CHAPTER IV

FRAMEWORK FOR THE ORGANISATION OF INDUSTRIES ANCILLARY TO AGRICULTURE

In the preceding chapter I have been concerned essentially with the discussion of a number of cottage and small-scale industries which are either in common demand as "daily consumption goods" or whose progress is important from the standpoint of providing employment opportunities in specific localities. I came to the conclusion that these industries, if organised, co-ordinated and integrated on the lines indicated, could provide wide scope for new and untried activities which would be a healthy means of providing better opportunities for labour in India. In the present chapter it is proposed to discuss certain industries ancillary to agriculture, e.g. forestry, dairy farming, poultry farming, bee-keeping, fruit canning, which could help to make agriculture a full-time occupation and would reduce seasonal unemployment and migration to urban areas.

The best situation for the cultivators as well as the landless labourers would be one in which agriculture can
provide them with work for the whole year. This would economise the use of capital because the same agricultural equipment can be used throughout a year. In actual practice this is exceedingly difficult or even impossible, on account of agriculture's dependence on natural conditions. As a matter of fact in no part of the world is the agriculturalist solely engaged on land throughout the year. The best that can be done is to create conditions which can provide work for as large a part of the year as possible.

For example, double cropping can reduce the extent of seasonal unemployment. This measure is connected with the development of irrigational facilities which would make double cropping possible in those large tracts of the country which are deficient in rainfall. Although a large number of irrigational projects are under construction, their completion would take a number of years, and even after the introduction of double cropping there will be periods of idleness in which the cultivators will have practically no gainful employment. Hence, the development of industries ancillary to agriculture would be very healthy and a useful source of subsidiary income to the farmers and landless labourers. The employment of agricultural workers in forests, where many tasks can be carried on at times when other agri-
cultural work is suspended, is very helpful. Floods, famines and droughts result from ruthless exploitation of forests. Therefore, the policy of afforestation, whether regarded as temporary relief work or as regular and permanent work, appears to be a sound means for ensuring supplementary work as a remedy for unemployment in agriculture. In the neighbourhood of forests a variety of industries might be established which would provide enormous opportunities of employment and economic activity for raising the standard of living of the masses. Similarly, subsidiary industries like dairy farming, poultry farming, bee-keeping and fruit canning, etc., would afford greater stability to the farmers on account of the diversification of the farm output. Perhaps even more important is their contribution to a better balanced diet, especially through the provision of such products as milk, dairy products, meat, eggs, honey and fruits for the majority of the population whose diet is short of protein. In short, industries ancillary to agriculture would improve yields and stabilise the economic position of the cultivators and landless labourers. In the following paragraphs these industries are described in turn.
Forests possess great economic value in addition to their physical utility and natural beauty. Their worth depends on the products and benefits they yield when managed as crops and given protection against fire and other destructive agencies. Wood-producing and wood-using industries rank high in the economic life of countries favoured with productive forests. Forests are a renewable resource and hence the industries based on continuous conversion of forests contribute to a stable foundation for the economic development of countries endowed with forest resources. Benefits derived from forests that are not directly related to wood products include: control of erosion and stream flow, provision of grazing facilities for live stock, maintenance of wild life and provision of suitable areas for recreation. Forest managers, therefore, while striving to obtain a high yield of marketable products, should also recognize the other benefits and services that forests render to the nation as a whole. Where this is not possible, the State may feel justified in intervening in accordance with the requirements of public welfare to induce people to use forest resources. The protection of birds and beasts, rivers and landscapes and other public amenities provides a
worthy argument for slowing or staying the destruction of forests.

Forestry is a very ancient subject of state intervention. For example, on the continent of Europe the first recorded German prohibition of cutting occurred in 1165, while in 1237 an order was made to stop cutting to permit the regeneration of forests required for the working of the mines. There is a considerable amount of evidence, in the fifteenth century, of the sowing of trees by German cities. The motives were in general mixed, and included: the provision of masts and timber for ships, cover for hunting, fuel for charcoal and for the home. French forest policy was very similar. Repeated decrees were issued in the sixteenth and seventeenth centuries to restrict disafforestation. Explicit interest in conservation in the U.K. can be traced from the reign of William the Conqueror. This interest can be ascribed to the need for timber for defence purposes. But in the eighteenth century it was realised that while timber was the basis for the building of ships, which the U.K. needed for defence and for trade, forestry had other economic justifications. "In the

thirty years following the first world war, which saw the development of a clear forest policy for Britain and the formation of the Forestry Commission, organised forest research ... was mainly occupied with solving the immediate problems concerned with the formation of new forests on the types of land that become available for planting."

Many more examples can be cited where forests have been conserved by the state in the interest of public welfare. The need for intervention to ensure conservation may be reduced when the state provides education in forestry, so that resource owners are better able to seek profit by investing and allocating factors of production to projects which will overcome current shortages. The owner's determination of the most profitable rate of exploitation, together with the rate of interest as determined in the market, will influence his decision regarding afforestation or deforestation. Though the state has powers to regulate resource use, the most important methods are less direct, i.e. education or liaison which dispels ignorance about best methods of resource use and at the same time encourages private co-operation with state policies and arrangements.

1. Laurie M.V., Current Trends in Forest Research in Britain, Address delivered on August 30th 1956, at the Sheffield meeting of the British Association.
which adapt the scale of managerial control to the natural extent of the resource. While the implementation of these measures poses many fascinating problems, their discussion is, perhaps, less essential here. It would suffice to conclude that a certain area of forests has always been protected by the state from the operation of the free market in order to ensure that the rate of exploitation which is privately profitable does not conflict with the requirements of the community.

Turning now to the discussion of Indian forests it can be pointed out that most of the cottage and small-scale industries which I have described in the previous chapter lean heavily upon the forest resources of India, and that the Government should take suitable measures to protect forests from excessive felling. For example, the match industry needs soft wood for its development, the leather industry requires tanning material, textiles depend on wooden bobbins and tannind starch, all of which are forest products - all this needs no emphasis. The development of large-scale industries is also dependent upon our forest resources. But in the absence of a National Forest Policy for India, forests have steadily declined to such an extent that about 21 per cent of our land is under forest and there
are vast regions in the Indo-Gangetic basin where the proportion of forests is as low as 13 per cent. As a consequence the great desert of Rajasthan has been engulfing about fifty square miles of fertile land every year.

Afforestation can play a dominant role in repopulating those large areas which have suffered from the drift to towns and can at the same time create employment opportunities for a large number of unemployed persons. The following table gives the distribution of forest area in relation to the total land area in Part A States. If compared with the forest area in other countries it might furnish an instructive guide as to the proportion of forests to be aimed at.
<table>
<thead>
<tr>
<th>States</th>
<th>Total land area</th>
<th>State forests</th>
<th>Forests owned by Corporate bodies</th>
<th>Private forests</th>
<th>Total forest area</th>
<th>% of total forest area to land area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ajmer</td>
<td>2,417</td>
<td>73</td>
<td>235</td>
<td>285</td>
<td>593</td>
<td>24.5</td>
</tr>
<tr>
<td>2. Andamans</td>
<td>3,215</td>
<td>2,500</td>
<td>-</td>
<td>-</td>
<td>2,500</td>
<td>77.8</td>
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<td>3. Assam</td>
<td>85,007</td>
<td>20,948</td>
<td>501</td>
<td>474</td>
<td>21,923</td>
<td>25.8</td>
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<td>4. Bihar</td>
<td>70,330</td>
<td>2,727</td>
<td>11,173</td>
<td>13,900</td>
<td>19.8</td>
<td></td>
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<tr>
<td>5. Bombay</td>
<td>111,434</td>
<td>17,330</td>
<td>5</td>
<td>169</td>
<td>17,504</td>
<td>15.7</td>
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<tr>
<td>6. Coorg</td>
<td>1,586</td>
<td>829</td>
<td>327</td>
<td>1,156</td>
<td>72.9</td>
<td></td>
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<td>7. Madhya Pradesh</td>
<td>130,272</td>
<td>19,414</td>
<td>-</td>
<td>21,493</td>
<td>40,907</td>
<td>31.4</td>
</tr>
<tr>
<td>8. Madras</td>
<td>127,790</td>
<td>18,825</td>
<td>-</td>
<td>14,871</td>
<td>33,696</td>
<td>26.4</td>
</tr>
<tr>
<td>9. Orissa</td>
<td>60,136</td>
<td>2,874</td>
<td>-</td>
<td>1,678</td>
<td>4,552</td>
<td>7.6</td>
</tr>
<tr>
<td>10. Punjab (I)</td>
<td>37,378</td>
<td>4,873</td>
<td>-</td>
<td>-</td>
<td>4,873</td>
<td>13.0</td>
</tr>
<tr>
<td>11. U.P.</td>
<td>113,409</td>
<td>18,277</td>
<td>521</td>
<td>3,076</td>
<td>21,874</td>
<td>19.3</td>
</tr>
<tr>
<td>12. West Bengal</td>
<td>30,775</td>
<td>2,680</td>
<td>41</td>
<td>1,110</td>
<td>3,851</td>
<td>12.4</td>
</tr>
<tr>
<td>Total</td>
<td>773,749</td>
<td>111,350</td>
<td>1,303</td>
<td>54,656</td>
<td>167,309</td>
<td>21.6</td>
</tr>
</tbody>
</table>

Source: The National Forest Policy of India, Govt. of India publication, Delhi, 1952, page 3.
The proportion of forest area to the land area of the above states amounts to 21.6 per cent. In terms of forest area as a percentage of total land area, Europe, despite its industrialisation and dense population, has 28 per cent of her land under forest, against 29\% per cent for the world as a whole. Again, the area per head of population in India is 0.2 hectare as against 1.8 and 3.5 hectares in the U.S.A. and U.S.S.R. respectively. The consumption of pulp products per head is 1.6 lbs. in India as against 76 lbs. in the U.K. These figures indicate the gap that has to be made up in order to attain a comparable level of consumption.

Attention may also be drawn here to the employment opportunities which forestry provides in the U.S.A. The lumber and wood-using industries, according to the U.S.A. Bureau of the Census of 1939, ranked fourth in the number of establishments, fifth in the number of wage earners, seventh in the total amount of wages paid, tenth in the cost of materials, tenth in the value of products and ninth in value added by manufacturers. It is no accident that the most advanced countries in the world are

those with the highest per capita consumption of wood.

Great Britain, with the lowest proportion in Europe, i.e., five per cent of forest area, was awakened by the stress of war conditions to the need for forests of her own. Apart from government forests, attention has been paid particularly to private forests, which constitute 80% of the total forest area. State aid provided to private forest owners has taken the form of free technical advice and grants and contributions for education and research. A policy known as the "Dedication Scheme" has been introduced since the war, whereby an owner dedicates his woodlands for the specific purpose of timber production and enjoys a state subsidy until they become self-supporting. The management of public forests rests in the Forestry Commission. This reflects the importance of forests in the national economy of a highly industrialised country like Britain.

In India, we have tropical sun, uneven rainfall, steep mountain slopes, a lower forest productivity and a predominantly agricultural population. Considering these limitations a somewhat higher proportion of forest area than that of Europe appears to be essential. We should aim at raising the proportion of our land which is under forest to at least one-third, in order to maintain the geo-physical
features of the country as well as to provide for the vital needs of our growing industries. Hence the policy of afforestation requires immediate attention in order to check the further advance of the desert, to fight soil erosion and ravine formation along hill and river slopes and to provide fuel and timber for the development of our cottage, small-scale and large-scale industries. The deficiency in the proportion of forest area should be made good by afforestation of waste lands which are unfit for cultivation. To maintain an over-all average, it is desirable that states better suited for the growth of forests, like Andamans, Coorg, Madhya Pradesh and Assam should aim at making good the deficiency in those states where climatic, economic and edaphic factors militate against tree growth.

What we need today is the vigorous control of private forests, which would ensure that the National Forest Policy of India is formulated on the basis of the country's needs. Although in 1942 Private Forest Control Acts have been passed in Bengal, Bihar, U.P. and Madras, yet in considerable parts of the country there is no control over private forests and where there is control it is only partially effective. As a result cow dung, which is a most valuable manure, is being burnt in villages for want of forest fuel.
Trees have been recklessly destroyed to increase agricultural lands, and as a consequence forests are dangerously reduced, water tables have fallen and nature has taken its revenge in many ways.

Framework of Organisation:

It is imperative, therefore, that the National Forest Policy of India should evolve a system of balanced and complementary land use so that each type of land could be put to its most productive use. A detailed survey of lands with a view to their proper utilisation is highly desirable. The role of forests in the national economy is both 'protective' and 'productive'. The primary object of the management of forests should be to utilise their protective influence on the soil and at the same time to concentrate on the production and exploitation of timber and open new avenues of employment for labour. The following are the functional classifications of Indian Forests:

National Forests: They comprise valuable timber bearing regions whose produce is indispensable for defence, communications and a number of small-scale and cottage industries.

1. Protective Forests are those forests which are found or required on hill slopes, river banks, sea-shores or other erodable localities. The need for such forests is based on physical considerations like prevention of erosion, control of floods, etc.
They must be managed in the interest of the nation as a whole, their organisation and development is one of the primary functions of the State. Their management on sound business lines is essential for maintaining a sustained supply of wood for industry, defence, communication and other purposes.

**Village Forests:** Apart from 'National Forests,' there are village forests which are maintained to serve the needs of the surrounding villages in respect of timber for rural housing, agricultural implements, firewood, leaves for manure and fodder, fencing thorns, grazing and edible forest products. Such forests, if properly managed, can also develop certain small-scale and cottage industries in the villages, e.g. hand paper making, manufacture of musical instruments, sporting goods, pens, pencils, etc.

If these forests are integrated with the local needs of the villages, they should provide employment avenues to the villagers, and the expense of the development and maintenance of such forests would be met out of their own income. The way in which some progress can be achieved in the development of village forests is to give free plants and seeds to the villagers to grow trees on village commons and along the roadside and to grant them the benefit of fruits, timber and other products of the trees planted by them. The
necessary technical guidance and help should be furnished by the Forest and Industries department.

Protection forests: These forests are those which are preserved for physical and climatic considerations.

The functions of the various categories of forests do of course overlap. Every forest performs more than one function and its utility may be of local, regional or national significance. It cannot be denied that the country as a whole has a vast stake in the conservation of all forests, irrespective of their function and ownership. Every advance in employment will be reflected in an increased demand for forest products.

It is quite evident from the above account that the general benefits derived from forests are widely shared. It would, therefore, not be out of place to suggest that there should be extensive state ownership of forested regions, particularly where multiple-use management is essential. Forest programmes should be drawn up by different states on a uniform and systematic basis, keeping in view local requirements. The Central Government should pay special attention to research, education, demonstration and co-ordination of the programmes of various states. A Forestry Commission, as proposed in the second Five-year
Plan, would be useful for the co-ordination of forest development and management. It would make itself responsible for improved forest statistics and market studies, and would collect statistical information for the standardisation of grading work with reference to timber and other forest produce.

Wild Life: The National Forest policy underlines the necessity for protecting the animal kingdom and particularly the rare species such as the lion and the rhinoceros which are in danger of extinction. It is necessary that bird and animal life should be controlled by special laws, and rare fauna should be preserved in Sanctuaries and National Parks. In order to preserve wild life, forestry programmes in the Second Plan include the establishment of eighteen national parks and game sanctuaries. This is a moderate attempt in view of the imperative need for protection of India's rich heritage of wild life. Wild life management if based on protection as well as the destruction of predators. A balance should be maintained among animals as well as in the vegetable kingdom. In the proper protection and organisation of wild life there lies a future of animal utilisation for both internal and foreign trade.
They can be the source of good opportunities for Indian labour.

Grazing: Forests can also help the development of the dairy farming industry and of animal husbandry. Their efficient management requires that grazing should be regulated, both as regards time and place and the cattle admitted. Unlimited or uncontrolled grazing in forests is incompatible with sound forestry. The formulation of a grazing policy based on rotational grazing is necessary. Space does not permit me to detail all the principles of grazing, but it may be pointed out for the sake of information that restrictions should be imposed on sheep grazing in forests and that goats should be totally excluded from them. Experience gained in India and elsewhere points to the fact that the damage which these animals inflict on young plants is often irreparable. It is recommended that special fodder reserves under rotational control should be created for them. For other cattle there should also be rotational grazing instead of continuous grazing on the same areas, which strains the grasslands and leads to the deterioration of its complex. The grazing rates should not be very cheap because cheapness leads to the increase of uneconomic cattle and reduces the quality of herds. The
growing increase of the number of uneconomic cattle kept by
the Indian farmer can be checked through reasonable grazing
charges. The system of owning as many uneconomic cattle
as possible must be combated. Free and indiscriminate
forest grazing has done positive harm to cattle breeding in
India. The grazing rules should be such as would improve
the breed of cattle, preserve grazing grounds and afford
opportunities for the development of the cattle wealth of
the country.

It should be mentioned that the conservation of forest
resources for long range development on the one hand and for
meeting the increasing demands for timber on the other,
requires due consideration of sustained yield in the manage-
ment of all classes of forests. Fluctuations in the annual
out-turn of forests upset state budgets, industries and
other national enterprises. All sound working plans, there-
fore, require the calculation of the increment of forest
products, in order to ensure that, over a period, the
planting of new trees is at least sufficient to make up for
felling of old trees.

There should be carefully planned afforestation schemes
to replace inferior tree growth by valuable species of
commercial importance. But this is a long range policy and
will require sufficient time for its maturity. To meet the growing needs of industry in the short run, artificial regeneration of industrial and commercial timber will therefore be inevitable. Any short term measures to upgrade inferior qualities of timber, which would not injure the long term prospects of development, should be adopted. For instance, so long as high quality wood is not grown, the durability of timber can be improved by the technique of plywood manufacture, seasoning, preservation and timber engineering. Similarly, chip-boards and hard-boards, instead of being produced out of timber, should be manufactured out of wood waste to meet the timber deficit.

**Forest Budgets**

The above suggestions indicate the importance of preparing forest budgets in each state, so that funds may be available for sustained forest operations such as replacement of what is removed annually, improvement of forest exploitation, through the development of communications and improved technique, etc. The creation of a sinking fund by investing a portion of the revenue in Government securities, more particularly during boom years, would make it possible to finance operations in lean years. Each state should set up a permanent organisation to deal with working
plans - their compilation and revision and deviations from them, and with research and statistics. Detailed surveys of forest resources are also essential for sound forest management.

The efficiency of forest administration depends on the adequacy of the forest laws. However, employment opportunities and industrial advancement are largely dependent on the training and calibre of the professional forest services, and the progress of research on both the biological and the utilization aspects of forestry. In short, there should be liaison with industry for the maximum utilization of the results of research by commercial and industrial interests. Liaison and publicity arrangements should be strengthened in order to ensure closer contact between the Forest Research Institute and the interests utilizing timber and forest products. Special technical courses in forest industries like paper making, plywood technology, wood preservation, timber seasoning and other cognate subjects should be organised to meet the demands of cottage, small-scale and large-scale industries for technicians. Although investigations into the biological aspects of forestry, silviculture, botany, and entomology are being carried on at the Forest Research Institute at Dehra Dun, it is also
desirable in the interest of efficient forest management that each state should set up a research organisation commensurate with its resources. This would help the development of the local forest industries of each state.

**Forest Education:**

Forestry courses are at present conducted for Forest Rangers and superior Forest officers at the Forest Research Institute, Dehra Dun, which is a well-equipped forest Research Institute and enjoys a world-wide reputation. A common forest education is an effective means of developing outlook in matters of forestry and ensures concentrated and integrated policies throughout the country. There is, however, no suitable arrangements for the training of lower executive staff on whose technical skill the proper execution of forest policies ultimately depends. It is, therefore, necessary that contiguous states should combine and co-operate in establishing up-to-date training schools to train their subordinate personnel in the most economical manner. Inadequacy and incompetence of the lower hierarchy would be followed not only by loss of revenue, but also by general degradation of forests and consequent unemployment in industries connected with forestry.
Co-operatives and Forest workers:

Although forest legislation, forest education and forest research constitute the basis for sound forest management, no forest policy can be successful without the willing support and co-operation of the forest workers. Special consideration should be given to the provision of facilities for forest workers, such as accommodation, medical assistance and other social amenities. At present, comparatively backward and tribal forest workers are engaged in forestry. They are exploited by the forest contractors. It is, therefore, necessary to strengthen the economic position of backward tribal workers by organising them in forest labour co-operatives which would instil in the people a direct interest in the utilisation of forests. Intermediaries who exploit both the forests and local labour should be supplanted gradually by forest labour co-operative societies, which should be formed to suit local conditions. If the local population learns to look upon the forests as a means of livelihood through the development of small-scale forest industries, the forest policies would be highly successful.

From the above description it is quite clear that Indian forests, if properly managed and maintained, offer
enormous scope for building up new industries. It is sufficient here to list some of the industries that might profitably be established, such as wood distillation, plywood factories, match making, paper making and rayon industry. By hydrolysis wood has been made to yield food materials like wood sugar. In the U.S.A. distillation of hardwood is an important industry which produces charcoal and a wide range of organic chemicals. This can also be developed in India. Plywood is used for many important purposes where a combination of lightness and strength is necessary, as in fuselage and wing construction of aeroplanes. It can replace common wooden boards in the manufacture of packing cases such as tea chests and travelling boxes of various kinds. Production of improved plywood locally would lead to its large-scale application in making high-class furniture, paneling of houses, shipbuilding and aircraft manufacture. India is largely dependent for its supplies of newsprint and pulp for staple fibre and rayon on imports from abroad. The firewood of the Himalayan region could, with the aid of research, be utilised for the manufacture of mechanical and chemical pulp for newsprint and staple fibre and rayon industries.

Again, a variety of soft woods grown in Indian forests
can be utilised for preparing toys and sports goods. Matchwood plantations in the states of U.P., Bombay, Assam and Travancore-Cochin, where the match industry has already been well-established, will afford further employment opportunities and strength to the industry, which is dependent upon the supplies which it can get from the Andamans. Again, if the timber from the forests is not removed in the form in which it is felled from the trees, but converted into required sizes or forms near the forests, extra employment can be ensured in the forest areas and difficulties of transport can be more easily avoided. This will open up new industries for the utilisation of waste material like uneven blocks of wood and small cubes from which articles like handles of ploughs and wooden tools of farmers, electric casing, etc. can be manufactured in cottage industries. Small portable sawing machines working in forests would help to relieve seasonal unemployment of agricultural labourers. The sawdust and chips which are burnt can be converted into solid artificial wood and containers for packing agricultural and engineering products. So also telephone receivers, wireless cabinets and ashtrays, etc. can be manufactured from sawdust and chips.
Minor Forest Products:

Indian forests also yield a large variety of minor products such as lac, tanning material, gums, resins, medicinal herbs, oil seeds and other nuts, cane and fibres and a number of miscellaneous products like spices, wax, honey, etc. Baskets and handbags can be prepared from the strong fibrous grasses growing in hilly tracts and mountain slopes, while some of the gums can be converted into chewing gums. The oil from seeds can be used for edible as well as for medicinal purposes. Better methods of collection and the use of small crushers can help to develop the edible oil industry. Tons of 'neem seeds' and 'thana' seeds which are simply wasted due to ignorance, can form the basis of a useful industry. Similarly Indian forests are rich in the number and variety of their fruits. They are consumed by animals and by the local population, and a huge quantity is not utilised at all. Some of them can be dried, while others can be converted into chutney, 'sahars' and pickles. Likewise mangoes, peaches and pineapples can be canned for urban consumption. Minor forest products lend themselves admirably to co-operative organisation. They should be exploited by forest labourers' co-operative societies. Their stability would be a
bulwark against depressions and a means of reducing migrations to urban areas.

To conclude this discussion it may be pointed out that the benefits of forests and the major and minor industries connected with them, can only be obtained in full measure if the both forestry and wood utilisation contribute to certain joint goals. The aim of foresters should be the sustained yield management of all forests with a view to producing as much high quality timber as possible, together with enough other wood to supply the needs of all the wood-consuming industries. The aims of wood-using industries should be such closer utilisation, more intensive manufacture, greater diversification and more complete integration - all of which will reduce waste and increase employment. India has failed to take advantage of technological developments in the utilisation of wood residues. Many of the forest products which hold out a promise for the development of new industries are wasted. The future depends largely on the extent of technical training for utilisation by the forest industries in the neighbourhood of forests.

DAIRY INDUSTRY

In the preceding discussion I have pointed out that the grazing rates in forests should not be very cheap because
cheapness leads to a reckless increase of cattle and reduces the quality of herds. As a result of uncontrolled grazing, and of unscientific feeding and breeding of cattle in India, there is not only a shortage of fodder but the huge multiplication of uneconomic cattle has hampered the farmer in developing the dairy industry which in countries like Australia, New Zealand, U.S.A., Ireland and Denmark has rescued the farming industry from decay and provided it with a lucrative subsidiary occupation.

India possesses the largest number of cattle in the world. According to the livestock census of 1951, there were 292 millions of livestock in India, including 155 million cattle and 47 million buffaloes. Their numerical strength is really great, but from the point of view of the dairy industry their case is very poor. Although in the output of milk, India is second only to the U.S.A, her production of milk cannot be considered without reference to the needs of the population who have to subsist on it. It is here that India occupies the lowest place among the dairy farming countries of the world. The following table will illustrate the position.
Estimated total production of milk, and estimated production and consumption per head of twenty countries.\(^1\)

<table>
<thead>
<tr>
<th>Country</th>
<th>Total production of milk 1950-54 (Million gallons)</th>
<th>Human Population Thousands</th>
<th>Daily production per head of population oz.</th>
<th>Daily Consumption per head of population oz.</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand</td>
<td>870</td>
<td>1,559</td>
<td>244</td>
<td>56</td>
</tr>
<tr>
<td>Denmark</td>
<td>1,200</td>
<td>3,551</td>
<td>74</td>
<td>10</td>
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<tr>
<td>Finland</td>
<td>620</td>
<td>3,666</td>
<td>49</td>
<td>65</td>
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<tr>
<td>Sweden</td>
<td>980</td>
<td>6,253</td>
<td>68</td>
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<td>U.S.A.</td>
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<td>55</td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>1,200</td>
<td>14,776</td>
<td>56</td>
<td>55</td>
</tr>
<tr>
<td>Belgium</td>
<td>651</td>
<td>3,092</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>Austria</td>
<td>545</td>
<td>6,760</td>
<td>55</td>
<td>50</td>
</tr>
<tr>
<td>Germany</td>
<td>5,396</td>
<td>28,000</td>
<td>31</td>
<td>39</td>
</tr>
<tr>
<td>France</td>
<td>5,150</td>
<td>41,655</td>
<td>33</td>
<td>30</td>
</tr>
<tr>
<td>Poland</td>
<td>1,300</td>
<td>31,946</td>
<td>27</td>
<td>22</td>
</tr>
<tr>
<td>Great Britain</td>
<td>1,474</td>
<td>45,266</td>
<td>14</td>
<td>39</td>
</tr>
<tr>
<td>Italy</td>
<td>1,050</td>
<td>41,177</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Romania</td>
<td>352</td>
<td>10,025</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>INDIA</td>
<td>6,400(^+)</td>
<td>752,656</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>


1. Includes both liquid milk and milk products, expressed in milk equivalents.

+ Assuming India's total production to be 600 million shrams.

N.B. Milk statistics in India are in the nature of broad estimates.
Countries which show production between 50 and 80 oz. per head per day have adequate milk for their nutritional needs and are self-supporting in their milk requirements. Countries like New Zealand, Denmark, Sweden, Australia, etc., which have production in excess of 60 oz. per head per day, are exporting countries and have a flourishing trade in dairy produce. The remaining countries which show production below 50 oz. per head per day either import milk or subsist on a diet deficient in milk. A highly industrialised nation like Great Britain imports sufficient milk products to raise consumption to an adequate level. The U.K., in fact, is the largest importer of butter, cheese, and milk powder in the world. "Indeed, the U.K. market for dairy products is of immense value to the economies of New Zealand and Australia, and both countries maintain permanent organisations here to promote the sale of their products. New Zealand and Australia exports of dairy products to the U.K. are valued respectively at £70 million and £50 million annually."

India cannot afford to import milk products to the level needed to meet her nutritional requirements, but she

1. The Times Survey of Food in Britain, Jan. 21, 1957, page v.
can certainly improve the quality as well as the quantity of dairy products by organising our dairy industry on sound business lines. The present yield of milk cows as well as the capacity of the working cattle are low as compared with other countries of the world. The average production of the better Indian breeds of cows and buffaloes is about 1500 lbs. per lactation\(^1\) while the average production per lactation in western countries ranges from 3,000 to 4,000 lbs.\(^2\) In well-organised dairy farms where systematic breeding and management have been provided, higher average figures have been obtained in India, but the number of such cows and buffaloes is extremely small. Generally the yields are poor, breeding bulls are scarce and dry cows outnumber the milk cows.

The table given below illustrates the above statement partially. It gives the number of cattle per 100 acres of cultivated area in the principal states.

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2. The Second Five-year Plan has estimated the daily consumption of milk per head as 5 oz., which is far from satisfactory as compared with the western standard.
### Cattle per 100 acres of Cultivated Area

<table>
<thead>
<tr>
<th>State</th>
<th>Working cattle</th>
<th>Breeding bulls</th>
<th>Milch cows</th>
<th>Dry cows</th>
<th>Young stock</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bihar</td>
<td>30.3</td>
<td>0.52</td>
<td>7.1</td>
<td>12.0</td>
<td>16.3</td>
<td>59.1</td>
</tr>
<tr>
<td>Bombay</td>
<td>12.8</td>
<td>0.21</td>
<td>4.3</td>
<td>4.1</td>
<td>7.2</td>
<td>26.9</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>10.5</td>
<td>0.16</td>
<td>7.2</td>
<td>9.5</td>
<td>25.9</td>
<td>51.3</td>
</tr>
<tr>
<td>Madras</td>
<td>52.4</td>
<td>0.49</td>
<td>13.7</td>
<td>22.7</td>
<td>32.7</td>
<td>130.4</td>
</tr>
<tr>
<td>Punjab</td>
<td>13.1</td>
<td>0.04</td>
<td>5.6</td>
<td>4.1</td>
<td>11.5</td>
<td>34.3</td>
</tr>
<tr>
<td>U.P.</td>
<td>23.5</td>
<td>0.03</td>
<td>6.1</td>
<td>9.1</td>
<td>14.3</td>
<td>58.6</td>
</tr>
<tr>
<td>West Bengal</td>
<td>29.1</td>
<td>0.26</td>
<td>10.5</td>
<td>14.2</td>
<td>31.4</td>
<td>68.3</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>12.6</td>
<td>0.06</td>
<td>7.5</td>
<td>6.7</td>
<td>14.0</td>
<td>44.2</td>
</tr>
</tbody>
</table>


The number of cattle per 100 acres of cultivated area is the largest in Madras followed by West Bengal and Bihar. Dry cows in each state exceed the milch cows with the exception of Punjab and Bombay, but in these states also there is no phenomenal increase of milch cows over dry cows. This state of affairs reflects the fact that the Indian cattle lack proper feeding and breeding. In villages, with the growth of population, pasture grounds for the cattle have been gradually encroached upon; the acreage left for grazing is quickly diminishing with the result that most of
the cattle are starving. Feeding of animals is an important item and the dairy industry should pay due attention to it. Inefficient supply of cattle feeds is a serious handicap in increasing the production of milk. It leads to irregular calving and adds to cattle epidemics and mortality. By good feeding the period of dryness can be reduced to the minimum and the quantity of milk can be increased substantially. Although there is a shortage of cattle feeds, taking the country as a whole, there are surplus quantities available in certain areas which, because of the difficulties of transport, cannot be utilised. If transport facilities were provided for the movement of fodder from surplus areas, the herd tribes which move from place to place along with their cattle in search of fodder could develop the dairy industry on organised lines. To solve the feeding problem it is also desirable that factories producing oil cakes, which are good feed for milk stock, should be as far as possible located in rural areas so that oil cakes can be readily available to the owners of cattle without incurring transport charges. Likewise, the fodder shortage can also be met by the introduction of leguminous crops in our cultivation, which would supply fodder to the cattle and increase soil fertility. The improvement in crop yields
would offset any apparent increase in the cost of milk production. In this way the outlook of the Indian farmer towards cattle raising should undergo a basic change. Its future lies more in a mixed farming system, which has not been practised widely owing to the ignorance and illiteracy of the farmers.

The above suggestions would be workable if the complete ban on the slaughter of all cattle were lifted. The ban has tended to increase the number of superfluous cattle and has jeopardized the well-being of the limited number of good cattle with whom they compete for fodder. An expert committee on the prevention of slaughter of cattle appointed by the Government of India in 1954, estimated that if the slaughter of cattle were totally banned the cattle population would increase at the rate of nearly six per cent per annum, and such trends are already noted by the states which have banned cattle slaughter. The states should take a realistic view of the situation in order to safeguard the cattle population of India as well as to develop a number of allied industries which would afford immense opportunities of employment for labour.

Turning now to the breeding of Indian cattle, which also affects the dairy industry, we find that breeding is done

more often with the help of stray cattle or 'Brahmani' bulls and not by pedigree or approved bulls. People are under the impression that any bull roaming about in the street is sufficient for the purpose. Again, the custom prevails in our villages of letting loose all sorts of animals in the grazing ground—cows, heifers, immature male stock and sickly beasts, so that it is impossible to prevent the cows in season from being covered. Comparatively slow progress has been made in the distribution of pedigree and approved bulls. For bringing about an improvement in the milking and working efficiency of cattle, the 'key village' scheme has been started which aims at establishing throughout the country a number of centres, each serving three or four villages, where breeding will be confined to a few superior bulls and all other bulls will be removed or castrated. This is a step in the right direction, but to accelerate its progress and to reduce the number of bulls required, artificial insemination centres should also be set up and action should be concentrated towards the intensification of castration measures in all the breeding areas.

The feeding and breeding of cattle on the lines indicated above would improve milk yields. An increase in yield would lower the cost of milk production by spreading
maintenance cost and cost of depreciation and labour on a larger output of milk. It is essential that the breeding of high-yielding strains should be greatly extended through the establishment of cattle breeding farms using selected milk-producing breeds of both cows and buffaloes. The Royal Commission on Agriculture rightly stressed the importance of she-buffaloes as the chief milk producing stock in India. They emphasised: 'It is the number of she-buffaloes, not the number of cows, that has to be taken into account when seeking an index of the milk production of a Province... where an important market for 'ghee' exists, it is the she-buffalo which mainly supplies it.' Her average yield is markedly higher than that of the ordinary village cow. The butter fat content of her milk is also higher than that of cows' milk. Therefore, attention should be paid to increasing the number of high milk-yielding buffaloes rather than the number of cows if milk production is to be increased.

Meaning of Calves:

Milk production can also be increased if the custom of allowing the calves to drink milk directly from their

1. An Indigenous milk product, commonly consumed in India, which is like clarified butter.
2. Royal Commission on Agriculture in India, 1927, page 184.
mothers is abolished. In western countries the calves are reared on separated milk or other substitutes for milk, and are separated from their mothers a few days after birth, the object being to obtain as much milk as possible for human consumption. Wherever possible, weaning of calves should be encouraged in India also, so that the milk thus released may supplement the supply available for human consumption. In India the majority of the population subsists on a vegetarian diet. In the absence of other food stuffs like meat, fruits, etc., milk can be the only available source of first-class protein in the diet of the common man. If standards of consumption were to be set at a level more akin to that aimed at in progressive European countries, the present output of milk would fall far short of the required quota. For the balanced diet of the Indians it is essential that each of them should consume milk and milk products in amounts sufficient to correct the present deficiency of protective elements in Indian diets.

The conclusions of this discussion are two-fold. In the first place it is essential that the production of milk in India should be vastly increased to provide first-class proteins, mineral constituents and vitamins for the vegetarian diet derived from a limited variety of foodstuffs.
Secondly, any increase in milk production would give rise to an important national dairy industry which would provide opportunities for employment both in villages and in towns.

Framework of Organisation of Dairy Industry in India:

Only in a co-operative organisation can we find a suitable agency to develop this industry. With the aid of co-operative machinery the poor peasant would not in the first instance have to find a large sum of money for initial investment. Further, he would get the money for the purchase of cattle and small machinery at a low rate of interest and repayable in easy instalments. The organisation would provide expert advice on the improvement of milk yields. The standard of breeding would be raised and the progeny would be excellent. The society would be in a position to obtain plots of land in the vicinity of the cattle-sheds in order to grow fodder crops and to utilise in the best manner possible the stable manure which would otherwise be wasted. The marketing of milk would be undertaken by the society. Expenses per head would be very small as the society would market in bulk, employing modern methods of transportation under hygienic conditions. The villagers will be relieved of the responsibility of maintaining the cattle, and they could engage in other subsidiary industries.
connected with dairying. If there were surplus milk in any society, it would be sent to the factory to be converted into products like ‘ghos’, butter, cheese, powdered milk, cascin, etc. This would check the waste of milk and develop new industries.

Market Requirements of Dairy Industry in India:

It is important in considering the development of the dairy industry that it should successfully meet the existing dietary habits of the Indian people. The results of the various surveys indicate that of the manufactured products, the demand for ‘ghos’ is far in excess of that of all the remaining products. Therefore production of ‘ghos’ must be considered as the most important single factor in any scheme of development of the dairy industry. Butter produced in Indian villages is of a poor standard. It cannot be prepared in good condition even for a couple of days. Moreover, villagers do not consume butter. It is only consumed in cities and only by a limited number of persons. ‘Ghos’ can be preserved for five or six months and it is in common demand. It would not be out of place to

1. Wright C. Norman, Report, op. cit., estimated that 75% of the milk was utilized for the production of ‘ghos’, page 3.
quote the following note by Mr. N. Smith, Imperial Dairy
Expert and Agricultural Adviser to the Government of India
1926, who has expressed the importance of the 'ghee' industry
in the following words:

"The value of 'ghee' produced in India cannot be below
Rs. 1,000,000,000 per year and it is no exaggeration to say
that the existing systems of ghee manufacture are crude,
wasteful and faulty. These methods are not only wasteful
in the out-turn of 'ghee' which they give from a given
quantity of milk but they are doubly wasteful in that they
make no provision for the proper utilisation of the by-
products of 'ghee' manufacture, namely separated or butter
milk. In many of the districts where ghee is made in
enormous quantities by jingly tribes who own large herds of
buffaloes, the butter milk is simply thrown away in the
rains season. The butter milk contains more than half
the nutritious constituents of the milk in a highly
digestible form, and the value of dried separated milk in
India at ports is about Rs. 700 per ton. It is certain
that under present conditions India deliberately wastes a
sum of not less than Rs. 50,000,000 per year in failing to
make proper use of the by-products in the manufacture of
ghee.... due wholly to want of technical knowledge and
organizing ability on the part of those engaged in the ghee industry.

The importance of ghee industry alone (one branch of the dairy industry) is certainly of equal magnitude to that of the steel industry in India, and yet the Government of India are paying yearly in bounties to one steel manufacturing company more than the total cost of the Imperial Agricultural Department.¹

Mr. Smith's remarks still hold good. The demand for 'ghee' is the highest and its production on up-to-date lines holds out great promise for the development of the dairy industry. The import of milk products represents a negligible percentage of the total milk products consumed in India, and its replacement by indigenous production would not involve a great expansion of output. An increase in the value of 'ghee' by only five per cent would add much more to the wealth of the dairy industry. As pointed out by Mr. Smith, 'ghee' is not only produced under primitive and wasteful conditions, but its adulteration is so universal that it is almost impossible to procure pure

butter goes at almost any price. Although legislation to prevent adulteration has been passed, it is ineffective in the absence of well-defined grades and standards. The problems of adulteration can be solved through the development of the dairy industry which will produce according to well-defined grades and standards. In the production of 'ghee' by dairies, the following by-products which are wasted or adulterated with pure milk can also be fully utilised.

Separated Milk: The separated milk (i.e. milk after separation of the butter fat from the whole milk) retains a high nutritive value. Separated milk can be sold at a price within the means of the poorer classes of consumers who are denied a milk diet due to its high cost. This separated milk can be used for human consumption as well as for the rearing of calves, either in fluid form or by its conversion into products like milk powder, condensed milk, etc. Those areas where milk is abundantly produced but from which, owing to transport difficulties, it cannot be transported in fluid condition to the consuming centres, should convert it into products like milk powder or condensed milk. In this way the inaccessible areas can supply milk products to remote corners of the country and
can also create additional employment for their underemployed labour.

**Casein:** Yet another important by-product of separated milk is casein. This is used more for industrial purposes than for domestic consumption. It is also used in a number of pharmaceutical preparations. For industrial purposes it can be used in several ways. For example, it is a good substitute for celluloid and can be turned into plastic. It can also be used as an insulating material for electrical goods. Similarly, artificial tortoise-shell, amber and ivory employed in making sun-goggles, watch cases, umbrella handles, toys, and mirror backs can be made from casein. It can also be used for the manufacture of sugar calender paper, wall paper, photographic material, paints, varnishes and soaps. The utilisation of these products depends upon the technical education of the country. At present, due to ignorance, they are wasted although there is a good demand for them.

**Lactose:** This is another by-product of milk. There is about five per cent of lactose in milk; it is the most easily digestible form of sugar and forms an excellent article of food for infants and invalids. There is a wide market for this product in India. It can greatly help in
reducing infant mortality due to intestinal diseases.

After discussing the by-products of the dairy industry which can be the source of additional employment and industrial advancement, it would not be out place to refer briefly to the problem of the supply of milk to urban areas and its proper solution. Much of the milk sold in towns is adulterated and is of poor quality. It is necessary, therefore, to devise means which will ensure the supply to urban areas of adequate quantities of milk, of guaranteed quality and at prices which are remunerative to the milk producer and within the consumer's reach. For this purpose 'producers' co-operatives' should be organised in villages where there are large surplus quantities of milk. The development of these 'milk pockets' through the establishment of creameries would make large quantities of milk available for fluid consumption in urban areas. Where distances are great, the railways should be asked to provide special vans with cold storage facilities, and wherever railways cannot be used, motor milk vans should be made available. To facilitate the receiving and distribution of milk in urban areas, cold storage facilities should also be provided. The organisation of milk distribution and creameries on co-operative lines would be associated with programmes of cattle improve-
ment and the maintenance of proper breed and milk records. It is needless to emphasise that in the present backward state of the dairy industry there is little hope of progress unless some kind of incentive is given in the form of subsidies, such as the provision of special refrigerator vans at reduced freight charges for the supply of milk and return of empty cans, the supply of dairy machinery at special rates, etc. Lastly, it is essential that to safeguard the interests of consumers, producers and distributors, a milk board should be established in each town, which would be responsible for all matters relating to the control and development of the milk supply of the area.

This discussion of the organisation of the dairy industry would not be complete without reference to the potential importance of technical training. Apart from the facilities of technical training provided at the Indian Dairy Research Institute, short courses on the production and handling of milk should also be arranged for a large number of workers trained in certain elementary dairy practices, including the management of dairy herds.

To sum up very briefly, it may be remarked that in the organisation of the dairy industry western methods should be employed for the enhancement of milk supply and the
utilisation of the by-products, but attention should be concentrated more on the production of indigenous milk products of common demand than on products of western origin. The contribution which the dairy industry can make to public health and to the economy of the country can be greatly increased by improvements brought about through judicious breeding and proper feeding and slaughtering of the surplus stock.

POULTRY FARMING

Poultry farming is a sadly neglected branch of Indian agriculture. There is hardly any organised trade in eggs, foals, geese, or turkeys, except in the neighbourhood of big towns and capital cities. Specialised and organised poultry farming is conspicuous by its absence. Leaving aside certain states where the Government have started poultry farms or subsidised private enterprises, poultry farming has not assumed the status of an industry. The indigenous poultry keepers are disorganised and backward. A good part of the production is purchased by itinerant dealers who pay weekly visits to the families, collect eggs and sell them to larger traders in the weekly market. The weekly dealers are the agents of still larger merchants who own retail shops of their own in the towns.
of it this organization appears to be sound because each middle man is performing a useful function of risk bearing which in his absence would have fallen on petty farmers, but in actual practice these itinerant dealers charge very heavily for their services, making the retail price to the consumer in the towns disproportionately high in relation to the price received by the producer. The actual producer seldom shares in a rise in prices. Normally the price that he receives is about 40 per cent of the retail price. Producers are not free to sell their produce; they are bound to sell only to particular buyers because of the obligation of an advance received from them. In order to do away with the agents who travel the country districts to collect eggs, and to provide a basis for the sound management of the industry, it is essential that societies should be formed which would not only collect produce, but also grade it and improve the breed of poultry. According to the Census of 1951 the total poultry numbered 73 millions, of which 67 millions were hens and only 6 million ducks. No statistics are available about the improved breeds, which are very small in number. The egg production is very low. The average indigenous hen produces about 50 eggs per year as against 120 eggs per bird in many other countries which
employ modern methods of production. The low egg production can be attributed to factors such as poor stock, disease, malnutrition and general mismanagement. The per capita consumption of eggs is calculated at eight as against 150 to 300 in other countries. The U.S.A. has three hens to every person, Britain and France under two, Western Germany about one, but in India there are about ten people to every hen. The per capita consumption per year of poultry meat in India is as low as 0.29 lb, as against 29.32 lbs. in the U.S.A., 20.94 lbs. in Canada, and 13.73 lbs. in France.

These facts give a clear indication that this industry promises great scope for development if tackled on sound business principles. In the Second Plan it is proposed to set up four regional farms, each with 3000 laying hens, for acclimatising exotic breeds, from which foundation stock will be distributed to 300 extension centres. Each extension centre is to comprise a demonstration unit with a development block attached to it, which would provide private poultry breeders with facilities for training in modern methods of poultry rearing. A defertilization unit is also to be

attached to each extension centre for processing village eggs in order to prolong their keeping qualities, particularly during summer months.

All these schemes of planning are quite healthy, but co-operative organisation appears to be the only suitable agency for the development of poultry as a subsidiary industry in every village. To develop poultry farming, the Government should sell eggs and birds of exotic breed, distribute cocks in rural areas and grant subsidies for poultry extension through co-operative societies. The substitution of an egg-selling co-operative society for the chain of middlemen would mean the establishment of an efficient business management which would establish contacts, guarantee quality and effect profitable sales. The main functions of the society would be to test eggs, grade them, and arrange for their quick despatch and delivery to the buyer or to the society's own shop. The grading is done by weight, size and freshness and prices are fixed accordingly. The accepted eggs are credited to the account of the producer who stamps his number on the lot he supplies. This enables the society to make a record in the pass book of the member and to suggest improvements in his produce. Through this process the society would build up branded
names for its eggs, which would compete successfully with the individual traders and bazaar men. Societies could borrow money at a low rate of interest from co-operative banks for making cash advances to the members and loans for buying birds of good breeds. The society should also sell special feeds, medicaments and poultry appliances, and the loans to members should be given in the shape of these articles instead of in cash. In case of epidemics, which have been a great handicap to poultry farming in India, the society can arrange prompt technical help and can prevent disastrous losses to the farmers. It can also arrange cold storage facilities in both villages and towns, and can prevent deterioration and loss.

The conclusion of the above discussion may be summarized as follows: There is considerable room for the development of poultry as a subsidiary industry in every village, provided improved stocks are made available in adequate numbers and satisfactory marketing and other facilities are organized on co-operative lines. Such improvement would increase the income of farmers, supplement their diet, which is short of protein, and lead to greater employment in industries like packing material, poultry appliances and other allied services.
THE BEE-KEEPING INDUSTRY

Bee-keeping in India is in its infancy. The general knowledge possessed by the farmers about the domestic economy of these insects is meagre. There are professional bee-hunters among the forest tribes who possess a very crude knowledge of bees. They go about in the forests during certain seasons, smoke down the colonies from the cavities of tree trunks, take out honey combs, very often with the brood, squeeze out as much of the fluid as they can and sell it as honey. The honey is thus extracted in the crudest and most unhygienic manner and contains an appreciable quantity of extraneous matter, including the animal juices squeezed from the brood. As a result it gets fermented by the time it reaches the consumer due to contamination and imperfect preservation. Despite the ignorance displayed about the bees and the crude system of extraction, honey itself has been used from time immemorial in Indian households, either as an important food ingredient or as a vehicle for many of the indigenous medicines.

In western countries honey is not only used extensively as a valuable food product, but the art of bee-keeping in these regions has become established as an organised industry. The production and extraction of bee products are carried
on an extensive scale and employing clean and hygienic methods. Bee-keeping is a large and well-established occupation, mainly of a subsidiary character, in many parts of the world. Bee-hives in almost every orchard have become a valuable and necessary adjunct to the farm, and subsidise its income. The production of honey is very large in countries like Switzerland, Australia, California and some other states of the U.S.A., which are important exporting countries. The production from individual hives in these countries is as high as 250 lbs. per season. It would not be out of place to discuss the organisation of the bee-keeping industry of Switzerland, which ranks among the foremost bee-keeping countries of the world. There are two apicultural associations. Each association publishes a journal and organises courses and lectures among the hives. There is an apicultural library; bee shows are arranged and propaganda work is carried out. The associations, with the approval of the public authorities, also check the qualities of different honeys, and deal with insurance against bee disease. Insurance is compulsory for all members. Bee inspectors, who are proposed by the bee-keeping societies, but attached to the Veterinary Division of the Ministry of Agriculture, have full powers and authority to visit the
hives and organise effective means of controlling bee disease. Samples are analysed in Government laboratories where important scientific work on apiculture is done. In this way the industry is highly organised and provides employment to a substantial section of the population.

For Indian farmers also bee-keeping can be an important ancillary industry. There is no dearth of bees or of nectar-yielding plants in India, but in the absence of proper guidance and knowledge of the subject, Indian farmers do not take advantage of these natural resources, and enormous quantities of honey remain unutilised. Although a beginning has been made in the keeping of honey bees and the production and sale of honey, it is not on organised lines and bee-keeping cannot be called a subsidiary occupation. Bee-keeping could also be a leisure time occupation for farmers in India, as it is in other countries. Its special feature is that it involves little investment and no day-to-day expenditure or supervision. Bees do not require constant feeding as they gather their own food, viz. honey and pollen from plants and flowers. Even when honey and pollen become scarce in the fields it is not necessary to feed them so long as there is a store of these substitutes in the hive. The colonies are easily established and they live, multiply,
flourish and gather and store honey. Once established the colonies continue to flourish for many years. The farmers should be taught the use of box hives in which brood combs and storage combs are quite separated and honey can be extracted from the storage combs without destroying the brood or spoiling the quality of the honey. The best way of extracting honey is by means of extracting machines instead of squeezing it out of the combs. It should not be left exposed. It is hygroscopic in nature, and absorbs moisture from the air which makes it sour and unfit for consumption.

To organise the industry, it is imperative to improve methods of keeping bees and to spread knowledge of proper methods of taking honey out of the combs and of the proper care of the honey. "As a concrete instance of what improved methods will do, the case of the U.S.A. may be cited. The old methods practised there were about the same as those followed in India. In 1850 the production of honey and wax was about 14,800,000 lbs. The improved methods were introduced about 1855 and the production of honey alone in 1860 was about 23,400,000 lbs, the wax produced in the same year being about 1,250,000 lbs." In India such phenomenal

progress cannot be expected because the bees are inferior in many respects to those of America, but it is certain that the adoption of improved methods will increase the production many times, will give rise to an important subsidiary occupation to many farmers and develop the marketing of honey and its products. For modern bee-keeping it is essential that hives, frames, etc., should be of standard size and all the keepers should adopt the same standard. It seems advisable to adopt the standard followed by the British Bee Keepers Association because it is desired to import European bees in order to improve the yields of honey. The adoption of the European standard would help the keepers to maintain the European bee without any additional expenditure on materials.

Co-operative sale societies:

The production of honey is small, both per individual and in the aggregate. Therefore co-operative sale societies would be the most suitable agency for converting the products into money. Co-operative bee-keepers societies should be organised on the Swiss model to develop the production of honey and the utilisation of its by-products. The work of such societies would include the rendering of financial assistance to members, in the same way as many
other sale societies. Loans would be advanced in the shape of bee-keepers' requisites and recovered from the sale proceeds of the members' produce. The society would improve the quality of the honey. Individual lots of honey differ in colour and consistency. These differences arise on account of flowers which the bees visit, and differences in the care exercised in the extraction and handling of honey. The society would remove unevenness and differences in quality, correct the taint and bring out one single standard of uniform quality irrespective of the season or the producer. For all these purposes the honey will undergo, in a society, some processing to suspend impurities and drawing off the clear purified honey for bottling. Bottles and jars of standard pound or half-pound sizes, with the society's distinctive labels, will increase consumers' certainty of getting pure, unadulterated honey. This will in turn command better prices than individual sales. The society would be in a position to employ trained staff to educate the members and would supply the necessary parts and equipments of beehive boxes. It would increase sales through advertising and create the habit of honey consumption among the masses. Recent figures of income per hive in U.P., where co-operative societies undertook the
sale of honey, indicated that the highest income per hive was Rs. 60-5-0 and the lowest Rs. 17-12, corresponding to a production per hive of 55 lbs and 15 lbs respectively. As the industry progresses, incomes and employment will increase. Taking into consideration that the industry needs little capital and takes very little of the workers' spare time, its income should make it very attractive to a large number of farmers. In view of the rapidly increasing population and the urgent necessity for improving and increasing food supplies, bee-keeping would materially help to solve the food problem of the country.

**COTTAGE FRUIT CANNING INDUSTRY**

It is a fact that a large quantity of surplus fruits and vegetables in India go to waste every year, or are sold at prices which return little or no profit. Much of the farm products which are wasted can be canned and preserved or dried, both commercially and for home use. The secret of success in canning is to prevent the food material from spoiling, which can be done by the simple process of heating and using preservatives so that the germs present in the material are killed and further growth of bacteria or fungi checked. Ordinary kitchen utensils aided by some cheap appliances are sufficient for the purpose. By its
very nature canning tends strongly to be a seasonal trade, and its production in villages would lower the cost per unit and would give additional employment opportunities to labour. The production can be divided into five broad categories:—

(i) Bottled products, which can be sub-divided into squashes, syrups and juices. The juice of such fruits as pineapples, oranges, blackberries, etc., may be extracted and made into a delicious wholesome drink, especially for the hot season.

(ii) Canned products, which can be sub-divided into canned fruits and canned vegetables—mangoes, pineapples, oranges, guavas, 'litchi', bald fruit, apples, pears and plums, etc. can be canned to the advantage of the producer as well as to the consumer. Once fruit canning develops, it will give rise to vegetable canning as well as fish canning. Vegetable canning would lead to co-operative farming of vegetables, which would utilise the seasonal gluts and supplement the inadequate supply of food grains.

(iii) Preserves—these can be sub-divided into jams, jellies, marmalade, 'morabbas' (sweet fruit products), candied fruits and peels.

(iv) Ketchups, sauces, pickles, achars and chutneys.

(v) Vinegar and 'gulkand'1 from rose petals.

1. Rose preparation used for medicinal purposes, etc.
An expansion of fruit canning would mean an increased demand for sugar. 'Khandasali' sugar, a cottage industry product, is quite as suitable as factory sugar and substantial economies can be effected by integrating the production of 'Khandasali' sugar with the cottage canneries. The production of khandasali sugar is undertaken in winter, beginning its busy season as the busy season of the jam-makers and canneries draws to a close, and a priori integration seems to offer a prospect of eliminating intermediate profits on sugar used by cottage canneries and affecting seasonal transfer of labour between canneries and khandasali sugar production. Besides sugar, another requirement of the canning industry is an adequate supply of well-made cans and bottles at low prices. The tin plate and glass industries are well established and they can cope with the demands of the industry. Packing materials, including labels, essences and colouring, are all found locally, so that the industry should not face any hardship in its development. As a matter of fact, the growth of cottage canning would afford opportunities to small engineering firms for the production of various types of washing and grading machines, syrupsers, seamers, cookers, coolers, viners, pea-shellers, peelers etc. Similarly, employment
would increase in other industries, like the making of fibre board packing cases in which canned goods are sent from one place to another.

In view of the lack of development of the cottage industries and their lack of bargaining capacity, it would be desirable that the entire production and distribution of the canning industry should also be undertaken by co-operative societies, which would establish direct contacts with the grocers and other retailers of canned goods. This would enable them to make a much closer first-hand study of consumers' tastes and preferences, to bring particular brands to their notice and to change production policy according to demand. Questions of finance and the technique of production, and the solution by research of problems connected with the transport and storage of canned food in a tropical climate, could be successfully tackled by the co-operative organisation.

In conclusion, it may be safely remarked that the expansion of the canning industry would not only open many avenues of employment for labour, but would also mitigate India's food shortage. The canning industry will help the growing population to derive greater utility from a given output, because a larger variety of food stuffs will be
available, not only at certain seasons, but throughout the
year. Inquiries conducted in Britain and elsewhere
indicate that such results are not obtained at the expense
of the sellers of fresh fruits and vegetables.

To review the main conclusions of this chapter, the
following may be noted:

India, being an agricultural country, can derive much
benefit from the development of industries ancillary to
agriculture. In their development lies the future of
India's industrialisation and the full employment of labour.
Forestry, dairy farming, poultry farming, bee-keeping and
fruit canning, if organised on the lines indicated, would
not only make agriculture a full-time occupation but would
also give rise to a large number of new industries affording
employment opportunities and economic activity which would
raise the standard of living of the masses. In the
discussion on forests it has been pointed out that forests
possess great economic value, in addition to their physical
utility and natural beauty. All major and minor industries
can heavily on the sound management of forests. The aim
of foresters should be sustained yield management and the
aims of wood using industries should be much closer
utilisation, more intensive manufacture, greater diversifi-
cation and more complete integration - all of which will reduce waste and increase employment.

Similarly, in the dairy industry much progress can be achieved if it is organised on western methods, but attention should be paid to the production of indigenous milk products in common demand rather than to products of western origin. In the discussion of poultry farming, bee-keeping and fruit canning, it has been maintained that they are not fully developed. They require little capital and are labour-intensive. Hence their development on the lines indicated would afford subsidiary income to the farmers, improve and increase food supplies and would expand other allied industries and services. Emphasis all along has been laid on improved methods based on technical training, which have a definite role to play in the proper development of industries ancillary to agriculture.