CHAPTER - III

DETERMINANTS OF AGRICULTURAL DEVELOPMENT
3.1 Introduction:

The importance of agricultural development for economic growth is stressed on the ground that agriculture is the most populous sector of the economy in the early stages of economic development in most of the countries. Hence, it is necessary to undertake an analytical study of determinants of agricultural development which forms the basis of economic development. Agricultural
development is, in fact a very complex and inter-related problem. It is appropriate here to discuss measures that can be fruitfully adopted to promote the development of this important sector of the economy. The measures can be identified and listed under three broad headings for the promotion of agricultural development. These are:

i) application of new technology and modern management practices;

ii) increase in productive capacity through increased investments; and

iii) application of adequate inputs.

These are three measures cover not only technical aspects but also encompass the non-technical institutions. Further, the institutional factors like land reforms, credit facilities, etc., have a very close bearing on what goes into the means for the development of agriculture.

For the increase of productivity and production, agriculture mainly depends upon two factors: Technical and institutional. Among the technological factors irrigation, fertilizers, improved seeds, mechanisation, (improved ploughs, tractors, combined harvesters and threshers), soil conservation, etc., help to raise productivity, even if no land reforms are introduced. The institutional factors
which help to increase agricultural productivity include the redistribution of land ownership, provision of the security of tenure, regulation of rents, credit policy, etc.

For the development of agricultural package programmes in agriculture are essential. It has been argued that a substantial rate of increase in agricultural production can be achieved largely through a more effective use of resources already prevailed in the agricultural sector. The main aspects of package programmes constitute of augmentation and intensive utilisation of irrigation facilities, greater use of High Yielding Varieties of seeds, increasing supplies of fertilizers and pesticides, multiple cropping through the introduction of short duration varieties good crop rotations, spraying and dusting of pesticides, control of plant pests and diseases and reduction of losses during harvest and post harvest operations, better cultural operations, good credit facilities, soil conservation, mechanisation of agriculture through the replacement of machinery wherever it is possible, education and training of the farmers and so on. Thus, the agricultural development is possible only with the combination of all the factors mentioned above. The introduction of modern techniques and improved practices and the improvement in processing and marketing techniques are also equally important.
Most of these package programmes and improvements are again interdependent or at least closely related. Higher yield is not possible without good irrigation system. The irrigated farming requires better varieties of plants and seeds and heavier use of fertilizers, pesticides, weedicides, etc.

3.2 Irrigation:

Among the determinants of agricultural development irrigation is indispensable for agricultural production. Irrigation is an ancient approach to promote agricultural productivity. Recent advances in agricultural research have also opened new possibilities for increased production, particularly with the use of water, high yielding seeds, fertilizers, pesticides, etc. But this increase may be feasible only in areas where assured sources of irrigation are available.

Irrigation can raise the productivity of land in three ways: by making possible multiple cropping by increasing the yield per unit cost and by making possible the production of more lucrative crops. The increase of agricultural productivity in Taiwan appears to have been something like 130 to 160 per cent over a span of 30 years.
between 1901-10 and 1931-40. Johnston attributed the increase in Taiwan's productivity to the expansion of irrigation, double cropping and increase of cropped area.

In India, also evaluation of irrigation benefits is being done by the appointment of irrigation commission. The Indian Council of Agricultural Research, remarks that "Crop yields can almost be doubled and monetary returns increased" by means of irrigation. Realising the importance of irrigation in India, Doreen Warriner observes that "in India as in Iraq and Iran, irrigation is the chief means by which it is possible to see real hope of raising yields and providing the scarce basis needed for investment in the complementary inputs". Alfred Bonne also pointed out that "the increased yield attributable to systematic irrigation in India, where the monsoon is usually erratic and some times fails, completely works


out at an average of 60 to 100 per cent". 4

In India the strategy of Intensive Agricultural District Programme and the High Yielding Varieties Programme have been introduced only in these areas which have assured rainfall and irrigation facilities. As the scope for extending the cropped area is limited greater reliance on irrigation is essential so as to have double or multiple cropping.

In India the Irrigation Commission5 has analysed the National Sample Survey data and found out that in 1967-68 the percentage increase in yield of irrigated over unirrigated crop was 52 per cent in the case of Paddy, 63 per cent for wheat, 26 per cent for Maize and it was high as 153 per cent for Cotton. The actual figures of yield per hectare in 1967-68 were 1,299 Kgs. for irrigated and 857 Kgs. for rainfed paddy, and for wheat it was 1,444 Kgs. for irrigated and 886 Kgs. for rainfed.

The Irrigation Commission6 also studied the importance of irrigation in the Intensive Agricultural District programme


6. I bid., P. 204.
areas. The Commission also observed that not only the average yields of crops under irrigated and unirrigated conditions differed but also the response of crops to irrigation with regard to fertilizers and manures was more favourable. Indices of yields can be seen from the table 3.1.

Table - 3.1
Indices of yields obtained in IADP. Districts under different manurial practices.

<table>
<thead>
<tr>
<th>CROP</th>
<th>Dry farming</th>
<th>Irrigated farming</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With no manures and fertilizers</td>
<td>With fertilizers and manures</td>
</tr>
<tr>
<td>Rice</td>
<td>100</td>
<td>152</td>
</tr>
<tr>
<td>Wheat</td>
<td>100</td>
<td>125</td>
</tr>
<tr>
<td>Maize</td>
<td>100</td>
<td>131</td>
</tr>
</tbody>
</table>


The indices indicate that the potentiality of fertilizers, manures and seeds depends much upon proper and regular water supply. The application of increased fertilizers and improved
seeds, unless they are accompanied by adequate water supply, may have adverse effect rather than favourable effects on land productivity. Therefore, for improvement of production and productivities in agriculture a considerable amount of emphasis on the extension of irrigated areas and an improvement in the systems of irrigation may be more essential.

3.3 Fertilizers:

Next to irrigation, fertilizers evidently occupy the place of utmost importance in the integrated programme of agricultural development. Application of more organic and chemical fertilizers is one of the important measures adopted for increasing land yields. Organic manures generally consist of animal manure, rural and urban compost, oil seed cakes, river and pond mud, green manure and night soil. Organic manures are more necessary for soils whose water retention capacity is less. Chemical fertilizers consist of potash, nitrogen, phosphate, etc. Soils, particularly in countries like India having been seriously depleted by age long cultivation, repeated crop production and multiple crop cultivation suffer from loss of soil fertility and hence need more fertilizers in order to compensate the deficit. Historical experience also reveals
the importance of fertilizers for the improvement of productivity. According to Bruce F. Johnston, within the span of 30 years, the increase in agricultural output (of nearly 80 per cent) in Japan was predominantly, "the result of increased use of fertilizers and advances in farm technology". 7

With a fast growing population, the use of larger and larger doses of chemical fertilizers to agriculture surely becomes an important way to increase food grains production. The new agricultural strategy was based on increased use of fertilizers in our country.

3.4. Improved Seeds:

Though fertilizers are an important factor in the increase of agricultural productivity, without, the use of improved seeds, their effectiveness would become considerably less. Infact, the High Yielding Varieties programme of food grains has become the important strategy in the campaign for self-sufficiency in food grains.

In Taiwan and Japan, High Yielding Varieties of seeds, contributed much to the agricultural productivity of their countries. In recent years the Green Revolution was achieved in India, mainly due to the expansion of area under High Yielding Varieties. Indian Council of Agricultural Research has done much to evolve and popularise improved and disease resisting varieties of seeds. Much research is also necessary to find out suitable improved seeds for different local conditions. A number of High Yielding Varieties of rice and wheat, hybrids of maize, jowar and bajra have been introduced in recent years.

In India, the High Yielding Varieties Programme was launched in 1966-67. The introduction of High Yielding Varieties of dwarf paddy and wheat as well as hybrid maize which respond to heavy doses of fertilizers has brought about a major breakthrough in the agricultural production. The average yield of various High Yielding Varieties of paddy such as I.R. 5, I.R. 8, I.R. 20, I.R. 22, Taichung Native-I, Hamsa and Jaya and that of the Mexican dwarf variety of wheat was very high than that of local varieties. It has been estimated that the High Yielding Varieties "covered 9.20 million hectares in 1968-69, 11.4 million hectares in

Multiple cropping and short duration crops are more essential to increase agricultural production. This programme was introduced in 1967-68 in India as a new strategy for the attainment of self-sufficiency in food grains by the end of 1971-72. The multiple cropping programme envisages fuller utilisation of all available irrigation potential through cultivation of two or more crops where only one crop grew before. The short duration of cereals and pulses are also necessary for a considerable increase in agricultural production.

3.5 Mechanisation of Agriculture:

Even the use of improved seeds and fertilizers can not bring much change in the production of agriculture without the introduction of mechanised techniques in the agricultural sector. Extensive mechanisation of agriculture helps to increase agricultural production enormously.

Mechanisation of agriculture may be defined as the replacement of animal and human power by machinery, wherever it is possible (for eg., tractors, electric pumps, oil engine, combined harvesters and threshers sugarcane crushers etc.). Hence, mechanisation of agriculture is primarily based on machinery for large scale production. Machines work faster than man and animal and work more accurately. Man by himself can produce only very little but with the help of machinery he can produce much more. What a farmer with a pair of bullocks can plough in 20 days, a tractor may do in one day with the help of farm machinery like tractors huge plots of land can be ploughed, large crops can be harvested with the help of harvesters, huge amounts of produce can be taken to the market; all these can be done by machinery without any loss of time.

The large scale cultivation increases output per hectare and the average output per man. The large scale production is possible only with the help of machinery than man and animal. Mellor also pointed out that "A dynamic contribution of economic development from the agricultural sector and significant improvement in rural welfare depend upon the modernisation of agriculture through technological
change. This is evident from the development of Japan, Taiwan and Denmark and more recent developments in the United States and other high income countries that modernisation of agriculture can be accomplished in a manner that contributed to the full set of objectives set for agricultural sector. 9

While commenting on mechanisation of agriculture in Japan, Hall pointed out that "the use of power hullers, threshers, polishers, engines to power pumps and other numerous other mechanical implements is common in all parts of Japan ....... with a hand tractor a farmer can do as much in one day as he can using animal power in 10 days". 10

Mechanisation of agriculture will create employment opportunities in industries and transportation developed to mechanise agriculture. Therefore, those thrown out of employment from agriculture due to mechanisation will be employed. Agro based industries in villages also can absorb labour that becomes surplus in agriculture. But


mechanisation of agriculture is a controversial issue in a labour abundant economy like India. Critics of mechanisation pointed out that mechanisation like use of tractors, and combined harvestors and threshers would displace labour from agriculture and aggravate unemployment. But this was not true in the case of United States Canada, because, the real problem there is shortage of labour and to overcome this difficulty, machinery is used.

However, there is shortage of labour in India during the peak seasons of agricultural operations like ploughing, transplantation and harvesting periods. The shortage of labour delays next crop in the same plot. Hence, in order to bring more land under cultivation and to grow the next crop without delay, mechanisation of agriculture is essential.

3.6 Plant Protection:

Mechanisation of agriculture without taking good steps for plant protection may not give big push to agricultural development. Between the sowing and harvesting of the crops, the plants are susceptible to diseases and pests and this requires serious plant protection measures to reduce the crop uncertainties. Plant protection measures
include seed treatment, intensive ground and aerial spraying, weed control and rodent control measures. It has been estimated that plant protection measures can save about 10 per cent of agricultural production from destruction.

In India, crops are damaged heavily by insects, rodents and other pests and on account of diseases, weeds, etc. Farmers also suffer heavily because of the deterioration of food grains and other agricultural commodities during storage through insects, animal pests, etc. For control of pests, insects and other diseases spraying pesticides, weedicides, fungicides and other chemicals help to a greater extent. In India, it is estimated that plant protection measures have benefited 58 million hectares in 1971-72 as compared to 17 million hectares in 1965-66.

3.7 Soil Conservation:

To protect soil from erosion, soil conservation measures are essential. Soil erosion takes place when the surface soil is washed away through excessive rains and floods. Soil erosion removes fertile surface of the soil and makes the cultivable lands less fertile. Soil erosion occurs because of cutting trees, removal of vegetation which exposes land to wind and rain, cultivation on hill slopes, etc.
For the development of agriculture through protecting soil fertility, soil conservation measures are more essential. The remedial measures to save land from soil erosion are preservation of forests and afforestation, contour bunding and regulation of land use, etc.

In India, it has been estimated that nearly ¼th of the land area in the country (i.e. 80 million hectares) is suffering from soil erosion. Knowing the importance of soil conservation the Government of India allotted Rs.16 crores in the First Plan, Rs. 18 crores in the Second Plan, Rs.72 crores in the Third Plan, Rs.160 crores in Fourth Plan, for soil conservation. For the development of agriculture all these technological factors may not contribute much without the help of institutional factors.

3.8 Finance:

The need for finance arises from various factors such as poverty reflecting in lack of food reserves, crop failures and other calamities, a rapid increase in population, the traditional customs of rural life which often involve heavy expenditure for religious and social ceremonies, etc. Increased quantities of capital are necessary to step up food production. Hence, the demand for capital is demand for credit.
Generally farmers all over the world have to borrow at least a part of the finances required to purchase their fixed capital (i.e., land and machinery). Thus farming like industry requires investment for the initiation of production. Farmers need, not only investment credit but also commercial credit providing incalculating capital to purchase agricultural inputs like seeds, power, fertilizers, pesticides, insecticides and livestock, etc.

Farmers in developing countries like India are generally poor because of small holdings and low yield. Hence, farmers require more credit facilities in developing countries to bring up their next crop, purchase agricultural implements, machinery and for improvement of land, etc.

Farmers require credit for short period of less than 15 months to meet the cultivation costs and domestic expenses. Cultivators also require medium and long term credits for the purchase of livestock, agricultural implements and agricultural machinery like tractors, power tillers and for sinking new wells, etc.

Further, risks and uncertainties are more in agricultural compared to industry. Therefore, agricultural credit requires additional concessions to come out successfully.
from the risks and uncertainties. Hence, a good agricultural credit system should fulfill the following characteristics:

a) Credit must be available at reasonably low rates compared to industry;

b) It should satisfy the principle of convenience;

c) It should safeguard the equity of the farmer in the event of his becoming insolvent;

d) The emergence of any monopoly in the capital market should be prevented;

e) Specialised institutions for financing of agriculture should be necessary;

f) The cost of credit to the farmer should be low (like stamp duties and other legal charges);

g) The credit should be available at short notice; and

h) It is necessary to supply three types of credit to the farmers (short, medium, and long term credits).

In underdeveloped countries like India, if farmers fail to get credit at required time, they may not be in a position to grow their next crop. It is because of low yield, small
holdings and uncertainty of monsoons that the farmers are not getting surplus income from agriculture. The unsatisfactory conditions of land tenure and the creation of too many intermediaries require land reforms for improvement of agricultural sector.

3.9 Land Reforms:

The institutional reforms include the redistribution of land ownership in favour of the cultivating classes so as to provide them a sense of participation in rural life, providing security of tenure, regulation of rents, etc. "There is only one fundamental method of improving village life........ namely the introduction of a system of peasant proprietorship under which the tiller of the soil is himself the owner of it and pays revenue direct to the Government without the intervention of any zamindar or taluqdar". So it reveals that the purpose of land reform is, therefore, two fold; on the one hand it aims at redistribution of land holdings from the view point of social justice and on the other hand from the view point of optimum utilisation of land.

Land reforms also aim at providing security of tenure, fixation of rents, confirmement of ownership, etc. In the countries where land is unevenly distributed, land reforms pave much for the agricultural development. "The experience of advanced countries shows that some countries have advanced very far and very fast without large owners, and with a very equal distribution of ownership in land". Warriner, also pointed out that even though there is no direct link between land reforms and agricultural development, concluded that "the land reforms in the conditions of many underdeveloped countries, is certainly a condition of development".

Land reform is also a prerequisite to technological change in agricultural industry. "The case for reform as a means of raising crop yields", says Doreen Warriner "is that it would help to valorize India's main productive asset ... cut out of the dead wood and improve agricultural organisation".

Land reforms alone cannot bring much change in agricultural


13. I bid., P. 290.

production. Without bringing research results to the farm nothing good can happen substantially in the field of production. Recently agricultural research occupied a prominent place in increasing agricultural productivity.

3.10 Agricultural Research:

We know very well that natural resources like land and water are limited in extent. Hence, the increase in agricultural production has to come primarily due to technological advance i.e., agricultural research. Agricultural research directs towards the adoption of western farm science and technology in a way suitable to local conditions.

The historical experience of Japan shows that it was able to borrow much of the technological advances from the advanced western countries. "Through establishing its own experimental stations, agricultural schools, seed propagation farms, and extension services, Japan was able to adopt western knowledge to its own conditions and special environment".  

Further, it is interesting to note that in Japan the improvement in agricultural productivity has been brought about more through improvement of technology that through increase in inputs. With the help of agricultural research, "between 1880 and 1938, agricultural production in Japan rose by 150 per cent while inputs rose by only 30 per cent. This trend has not only been maintained but even improved upon in recent years". 16

The experience of Japan shows the importance of research development for rapid increase in agricultural production. Improvement in technology can rapidly change the productivity of developing countries in the agricultural sector towards betterment.

Several types of technologies are being used, via., high level technology and low level technology, or intermediate technology, appropriate technology, low cost technology and so on. For a country like India, farmers can not use high level technology, because it is going to be a high cost technology also. "If the technology is good enough and we

can demonstrate to the people that is really worthwhile
and profitable, than farmers will adopt it much more
quickly". In order to bring and apply research results
to the form the results must be suitable to local conditions.
Therefore, a specific research is necessary to evolve methods
suitable to local conditions. In a vast country like India
with so much of varying agro-climatic conditions, of soil
types and so many other things, it may not be possible to
adopt a single type of technology through out the country.
Therefore, no single institute whether in Delhi, or Ludhiana
or Coimbatore can solve all our agricultural problems. But
ultimate objective of increasing production is possible only by
growing that crop to which climate and soil are suitable
and appropriate and ultimately production of the chosen crop
should be remunerative.

Hence, expansion of research and technological knowledge
and adoption of new and suitable methods constitute a power-
ful source of enhancement of farm productivity in developing
countries.

3.11 Extension Services:

Agricultural research without an efficient extension service will not be efficacious. In all countries which have a progressive agriculture, the agricultural extension service is much more intensive and active. S.R. Sen, also pointed out that if "any backward agricultural area has to be developed, the first impact of the agricultural extension service must be very intensive". Hence, the effectiveness of agricultural research dependents upon an extension education programme.

Extension staff carries research findings to farmers and carries knowledge of farmers problems back to the research staff. S.R. Sen recognised the important work done by the extension staff in communist China and pointed out that, "It is not commonly realised that much of the progress made by Chinese agriculture in recent years is due to the intensive extension work which is done by agricultural techniques". He further added, that "85 to 90 per cent of the recent increase in production in China is due to technical services and supplies and only 10 to 15 per cent due to the

18. S.R. Sen: Up.Cit., P. 10,
particular form of farm organisation which they have introduced\textsuperscript{19}

In our country also the agricultural research and extension staffs are growing day by day. Were increase in the number of extension workers can not solve the problem. Insincere and inefficient extension workers are more harmful to the cause than being useful. Whatever be the achievements of our agricultural research, we have a lot of material for transfer to the farmers. But without a well trained extension agency, and its effective functioning it would be difficult for the farmer to know the importance of new dimensions achieved by the research and apply them to the field. Therefore, extension staffs must help the farmer in all respects by educating them about the importance of research work. To describe succinctly help of extension worker must be a friend, philosopher and guide to the countrymen in the process of agricultural development.

\textsuperscript{19} I bid., p. 15.