Planning the Industrial Revolution in Sri Lanka

by D. L. O. MENDIS

Synopsis

This paper is a sequel to, and must be read in conjunction with two earlier papers presented to this Institution. These are “The Engineer and National Planning” published in these TRANSACTIONS in 1971, and “The Five Year Plan 1972-76, some comments on the role of the Technologist”, presented at the monthly meeting in June 1972.

The present paper presents a plan of action to implement the view stated earlier that to achieve the targets of the Five Year Plan, “an Industrial Revolution will have to take place, which will transform a predominantly agricultural economy into a partially industrialized one during this period”. This plan takes the earlier statement that “this implies a departure from the present practice of relying to a greater extent on foreign expertise than on local technical know-how” a step further, and presents a strategy for achieving a technological great leap forward in harmony with a recently expressed view that “if only we would look more completely inwards, with just an occasional outward glance, the prospect that would be revealed to us will not only be well within our reach, but will also be more fully satisfying than the elusive mirage we have been chasing all these years”.

Finally, this paper includes statements, necessarily brief, of actual realities faced during the last two years or so in the course of attempts to implement certain areas of the Five Year Plan 1972-76. Indeed, the strategy for planning an Industrial Revolution in Sri Lanka arose out of such experiences, the most significant of which undoubtedly was the pioneering Kotmale experience.

Preamble

1.1 25 years ago, in 1948, our country achieved political independence, after some 400 years of foreign domination, and became a sovereign state in the British commonwealth. Early last year we framed a new constitution and proclaimed ourselves the Republic of Sri Lanka, still within the Commonwealth.

1.2 After more than a quarter century of independence, our economic circumstances remain, nevertheless, obviously dependant on trade and aid policies of the rich nations. The generation born after 1948, who already constitute the numerical majority of the population, have never had to pay allegiance to a foreign power; they therefore tend to look at economic dependance with less patience than the older generation. Likewise their solutions to the nation’s economic problems tend to be more drastic and dramatic, less long-drawn out, and consequently harder on their elders who are less adaptable to change, than young people. In short their solutions will be of a revolutionary nature.

1.3 The rich countries have all experienced industrial revolutions. Consequently they possess manufacturing capacities that absorb primary products exported from the developing countries. So long as a country derives a large part of its foreign exchange from the export of primary products, it is described as being under-developed; it almost certainly would not have experienced an industrial revolution. Sri Lanka today is in such a situation. In a world where development is synonymous with industrialization, it therefore earns the sobriquet of an under-developed country, and receives the gratuitous attention of international development planners. This unique post-war era phenomenon, development planning, is now known to have failed to avert (if not actually precipitated) crisis after economic crisis in many a developing country. Nevertheless it is still actively promoted by international economists and other professionals, through various United Nations agencies. Following closely on their heels, so to say, are the international finance agencies and the multi-national corporations. The former lend money, while the latter invest in technical infrastructure for development often in direct proportion to the known natural resources of the developing country.

1.4 In the course of such development planning, the indigenous talent and native genius of the people of the developing country are never properly utilised. The national planners, themselves, are without exception, urban, west-educated and largely western-oriented. In the local context they belong, invariably, to the privileged minority of society, and many of them, in varying degrees, suffer a sense of inferiority towards the more developed world, the world

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of their erstwhile rulers, (which they visit from time to time, for ‘official’ reasons). Rarely, therefore do they turn their minds’ eye inwards, to the resources within their country, the resources of their own peoples, to sustain their planning efforts. Sri Lanka generally has been no exception to this rule.

1.5 Recently, however, a small but determined group in the Ministry of Planning and Employment has embarked on a new approach to development planning, based on faith and confidence in the ability of our own people, the masses of this country, the largely rural masses, not merely the urban elite. The Five Year Plan published two years ago has expressed this faith, and that too may not have been the first time that such an attitude has been adopted; but, so far as is known, this is the first time that an attempt is actually being made to translate such an attitude into practice, systematically.

1.6 Sri Lanka is an agricultural country, although only about 35% of its gross national product is derived from the agricultural sector, because nearly 90% of the working population is directly or indirectly employed in agriculture. An industrial revolution must therefore be planned on the basis of walking on two legs, which means that Agriculture and Industry must grow together. This in turn means that the industrial revolution in Sri Lanka must be implemented in the rural rather than the urban areas, using local rather than foreign resources. This is the basic philosophy behind this paper.

Introduction

2.1 "We should not expect industrial revolutions either to just happen or to be actively promoted by the traditional engineer in traditional government employment". Referring to Figure 1, this "traditional engineer" is identified as a typical member of the privileged minority of our society, who is subjected to powerful socio-economic forces drawing him (or her) towards the developed world, towards the U.N. and other international agencies, and towards centres of development in the developing world, outside Sri Lanka. In other words a typical member of the Engineering profession, or a typical member of this institution cannot be expected to generate or sustain an Industrial Revolution in this country, so long as such a person’s thinking is oriented away from the resources of this country, and is dependent instead on foreign resources. In this context it is also worth noting that "natural resources are not a static thing. Modern technology and organising skill have made them the most dynamic things of our times".

2.2 Figure 1 also depicts ideological forces which act on the minds of the under-privileged masses of our country, drawing them with an all but irresistible attraction to other parts of the developing world, the China of Mao-Tse-Tung, the Vietnam of Ho-Chi-Minh, the Korea of Kim II Sung and so on. These forces could be broadly interpreted as a reaction to the socio-economic forces acting on the privileged minority. Table 1 depicts the population distribution in our country, district-wise, according to age groups. These figures together attempt to convey the potential for revolt in the people of our country. It has been observed that "a world movement of youthful protest can be said to exist, dependent not upon a common programme or a common cause, but resulting largely from common factors of the modern situation. This situation was one of inadequate opportunity and of dissatisfaction with the way the world was being run". Consequently "authority was challenged successfully by students in 1968 in America, France and Britain, and vigorously, if less successfully in West Germany and Yugoslavia", But in Sri Lanka in 1971 the challenge to authority was not merely unsuccessful, but was a tragic set back to the development effort. (Although some may argue that it has jolted the country to a new effort, afterwards). In planning for the future we should at least attempt to harness the energy of youth who are after all the citizens of the future.

Table 1

<table>
<thead>
<tr>
<th>District</th>
<th>Under 18</th>
<th>Over 18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>years</td>
<td>years</td>
</tr>
<tr>
<td>Colombo</td>
<td>1,105,135</td>
<td>1,567,485</td>
</tr>
<tr>
<td>Kalutara</td>
<td>306,130</td>
<td>425,694</td>
</tr>
<tr>
<td>Kandy</td>
<td>543,151</td>
<td>643,719</td>
</tr>
<tr>
<td>Matale</td>
<td>154,576</td>
<td>161,768</td>
</tr>
<tr>
<td>Nuwara Eliya</td>
<td>206,820</td>
<td>246,428</td>
</tr>
<tr>
<td>Galle</td>
<td>322,900</td>
<td>414,461</td>
</tr>
<tr>
<td>Matara</td>
<td>271,474</td>
<td>316,780</td>
</tr>
<tr>
<td>Hambantota</td>
<td>172,537</td>
<td>168,468</td>
</tr>
<tr>
<td>Jaffna</td>
<td>317,725</td>
<td>386,625</td>
</tr>
<tr>
<td>Mannar</td>
<td>38,790</td>
<td>39,132</td>
</tr>
<tr>
<td>Vavuniya</td>
<td>47,402</td>
<td>48,134</td>
</tr>
<tr>
<td>Batticaloa</td>
<td>135,761</td>
<td>122,343</td>
</tr>
<tr>
<td>Amparai</td>
<td>142,214</td>
<td>130,576</td>
</tr>
<tr>
<td>Trincomalee</td>
<td>98,200</td>
<td>93,789</td>
</tr>
<tr>
<td>Kurunegala</td>
<td>489,820</td>
<td>538,287</td>
</tr>
<tr>
<td>Puttalam</td>
<td>174,088</td>
<td>205,689</td>
</tr>
<tr>
<td>Anuradhapura</td>
<td>200,842</td>
<td>188,365</td>
</tr>
<tr>
<td>Polonnaruwa</td>
<td>81,958</td>
<td>81,900</td>
</tr>
<tr>
<td>Badulla</td>
<td>302,876</td>
<td>313,439</td>
</tr>
<tr>
<td>Monaragala</td>
<td>102,000</td>
<td>89,505</td>
</tr>
<tr>
<td>Ratnapura</td>
<td>300,265</td>
<td>361,448</td>
</tr>
<tr>
<td>Kegalla</td>
<td>293,839</td>
<td>358,255</td>
</tr>
</tbody>
</table>

Total: 3,898,863 6,902,280 12,711,143

2.3 The strategy for planning the industrial revolution proposed here has been developed from actual experience in the past two years, chiefly but not entirely in the implementation of Development Council Projects. With the restructuring of the former Ministry of Planning and Economic Affairs into the new Ministry of Planning and Employment in May 1970, the stage was set for a situation approximating to the following: "the Planning Board established by a reform Government remains more or less impervious to the influences, pressures and bribes of powerful interests, is staffed by honest reformers who believe in the independence and omnipotence of the state in the capitalist society and set out to introduce far reaching changes in the national economy. In that case the Board is bound to run into tenacious resistance and sabotage on the part of the ruling class, achieves very little if anything, and ends up in a state of frustration and impotence with the fatal bi-product of discrediting the very idea of planning in the eyes of large strata of the population". In fact, there have been indications of "tenacious resistance" to the Planning effort with the idea of "discrediting the very idea of planning in the eyes of large strata of the population". This has taken many forms one of which has been a determined lobbying for and on behalf of foreign manufacturers and prospective investors in this country, with the attendant adverse effect of suppressing indigenous technological development. (Examples will be given later).

2.4 The strategy proposed is oriented towards a time when "planning becomes the battle cry of a broad popular movement, is fought for relentlessly against the entrenched beneficiaries of the ancien régime, and is turned into the basic organisational principle of the economy by a victorious social revolution sweeping aside the former ruling class together with the institution of private property in the means of production on which its very existence rests". The intention is to involve the masses of Sri Lanka in the development effort, to concentrate on development in the rural sector rather than the urban sector, to achieve interdependence of Agriculture and Industry through the use of indigenous technology, to maximize import substitution, and to generate new export products; in short, to liberate hitherto untapped forces of production for development. The strategy has been worked out as a golden thread running through the fabric of national planning, weaving a picture that draws its inspiration as much from the Tank and the Stupa of ancient Lanka, as from the traditional genius of our craftsmen as eulogized by Coomaraswamy in recent times.

3. The UN Development Decade 1960-70

3.1 The background to the first development decade has been described as follows: "Consistent with the Rostovian view of the world, which flourished at the end of the 1950-60 decade, was the optimistic belief that liberal democracies would govern the ever increasing number of ex-colonial territories which, according to American idealism should be freed from the various old imperial yokes as quickly as possible. The only exception was to be for territories acquired by the United States, and this was on the grounds, then still seriously argued by American officials, that the United States, because of its 18th Century record, was above the suspicion of imperialism in 1980. The new nations would of course need considerable economic assistance in their early stages (pre 'take-off') and, therefore the 1960's were to be the 'development decade', the turning point in history. "Shallow, facile and incorrect though this analysis seemed to be to most international planners and statesmen outside the hot-house of Washington, there was no strong motive for many to oppose it. After all, if the American Government and people chose to bemuse themselves with an ideology that seemed to be consistent with small-town oratory on July 4th that was to a large extent their own affair".

3.2 Thus was the first Development Decade launched. National and international economists zealously collected data and prepared models of economic growth for developing nations all over the world. They quantified the inadequacy of domestic savings and the growing import requirements in these countries and worked out minimum levels for transfer of foreign savings from the developed countries. The United Nations took up the cry that a minimum transfer of 1% of the gross domestic product of the developed countries to the developing countries was necessary. This would consist of both commercial investment and "Aid" which in turn includes both outright grants and long term loans which have to be repaid. It should be noted that "only Official Development Assistance should be designated as 'Aid'. The flow of private capital and official credits undertaken for commercial reasons have no more the character of 'Aid' when they flow to developing countries than when they flow between industrialized countries". This will be discussed in greater detail with examples.

3.3 However, towards the end of the first development decade Aid givers and recipients alike had realised that development according to the Rostovian model was not in fact taking place in the developing countries as had been expected. National and international economists then took it upon themselves to find out what had gone wrong. One conclusion was that this was because Aid was intimately tied with politics. The Pearson Commission appointed by the
World Bank to study the problem of development in fact incidentally proposed a strategy for “untying” Aid. Nevertheless, the prediction for the future, based on the experience of the past was that “if the political interests of the giving nations are not better served by gifts in the 1970’s than in the 1960’s the total value of transfers, inadequate though they are as pump-primmers, will not substantially increase”.

3.4 An aspect of the failure of the first development decade in some developing countries was “the polarization of society into the ‘dual society’, characterized by the emergence of a small, very rich, politically powerful and city-centred elite, which draws its values (and not infrequently much of its wealth) from the west—and perhaps most damaging of all—its education, especially as regards economics, from the same source”. Other features of this dual society were, a tendency towards migration to cities and towns from the rural areas, and rural unemployment and under-employment, (on account of a minimum creation of new jobs because of bad choice of techniques and technologies), internal and external brain-drain, and finally an increasing national balance of payments problem.

3.5 The emergence of the dual society is most evident in the Latin American countries whose economic and social problems resulting from the development effort are perhaps a decade “ahead” of our own problems. We are therefore fortunate in having a good example of what not to do in planning our own development, and we should make the most of this fortuitous circumstance. For example, it has been stated that the problems now faced by some developing countries as described above, “are symptoms, manifestations of an approach to development which is based upon western technologies and their related institutions in the fields of education, provision for health, and ways of living. More precisely they are the results of directly transferring technologies from the industrialised to the developing countries”.

3.6 Transfer of Technology

3.6.1 Technology that is inappropriate or superfluous may be transferred from the developed to the developing nations through private foreign investments or public foreign investments. The former usually takes the form of a joint venture or manufacturing enterprise on licence, whereby an established manufacturing firm sets up a branch organisation in the developing country with certain rights to remit profits abroad. (This type of investment especially in wholly-owned subsidiaries by the so-called multi-national corporation has come in for severe criticism). The latter type of investment often takes the form of multi-lateral or bilateral aid. Bi-lateral aid is between two Governments, whilst multi-lateral aid comes from organisations like the World Bank, Asian Development Bank or some UN Agency. In either type of investment unless there is strict technical screening there will in general be some transfer of inappropriate technology, and occasionally of superfluous technology.

3.6.2 Superfluous technology has one characteristic—it already exists in adequate measure in the developing country. In the absence of effective technical screening, even Aid, (both Commodity Aid and Project Aid) can result in the transfer of superfluous technology to the developing country. In such cases the term Aid appears to be wrongly used to describe what is in fact the “flow of private capital and official credits undertaken for commercial reasons”. However, by far the commonest transfer of superfluous technology takes place under “lines of credit”. These lines are often no more than suppliers credits, but they are sometimes loosely referred to as ‘Aid’, especially in the press.

3.6.3 Two examples of the transfer of superfluous technology have been mentioned earlier, the import of the mammy for irrigated paddy cultivation, and weighing machines for the Paddy Marketing Board. The latter was under a line of credit, whilst the former was on free foreign exchange. Two more recent glaring examples of attempts to import superfluous technology may be mentioned. Machinery for manufacture of straw-board was being developed at the Technical Services Agency of the Industrial Development Board, but a strong lobby was attempting at the same time to import machinery, and that at a higher cost as well. At the same time various subterfuges were being tried to condemn the local equipment even before their manufacture had been completed. The second example concerns the local manufacture of small hand-operated, bullock-driven, and power-operated sugar cane crushers. Here again a strong lobby has been doing its utmost to promote imports of these simple machines under a foreign credit line, and suppress the effort to make them with local resources.

3.6.4 Inappropriate Technology has one or more of the following characteristics:

1. It is appropriate for abundant (cheap) capital and scarce (dear) labour as in the developed world.

2. It is designed for use in large scale plant (or in specialised plant not necessarily large) for large (or specialised) markets, using skilled management and trained labour, with freely available spares, imported or scarce
raw materials, large inputs of fuel and power etc.

3. Even working below capacity it can produce more goods more cheaply than by traditional methods. (Hence traditional craftsmen are thrown out of employment).

4. It cannot spread or grow in the developing countries by any normal process of growth. This is explained by the concept of owning one's own workplace through less than a lifetime savings effort. For example a blacksmith in an industrial co-operative like Kotmale can save Rs. 5,000/- which is the value of his workplace, in 10 years at Rs. 500/- per year; but a latherman in Colombo cannot own his workshop in less than 100 years if it costs Rs. 50,000 and his savings amount to no more than Rs. 500 per year.

3.6.5 We may assume that one of the reasons for the general failure of the first development decade was the effort to promote development through the transfer of inappropriate technology. This has aggravated imbalances in employment and wealth, promoted brain-drain not achieved a real nett increase in wealth (in some cases, actually reversed the movement of capital and resources from the developing to the developed world) and in some cases provoked a tendency to find revolutionary solutions to the problems of underdevelopment. If all this has been caused by inappropriate technology we must surely use appropriate technology, but what is appropriate technology?

3.6.6 Appropriate Technology has the following characteristics:

1. It stimulates economic progress by making use of locally available resources including man power, and meeting local needs.

2. It promotes social progress by enabling mass participation in the new development as well as wide sharing of attendant benefits.

3. It should spread in the local environment, and constitute a technical improvement compared to what existed previously.

4. It should be progressive over time and improve in response to the developing economy's requirements.

5. It should create employment where people already live and not in new distant work places.

6. It should aim as far as possible to make its own capital equipment locally.

Appropriate technology with a majority of these characteristics will be a progressive technology. It will promote self confidence and self reliance; “while it would stretch peoples’ abilities, it would not be beyond them; it would make them feel more capable, not more helpless (as they feel when confronted with some super technology from the west”).

4. Prospects for the second development decade 1970-80

4.1 Application of science and technology to development.

4.1.1 Faced with the disappointments of the first development decade, the UN General Assembly took action to try to improve the prospects for the second development decade, by the application of modern knowledge to development. The Advisory Committee on the Application of Science and Technology to Development established by Economic and Social Council resolution 80 (XXXVI) in 1963, commissioned a report on a “World Plan of Action for the Application of Science and Technology to Development”. This was approved at the 14th Session of the Advisory Committee held at UN Headquarters from 16th to 25th February 1971.

4.1.2 The World Plan of Action is an exhaustive study which examines the priority areas where science and technology can make the biggest impact for economic development. The report outlines proposals for implementation and financing of the plan. It goes into more detailed proposals over a wide range of areas based on material submitted by working groups in each of the following areas:

1. Science and technology policies and institutions
2. Science and technology education
3. Natural resources
4. Food and Agriculture
5. Industry
6. Transport and communications
7. Housing, building and urban development
8. Health
9. Population

4.2 Sri Lanka in the second development decade.

* A synopsis of a paper by Keith Marsden on “Progressive Technologies for Developing Countries” is given in Annex 1.
4.2.1 Sri Lanka entered the second development decade with a dramatic electoral Revolution in April 1970. Following this, changes took place in the Central Planning authority, the chief of which was a considerable reduction in the number of UNDP personnel. The Five Year Plan 1972-1976 was published in late 1971 and outlined certain strategies for development which depended on use of local resources to an extent never attempted before. New administrative structures were also conceived to implement the plan, the most noteworthy of which was the Development Council.

4.2.2 The Development Council was a Co-operative Organisation at Divisional level which could harness locally available resources at grassroots level with a minimum representation of public officials. The Development Council concept although sound in principle has suffered the disadvantage of being a creature of the Co-operative Department. To remedy this and other short comings a proposal to set up a Regional Development Authority has been recently approved by Cabinet.

4.2.3 Although not spelled out in so many words, one aspect of the new approach to development will be the development of the rural economy to some extent at the cost of the urban sector. For this reason the Regional Development Authority will play a leading role in the coming years. The Urban sector in this definition includes Colombo and other principal towns as well as some public sector institutions such as the large Corporations, although some of their factories and work places which represent high capital investments, a characteristic of previous development policy, are actually located in the rural areas. These factories will be planned to function as growth agents for the development of the rural economy in the future, unlike in the past. (See Sections 5.5 and 5.6).

4.2.4 Large capital investments, including foreign capital investments will continue to be made for the creation of essential infrastructure which includes hydro-electric power and multiple purpose irrigation projects such as the Mahaweli Development Project and the proposed Southern Area Development Project. However, it is envisaged that unlike in the past such capital will also be utilised to create permanent industrial infrastructure in the rural areas in the future, incidental to implementing a construction programme. This is in keeping with the concept of appropriate technology, and may be illustrated by the following example from the Mahaweli Stage II construction contract.

4.2.5 Dhun Oya re-training work.

2,000 cases of water diverted from the Mahaweli Ganga at Polgolla to the Ukwella Power Plant through the Polgolla tunnel will fall into a small existing stream called the Dhun Oya which does not have a capacity to carry such a large amount of flow. This Oya has therefore to be widened, deepened and straightened for a distance of one mile. The quotation for this work by the successful contractor amounts to Rs. 35 lakhs of which the foreign exchange component is Rs. 12 ½ lakhs, a percentage of 35.7.

This area between Ukwella and Matale town is well populated and there is evidence of widespread unemployment and under employment especially amongst the younger people in this area. This work could have been undertaken with a judicious choice of technology as described in several earlier papers. Some of the foreign exchange would then have been used to set up a permanent Industrial Centre near Matale which would have had machine shops, welding shops, and foundry capacity, to manufacture small pieces of equipment such as wheel barrows, tractor trailers and two wheeled tractors. This equipment together with a large amount of manual labour would have been used on this job which had originally been programmed for 5 years. Thereafter the Centre would have been made to catalyse and service industrialisation in the Matale district. In actual fact no such thing has been done and the work has been started at the end of the third year of the contract using the highest level of technology. Only the final trimming of the channel will now be done manually and this will hardly permit the creation of any permanent industrial infrastructure for this locality as described above.

4.2.6 It is important that on all future earth works in the Mahaweli project, appropriate technology should be used, and wherever foreign exchange is available, industrial development could be promoted in this fashion. It is interesting to observe that the Chairman of the Mahaweli Development Board has said recently in regard to Industrial Development in the Mahaweli project, that this "had not been studied in as much depth as he would have liked due to certain limitations".

4.2.7 It may be observed in passing, that appropriate technology has been used by at least one local construction company, with a considerable saving to the country in the foreign exchange component of the costs of contracts. Again, appropriate technology based on indigenous engineering research has been widely used in the State Engineering Corporation, not merely with the immediate benefit of a low foreign exchange component in the construction cost.
of a particular project, but with the prospect of achieving a "technological breakthrough in the vicious circle of underdevelopment" in the future. Indeed, the concept of a National Engineering Research and Development Centre was inspired by various achievements of the Research and Development Section of the State Engineering Corporation under Mr. A. N. S. Kulasinghe, up to about 1970. Unfortunately, the future of NERDC now appears to be more dependent on foreign expertise (from UNIDO etc.) than on local talent such as was so brilliantly evident when it was systematically harnessed in S.E.C. at that time. (See also, Section 5.4). Meanwhile, more than one large engineering firm in the private sector has institutionalized engineering R & D, following the successful example of the S.E.C., whilst in the public sector, the NERDC is still "struggling to be born".

5. Planning the Industrial Revolution

5.1 Sector Plan for Industry

Sector plans have been prepared in the Ministry of Planning for the Agricultural Sector and the Industrial Sector. The Sector plan for industry highlights the following expectations during the Five Year Plan period:

(i) a sharp swing towards the small scale sector;
(ii) production of commodities for mass consumption;
(iii) rationalisation of existing industry and containing output in certain non essential items;
(iv) the growth of a substantial sector of export based industries.

5.1.2 This is in keeping with the following urgent needs:

(i) the need to create employment opportunities;
(ii) the need to keep the foreign exchange commitment for industries and raw materials within manageable levels;
(iii) the need to expand the production of essential commodities for consumption to meet the expected increase in demand consequent to the re-distribution in incomes and expansion in employment;
(iv) the need to gear the process of industrial expansion to the export market as the production for import substitution progressively diminishes.

5.1.3 From the point of view of new employment opportunities, the principal growth areas have been identified as:

(i) textiles
(ii) wood products
(iii) mining and quarrying
(iv) light engineering
(v) paper products, printing and publishing
(vi) structural clay products.

The highest rates of growth are expected to occur in the following areas:

(i) rubber products (including foot-wear) 108%
(ii) machinery and equipment (excluding transport equipment) 100%
(iii) chemicals and chemical products 98%
(iv) textiles 95%
(v) other processed and animal feed 83%

5.1.4 New capital intensive projects that will be financed during the plan period are given in Table 2.

**Table 2**

<table>
<thead>
<tr>
<th>Project</th>
<th>Total (Rs. Mn.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese Spinning and Weaving Mill</td>
<td>140.0</td>
</tr>
<tr>
<td>Steel Foundry</td>
<td>5.5</td>
</tr>
<tr>
<td>Structural Shop and Galvanising Plant</td>
<td>4.6</td>
</tr>
<tr>
<td>Boron Rubber wood project</td>
<td>0.9</td>
</tr>
<tr>
<td>Ligno Plastic wood project</td>
<td>0.7</td>
</tr>
<tr>
<td>Embilipitiya Paper Mill</td>
<td>110.5</td>
</tr>
<tr>
<td>Expansion Paranthan Chemicals Plant</td>
<td>5.0</td>
</tr>
<tr>
<td>Ilmenite factory expansion</td>
<td>48.4</td>
</tr>
<tr>
<td>Titanium Dioxide (Preliminary expenses)</td>
<td>10.0</td>
</tr>
<tr>
<td>Oleo chemicals factory</td>
<td>53.0</td>
</tr>
<tr>
<td>Mahaweli Development Scheme Timber Project</td>
<td>5.0</td>
</tr>
<tr>
<td>Urea Plant</td>
<td>340.0</td>
</tr>
<tr>
<td>Petroleum refinery expansion (removal of bottlenecks)</td>
<td>4.0</td>
</tr>
<tr>
<td>Graphite Mining and Processing</td>
<td>10.0*</td>
</tr>
<tr>
<td>Expansion of Flour Mills</td>
<td>5.0*</td>
</tr>
</tbody>
</table>

| **Total** | **743.5** |

These will all be new public sector investments.

5.1.5 The sector plan identifies the following broad categories in the small scale sector where there is significant production at present—
1. textiles
2. wood products
3. mining and quarrying
4. non-metallic mineral products
5. coconut products
6. food products
7. tobacco products
8. printing and paper products
9. light engineering
10. leather products
11. rubber products

It is expected that there will be an approximate doubling of the value added component contributed by the small scale sector in these areas during the five year plan period. It has been said that "special attention should be paid to organising the textiles and light engineering industries in the small scale sector if they are to fulfil the leading roles which have been assigned to them in the plan". 23

5.1.6 In regard to the transfer of technology the sector plan states that "no large scale programme of industrialisation can be based solely on capital imports, due to the strain imposed on the balance of payments. Secondly, a self-generating programme of industrial development in this sector cannot be expected to grow if every machine and most spares and accessories have to be imported. While the scope for import substitution of capital goods required for the large scale sector would be strongly limited, the fabrication of simple machines required for the small scale sector, a wide range of spares and accessories, capital items such as pumps and motors, offer an identifiable field for import substitution and the expansion of the indigenous capital goods industries. Thus, it is essential to encourage the development of the existing machine building industry in the country, the growth and development of which has been crippled by the unrestricted import of even the simplest types of machines. Very high priority will be given, and every possible effort will be made in the plan period to harness the skills and the untapped potential in the engineering industry to meet the demand for machinery required by the rapid growth of small industry envisaged in the plan". 24

5.2 The Light Engineering Industry

5.2.1 The sector plan for industry states "the establishment of a dispersed small scale light engineering sector will also act as an agent in spreading technological skills in the rural areas". 25 The first purposeful steps in this direction commenced with the successful organisation of village blacksmiths at Kotmale, a project that was formally inaugurated on 11th January 1972.

5.2.2 Industrial Co-operatives of the Kotmale type have since been established as Development Council projects in other D.R.O.'s and A.G.A.'s Divisions all over the island and some 45 of them have now been set up in 15 districts. The principal features of these organisations are that the worker is not separated from his work place, that he has the prospect of owning his own work place within his working lifetime, and that he is provided with inputs (raw materials, tools etc.) and outputs (markets), without the intervention of a middle-man. Thus the productive capacity of the rural industrial worker has been liberated.

5.2.3 The next step was the organisation of the D.D.C. Medium-scale Industrial Co-operatives of small machine shops, welding shops and foundries in the various districts. This organisation too has been done on co-operative lines with the same organising principles enunciated above. Such a project is already functioning in Matale, and others will soon be functioning in the Kandy, Jaffna, Kegalla and Kurunegala districts. These medium-scale co-operatives are being provided with Technical Centres for quality control for systematic production of small machines and spare parts. Each Technical Centre will be equipped with a heat treatment plant, a rectification centre, an assembly centre, a central stores and a sales centre. Quality control of production will be ensured by consultancy services provided by the Faculty of Engineering, the Technical Services Agency of the IDB and the University. Industrial infrastructure set up during construction of big development projects as described previously will also eventually be organised as medium scale industrial centres.

5.3 The Agricultural Sector

5.3.1 One of the fundamental reasons for organising the Light Engineering Industry is to achieve import substitution of inputs such as simple tools and implements for the Agriculture Sector and the Construction Sector, that are still being imported. Previous industrial policy had concentrated on large capital investment in the State Hardware Corporation to achieve import substitution of small tools and implements. For example in the village Paratulah near Moratuwa, local craftsmen had been making various items of hardware from time immemorial 26 but after the State Hardware Corporation was set up, one of these craftsmen had been informed in effect that he need not pursue his traditional industry because the new Corporation will manufacture the country's total requi-
reaments of such hardware. (See Annex 2). This is not so much a spectacular example of the transfer of inappropriate technology as an example of bureaucratic stupidity, which unfortunately still exists in varying degrees in the administrative infrastructure in our country. Meanwhile import substitution of small tools and implements has progressed very slowly indeed.

5.3.2 Consequently the Ministry of Planning has had to perennially face the problem of finding foreign exchange to meet the demands from the agricultural sector for the import of tools and implements. The example of the mammoth is typical of the apparent lack of concern or unawareness of the critical foreign exchange situation today. Tables 3 and 4 indicate previous imports of mammoths from 1965, and production of mammoths by the State Hardware Corporation from 1969. Table 5 indicates the alleged demand for imported mammoths in 1972 and 1973 respectively. These figures submitted by the Ministry of Agriculture were an aggregation of figures submitted by Government Agents to that Ministry in their District Agricultural programmes. Not a single mammoth has been imported since the 1972 request was made but no shortage has been felt on the field. This has been due partly to the increased production from the State Hardware Corporation in 1972, the organisation of the village blacksmith (who makes the local ‘ndella’) into industrial co-operatives, and due to a carry-over from previous imports. The increase in the alleged demand figures in 1972 to more than twice the largest number ever previously imported in one year, and a similar high figure for 1973, may be partly explained by a story that cultivators had been informed that this may be the last time when mammoths would be imported into this country, so that they exaggerated their requirements as an investment for the future. However, that may be, the fact remains that Government Agents all over Sri Lanka, the highest Government officials in the provinces, merely forwarded what could have been easily identified as exaggerated demand figures, to the Agriculture Ministry, and that Ministry in turn sent these figures to the Industries and Planning Ministries, for allocation of foreign exchange, at a time of critical foreign exchange shortage.

Table 3

Imports of Mammoths 1956 to 1972

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1956</td>
<td>321,775</td>
</tr>
<tr>
<td>1957</td>
<td>417,694</td>
</tr>
<tr>
<td>1958</td>
<td>249,185</td>
</tr>
<tr>
<td>1959</td>
<td>423,104</td>
</tr>
<tr>
<td>1960</td>
<td>293,199</td>
</tr>
<tr>
<td>1961</td>
<td>160,000</td>
</tr>
<tr>
<td>1962</td>
<td>286,000</td>
</tr>
<tr>
<td>1963</td>
<td>178,000</td>
</tr>
<tr>
<td>1964</td>
<td>421,000</td>
</tr>
<tr>
<td>1965</td>
<td>300,000</td>
</tr>
<tr>
<td>1966</td>
<td>480,000</td>
</tr>
<tr>
<td>1967</td>
<td>247,422</td>
</tr>
<tr>
<td>1968</td>
<td>N.A.</td>
</tr>
<tr>
<td>1969</td>
<td>N.A.</td>
</tr>
<tr>
<td>1970</td>
<td>200,000</td>
</tr>
<tr>
<td>1971</td>
<td>N.A.</td>
</tr>
<tr>
<td>1972</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

The IDB report gives the following import figures:

Table 4

Production by State Hardware Corporation

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967/68</td>
<td>105,997</td>
</tr>
<tr>
<td>1968/69</td>
<td>188,137</td>
</tr>
<tr>
<td>1970/71</td>
<td>58,051</td>
</tr>
</tbody>
</table>

Table 5

Alleged demand for imported mammoths

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971/72</td>
<td>1972/73</td>
</tr>
<tr>
<td>7'×10'</td>
<td>70,071</td>
</tr>
<tr>
<td>8'×10'</td>
<td>667,427</td>
</tr>
<tr>
<td>9'×9'</td>
<td>198,204</td>
</tr>
<tr>
<td>10'×10'</td>
<td>38,024</td>
</tr>
<tr>
<td>Total</td>
<td>973,826</td>
</tr>
</tbody>
</table>

5.3.3 The import substitution of tools and implements in the agricultural sector is the first step in the planned progressive development of technology in this area. The next step is the development of small machines for mechanization in agriculture. Previously, we have had the introduction of the four wheeled tractor for agricultural practices in the country and the beginning of the elimination of the buffalo from agriculture and possibly its ultimate extermination, for no better reason than that it was promoted by foreign “experts”. Thereafter a school of thought developed that the four wheeled tractor would do permanent harm to our agriculture, and that the two wheeled tractor was the appropriate machine.87 A Ceylonese authority on Agricultural Engineering Mr. Ray Wijewardena has described our efforts at mechanisation in agriculture as “the mechanisation of the buffaloes”.88

5.3.4 Today, more and more Scientists and Technologists in this country are beginning to realise that the buffalo performs many more essential functions in agriculture than those identified for substitution by the tractor. The buffalo’s role as the small farmer’s fertilizer factory89 has yet to be studied systematically. So also, has the effect of the buffalo’s hooves in tamping the layer of clay in the sub-soil to such a density during ploughing operations, as to make it virtually impervious, thereby making a very real contribution to water conservation. It is thus seen that even the apparently straightforward draught ploughing operation which has been mechanized by the introduction of the tractor, is neither so straightforward nor so easily mechanized. Thus the 4 wheeled tractor in many parts of the country, ploughs too deep, and recent rapid silting in many small tanks has been attributed to this cause. The 2 wheel tractor does not cause such adverse side effects,
but nevertheless water conservation is not achieved as with buffalo-ploughing as described above. It is thus evident that mechanization in agriculture does not mean the elimination of the buffalo, and in fact should not even start with total substitution of the tractor for the buffalo. It should be carefully planned, and based on research based indigenous technology.

5.4 Engineering Research and Development for Industrial Development.

5.4.1 At a time when the scarcity of foreign exchange has assumed crisis proportions we become vulnerable to vendors of various credit lines whose bargaining position has been strengthened by our crisis. On the other hand we are more likely in these circumstances than at more affluent times, to take the plunge to start an all out effort to develop indigenous industry, provided the necessary indigenous engineering R & D capacity is available. The proposal to set up the National Engineering Research and Development Centre made nearly three years ago had anticipated such a situation. In fact the Sector plan has categorically stated “a separate institution for Engineering Research and Development will be set up to examine the types of machines which can be made domestically and for the design and supply of the prototypes for their manufacture. Research and development of various machines such as pumps, presses and kilns has already been done. This work has to be continued on a more systematic basis geared to the domestic manufacture of some of these items and work in this direction will be accelerated according to the needs of the industrial sector. Further, this institution will in future examine the technical details of turn key jobs offered to this country in the industrial sector with a view primarily to determining the possibilities of local manufacture of component items in such projects”. Unfortunately NERDC C has still not begun to function, and there even is a suspicion that it might become a still born baby.

5.4.2 With the proposed NERDC non-functional, it has fallen on the Ministry of Planning to find a way to promote industrial development without institutional support for engineering R & D. The method adopted in this Ministry started simply as an attempt to conserve foreign exchange by encouraging local manufacture of various machines that previously were being imported. The method was to set up an adhoc committee of individuals who are known to be interested in the subject and to seek the support of the institutions to which they belong and which have a capacity to manufacture these machines. A few other members of the committee are specialists who could contribute their specialised knowledge to any actual manufacturer, this contribution being voluntary and free. This committee works out a “modus operandi” to achieve the desired objective. It is interesting to observe that “adhocracy” is now being talked of in the developed world, as the alternative to bureaucracy in the future: “Task forces and other adhoc groups are now proliferating throughout the government and business bureaucracies, both in the United States and abroad. Transient teams, whose members come together to solve a specific problem and then separate, are particularly characteristic of science and help account for the kinetic quality of the scientific community. Its members are constantly on the move, organizationally, if not geographically”.

5.4.3 The first such effort at “adhocracy” concerns weighing machines and has been discussed earlier. In that instance, the foreign supplier who had negotiated to supply 50,000 worth of platform weighing machines under a line of credit agreed in the first instance to assemble these machines locally with as much as 85 per cent of the components also manufactured locally. Ultimately, however this project fell through and the Ministry of Industries had then to approve a local manufacturer who however did not have a well-known “brand name” to enhance his product. The outcome of this has not yet been completely finalised.

5.4.4 A recent successful example of the “adhocratic” approach was the local manufacture of the two-wheeled tractor. A set of working drawings were obtained from Dr. Teddy Wickramanayake, who had been associated with the development of this somewhat basic model, and given to members of the adhoc committee, many of whom agreed to attempt to manufacture the machine in their respective institutions. Within three months no less than five different institutions had manufactured this two-wheeled tractor with about 75 per cent locally made components. The engine, the bearings and the chain were imported. At the time of writing two of these machines (made by the Sri Lanka Air Force and the Technical Services Agency of the I.D.B.) have been exhibited at an Industrial Exhibition at Matale where members of the newly-formed Medium scale Industrial Co-operative are preparing to manufacture it locally. Similar steps are being taken at Kurunegala. The Government Factory, the Sri Lanka Air Force and the State Engineering Corporation have also already taken steps to make improved prototypes featuring steering clutches and gears, based on R & D done entirely by them. This is an encouraging sign of the potential for engineering R & D, despite the hasco of NERDC.
5.4.5 The next item to be taken up for local manufacture in this fashion is the engine itself. An adhoc committee has just been appointed to take up the development of at least three different single cylinder, internal combustion engines of approximately 2 h.p., 3½ h.p. and 5 h.p. respectively.

5.4.6 Until such time as NERDC or some other institution geared to development of indigenous engineering capacities, manned by local technologists who believe in the use of local resources and do not lean heavily on foreign resources, is available, it looks as if the Ministry of Planning will have to continue with this “ad hoc” approach. It should be emphasized that in this exercise we have kept in mind the concept first described by Professor Gadgil of the Indian Planning Commission, of three ways of achieving appropriate technology namely—

(i) to upgrade and make more productive traditional ways of doing things (e.g. village blacksmiths’ co-operative);
(ii) to strip down, modify and reduce the cost of sophisticated machinery and equipment (e.g. the two-wheeled tractor);
(iii) by new inventions to suit the given factor proportions, using advanced scientific and technological knowledge. (Many examples are available from the R&D section of the State Engineering Corporation, for example).

5.4.7 In regard to the last category, new inventions, (which should really be the province of NERDC) we have tried to harness the available functional scientific and technological institutions in the country to act as consultants on various projects. The Faculty of Engineering in the University of Ceylon, the Technical Services Agency of the Industrial Development Board and the CISIR have been prominent in this category. Recently the General Research Committee of the Ceylon Association for the Advancement of Science has also offered the services of its members to provide research-based solutions to technical problems that may arise in Industrial Corporations. It is hoped that through this means it will be possible to harness the talent of large numbers of scientists and technologists in our country for the development effort.

5.4.8 A recently established organization, the Association of Scientific and Technical Workers holds promise of making a special contribution in this area. This is because this Association has a very wide membership embracing all technical personnel from semi-skilled workers to professionally qualified technologists. (Even those under training for employment in these jobs can be enrolled as Acolyte members).

This is an unique professional institution which can provide a solid foundation for the Industrial revolution in Sri Lanka if it develops on the proper lines, because its membership has the inherent potential to check and ultimately reverse the growth of the “dual society”.

5.5 Large Capital Investments as Growth Agents—Large, Medium and Small Projects.

5.5.1 A list of public sector Corporations together with their lines of production and possible production by the small scale sector, has been presented earlier. It is now necessary to examine in detail the possibility of organising small scale and medium scale co-operatives for this purpose. Unnecessary competition must be avoided, the best use must be made of local resources, and new export markets will have to be found. This combination of small, medium and large will be the general pattern of the organisation for production of various types of manufactural goods in any industry. In general, any product which can be economically manufactured by the small scale co-operative will not be made by the medium scale co-operative or by the large corporation. This is because the smaller organisation generally provides more employment than the larger for the same capital investment. A product which can be made at the medium scale level will not be made in the large Corporation. Thus the large Corporation will be free to use its capital intensive technology to manufacture products which will otherwise have to be imported. In other words an optimum product mix will have been achieved consistent with the maximum employment potential in the industry and with prospects of increasing import substitution and export. Further, primary products that are presently exported by the large organisations can be used as inputs for manufacturing finished consumer goods. For example—tanned leather presently exported may be used to manufacture hand-made finished leather goods by small-scale co-operatives for export.

5.5.2 The Light Engineering Industry will be discussed in some detail. Large capital investments have already been made in the State Hardware Corporation and the Steel Corporation in this sub-sector. These should be tied up with the Light Engineering (small-scale) and Medium-scale Industrial Co-operatives that are being established in all parts of the island, to determine the optimum product-mix from large, medium and small. Other big factories and workshops in the public sector, may also be used for promoting development on these lines. These include the Government Factory, the Railway Workshop, the R.V.D.B. workshops and the Regional workshops of the newly established Department.
of Machinery and Equipment. The latter were established primarily to service construction work and the former for efficient maintenance of the old P.W.D. and the C.G.R., but they too can be tied up with small and medium scale industrial co-operatives, for example for the supply of some spare parts. Products which can be made in the small scale co-operatives like the mammoth for irrigated paddy cultivation, the local "Udalle", will not be made in the medium scale co-operatives. Likewise small machines such as the two-wheel tractor, sugarcane crushers, equipment for making strawboard, and so on, will be made in the medium scale co-operatives and not in the large corporations. Thus large organisations will be able to use some of their capital intensive technologies to begin the Heavy Engineering Industry by the manufacture of some large plant and equipment which would otherwise have to be imported. A recent example of this is the manufacture of radial gates in the Government Factory for the Irrigation Department. An earlier example that had been proposed, but not implemented was the manufacture of penstocks for the Ukuwella Power Plant in the Mahaweli Project Stage 1.16 It is hoped that the newly established Central Engineering Consultancy Bureau in the Ministry of Irrigation, Power & Highways will promote the progressive development of indigenous technology by adopting suitable design techniques in the future.

5.5.3 Of course it must be mentioned that previous industrial policy, or lack of consistent policy, has caused a chaotic situation in the State Hardware Corporation factory at Yakalai which will take sometime to put right. Likewise, heavy investments in the Endamulla foundry for manufacture of cast iron pipes may not appear to be justified on account of lighter alternatives now available. Meanwhile other cast iron items such as valves and other specials including simple cast iron manifold covers are still being imported. In this context a report prepared by foreign consultants on the "Local manufacture of equipment and materials for Water Supply, Sewerage and Drainage Projects" states:

"Discussions with a local engineering company and analysis of costs show that slive valves and hydrants cannot be produced economically in Ceylon and must be imported".47 We must safeguard ourselves against acting on this type of report which tends to promote imports at the cost of indigenous technological development.

5.5.4 A somewhat special example in the light engineering industry is the re-conditioning of engines and transmissions for the Ceylon Transport Board in the regions. This work can be undertaken by medium scale co-operatives so that the C.T.B. depots could stock a certain number of re-conditioned engines, gear boxes etc., which would be used to replace the old units when a bus is garaged for such an overhaul. By re-placing the unit completely, time lost on repairs will be reduced and the running time of each bus maximised. Further, the C.T.B., already a mammoth organisation, need not expand any further to achieve this. Quality control will have to be ensured at the medium scale industrial co-operative, by the establishment of a Technical Centre for this purpose. A schematic diagram of the proposed Technical Centre is shown in figure 4.

5.5.5 Another example that may be given is the textile industry. A considerable capital investment has been made in the Textile Corporation's mills, as well as in mills in the private sector. At the same time there are power-loom projects in many parts of the country. Finally there are an estimated 100,000 handlooms distributed throughout the length and breadth of the country. What is the interdependence, if any, between these three types which could be described as large, medium and small investments in the textile industry? Apparently there is official "regulation" of raw material inputs supplied to the large, medium and small and recommendations made in regard to the items to be produced. However, despite this system, more than a lakh of handloom sarongs remained unsold some years ago. Here then is an area where this type of planning for small, medium and large projects to co-exist and stimulate each other's growth must be done very early.

5.5.6 In the context of the co-existence of large, medium and small, another example may be mentioned, not from industry but from the agricultural sector—a part of the essential infrastructure, the construction of irrigation reservoirs and tanks. The modern irrigation engineer does not have much faith in the small village tanks, and considers that the large irrigation reservoir and channel system can totally replace the small village works that already exist. However recent experience of large irrigation projects has given room for doubt about this attitude, even in the minds of trained engineers. The Walawe Project is perhaps the most glaring example. On the other hand, village cultivators have long expressed their faith in the small village scheme. The argument against the small village tanks in the dry zone is that the ratio of water-spread to area irrigated is much higher than in the case of a large reservoir. Also, the high evaporation rate in the dry zone which is between 1/3 and 1 inch per day, perhaps averaging 1/3 inch per day, results in an annual evaporation loss of perhaps 7 or 8
feet of water. Therefore it is argued that a village tank which generally is less than 9 or 10 feet in depth is not economical. To meet this argument one can see that the area covered by water in a village tank is also a source of agricultural produce, or more generally, food. It has been said that one acre of village tank can provide 100 bushels of 'Olu' seed per year. Various other aquatic crops like ‘Kekatiya’ have commercial value perhaps unknown to the modern engineer. Fish food may also be mentioned. Finally, the social aspect of the village life and culture that exists around the small tanks can never be given a commercial price. For these reasons the small tanks must remain an integral part of our irrigation system, but the integration of large, medium and small must be carefully planned and laid out, so that the capacity to resist drought that is possessed by the large reservoirs is combined with the short term benefits that are associated with the small tanks.

5.5.7 A good example from history is the famous Kalawewa system, where the large twin reservoir, the Kalawewa-Badagawewa built in the 8th century A.D. benefitted and consolidated an existing system of small and medium scale tanks built centuries earlier. Later the Kalawewa complex had been augmented by a trans-basin diversion of waters from the Nalanda Oya in the Mahaweli basin, through the Ebbawela cut, and this ancient system was restored with the construction of the Mahaweli concrete dam and the Ebbawela regulator in recent times. And now, the Mahaweli diversion project will further augment this system so that some of the ancient small tank beds will now be cultivated.

5.6 Large Capital Investments as Growth Agents—Linkages.

5.6.1 Whilst large, medium and small projects must co-exist in each particular industry, there must also be linkages between different industries. In general this will be built around the inputs, the outputs and the waste from each large project. The chain of organisation in some cases will extend from a large investment in the industrial sector to a source of raw materials in the agricultural sector resulting in a new project in the latter sector. In this fashion the inter-dependency of the agricultural and industrial sectors will be expressed as a functional inter-dependence of organisations. The concept of walking on two legs, the growth of agriculture and industry together, is made meaningful through this type of planning.

5.6.2 The use of a large capital intensive investment to function as a growth agent in this fashion has been described as follows:

"1. The input provision, derived demand or backward linkage effects i.e. every non-primary economic activity will induce attempts to supply through domestic production the inputs needed in that industry.

2. The output utilisation or forward linkage effects i.e. every activity that does not by its nature cater exclusively to final demands will induce attempts to utilise its outputs as inputs in some new activities".

5.6.3 These so called "Hirschmanite linkages" can be worked out not only around existing large investments, but for future development projects as well. For example, we can plan development around a ship-breaking project that would use the Trincomalee Harbour, one of our valuable natural resources, as follows:

Forward linkages—Trinco Harbour—Ship breaking—Light Engineering (small scale and medium scale)—Mechanisation in agriculture (two wheel tractor etc.) etc.

Backward linkages—Ship breaking—Manufacture of welding generators and welding rods—New oxygen factory near Trincomalee—Exploiting recently discovered iron ore deposits in Seruwila area—Heavy engineering, etc. A proposal for an indigenous ship-breaking project has been made, to start with cutting up our own Navy’s former flagship, the ‘Vijaya’, which has been lying aground in Trincomalee harbour since 1964. It has been estimated that about 500 tons of steel plate can be obtained which would suffice for a years supply of the local ‘udella’. Another proposal has also been made by a foreign organisation to set up a ship breaking project on a much larger scale with large liners purchased abroad. Neither proposal has yet been finalised.

5.6.4 The linkages for the Textile Industry will reach from the Industrial Sector to the Agricultural Sector because the supply of raw cotton could be organised on a systematic basis. Here again the organisation in the agricultural sector need not be on a vast scale of cultivation such as is usually envisaged under multi-purpose projects like Walawe and Galoya. Whilst these projects could remain, smaller projects where individual owners cultivating cotton are organised into cotton producers co-operatives to supply inputs to the textile industry, can be started. These in turn may possibly be set up around abandoned village tanks, specially restored for the purpose. Again, the output from the textile mills could be used to set up medium and small scale co-operatives for processing the product. Screen printing, batik printing and manufacture of garments can be undertaken by such organisations. One
of the white elephants of previous industrial policy the Pallekele Industrial Estate, may at last be put to some use if a complex of large medium and small organisations can be set up in and around the Rs. 10 million investment in buildings which has been established there already.

5.6.5 A couple of examples may be given of what could have been achieved in the past if there had been thinking on these lines. Firstly, when the decision was taken to scrap the Trolley-bus system run by the Colombo Municipal Council, this multi-million rupee investment which was being written off at one stroke of the pen as it were, could have been used as a growth agent for existing small industries, in a similar manner to the ship-breaking project mentioned above. The second example is the dieselisation programme of the Ceylon Government Railway which was brought into effect a few years ago with the immediate effect of taking a large number of steam engines off the rails and into the scrap yards. The boilers of these locomotives as well as other component parts and materials should have been used to induce growth in the small scale sector. However, it is perhaps not too late even at the present time to do this in a planned and systematic manner.

5.6.6 In concluding this section, a few words may be mentioned about the location of industries. In spite of resource surveys and other theoretical considerations including research done in the Universities, in the last analysis it would appear that the over-riding criterion for location of a particular investment is its political desirability. This is not unusual in a context where unemployment and under-employment is high, and where there is a steady drain of resources from the rural to the urban sector of the economy, a characteristic of the "dual society". However, if investments are planned not only as individual investments but as growth agents as well, as discussed in this section, faulty location of an industrial complex for purely political reasons may be to a large extent avoided. To take an example from the recent past, the Plywood Complex situated at Salawa near Avissawella, far from the source of timber, may have been better located elsewhere, and subsidiary medium and small scale manufacturing carpentry co-operatives set up near Avissawella, thereby giving more employment benefits to that area. In this context it would appear that it is the unenlightened public official over-anxious to 'please' the politician at any cost, who does the damage.

5.7 Energy and Power.

5.7.1 Any industrialization plan requires a supporting plan for development of energy and power. A plan for an industrial revolution, which implies rapid industrialisation must have a corresponding plan for rapid development and utilisation of energy and power.

5.7.2 Glancing briefly at the history of some other countries that have embarked on rapid development programmes, we can say that electric power and energy has been the basis for such development in countries like U.S.A. and U.S.S.R. whilst manpower and human energy has been the foundation for rapid development in the People's Republic of China. Whilst Sri Lanka has a reasonably good potential for hydro-power development only a small percentage of which has been harnessed to date, we should also, in the current context, take a look at our manpower and human energy resources with a view to utilizing this resource more effectively in the future.

5.7.3 A rural electrification programme exists in the Ministry of Irrigation, Power & Highways financed with our own resources. Similarly, a programme for electrification in the plantation sector is being implemented at present on a loan from the Asian Development Bank. The latter programme has resulted in the scrapping of some small scale hydro-power plants in up-country estates, which have been utilizing these sources of energy previously. This is an example of waste resulting from absence of a policy for the co-existence of large medium and small. Such a policy should now be postulated for electric power and energy, and applied to the two extensive programmes mentioned above. Resulting from such a policy it will be possible, for example, to set up small wood-burning or oil-fired power plants in remote places where some natural resources are available for exploitation through small scale industry, instead of running a highly capital-intensive transmission line a considerable distance, for this. Again old steam locomotive boilers may possibly be used for this purpose. Finally, a fresh study should be made of the economics of electrification of our national railways, especially because the impending scrapping of the fleet of ex-London Transport double-deckers will impose a new load on the sub-urban passenger transport services.

5.7.4 Conventionally per capita consumption of electric energy is used as an index for economic development. Dr. K. L. Rao has said that a per capita consumption of 300 Kwh per annum represents a state of development corresponding to the Rostovian point of take off, or more generally a point of economic independence. At present the annual per capita consumption of electric energy in Sri Lanka is only 55 Kwh hours whilst even in India the figure is 80 Kwh hours per year. Dr. Rao had
also suggested that we should plan to achieve an average consumption of 300 Kw hours per year by the time our population reaches 15 million. This corresponds to a total installed capacity of 1000 MW, compared to our present installed capacity of about 300 MW with a population of about 12.5 million. It should be stressed that this is the conventional approach to energy and power for development.

5.7.5 The other source of energy (albeit a 'non-traditional' one) that must be harnessed without delay is of course manpower. This is considered a resource which has not been properly exploited so far for various reasons. One of these reasons is the tendency for the emerging "dual society" to be divided in its attitude to this resource, the privileged largely urban minority not having much faith in human energy as a resource, and the underprivileged largely rural majority that constitute this resource not having any say in the matter. Now however, with an inward looking rather than outward looking policy for industrialisation, ways and means must be quickly found for utilizing human energy for development. The construction of the Bandaranaike Memorial International Conference Hall recently by Chinese and Sri Lanka Technicians gave us an opportunity to see some techniques for achieving this. One aspect which may be mentioned is the need for a strong, light and reasonably cheap wheel that can be mass produced by the masses of our country. With such a wheel available, transport in rural areas can be powered up to a far greater extent than at present. It is interesting to observe that the bicycle as a mode of transport was becoming very popular in the rural areas until recently the price of a bicycle increased by a substantial amount in a very short time. Nevertheless it is expected that the trend will pick up once again in the near future. Steps are therefore being taken to do some research on the wheel, and results are expected to be available in the near future.

5.7.6 Another area in which research will be undertaken shortly, perhaps in the Technical Centre of a Medium-scale Co-operative, will be the all-electric vehicle. Some designs for a motorcycle with a range of about 28 miles, and a mini-car, both powered by lead-acid batteries, are available, to commence this research.

5.8 Management.

5.8.1 From planning to implementation through management is a well known and well trod path. Generally the strategies for development are first discussed, and a plan formulated. Thereafter, the role of the engineer in the implementation of the plan is worked out and finally the vital role of the engineer in management is discussed in detail. However, in this paper a less orthodox approach to this aspect of industrial development is presented.

5.8.2 Within the last few years we have seen in this country the displacement of technologists from positions of higher management in the public sector and their replacement by non-technical managers, sometimes from the Administrative Service, and occasionally from outside. At the Chairman level this has happened in the State Hardware Corporation, the River Valley Development Board and the State Development & Construction Corporation where professional engineers were displaced, and in the Steel Corporation where the out-going technologist was a Chemist. Further, in the State Hardware Corporation an Engineer Managing Director and later an Engineer, General Manager were replaced by an Administrator General Manager. More recently a Scientist, Chairman of the Tyre Corporation has been replaced by an Administrator. Again the Industrial Development Board has always had an Administrator as its Chairman, and more recently the Director of the Technical Services Agency of the I.D.B. has been removed from the Board. Finally the steering committee for the proposed National Engineering Research and Development Centre has had an Administrator appointed as Chairman.

5.8.3 The logic behind this type of action is that modern management is a full time profession and that specialists and other professionals should not be wasted in the full time profession of management. Thus the role of Manager falls on the non-specialist, non-professional administrator who of course sees to it that managers are better rewarded than other professionals. The administrator is also given the opportunity to undergo training in "modern Management" and two institutions are now available in Colombo for this purpose, namely the Academy of Administrative Studies, and the Management Development Productivity Centre. Engineers are also given the opportunity from time to time to undergo "Management Training" in these institutions and this of course incidentally recognizes the fact that engineers are also part-time managers. But the fundamental question is whether "modern management" as defined by managers from the developed world, is suitably adapted to suit local conditions? If this is so, we should expect much better results in the actual running of projects in the public sector, by these trained managers, than by untrained managers. It is perhaps too early to pass judgement on this, at the present juncture.
5.8.4 Meanwhile the traditional rivalry between scientists and technologists on the one hand and administrators on the other hand in the Public Service remains. By and large the erstwhile members of the now defunct Ceylon Civil Service continue to enjoy the highest privileges in the newer Ceylon Administrative Service. Public Service Engineers have successfully organised themselves into a Ceylon Engineering Service, through which they will no doubt campaign for a better position vis-a-vis their traditional "rivals" for the privileges of office; but the question arises whether either group is really making their best contribution to national development. Referring to figure 1, we see that the upper echelons of the Public Service as well as the engineering profession generally, are represented in the privileged minority of our society, which minority probably constitutes much less than one percent of the total population. We engineers who belong to this privileged minority, are often unfortunate aliens in our own land, the land of our birth. We are constantly being drawn to the attractions of the developed world where most of us have prospects of good employment. We therefore feel that by remaining in Sri Lanka we are being loyal to our motherland beyond the line of duty but are inadequately rewarded for our patriotism. But just as "the steady decline in the standard of living of the upper half of Cuban Society has led to the emigration of nearly one fifth of that upper half, yet the rest have stayed to learn from the moral basis for the Revolution", so also, if we who remain in Lanka discipline and dedicate ourselves to work consistently in the service of the underprivileged peoples of our country who constitute by far the larger proportion of the population, it is possible that the conflicts within us, may be reduced to insignificance. We may then be liberated from the conflicts amongst us, and from the numerous petty values that now dissipate tremendous amounts of our nervous energy. Then and only then will we be rewarded with the joy and pride of real service to our fellow-men.

5.8.5 Some, however, may consider such an attitude to be sentimental rather than practical. A few more words on this subject are therefore necessary for the benefit of such sceptics. If in Sri Lanka, the 'dual society' has yet not emerged in all its ultimate brutal ugliness, we are nevertheless on the threshold of such a development to avert which we should strain every sinew. We are at the stage of the 'two cultures', the precursor of the dual society. In Sri Lanka, however, the two cultures do not conform to Sir Charles, Snow's classic analysis of the division of society into the Science and the Arts groups. In our country, the two cultures broadly represent the urban and the rural sectors.

5.8.6 By far the larger majority of our professionals including Scientists and Technologists are of urban origin. On the other hand, whilst the majority of Administrators of the old Civil Service also belonged to the urban sector, today more and more recruits to the Ceylon Administrative Service have rural roots. Thus, although the technical man undoubtedly holds the key to economic development, in actual fact we may be pushing in the wrong direction in our efforts to accelerate development on account of a built in urban-bias in our thinking, which the majority of new Administrators, especially in the rural areas, may not have. This may be at the bottom of some of our management problems.

5.8.7 However the Engineer, whether of rural or urban background, and of whatever vintage, has a distinct advantage over all other professionals in adjusting to the requirements of the fast-changing social milieu in our country. This arises from the fact that in our society, science education is available only to a small fraction of the people, so that in the ultimate analysis, only a small minority of those who aspire to become scientists and technologists can actually achieve their ambitions. In other professions (such as medicine) those who lack the necessary opportunities (or at least the large majority of them) go into other quite unrelated types of employment, but in engineering a majority of those who have technical talent but cannot become engineers for lack of social opportunity, find employment in minor professions, at the appropriate stratum of our much stratified society, within the broad spectrum of engineering. This undoubtedly accounts for the well-known talent and genius of our minor professionals in all branches of engineering, be they mechanics or machine operators, electricians or fitters, masons or carpenters, blacksmiths or welders, or whatever else. This provides a wonderful opportunity for the intelligent engineer, the inward-looking man, to build on a solid foundation of rare human talent, to create the permanent technical infra-structure for the achievement of economic independence. To discover this, is the essential pre-requisite to being liberated from conflict both outward and inward, the former being the rat-race of inter-professional rivalry and the latter the dyspepsia of selfish aspiration. Unless the engineer is thus liberated, the profession as a whole is certain to lose the rat-race, because the new non-urban-oriented Administrator is going to lead the industrial revolution—witness the Kotmale example.
6. Conclusion

6.1 The Industrial Revolution in perspective.

6.1.1 The Industrial Revolution in Sri Lanka is now well under way. If it's beginning has to be dated, it may be given as January 11th, 1972, the day the Kotmale Industrial Project was formally inaugurated. Meanwhile, the Five Year Plan has categorically stated that: “net foreign borrowing should decline after 1973” and more recently announcements have been made that the import of rice, one of the major sources of foreign exchange expenditure, will cease by the end of this year. To reach these objectives, a tremendous increase in agricultural output has to be achieved, to a degree that would approach an agricultural revolution. Therefore the question may arise whether our country can simultaneously experience an industrial revolution and an agricultural revolution. The answer is that the way to self-sufficiency in agriculture must start with the industrial revolution and finish with the successful organisation of an agricultural revolution. This puts the industrial revolution in its proper perspective.

6.2 The coming Agricultural Revolution.

6.2.1 The Agricultural Revolution in Sri Lanka is now ready to be launched. Unlike the so-called green revolution of yester-year, this agricultural revolution will be the revolution of the village farmer. It will be based on the buffalo and the locally developed two-wheeled tractor and other mechanizations, rather than on the imported, more sophisticated two-wheeled and four-wheeled tractors and other equipment. It will depend on the use of organic fertilizer, both compost and urea, as much as on chemical fertilizer, presently imported at enormous cost but shortly to be manufactured locally. It will not eschew local seed merely because exotic high yielding varieties are given wide publicity. And finally, it will start, and spread throughout the country, from the small village tank which will itself be integrated into large development projects, like the Mahaweli Project and the proposed Southern Area Development Plan. This agricultural revolution will thus have many features which will surprise the international planner, the foreign-oriented national planner, the foreign ‘expert’ on the local agricultural scene, and even the foreign-oriented local research scientist. It will surprise them because it will be based as much on the ancient wisdom of our people as on modern science and technology.

6.2.2 This agricultural revolution will be launched with the setting up of Agricultural Producers Co-operatives as D.D.C. Projects in the rural areas, financed initially by the People’s Bank. Each Co-operative will consist of a group of villages brought together by some common needs. For example, in a pilot project in the Kurunegala District, nine villages having a common village tank irrigation system will make up a single co-operative. This organisation will set up the following common service facilities for its members:

1. Pens or stockades where buffaloes will be herded in at night.
2. Stalls where cattle will be kept at night.
3. Milk collection and distribution to the Milk Board.
4. Compost pits using dung and urine from the pens and stalls.
5. An organic urea project based on modern scientific research financed by the D.D.C., and an Agricultural Research Centre.
6. Highland crops drive.
7. Permanent crops drive (forestry and fruit trees).
8. Purchasing and Marketing Centre providing credit facilities, storage, etc., for all produce.
9. Processing centre for processing surplus produce.
10. Services for agro-based small scale industries.

6.2.3 Improvements to the existing minor irrigation system on a Shramadana or self-help basis will be the initial step in bringing the village workers together, prior to organizing the co-operative as a D.D.C. project.

Available Government extension and advisory services in agriculture, animal husbandry etc. will be utilized by the Agricultural Producers Co-operative. Further, links will be established with the small-scale and medium-scale Industrial Co-operatives that have already been established, on an inter-dependent basis. These inter-dependent services will be built up and managed by the village farmer through the co-operative organization, so that he will be safe from exploitation by middlemen. Thus, the rural agricultural workers’ full capacity for production will be liberated. This will be the agricultural revolution.

6.3 The entrenched beneficiaries of the ancien régime.

6.3.1 It would of course be rather naive to expect such a scheme for an agricultural revolution to be universally acceptable. For years we have been led to believe by the massive propaganda machine of the developed world that we lack the will to achieve economic independence. Some scientists who go abroad to acquire know-
ledge and be trained in modern techniques, whilst being completely ignorant of, or effectively alienated from traditional knowledge in that field, are the commonest victims of such propaganda. On their return home therefore, they are so completely indoctrinated that they actively promote dependence on foreign techniques and practices; and, instead of working to close the gap between modern and traditional, urban and rural, privileged and under-privileged, they try to impose the former on the latter, with disastrous results: This has been especially evident in some areas of agricultural science, where some local scientists promote agricultural practices developed outside the country, and dependant to a very large extent on imported seed, fertilizer, machinery and techniques, with almost missionary devotion and vigour.

6.3.2 Generally such foreign-oriented scientists believe that we have to be entirely dependent on the Capital, the Technology and even the good-will of the richer, more powerful nations, at every step in the development effort. This attitude is especially evident when, from time to time, some newly discovered natural resource has to be exploited. Rock phosphate recently discovered near Kekirawa, iron ore near Srilanka, and perhaps the future discovery of oil, all fall into this category.

6.3.3 This dependant attitude had been very evident in the former Ministry of Planning and Economic Affairs which derived most of its inspiration from foreign economists, and leaned heavily on the United Nations Development Programme. At that time large projects were in vogue, and these were elaborately programmed on the panels of the National Operations Room that was set up with much publicity for the purpose. Thus, in some instances there was a transfer of superfluous or inappropriate technology, because "large capital-intensive projects generally get their funds at lower rates of interest, which do not reflect the real cost of capital; and it is much easier, administratively to handle a few big projects rather than many small ones". An example is the Plywood Complex, which according to a recent report, would have put 96,000 carpenters out of employment if implemented as originally planned. (It may be noted that this is similar to the Hardware Corporation project—see Annex 2). One such large project that was actively canvassed by foreign agencies, supported by local allies at that time was the Highways Project. This project was largely superfluous and would have suppressed the growth of indigenous technology which, in the case of bridges, was already very highly developed and certainly of international standard. A handful of Engineers, led by Mr. M. Chandrasena, then Chief Engineer (Bridges) stoutly resisted this project until, with the change of government in April 1970, the new Ministry of Planning and Employment had no hesitation in rejecting it outright.

6.3.4 However, the purveyors of such project have not been inactive since then. Recently some new projects have been launched in the teeth of opposition from local organizations that claimed to have the know-how, the capacity and even the capital to undertake these projects without so-called foreign aid. (In these instances, the word 'aid' is also obviously wrongly used). These projects include the manufacture of fibre-glass fishing boats for the Ministry of Fisheries, on a loan from the A.D.B. and the supply of farm tanks and other equipment for the Milk Board under the Danish line of Credit. One project that did not go through as planned was a proposal put up by a foreign 'expert' for the supply from abroad of the entire range of new equipment for purchasing paddy by weight, instead of by volume, by the Paddy Marketing Board, financed by a loan from the Asian Development Bank. In this instance, although the foreign expert's proposal for purchase by weight was accepted, the Ministry of Planning headed the protests of local engineers, and set up a local consortium of engineering organizations led by the State Engineering Corporation, to implement the project, without the foreign loan.

6.3.5 Another recent project about which doubts and misgivings have been expressed by some officials in other Ministries, is the Planning Ministry proposal to stop imports of the two-wheeled tractor this year, and import only spare parts, whilst simultaneously embarking on full commercial production of the locally manufactured two-wheeled tractor. The matter is still under discussion, but it is significant that institutionalised research for the development of the local tractor, has not been started, apart from the 'ad hoc' attempts made through the Planning Ministry described earlier, and NERDC has hardly been in on these attempts. The JDB has started a project to manufacture the two-wheel tractor-trailer, while the Farm Mechanisation Unit at Maha Illupallama has made a contribution to development by testing the prototypes of the two-wheeled tractor. The Agricultural Implements Factory at Welisara and the Medium-scale Industrial Co-operatives have ample capacity for making the two-wheel tractor on a commercial scale, but the absence of institutionalised research may be the deciding factor, ultimately, in postponing commercial production, as recommended by the doubting Thomas.
6.3.6 The question then arises what should be done about such doubting Thomas' who constitute a real impediment to industrial development? If their alleged doubts and fears are politically motivated, it is obvious that they are doing it to retard development, their actions fall outside the scope of this paper, even though they may make front page headlines in the daily press. If however, such actions are not politically motivated but based on genuine fears (even though caused by their own ignorance) a remedy has to be found, and found quickly. It is suggested that this should take the form of a policy to encourage 'export of brains'. Thus, not only those who are out of step with the non-dependant attitude to national development, but even discontented persons, will be encouraged (and perhaps even helped) to find employment abroad; but they should be free to return to Sri Lanka if and when they so desire. For example, those officials who have expressed their conviction that UNIDO assistance is essential to set up the NERD Centre will fall into this category and should be encouraged to find employment abroad—perhaps in UNIDO itself. Their departure, those who have definite plans to set up NERDC with local personnel and with a minimum of foreign resources will be able to do so fast, and fill the void in engineering research in this country.

6.3.7 Free movement out of our country and back should generally be available to everybody, but it is especially desirable for scientists and technologists. It is my view that if such free movement is available, the net movement of trained personnel out of the country will be less than with restrictions. After all, even in Cuba after the Revolution, only some 20 per cent of the privileged, wealthy upper class chose to emigrate in spite of a very considerable decrease in their living standards. Surely Sri Lanka can well afford to lose 20 per cent of its so-called elite, indeed would be much better off without them, because the majority of those who might migrate would probably represent the 'entrenched beneficiaries of the ancien-regime'. Those who live abroad will have to contribute some of their earnings for the purchase of new non-traditional exports from Sri Lanka, or promote the exports in some other tangible way. A step in this direction has been taken with the establishment recently of a Cooperative in London by some 6000 of our people there, for the distribution of new exports (including food-stuffs). Finally, one can expect that those who do return willingly to Sri Lanka after a sojourn abroad will, like those who willingly remain here, be fired with the determination to strive to achieve economic independence within our own lifetime, rather than to mortgage generations yet unborn by following the dependent path that leads not to independence but to enslavement.

7. Acknowledgements
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It is also my pleasant duty to acknowledge with deep gratitude, the wholesome co-operation and enthusiasm of those of my colleagues and fellow-workers who believe in our country's ability to develop rapidly through our own efforts, with a minimum of so-called foreign aid. I trust that others of my colleagues will forgive me if I specially thank Mr. W. A. Jayasinghe former A.G.A. Kotmale, new Deputy Director Regional Development Division in this Ministry, and Mr. N. G. (Berty) Gunasekera, Divisional Development Assistant attached to this Ministry, for their abiding faith and confidence in the ability of our Sri Lanka people to achieve economic independence within our own lifetime.

Annex 1

SYNOPSIS: Progressive Technologies for Developing Countries
by Keith Marsden, I.I.O.— 10.3.1967

Part 1— Some Reasons why the Direct Transfer of Technologies from the Industrialized to the Developing Countries may be Inappropriate:

(a) Capital is dearer and labour cheaper in the developing countries.
(b) Large-scale production may be inefficient in the conditions prevailing in some developing countries.
(c) Advanced technologies may reduce both employment and real incomes in certain circumstances.

Part 2— Policy Guidelines for the Selection of Progressive Technologies:

(a) Wide disparities in capital intensity per worker between one sector of the economy and another should be avoided.
(b) Technology should suit the economic and social environment in which it is employed.
(c) New technologies should stimulate output in indigenous industries and be capable of being reproduced locally.
(d) The productivity of capital should be maximised and the real social cost of making a product minimised.

Part 3—Sources of Progressive Technology and ways of increasing its Availability:

(a) New Designs
(b) Modern Technologies
(c) Long-established Designs
(d) Second-hand Machinery

Part 4—Some Policy Measures open to Governments to ensure the Implementation of Progressive Technology:

(a) The formation of customs unions with other states at a similar stage of development and with complementary resources. These would encourage a new international division of labour and a competitive stimulus for efficiency, while avoiding head-on, heavily one-sided encounters between rich and poor nations in the international trade and technology fields.

(b) Higher official interest rates* to raise the price of capital vis-à-vis labour costs. This would tend to bring more labour into productive employment as well as increase the propensity to save.

*It should be made clear that this is not suggesting that Governments should pay a higher interest rate on what they borrow from advanced countries or international agencies.

(c) Providing indigenous industries with ample scope to expand, develop and diversify over time without bumping their heads against competing industries which are technically more advanced because greater resources (uneconomically priced) have been placed at their disposal. Giving a clear run ahead to indigenous entrepreneurs is likely to be more conducive to growth and development than protective subsidies and quotas in an attempt to have the best of both worlds.

(d) Tax concessions and political guarantees to attract foreign capital and know-how, accompanied by legislation requiring all companies to buy a certain proportion of raw materials, components and replacement machinery of local manufacture within a fixed time period (as in Mexico).

(e) The setting up of documentation and information centres to keep track of past and current technological developments throughout the world. These would establish close liaison with international and other national advisory services for the selection of equipment.

(f) The provision of widespread primary and technical education facilities at the apprentice level, combined with night school tuition and upgrading courses for practising operatives, supervisors and managers. I.L.O. sponsored vocational, instructor and management training institutes already function in many countries; while U.N.E.S.C.O. programmes cover school, college and university education.

(g) Training courses for managers and planners in feasibility study and cost/benefit analysis techniques to increase the 'rationality' of investment decisions and in the use of other management tools (e.g. work study) which will increase the efficiency of existing manufacturing methods. The I.L.O. and U.N.I.D.O. are operating here.

(h) The encouragement, by state subsidies, grants, etc., of trade and research associations for each industry, sponsored and run by the members themselves. Special budgets could be allocated for importing standard machines to be stripped down, adapted and eventually reproduced locally.

(i) The institution of incentive rewards schemes for inventions, plus patent protection for local adaptations of foreign designs.

(j) The formation of common facility co-operation and joint production workshops to raise the opportunity of artisan and handicraft industries. The I.L.O. Co-operative and Related Institutions Branch provides technical assistance in this field.

(k) The provision of extension services for small-scale entrepreneurs, providing advice on product and process development, technical skill formation and the selection and use of appropriate technologies. Again the I.L.O. is active in this work through Small Industry Institutes and experts on individual assignment.

(l) Long-term planning of man-power and skill requirements in the various sectors of the economy, closely related to the foreseeable rate and character of technical change. The Man-power Planning Branch of the Human Resources Department of the I.L.O. is advising several Governments in this field.

(m) The adoption of factory legislative and safety regulations which provide adequate working conditions and safeguards for all groups of workers and do not create dual standards (i.e. for those within and those outside the practical jurisdiction of the laws) or act as barriers to expansion for the smaller enterprises.

(n) The creation of central quality control and inspection schemes to ensure that products destined for export meet external quality
standards, but without imposing unrealistically high standards on total production within the country.

(o) Priority in the allocation of import licences for machinery and materials given to those organisations which have already demonstrated the aptitudes, skills and motivations required for success in the export markets.

(p) Conducting systematic market research surveys abroad to identify precise consumer needs (and appropriate distribution channels) which might be satisfied by the use of relatively labour intensive techniques. U.N.C.T.A.D. and G.A.T.T. have already sponsored and carried out such investigation on behalf of member governments.

(q) The establishment of special Small Business Development Banks to reduce the differentials in capital accessibility between the traditional and the modern sectors. The I.B.R.D. is giving, technical and financial assistance in this area.

(r) The planned distribution of industry to backward areas to provide more employment opportunities outside the major cities and to reduce income inequalities between regions. Processing of agricultural and other land-based products are obvious choices (the F.A.O. has substantial interests in this field). Valuable planning techniques have been devised in the socialist countries for this purpose.

(s) Financial incentives (e.g. tax rebates on training costs) to international companies to set up apprentice training schools, management development programmes and planned succession to management positions for indigenous staff. This would reduce the foreign exchange costs of expatriate staff, while ensuring that their essential expertise in operating, servicing and managing more advanced technology is passed on to local personnel.

(t) Revaluation of currencies to ensure that the importer has to pay the real cost of foreign machinery and materials, and a proper evaluation is made in initial feasibility studies.

(u) State financed hire purchase and rental schemes with lower interest rates for imported second-hand machinery and locally made equipment.

(v) Subsidised factory premises in provincial towns and villages to slow down the population drift to the cities. The subsidies could be equivalent to cost of housing and other facilities which would otherwise have to be provided in the cities.

(w) Tax holidays to foreign machinery and component manufacturers to set up local design and production plants to develop indigenous technologies.

Annex 2

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Figure 1. A NEW MAP OF THE WORLD

2. Ibid.


9. Some examples of foreign manufactures are mammyots (see Reference 4, page 6), equipment for making strawboard, sugar-cane crushers. A sample of a prospective foreign investment is the two-wheel tractor.


14. See, for example, Reference 7, page 92: "One political motive is fear, just as one is a kind of altruism, but neither of these motives implies that a developed country will want to place an undeveloped one so much on its feet that its future actions become unpredictable. Fear of an economic collapse is counter-balanced by fear of an economic miracle."

15. Reference 7, page 93.


18. Reference 16, pages 89 and 90.


22. See: Jules Pierre (1969). The Third World in World Economy. Monthly Review Press. Chapter VI. Movements of Capital and Aid to the Third World, especially The Return Flow of Capital, pages 114 to 150, and Tables VI-1 to VI-7. Quotation from page 117. "As far as can be determined, the total drain on the Third World by the imperialist countries came to some $12 billion in 1964-65, that is 1.5 times the total volume of aid. So it is not the imperialist countries which aid the Third World, but the Third World which aids imperialism."


27. A concept described in: Divatia M. V. (May 1971) Small-scale Industry—Dimensions and directions of expansion of Small-scale Industry. Ministry of Planning and Employment (Mammographed), and quoted in Reference 1, page 78. Also developed further in the present paper paragraphs 3-3 and 4-5.


29. Reference 1, page 90.

30. Reference 1, page 88.


32. Reference 31 page 90.

33. Reference 31 page 11.

34. Reference 31 pages 4 and 5.

35. Reference 31 page 12.

36. A quotation from a book published 179 years ago, is of interest here:

"they (local carpenters) complain greatly of the English tools as being very badly adapted to the hardness of eucalypt and inshorewood timber. I would therefore suggest to the British Manufacturers to study the shape and temper of the native tools which are of the most simple construction and thereby ensure certain and available returns from their export to the Ceylon Market."


38. This vivid expression was explained by Mr. G. W. Wijewardena at a talk given under the auspices of C.A.A.S. Section C Engineering, and the College of Tech-
nology, Katubedda, on July 12th 1972, on the subject: "Innovative Design and Development in Intermediate Technology".

39. Unpublished communication on "The Buffalo—the poor man’s Fertiliser Factory" by Mr. T. N. Manikkavasagai of the Agriculture Department.

40. The National Engineering Research and Development Centre was originally intended (in 1970) to fill the gap between the existing C.I.S.I.R. and the I.D.B. It was to be built up as a separate institution for engineering research, especially in the light engineering industry, either using the facilities already built up for engineering research by Mr. A. N. S. Kulasinghe (See, Presidential address, 1970, C.A.A.S., and Presidential address, 1970, Institution of Engineers, Ceylon) in the State Engineering Corporation, or starting again on the same lines. The proposal received approval in principle, by the Cabinet on 31st July 1971, but meanwhile a request had been submitted to UNIDO by the Permanent Secretary, Ministry of Industries and Scientific Affairs, and two 'experts' from that organisation visited this country in November-December 1971, and submitted a report giving their proposals for the project. But UNIDO funds were not to be available till June, 1973 the earliest, and in any event this approach to NERDC was quite different from the original proposal, which had been approved by the Cabinet. In fact the Prime Minister’s instructions given on 24th March, 1972 were: "The National Engineering Research and Development Centre should be established without delay. As far as possible local engineering talent should form the nucleus of this organisation and foreign expertise obtained only in areas where the relevant skills are not available in this country". Finally, on October 28th 1972, a steering Committee was set up by the Minister of Industries and Scientific Affairs to take steps to set up NERDC. This Committee consists of: Mr. M. Wijenikale, Chairman, Messrs. C. H. de Tissa, D. Madlige, D. H. S. Abeywickrama, I. Obeyesekera and D. L. O. Mendis (See also, Reference 1, pages 79 and 80, Reference 4, page 7, and Reference 19 (2) pages 7-9).


42. Toffler Alvin (July 1970) Future Shock, Bantam Edition (August 1971), page 134. Also see pages 124 to 131, Chapter 7 on "Organizations: the coming Adhocracy".

43. Reference 4 pages 5 and 6.


45. Reference 1 page 99.

46. Reference 1 (ii) pages 10 and 11.


48. It is expected that the Chinese Technical Team presently in Sri Lanka to frame proposals for a flood protection scheme for the South-Western Wet Zone area, which falls within the Southern Area Development Plan, (see Reference 1, pages 83 and 84) will adopt this principle in their proposals.


55. Reference 16, page 93.


57. Times Weekend, Sunday 13th May 1973 page 1, headline: "Economic Coup in the Offing". See also, Ceylon Daily Mirror, Friday, May 18th 1973. "Net closing over Mystery Man—Economic Coup confirmed".