CHAPTER III

THEORETICAL FRAMEWORK: THE PROCESS OF AGRICULTURAL MODERNISATION

Agricultural sector is generally not considered as important as the industrial sector. The case for agriculture was weakened further by the concept of linkages developed by Hirschman\(^1\) who has made a strong case for industries as these have more forward and backward linkages. Thus the growth economics has mainly been concerned with the sector other than agriculture and has had little place for agriculture.\(^2\)

3.1 The Role of Agriculture:

There has been, however, a growing concern about the place of agriculture in economic development since various economists regard agriculture as an important source of economic growth. Johnston and Mellor\(^3\), among these economists, have made an attempt at highlighting the role of

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agriculture in the development of an economy. In their view, agriculture contributes in a number of ways which are given below:

(i) Agriculture provides an increased supply of food which may otherwise impede the rate of economic growth in an economy. (ii) the expanding sectors other than agriculture, may draw upon the large amount of foreign exchange to finance the imports which are essential for growth. (iii) the expanding sectors other than agriculture, may draw upon the large amount of labour existing in agricultural sector. (iv) a dominant agricultural sector provides capital for essential overhead investment required for growth, (v) a stimulus to industrial growth may be provided by the rising net cash incomes in agricultural sector of the economy.  

The economists, treating agriculture as a source of economic growth claim that agriculture may also lead to reduction in unemployment. A study suggests four major ways to ease the problem of unemployment in a developing economy. (1) the horizontal expansion in area under

4. Ibid. P. 571
cultivation may bring down the level of unemployment (2) The advancement in technology capable of leading to increase in cropping intensity may also help in solving the problem. (3) If crop-mix is changed in such a way that it becomes labour-intensive than more hands would get productive employment in the sector. (4) The changes in land relations particularly in favour of labour class may play a crucial role in providing additional employment in the country. These arguments further substantiate the case for agricultural sector as a source of economic growth.

Traditional agriculture, however, would not be capable of making a contribution to economic growth in the economy. On the contrary, the "modernised agriculture can be a powerful engine of growth". And modernisation of agriculture comprises different stages for the simple reason that it "connotes a variety of structural and institutional changes in the framework of economic activity".

3.2 Phases of Agricultural Modernisation:

The question of land tenure assumes importance since any approach to modernisation warrants incentives and profitability of the venture. A tenurial system which is not in favour of land tillers would lead to insufficiency and may also be an obstacle in the process of agricultural modernisation because an unfavourable tenurial system may not change the attitude of the farmers towards modernisation and use of new inputs. Since "the aggregate pattern of land ownership determines the manner in which land and labour are combined for production purposes, with consequences for the quantum and distribution of the product", this aspect should not be neglected. This problem is visible in the absentee arrangements where the absentee landowners are not generally successful in providing incentives to the actual farmers and the former do not transfer their decision making rights to the latter; while in any approach to modernisation, operating and investment decisions influence the use of modern inputs.


and methods of cultivation. Moreover, if the ownership of resources is separated from resource use, the development of socio-economic overheads may lead to benefit the owners of resources and may not accrue to the managers of resources. 10

However, the attitude of the former towards modernisation may not change if market outlets and availability of consumer goods are not assured. 11 But these are essential conditions and not sufficient to accelerate the rate of adoption of modern agricultural technology. Institutional bottlenecks may be significant and may arrest the rate of modernisation. The simple reason for slow rate of modernisation could be lack of capital needed for the adoption of modern agricultural technology which is capital intensive.

Transitory stage has certain distinct features viz., dominance of agricultural sector; increasing demand for food during the period, inducing growth mainly determined by the rate of population increase and growth in per capita income; a marked scarcity of capital to finance industrial development; and resources having low opportunity costs, in the economy. 12

12. Ibid., p. 583.
During this phase generally highly complementary inputs are used. An abundance of some inputs and scarcity of others would result in low productivity on account of inputs being complementary to each other. Developing economies in transforming their traditional agriculture have experienced this phenomenon. In order to overcome the problems of low productivity, extension, research, credit and marketing facilities are needed along with the supply of improved seeds and other material inputs. Since it is difficult for a farmer to arrange these facilities, the Government could take up this responsibility to overcome the problem.

Moreover, commercialisation is necessary to change the nature of agriculture from 'a way of life' into that of an enterprise. The commercialisation of agriculture would provide marketable surplus and it would lead to modernisation.

However, the supply of modern inputs, technical knowledge and education to the farmers plays a crucial role during the phase of transition. The 'training' and

'visit' programme (TV programme) may be catalytic in modernisation process. Such programmes would not only transfer the technology from laboratory to farm but would educate the farmers regarding the assimilation of new technology. Moreover, periodic programmes of training and demonstration with respect to optimum utilisation of improved inputs would help the farmer to get maximum out of new resources.

Research is another aspect which assumes significance in the third phase of agricultural development. In sustaining the technological breakthrough made once, such as Green Revolution in India, it is necessary to improve upon the varieties which were new at the time of their introduction. For this research should be in continuity rather than intermittently or sporadic. Since, agriculture during this phase becomes capital intensive it may place an over-increasing demand for capital on the economy. In this context research assumes a significant role since it would aim at reducing the cost of technology to make possible further advancement in agricultural development and

thereby in modernisation. This factor alone may be able to sustain the agricultural development in the long run. Indian agriculture, for example, is experiencing the problem of reducing the cost of agricultural technology. That phase during which the country's gain in terms of reduction in food imports or in building up buffer stock of foodgrain is over. Now the task is not to increase agricultural production only or to maintain buffer stocks or to reduce dependence on food imports but is to enhance per capita availability which, in turn, is possible by curtailing the cost of agricultural technology. Hence efforts have to be made to increase per capita availability through increased production and, that too, at the reduced cost of technology.

3.3 Modernisation Requirements:

The complex process of agricultural modernisation warrants a number of factors. The foremost factor in this regard is to determine the priorities with respect to the approach to be adopted for modernisation of agriculture. At least two approaches are worth mentioning. In one approach, existing institutional arrangements such as pattern of land holdings, tenurial system, and credit
and finance facilities, remain the same while technological changes are made to alter the input-mix in agriculture. In the second approach, institutional arrangements are to be changed first to introduce new technology. India has adopted the latter approach where land reforms and other institutional changes have been made to adopt modern technology. But whatever approach is selected the requirements of transformation remain and are delineated below.

An approach encompassing policy requirements and production input requirements would certainly lead to modernisation of agriculture. In the first part of this approach, research and development becomes a critical component in agricultural transformation. It becomes a decisive factor since it is a "reproducible source". Moreover, the efforts classified as "productivity - maintaining" are essential in the sense that the former takes care of the existing production situations while

the latter safeguards the future production. The high yielding varieties of seeds, for instance, are prone to various types of pests and other diseases which adversely affect the productivity. Moreover, the new technology has more risk and uncertainty. The research activities should not slacken. Among other things, it would minimise the risk and uncertainty in production and in productivity. Similarly, the productivity augmenting research assumes a significant role as the need for food is growing in India. The less developed countries including India have not been providing sufficient funds for agricultural research. India, for example, had only 1.2 research workers per one lakh of agricultural population. This ratio has slightly improved to 1.3 in early seventies. In comparison, Japan had 60 and 169 workers during the corresponding periods.\(^\text{18}\) Such deficiencies must be dispensed with otherwise the pace of modernisation would be slow.

A positive relation may be expected between education and the use of the technology by the farmers.\(^\text{19}\)

\(^{18}\) Ibid., p. 129.

\(^{19}\) Marc Nerlov, "The Use of Modern Inputs in the Agricultural Sector of Developing Countries: The Case of Brazil", in paper presented at VIIIth World Economic Congress of International Economic Association, Indian Economic Association, New Delhi, Dec. 1 - 5, 1986, p. 110.
played by education and extension services in agricultural production has been effectively shown by Griliches. Education broadens the horizon of the farmer's knowledge and extension services convince him to adopt the new technology. 20 There are many instances where a large investment in the education has helped in the modernisation of agriculture. Schultz has cited cases of Denmark, Holland, Israel and Japan where modernisation and education has provided the skill and knowledge to the farmers which has helped in attaining a rapid growth in agriculture. 21 Thus the investment made in research and in educating the farm people leads to adoption of new technology which, in turn, helps in raising the productivity in agriculture.

The policy requirements as discussed above are essential but not sufficient to modernise agriculture in a developing economy. Besides policy requirements, the requirements of production inputs have to be satisfied to change the nature of agriculture. The latter requirements comprising irrigation and investment in the infrastructural facilities is necessitated on two accounts. Firstly, existing system of irrigation in the country was


not designed to meet the requirements of new varieties of seeds. Secondly, in addition to rehabilitating the old ones, a new distribution system has to be introduced to bring an additional acreage under irrigation. In the absence of the above, diffusion and adoption of seed-fertiliser technology would be limited. Among the prominent reasons for not adopting new technology or new inputs in a large area in the country is the lack of irrigation facilities. Hence it becomes a mere limiting factor if the distribution of rainfall is not uniform in the country. In such a situation, investment in irrigation becomes more critical. However, expenditure on irrigation in various States shows a wide disparity which in turn widens the existing disparities among the States since more is spend in those States which already have better facilities. For instance, Punjab, where irrigation system is well developed, had the maximum expenditure, that is, ₹2836 per cultivator while Assam, a backward State, has only ₹33 in the year 1970. Without providing adequate irrigation facilities, modernisation in backward States cannot be expected.


Assured irrigation encourages not only the use of new seeds of hybrid varieties but also the use of chemical fertilisers. The aggregate requirement of fertilisers is increasing and may increase further in future. In support of the above, two arguments may be forwarded here. Firstly, the present consumption of chemical fertilisers is less than optimal since the recommended dose in 1970-71 for rice and wheat was 166 kg per hectare, while the consumption per hectare of agricultural land in the country was 14.53 kg only around the same period.24 And secondly, the requirements of new varieties of seeds is higher as compared to the local varieties. Now an expansion in the area under HYVs would increase the consumption of fertilisers because the latter essentially goes with the former. Moreover, the supply of fertilisers is less than what is required in the country. Further, the distribution and use of fertilisers has not been uniform since in Punjab and Tamil Nadu it is used substantially while in other States like Assam, Jammu and Kashmir, Madhya Pradesh and Orissa the consumption of N.P.K. is sparse.25 Such disparities should be removed as far as possible to have a proportionate distribution of gains from new technology in the country.

24. Ibid., Table II.
25. Ibid., Table I.
Regarding the consumption of fertilisers, share croppers have a peculiar problem. They are unable to use and to increase the consumption of fertilisers because for them credit facilities are limited. The share croppers "... produce title or lease deed as collateral" and "... cannot buy fertilizers". Since the number of share croppers is significant in the country, this problem need to be tackled.

The new agricultural technology revolves around the high yielding varieties of seeds. These have mainly been introduced because they are insensitive to differences in day length in early maturity and also give a better response to chemical fertilisers. Consequently their yield is higher than the local varieties. But the Indian farmers have relied on the natural spread of these seeds. They are generally suspicious about the quality of seeds available in the market, and this had led to the natural spread of HYVs. However, the natural spread has caused two main problems, the first being the low rate of germination, and second that seeds obtained by natural spread require higher doses of fertilisers. This practice has to be watched out and supervised by official agencies and if it is not possible

then the distribution of certified seeds should be done in more effective ways. Moreover, the problems of quality control regarding certified seeds has to be solved but no legislative or administrative steps have so far been taken by the Government.27

It may seem strange but seeds of the uniform quality distributed in the country are posing problems since pest problems may become epidemic in such situation.28 But the seeds of different qualities, if supplied, in different areas may minimise the risk since diseases in one type of seeds may not affect the crops using other types of seeds. However, in most of the regions, seeds of the same quality are released by official and non-official agencies and no effort is being made to thwart such dangers.

The foregoing discussion makes it clear that there are three mainsprings of growth in agriculture based on its modernisation. These are "active research, a well-trained and vital extension service, and a supply line that effectively makes available to the cultivators the

28. Ibid., p. 69.
range of modern inputs which match the extended findings of the research stations.  

Undoubtedly Indian agriculture has achieved success in the field of research as certain varieties of seeds like Kalyan Sona, Sonalika, Safed Lerma and Choti Lerma etc. of wheat and ADT-27, Mashori, Co25, Co29, Jaya, Padma etc. of rice have been developed. But the extension service has not made any significant impact in the country. Moreover, the range of modern inputs brought from the laboratories to the field has been restricted to the progressive farmers which has arrested the growth of modernisation in a large area of the country. The present strategy being capital intensive has left the small and marginal farmers at the periphery. Thus the scope of agricultural modernisation has been, and will remain, limited if the basic approach is not changed.


3.4 Survey of Literature:

There is no dearth of literature in the field of agricultural economics. Various aspects of agriculture have been studied. Schultz, for example took up the question of welfare and delineated conditions necessary for progress in less developed areas. Cohen discussed among other things, specialisation and technology as the key factors for economic progress in a country. He had also analysed technological aspects with respect to farm size. An excellent work regarding agricultural modernisation and providing a new approach to deal with agricultural backwardness was by Schultz. The basic questions which he addressed were: "(1) Can low income communities increase agricultural production substantially by an efficient allocation of the agricultural factors of production presently at their disposal? (2) Which agricultural factors of production are primarily responsible for the large differences among countries in the success of the agricultural sector in contributing to economic


33. Ibid., pp. 49 - 73.

34. Theodore W Schultz, Transforming Traditional Agriculture, Yale University, New Heaven, 1964.
growth? (3) Under what conditions does it pay to invest in agriculture? In resolving these unsettled questions, Schultz has advanced a persuasive hypothesis. His suggestion regarding agricultural growth stimulation is to raise the investment opportunities by means of new agricultural factors which necessarily embody technological improvements. Such an approach does affect the agricultural community as Nicholls has shown in his study. He has shown that the mechanisation may lead to deleterious social effects and could change the agrarian institutions in a significant manner.

Schultz's approach has changed the perception of agricultural sector in the context of economic progress. A new stream of literature came into force. Among such attempts, an empirical study worth special mention is a recent paper on the contribution of agriculture to economic growth. In this study, decomposition of growth sources highlight the contribution of capital which comes to as high as 48 per cent. Indirectly suggested is that

35. Ibid., pp. 15 - 16.


the agricultural modernization leads to growth of output faster than by means of the conventional factors. It has been estimated that the productivity differences for accounted by conventional inputs could be only one-fourth. There is thus a case for modernization.

These are, however, macroeconomic studies providing theoretical foundations and guidelines to researchers. Indian scholars, on the other hand, have examined a number of aspects related with agricultural modernisation and that too, in different micro and meso regions as well as at macro level.

A number of studies have been made to evaluate and assess the effects of modern inputs, such as, fertilisers, hybrid seeds, tractors and tubewells etc.

Among the modern agricultural inputs the most favoured is chemical fertilisers and a number of studies have been made in this regard. Sirohi and Chaudhari have analysed the allocational aspects of fertilisation in various regions of U.P., while the role of NPK in production


economics has been examined by Hopper. A general discussion on the role of fertilizers in agricultural production was made by Menon, Minhas and Srinivasan. An extensive study has been made to study the impact of chemical fertilizers in those districts of the country which were selected for the package programme. Singh has studied the optimum level of fertilization but his results cannot be generalized in view of varying nature of agriculture in various parts of the country. Another such study about the return on fertilizer was made considering the field of a farmer. However, all these studies are similar in the sense that they concentrate on the role of chemical fertilizers and the other inputs do not fall in the purview.


A strong case was made by Sen\textsuperscript{46} for the HYVs around which the NAT revolves. Baruah\textsuperscript{47} made a study of the role of quality seeds in two agriculturally developed regions of the country but his effort does not throw light on the process of modernisation since other parts of the NAT were not considered by him. A comparative analysis of 'desi' (local) seeds and HYVs is an interesting reading presented by Chaurasia and Singh.\textsuperscript{48} The impact of modern input on the production of crops makes the case for HYVs very strong.

Some scholars have paid their attention to the M - type component of NAT which comprises modern means of irrigation as well as means of cultivation. These are also considered here since M - type component does play a significant role in agricultural modernisation.

\begin{itemize}
  \item \textsuperscript{46} B.D. Sen, \textit{The Green Revolution in India}, Wiley Eastern, New Delhi, 1974.
  \item \textsuperscript{47} U. Baruah, "The Role of High Yielding Varieties in Agricultural Development in Punjab and Haryana", in Ali Muhammad (ed.), \textit{Dynamics of Agricultural Development in India}, Concept, Delhi, 1979, pp. 17 - 38.
  \item \textsuperscript{48} R.R. Chaurasia, and V.N. Singh, "Economics of Local and High Yielding Varieties of Paddy and Wheat in Panagar Village of Madhya Pradesh", \textit{Indian Journal of Agricultural Economics}, Vol. XXVII : 1, pp. 93 - 98.
\end{itemize}
Assured irrigation is a key factor in NAT. Among its various means tubewell has acquired an important place in Indian agriculture. Dhawan has selected the same to assess the requirement and its shortfall. He has focussed his attention on Government tubewells and shown that there is not only regional disparities but lack of this factor in the region. And the process of agricultural modernisation has been adversely affected in those areas where tubewells are not in required number.

A debatable and unresolved issue pertains to tractorization in Indian agriculture. Singh and Motilal have found a positive role of tractorisation in agricultural operations. But negating their approach is a study made by Upadhyaya and Aggrawal. They have refuted the popular view on tractorisation having a positive bearing on agricultural production. They conclude that tractorisation generally has an adverse or, in some areas, marginal impact on production and productivity.


The impact of technological changes on gains and their distribution has been a subject of a number of scholars. Kahlon provides an excellent theoretical exposition of the subject in Indian context. While Rao has studied the aspect of distribution of gains arising out of technological change in the country. Similarly, the impact of NAT on the distribution of agricultural income is another widely discussed topic as evident from the studies made by Singh, Jakhade, Sharma and Mehta, Singh, Sadhu and Singh. All these studies, however, concentrate on the impact of NAT on income distribution while other social and economic aspects have not been considered.


Mellor and Lele have made an empirical study of the distribution of increased payments arising out of HYVs between various inputs. They have concluded that the gains are unevenly distributed even in a compact area.

Another approach to modernised agriculture is that of assessing its impact on regional agricultural development. A study by Tyagi is an example of the said approach. However, the shortcoming of this study is that it pertains to regional development and not, as such, to agricultural modernisation. The policy aspects of NAT were taken up by Subramaniam and he has neglected the process of modernisation or its impact on agriculture. The book has political rather than any economic orientation. Moreover, it gives a sort of sweeping survey. A micro study on NAS gives a better insight into the matter of


agricultural development. A significant contribution in analysing the rural transformation has been that of Chadha. In this remarkable study various socio-economic aspects of rural transformation have been analyzed. The work done by Dasgupta is worth mentioning. Though he has undertaken a macro study, certain empirical evidences at micro level makes it not only an interesting reading but also gives an insight into the nature of input of NAT on agricultural development in an area. The objective of the study by Singh is to assess and evaluate the process of agricultural modernisation. He has selected a backward area of U.P. for his study. But no attempt, so far, has been made to assess the process of modernisation and the impact of modernisation on agriculture in Shahjahanpur, which happens to be a backward district in Uttar Pradesh.

