dealing directly or indirectly with an industrial technology and its improvement: (i) The development of Technical Development, Ministry of Industrial Development; (ii) the Small-Scale Industries Development Organisation (SSIDO) with its national network of Small Industries Service Institutes (SISIs) and Prototype Training-cum-Production Centres (PTCs); (iii) the Council of Scientific and Industrial Research (CSIR) with its national network of research laboratories and institutes; (iv) the Small Industry Extension Training Institute (SIETy Institute), Hyderabad; and (v) the Planning and Action Research Institute (PARI), Lucknow. These are the agencies to which the responsibility for promotion and carrying out applied research in low capital technology should be assigned.

A tentative formulation of the functions and areas of operation of these agencies would be as follows:

<table>
<thead>
<tr>
<th>Agency</th>
<th>Function</th>
<th>Area of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Dev. Ministry/DSTI (including appropriate technology cell)</td>
<td>a) Promotion</td>
<td>All types of industries</td>
</tr>
<tr>
<td></td>
<td>b) Co-ordination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Screening of applications for licence from the technology angle</td>
<td></td>
</tr>
<tr>
<td>Agency</td>
<td>Function</td>
<td>Area of operation</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>ii. SIET Institute, Hyderabad</td>
<td>Applied research in low capital technology</td>
<td>Small-Scale Industries</td>
</tr>
<tr>
<td>iii. SSIDQ/SISI</td>
<td>Promotion &amp; Technical guidance</td>
<td>Small-Scale Industries</td>
</tr>
<tr>
<td>iv. PICA</td>
<td>Applied research in low capital technology</td>
<td>Small-Scale Industries</td>
</tr>
<tr>
<td>v. P &amp; ARI</td>
<td>Applied research for technological improvement</td>
<td>Labour intensive sector (household and hand industries)</td>
</tr>
<tr>
<td>vi. CSIR/network of laboratories and institutes</td>
<td>Promotion &amp; Applied research</td>
<td>All types of industries</td>
</tr>
</tbody>
</table>

All these agencies which may be collectively designated as low capital technology group (LCTG) will have to work in close co-operation with each other and the demarcation of area of operation is only meant for the sake of division of labour. After all, they have all once common goal, viz., promotion of technologies suited to the requirements of the country. Their success depends almost entirely on their enlisting the close co-operation of industrialists for whose benefit low capital technologies are going to be explored.

There are four ways in which the LCTG can endeavour to device, promote and encourage the use of low capital technologies; (i) at the level of the individual from working with entrepreneur-managers or boards of management;
(ii) through industries' associations; (iii) through publication of plant guides or "model schemes"; and (iv) through the Industrial Licensing Committee at the time of licensing individual industrial undertakings.

Since it is the individual entrepreneur-managers or boards of management who make decisions concerning expansion of existing enterprises or establishment of new ones, it is necessary to work with them and canvass new ideas. There is generally a tendency among industry owners and managers, specially those who have had training in advanced countries, to go in for the most modern technology regardless of economic viability in terms of social costs, and sometimes even of long-term private costs. This tendency can be corrected through proper counselling at the time of decision-making. This may be done through the Licensing Committee in respect of large and medium industries at the time of licensing expansion of existing production capacity or establishment of a new enterprise. This committee may be in a position even to exercise a certain amount of compulsion on industry owners. However, enough work should be done to suggest low capital technologies before applying such compulsion.

In the case of modern small industries and the household industries which do not come under the purview of the Licensing Committee, counselling services should be provided by the extension services of the SSIDO and the SISIs, the P & API, Lucknow, the CSIR, and SIET Institute. To begin with, such services may be provided intensively to the new breed of technician entrepreneurs
who are entering the industrial field under the auspices of various government assistance programmes. Similarly, work can be initiated on the types of equipment most suitable for industries working as ancillaries to large undertakings in major industry groups.

In respect of both large, medium, small and household industries, their active co-operation should be sought in setting up applied research facilities to investigate into the potential of low-capital technology. Apart from individual enterprises, the co-operation of the industries' associations throughout the country, including in particular, national organisations such as the Federation of Indian Chambers of Commerce and Industry (FICCI), the Federation of Associations of Small-Scale Industries (FASII) and the All-India Manufacturers' Organisation (AIMO), should be sought. It will be enormously easier to propagate new ideas through them because they will not only afford facilities for investigation but also act as effective media for spreading the concept of low capital technology. It will also be easier through them to convince industry owners that low capital technology does not mean use of antiquated methods of production or equipment but the use of equipment that is most appropriate to a given process of production, and therefore, the most economic one.
The publication of "plant guides" or "model schemes" for selected product lines which concretise the modus operandi of combining capital and labour so as to economise capital without sacrificing efficiency and product quality would further strengthen the efforts of the LCTG in promoting low capital technology. It will also be a measure of assistance to prospective entrepreneur-managers who need to take decisions regarding the technology to be employed. Work of this nature is being done already to a certain extent by the CSIR laboratories and institutes and the SSIDO and this should be strengthened. In addition, appropriate facility should be set up at institutions like NITIE (National Institute for Training in Industrial Engineering) to cater specially for modern small industries the development of which has been given a high priority in our national plans. Such a facility should be staffed by a team of well qualified and experienced technologists, industrial economists, industrial engineers and management specialists and research investigations should be carried out by them on a continuing basis. New ideas developed by them can be disseminated directly through the SSIDO's national network of SISIs and other developmental agencies at Central and State Government levels.

Limiting factors

While the adoption of low capital technology can no doubt bring in a lot of benefits to the national economy, certain limiting factors to its use should be noted,
Other things being equal, limits to its use are set by the existence or otherwise of a high level of human organisation and skills. There is first of all the need for institutional support in the form of helpful and effective government policy, existence of applied research facilities and agencies for dissemination of new ideas, and trade union co-operation in the education of labour to play its part well. There is also need for management support for introducing capital saving technology. A wide variety of skills are also required to push the idea ahead, viz: the development of indigenous engineering and design capabilities; the training of a high level of management skills; and an equally high level of manufacturing skills. Just as it has involved a lot of research and hard work to develop the most sophisticated machine, so does the development of the most sophisticated worker, technician, and manager. It, therefore, means that a well-thought out programme for the training of entrepreneurs, workers, technicians, engineers, managers and trade union leaders will have to be mounted for the successful promotion of low capital technology. Finally, policy supports are also needed to prevent the distortion of prices of various factors of production, particularly capital and labour. In other words, measures will be required to maintain the price of capital and wages of labour at a level consistent with the substitution of capital by labour, if the entrepreneurs so decide.
Need to make them bold

The enhancement of appropriate technology and/or of proper industrial growth, depends upon numerous day to day decisions, large and small, of which many may require a trial and error approach, and unless the agency proposed for handling such work is willing to risk mistakes with implicit approval of the government, it will fail to make much headway. It is well-known that when mistakes are made in government institutions, the blast of criticism and chastisement place a damper on the vigorous experimentation, which is essential for this type of work. If a civil servant does 9 good jobs and 2 bad jobs, he may not be rewarded for the good ones, but for the bad ones he alone has to suffer. The already slow process of bureaucratic decision making is, therefore, further slowed down, and the civil servants in order to escape troubles and explanations, freeze into rigid attitudes.

The Ford Motor Company of U.S.A. invested some 300 million dollars in building a new model of a car which turned out to be a flop and the Company suffered a huge loss. Not a single finger was raised against this as the shareholders were mainly concerned with their dividends which the Company managed to pay, but had it occurred in a public sector undertaking, the fate of the persons in charge and the government in power responsible for this could better be imagined than described here.
It is, therefore, essential that if any agency is made responsible for this type of developmental work, the government has to protect it and ignore the losses made by it and not only that, but lots of funds will have to be placed at the disposal of the agency for experimentation and developmental purposes which may not give any dividend in the near future, but ultimately proved helpful and beneficial for the healthy development of industry with appropriate techniques.

If real headway has to be made, any one single agency will not be able to do much. All those who are in one way or the other helping development of industry, or running industry, will have to shoulder the responsibilities and lend a helping hand. The large scale industries, especially of the consumer engineering items type, will have to evolve simpler and cheaper technologies and to diversify their requirements of components to smaller units helping them with single-purpose, simple and cheap machines which could be operated by semi-skilled workers. Even for their own requirements the large scale units may have also to resort to such technology. In other words, as far as possible, the production by assembly line methods may have to give place to diversified products in small units.

'Appropriate technology' should be given a concrete content, should be made amenable to measurement and given a formulation which can be put to practical use. For this purpose Four Regional Appropriate Technology Centres and a Technological Information and Extension
Service would be needed. Details about this proposed measure are discussed in the following part of this chapter.

**Proposed outline for Regional Appropriate Technology Centres**

In the present Indian context, the problem of developing appropriate technology has two facets:

(i) Upgrading the subsistence level technology used by the smaller entrepreneur so that his products attain an acceptable standard both in the home market and for export abroad. He is also able to invest for further development.

(ii) Simplify some of the processes and machines so that the capital cost is reduced, plants made smaller in capacity to meet the small market. Plants can be so modified so that they are able to use local raw materials and can be handled and repaired by local skills.

2. The development of appropriate technology is a syndicate procedure and calls for a joint effort on the part of the innovative technologist/engineer, economist and management specialist. Along with the development of technology, suitable managerial and technical skills will have to be developed and disseminated to the entrepreneur who takes up these new technologies. It may be mentioned that some of the skills which are built in machines, in modern technology, will have to be performed by men. And lesser the capital intensity in the project, the greater the managerial and technical skills required.
to optimise the use of the capital if a product of equivalent quality and price has to be produced.

3. The main difficulty in the promotion of such technology is the lack of organisational support like marketing, interlinking of the product manufactured by one unit with another, quality control, quality marking, etc. e.g., though several very small solvent extraction units are technologically feasible, the units so developed find it difficult to market the de-oiled cake produced. (The de-oiled cake has to be exported). Similarly, small cattle-feed units find it difficult to sell their produce as there is no linking of cattle-feed units with dairy development projects, milk procurement centres etc.

4. The problem in developing and promoting appropriate technology calls for an integrated approach from the research lab to the design office followed by action studies in the field situation. The proposed centres should not hesitate to experiment with new ideas of capital saving methods and should be willing to build up proto-types and try them in the field. Organisational structure for such an institute should have on their staff, very competent, technologists/engineers, economists, management specialists, cost accountants and extension agents. Each of these Regional Appropriate Technology Centres should also have a drawing office, laboratories, workshop and pilot plant facilities.

5. A few action steps

Some of the steps these centres may have to take for developing and promoting appropriate technologies
are the following:

(i) Identify technologies that can be taken up for study. For this, it is suggested that ubiquitous industries, i.e., industries that have scope for development in a number of areas should be taken up. Area studies done by various organisations will be helpful in identifying such industries. A suggested list (indicated in Annexure II) based on discussion with various institutions, Government/semi-Government organisations and with the Intermediate Technology Cell, Government of India, is appended to this chapter.

(ii) Survey the different processes, sizes of plants, and types of equipment available for the manufacture of a particular product or for the performance of a job. Survey need not be restricted to this country alone. The study of growth of technology over years would also be of value. The survey would point out gaps in the range of technology available in respect of

   a) Capital cost  
   b) Capacity  
   c) Capital cost/unit of production

(iii) The survey would also indicate:

   (a) as to whether there are gaps in the technological range available. Filling up of these gaps would help an entrepreneur in making rational investment decisions as he can choose from a range of technologies.
to suit a particular requirement. Many a time the entrepreneur selects a particular technology not because it is the best course but as there is no alternative available. This results in high cost of production either from low utilisation of capacity or from non-availability of skilled labour, etc.

(b) filling up of the gaps will also help the extension agencies in selecting technology most suited to backward areas and smaller towns. This is particularly true as the appropriateness of technology is related to the degree of development, and that what is appropriate for a metropolitan town may not be suitable for a small district town; and what is suitable for a state like Punjab may not be suitable for a backward district of Madhya Pradesh or Bihar.

(iv) Having established the technology to be studied, the next step would be to analyse it into various elements to establish as to whether the particular step needs simplification or sophistication. Suitably modified designs and drawings for the production of prototypes should be prepared. Norms will have to be developed regarding the 'appropriateness' of a particular technology. Some of the criteria could be:

(a) Possibility of repairs with local skills
(b) Suitability for use with indigenous raw material
(c) Ability to work where power failures may be more often
(d) Highly skilled labour may not be available
(e) Nature of toolings
(v) Technology developed should be field tested. This can be done by adopting one or two of the Rural Industries Project Districts. Entrepreneurs' acceptance of the technology would need to be tested. Field testing will also help in understanding the marketing problems, raw material procurement problems, maintenance problems, etc.

(vi) Since it is anticipated that the appropriate technology may have to co-exist with other technologies, it would be necessary to provide some institutional support in the initial stages. It is not presumed that products from appropriate technology are not competitive or of inferior quality. This developmental support can be withdrawn subsequently or the support itself can be paid for by entrepreneurs. The centres through their research studies will have to assess the nature and extent of such support.

(vii) For new research done, the centres will collaborate with the National Laboratories and help them in translating the research into technological reality. Likewise, it should also continuously engage itself in modifying the technology developed in other countries so that they can be transferred to our country.

(viii) The centres can prepare project reports for industries based on low cost technologies and promote decentralised manufacturing activities.
6. Organisation

These centres for the development of appropriate technology should be headed by a Director General and assisted by three Directors and six Deputy Directors with different subject specialisations. It is not possible to cover all the branches of science and technology with this much of senior staff. This nucleus staff can collaborate with specialists in the Small Industries Service Institute and the National Laboratories under the CSIR for specific projects. They will also take help from special institutions like the Central Machine Tools Institute at Bangalore and the Central Institute of Tool Design at Hyderabad. The Institute will depend for documentation assistance on the Documentation Centre at the SIET Institute.

7. Suggested staffing for each of such 4 proposed Centres

(1) Director General for the Institute in the grade of Rs.3,000 - 4,000.

(2) Directors (three) in the grade of Rs.2,000 - 3,000.
Suggested subjects are: mechanical engineering; chemical technology; and management specialisation.

(3) Deputy Directors (six) in the grade of Rs.1,100 - 1,600. Suggested subjects: chemical engineering; cost accountancy; marketing; industrial economics; industrial extension; industrial engineering (with special background in work-study)
In addition to the above-mentioned specialists, supporting staff for workshops, design office,
laboratories and administration would be required.

6. Capital requirements

Fixed capital

<table>
<thead>
<tr>
<th>Building:</th>
<th>Offices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference rooms</td>
<td></td>
</tr>
<tr>
<td>Drawing offices</td>
<td></td>
</tr>
<tr>
<td>Workshops</td>
<td></td>
</tr>
<tr>
<td>Laboratories</td>
<td></td>
</tr>
<tr>
<td>Workshops for pilot plants</td>
<td></td>
</tr>
</tbody>
</table>

Fixed capital investment on 4 centres

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Machine shop (details as per Annexure I)</td>
<td>6,56,000</td>
</tr>
<tr>
<td>2. Drawing office</td>
<td>30,000</td>
</tr>
<tr>
<td>3. Fabrication shop and Sheet metal shop</td>
<td>1,50,000</td>
</tr>
<tr>
<td>4. Pattern shop</td>
<td>24,900</td>
</tr>
<tr>
<td>5. Chemical Laboratory and Chemical Engineering Laboratory</td>
<td>2,50,000</td>
</tr>
<tr>
<td>6. Pilot plant section</td>
<td>2,50,000</td>
</tr>
<tr>
<td>7. Office equipment</td>
<td>1,00,000</td>
</tr>
</tbody>
</table>

Total: Rs. 14,60,900

Say: Rs. 15,00,000

Non-recurring expenditure: 60,00,000

Salaries for Officers

Director General - Rs. 3,000 - 4,000 (Rs. 3,500 p.m) 42,000

Directors (3) - Rs. 2,000 - 3,000 (Rs. 3,000 p.m) 1,08,000

Deputy Directors (6) - Rs. 1,100 - 1,600 (Rs. 1,500 p.m) 1,08,000
Allowances for Officers 1,00,000
Supporting staff 3,10,000
Miscellaneous expenditure 2,00,000
Pilot plant experts & field trips 5,00,000

Total Rs. 13,68,000
Say Rs. 14,00,000

Total Recurring Expenditure for the entire scheme for 4 Regional Centres 14,00,000 x 4 Rs. 56,00,000

9. In addition to the above expenditure, the centres may have to buy some extra equipment for workshops from abroad as well as buy some equipment which can be used as prototypes and models for the design office for modification and reproduction. The Institute can also benefit from international experts and visits of faculty to international design and development centres.

10. It is expected that the centres should be in a position to develop at least 10 technologies in the first year and at the rate of 20 technologies in the subsequent years. The centre could also act as a training-cum-consultancy organisation to both entrepreneurs and extension agents. The close collaboration envisaged between the entrepreneur and the extension agents will help the centres in getting problems from the field. The centres could also collaborate with similar institutions in other countries engaged in the field.