CHAPTER - VIII

SUMMARY AND CONCLUSIONS

[8.1] FINDINGS FROM PRIMARY DATA.

[8.2] FINDINGS FROM SECONDARY DATA.

[8.3] CONCLUSIONS.

[8.4] RECOMMENDATIONS.
SUMMARY AND CONCLUSIONS

[8.1] FINDINGS FROM PRIMARY DATA -

The factors having a relevance to the study of economic impact of change in technology in agriculture are, family size, literacy rate, land use pattern and cropping intensity, capital investments, cropping pattern, new technology adoption level i.e. use of new technological components, labour utilisation, shift towards high remunerative crops, productivity of level, cost of cultivation, profitability index, non farm income and resource use efficiency. The study of these factors revealed the following.

(1) FAMILY SIZE -
Use of new technology leads to prosperity by increase in production and income. But if increase in production is followed by disproportionate increase in the size of family in term of members then the economic status of farmers would be adversely affected. Therefore family size and its composition when studied, it was found that during last 10-15 years the average family size of farmers has been mostly constant. As found in the past studies, it was 5.42 in irrigated and 5.28 in rainfed areas in the year 1991. But in this study it was found to be 4-6 members per household in both areas during 1999-2000. (Chapter 7 section 1)

(2) LITERACY RATE -
Education is one of the factors upon which acceptability and implementation of new technology depends. Literacy rate among the selected farmers families was 95 percent in irrigated and 82 percent in rainfed areas. Thus there is a significant increase in the rate of
literacy as compared to Ahmednagar District average literacy rate of 63 percent in the past year 1991. (Chapter 7 Section 1)

(3) **LAND USE PATTERN AND CROPPING INTENSITY**-

The study of land use pattern revealed that intensity of cropping increased by 6.3 percent in irrigated and 1.9 percent in rainfed farms during the year 1991-2000. In 1991 it was 91.7 at district level but in 1999-2000 it was found 98 percent in irrigated and 93.6 percent in rainfed areas as compared to 8.30 in 1990-91 (Ref. Chapter 7 Section 2)

(4) **CAPITAL INVESTMENTS** -

Capital investments made by the farmers during last 10 years indicate that irrigated farms under study were better in resource position than that of the rainfed farms. It was found that the average values of investments in land, farm houses, and implements in region 'A' were Rs. 113528, Rs. 27829, Rs. 10521 respectively where as their values in region 'B' were Rs. 69650, Rs. 10871 and Rs. 2592 only which were less than region 'A'.

(5) **CROPPING PATTERN** -

In region-A 5 large 3 medium and 4 small size farms out of 20 samples of each category had multiple cropping pattern (i.e. 25%, 15% and 20% respectively). While in region-B only 1 farmer out of 20 medium size sample farms was found having multiple crop pattern (i.e. 5% only), which was very much less than percentage of region-A (Ref. Table. 7.8 Chapter 7 Section 4)

(6) **NEW TECHNOLOGY ADOPTION LEVEL** -

A study of adoption level of new technological components like irrigation facility, use of chemical fertilizers, use of H.Y.V. Seeds, Plant protection, and mechanization was made. It revealed -
(a) It was found that in irrigated areas 50 farmers out of 60 sample farmers (83%) have full irrigation facility where as in rainfed areas 24 farmers out of 60 (40%) had full irrigation facility available.

(b) Use of Chemical Fertilizers in irrigated area was high. 96 percent farmers in irrigated area use Chemical Fertilizers on full area they have sown. In rainfed region 73 percent make full use of Chemical fertilizes.

(c) In irrigated areas 100 percent farmers were found using H.Y.V. seeds and in rainfed area this percentage was 83. Use of H.Y.V. seeds is found high and significant in both areas.

(d) More than 90 percent farmers in rainfed and irrigated lands use new methods of plant protection, by using pesticides and sprays etc.

(e) Rate of Mechanization in irrigated lands was nearly 100 percent where as in rainfed areas it was 60 percent. (Ref. Chap. 7 Section 5)

(7) **TECHNOLOGY ADOPTION INDEX**-

Overall technology adoption index was found to be 0.90 in irrigated and 0.65 in rainfed areas. Technology adoption was significantly higher in irrigated area as compared to rainfed area. (Chapter 7 Sec. 6)

(8) **LABOUR EMPLOYMENT**-

Impact of new technology on labour employment was studied. It was found that, share of female labour has been more in irrigated areas. Proportion of female labour in irrigated area was 0.88 and in rainfed area it was 0.68. (Chapt. 7 Sect. 7)
(9) **Hum an Labour Utilization** -

Labour utilization in terms of mandays was worked out and it was found that per acre human labour utilization at over all level in irrigated area was 60.25 mandays, while in rainfed area it was 27.74 mandays per acre per annum. Compared with past data of the year 1991-92 it was 57.57 mandays in irrigated and 28.35 in rainfed area. This means, in irrigated area it increased by 4.65 percent and in rainfed it declined marginally. Efficiency of labour in mandays increased moderately over past 10 years. But there occurred unemployment of casual or seasonal male labourers to the extent of 30 - 35 percent, due to Mechanization. (Chap. 7 Section 7)

(10) **Animal Labour** -

During last 3 decades (1970-2000) the use of animal labour had been constant in irrigated area e.g. in 1973-74 it had 4.45 labour days per acre and in 1999-2000 it was 4.78 labour days per acre, resulting in a negligible increase. But in case of rainfed area the corresponding statistics is 2.75 labour days in 1973-74 and 5.34 labour days in 1999-2000. Use of animal increased to almost twice the previous one in rainfed areas. (Chapter 7 Section 7)

(11) **Shift Towards High Remunerative Crops** -

More area sown under cash crops like Sugarcane, vegetables and fruits specially in region-A (irrigated) suggests a shift towards more remunerative crops. Increase in production was also observed in irrigated and rainfed areas. Area under cash crops like Sugarcane, pulses, vegetables and fruits in region-A was, 85, 19, 127 and 38 acres respectively but in region-B area under the said cash crops was 27, 66, 47.5 and 3 respectively, which is considerably less than region-A except area under pulses. (Ref. Chapter 7 Table 7.24)
(12) **PRODUCTIVITY OF LAND** -

Resource use efficiency of land increased and improvement in productivity of crop per acre was found. Per acre production of some important crops increased. Production of wheat per acre has been increased by 26.4 percent in 1999-2000 over 1991. Production of jowar increased in rainfed area from 1.84 quintals in 1991 to about 5 quintal per acre in 2000. Production of Bajra per acre increased by 19.83 percent in irrigated and 44.62 percent in rainfed area over 1991. Production of pulses per acre increased by 25 percent in irrigated and 30 percent in rainfed area during the same period.

Sugarcane production per acre increased by 38 percent in irrigated and 26 percent in rainfed areas as compared to that in the year 1991. (Ref. Chap. 7 Section 9)

(13) **COST OF CULTIVATION** -

Inverse relationship was found in area of farm and cost of cultivation at Cost-A, level in irrigated area i.e. as the size of farm goes on decreasing the operating cost goes on increasing e.g. in region-A per acre cost for large medium and small size was Rs. 8042, Rs. 9196 and Rs. 10241 respectively. This is due to high cost of fertilizers and machinery hire etc. (Ref Table 7.27). Opposite trend was observed in rainfed area, and there was direct proportion in area and cost-A1 (operating cost) e.g. in region-B cost-A1 was Rs. 5797 for large size, Rs. 5140 for medium size and Rs. 4175 for small size farms (Ref. Chap 7 Table 27.B)

(14) **PERCENT SHARE OF LABOUR** -

Percentages in region-A for hired labour were 12.71, 6.90 and 7.57 for large medium and small size, in region-B corresponding percentages were 10.34, 7.62 and 2.26 percent respectively.
Percentage of family labour input was 5.77, 5.66 and 9.65 for large, medium, and small size in region-A the corresponding percentages in region-B were 6.19, 11.65 and 17.61 (Ref. Table 7.28 A and 7.28 B Chapter 7). This shows higher efficiency of self employment in small size farms.

(15) **Profitability Index**

When a crude index of profitability, relationship as output input ratio was worked out it was found that the ratio was more than unity in case of all categories of farms in rainfed and irrigated farms. Magnitude of ratio is more than 1 which shows increasing returns to scale. This shows increase in production and consequential increase in income of farmers.

In region-A profitability indices for large medium and small size farms were 1.5, 1.29 and 1.30 respectively and corresponding indices of region-B were 1.35, 1.14 and 1.28 for large, medium, and small size farms. (Ref. Chapt. 7 Table. 7.28 C)

(16) **Non Farm Income**

This is net addition to the farmers income from other than farming business.

It was found that large size farms had higher income from non farming upto Rs. 87400 per annum. in irrigated than Rs. 47560 in rainfed areas per annum. Over all Average non-farm income per farm in irrigated area was Rs. 55870 per annum, where as in rainfed area it was Rs. 38419 per farm per annum. This was a net significant addition to the income of farmers during the period under study i.e. 1991-2000. (Chapt. 7 Section 10)
(17) **RESOURCE USE EFFICIENCY AND RETURNS TO SCALE**

Cobb-Douglas Type of production function was used for assessment of resource use efficiency and returns to scale. The result of the function revealed that both, values of constant (intercept) and Summation of coefficients of regression were more than unity which show increasing returns to scale (Table No. 7.30 a, and 7.30 b) in irrigated and rainfed areas for all size groups of farms.

However it was found that some of the coefficient of regression (elasticities) of independent variables like gross cropped area in small irrigated farms, human labour in large irrigated farms and overall average human labour in irrigated farms, fertilizers in case of medium and small size irrigated farms, drought power in small size, and overall technology adoption, has turned out to be marginally negative. It was nearly the same in case of rainfed area. This was because of over utilization of these resources. If left uncontrolled, it would affect productivity of the farms in future. Over spending reduces the profit margin. (Chapt. 7 Section 11)

(a) According to findings of Cobb-Douglas functions, most of the coefficients of regression of independent variables were positive and non-significant at 0.05 level of significance. Few of them like analyzed fixed capital and farm draught power were positive and significant for both irrigated and rainfed areas. What is important is that, all the independent variables together have a significant combined effect on production, due to new agricultural technology used. (Chapter 7 Section 12)

(b) Study of other socio-economic indicators like, house building or farm house construction, use of modern home appliances are related to general economic uplift. During last decade average 25-30 percent farmers were able to construct farm houses which are useful for them to look after the farms in more efficient way. (Chap. 7 Section 12)
It was found that 90 percent farmers have their own two wheelers, 5 percent had four wheelers, 80 percent use L.P.G. at home. Televisions are common now in rural areas. About 20 percent use cell phones and 60 percent had land line telephones. All these data show economic development of farmers. (Ref. as above)

[9.2] FINDINGS FROM SECONDARY DATA -
Secondary data of agricultural production and productivity, cropping pattern, use of agricultural inputs, labour utilization, etc. was collected for the period of last 30-40 years from various government reports, publications and census. It was compiled tabulated and analyzed. It has been treated separately in the concerned chapters (IV, V, VI). On national level it was found that, during all the nine five year plans, substantial efforts for agricultural development in the country have been made, by the government of India.

It was encouraging to note that the total area cropped increased by 3801 thousand hectares from 1991-2000. Cropping intensity increased from 123 percent in 1980-81 to 135 percent in 2000-2001. (Table 4.4). Almost all crops show an increase in per hectare yield; during the period 1980-81 to 1999-2000. Compound growth rate of principal crops increased very fast from 1980-81 and reached upto 2.56 in 1990-91, but thereafter a trend of deceleration was observed at overall national level as the growth rate dropped to 1.31 in 1999-2000. (Ref. Table No. 4.5 Chapt. 4).

There appeared a significant growth in the use of agricultural inputs. Irrigation potential increased from 68.6 million hectares in 1991 to 84.70
million hectares in 1999-2000. Production and distribution of High Yielding variety seeds in the country increased significantly.

In Maharashtra State also there was growth in agricultural production. Productivity as yield per hectare also increased as seen in Table No. 5.3b. Crop wise index numbers show a growing trend of production in the state. Use of all agricultural inputs increased substantially, during last 2-3 decades.

Scenario of Ahmednagar district also is not very different from that of the nation and Maharashtra State. Number of small irrigation projects increased by 1172 during 1992-2000 (Table 6.3a). Gross cropped area increased from 73.45 percent in 1991 to 75.67 percent in 2000. Area under crops like cereals and pulses increased except Sugarcane which was constant, (Table 6.5), as in 1991 it was 79.23 thousand hectares and in 2000 also it was 79.22 thousand hectares.

Annual production of important crops increased significantly (Table 6.6). Crop productivity per hectare increased in case of almost all crops (Table 6.7). For instance production of all cereals increased from 4433 hundred metric tonnes in 1991 to 4677 metric tonnes in 2000. Production of pulses increased from 287 million tons in 1991 to 497 million tonnes in 2000.

Crop production index numbers worked out, show increase in production from 1991-2000 (Table 6.8). Use of agricultural inputs have also found increased during the last decade. Rate of farm mechanization in the
district increased very fast. Number of tractors in the district was upto 3731 in 1991 increased to 11645 in 2000. Number of farm implements also increased by 3 percent during 1991-2000.

[ 8.3 ] CONCLUSIONS -
This study was aimed at knowing economic impact of new agricultural technology on agriculture of Ahmednagar district. Therefore five parameters were used to assess the impact. Here criteria is that, if answers of findings of these parameters are positive, then there occurs economic development in the area under study. Accordingly, in the light of findings and criteria the following conclusions have been drawn.

(1) IMPROVEMENT IN PRODUCTIVITY OF FARMS -
Output - input ratios serve as a crude measure of productivity and returns to scale. Such ratios for all groups of farm, irrigated or rainfed areas, though not very significant, but in cases where they are positive and more than unity, show an improvement in productivity. Moreover results of Cobb-Douglas production function revealed that there was improvement in resource use efficiency, and consequent increase in productivity. Increasing returns to scale were observed as total of elasticities of independent variables (inputs) was more than unity. In region-A sum totals of elasticities were 1.85, 1.71 and 1.18 for large medium and small size farms and in region-B corresponding totals of elasticities were 1.25, 1.08 and 1.34 in large medium and small size farms. (Ref. Table No. 7.30 (A) and 7.30(B)
(2) IMPROVEMENT IN EMPLOYMENT -

Improvement in employment was found in the area under study; as the mandays increased especially in irrigated areas. In 1991 it was 57.57 mandays in 2000 it increased to 60.25 per acre in irrigated area. In rainfed area it was 28.35 mandays per acre and in 2000 it was 27.74 a marginal decline is seen. (Ref. Table No. 7.23). Share of women labour increased because of more employment opportunities created by the adoption of new technology. As the maximum number of farms in region-A who employed four or more women labour was 37 and in region-B the corresponding number was 23 (Ref Table No. 7.21). Adoption of new technology increased cropping intensity and multiple cropping which requires more labour.

(3) SHIFT TOWARDS HIGHER REMUNERATIVE CROPS -

With the help of new technology, it was possible for farmers in both irrigated and rainfed areas to have double and multiple cropping pattern in farming. Comparatively more area came under cash crops like sugarcane, vegetables, onion, fruits etc. which suggest that a trend of Shifting towards more remunerative crops existed in general and in the irrigated area in particular. (Ref. Finding No. 11 and Table No. 7.25).

(4) INCREASE IN INCOME OF FARMERS -

Increase in income of farmers depend upon increase in production and efficiency of resources. As referred in previous paragraphs production and resource efficiency have been increased, which proves increase in income

426
from farming. Moreover farm income was added with non-farm income from sources like dairying, trading and hiring out wages etc.

Due to adoption of new technology, farmers under study area have been able to take more crops particularly cash crops which fetched good price i.e. vegetables etc.

Per acre net income in irrigated area was highest in case of large size farms (Rs. 7336 net per acre but in rainfed area it was Rs. 3454 per acre only). Net farming income of medium size farms in irrigated area was Rs. 4780 per acre and small size had Rs. 5147 per acre.

In rainfed area medium size farms had only Rs. 1116 and small size had Rs. 2163 per acre net income. Average total net income per farm from farming and nonfarming sources in irrigated area was Rs. 77,248, Rs. 31930 and Rs. 17345 for large medium and small size respectively. In rainfed area, average per farm income from farming and non-farming sources was Rs. 33814, Rs. 5881 and Rs. 8111 for large, medium and small farms respectively. Thus average annual per farm income from all sources of farming and non-farming was Rs. 98044 in irrigated and Rs. 54354 in rainfed area.

According to the study of R.C. Rout in 1997, "The study of impact of new agricultural technology on employment and income in Western Maharashtra Page 188", (Mahatma Phule Krishi Vidyapith, Library, Rahuri Unpublished Thesis) the average income of farmers from different sources in
Western Maharashtra, including Ahmednagar district in 1991 was Rs. 40135 and Rs. 15980 in irrigated and rainfed areas respectively. If compared with these incomes of 1991 the income of farmers under study has increased significantly, almost one and half times and three times in irrigated and rainfed area respectively. This proves that adoption and use of new technology in agriculture has a positive economic impact on incomes of farmers during last decade (1991-2000). (Ref. Table No. 7.4, 7.27A, 7.27B and 7.29).

(5) **ADOPTION LEVEL OF NEW TECHNOLOGY**

Adoption level measurement was one of the parameters. This is useful in measuring the extent of use of new technology. The level in the past as estimated by R.C. Rout (as referred elsewhere) the average technology index in 1991 was approximately 50 in irrigated and 40 in rainfed area. The present study indicates that adoption index increased up to 90 in irrigated and 65 in rainfed area (Table No. 7.20). This shows a trend of increasing use of new technology; during 1999-2000.

From the discussions so far made it can be concluded that use of new agricultural technology has been instrumental in increasing output, income and employment in the drought prone district like Ahmednagar. The impact was more intensive in irrigated area than rainfed area. Economic development of the district has taken place, though there is still a vast scope for further development.
However new agricultural technology is not an unmixed boon. It has to be used with due care. Experience of some of the countries and some places in India show that components like Chemical Fertilizers, pesticides, and extensive irrigation etc. have adverse effects on soil and environment.

[ 8.4 ] **RECOMMENDATIONS** -

On the basis of findings discussed above the following recommendations have been suggested by the researcher in order to speed up the economic development of the district under study.

**Pre-requisites** -

1. Farmers were found using some of the inputs like chemical fertilizers, pesticides, extent of irrigation without correct & scientific knowledge of the quantity to be used for particular crop and soil (Over spending on these factors was also revealed by negative regression coefficient). It is therefore, recommended that farmers be educated in this regard by more extension services. This will keep away degeneration of soil productivity and waste of money enabling the farmers to reap the advantages for a longer period.

2. Water is the most valuable and scarce resource the use of which should be economized. Prevailing irrigation methods were found to be much wasteful. More than required amount of water is being used for irrigation. To avoid this drip and sprinkler system needs to be encouraged though it is little expensive.
(3) Mobile Chemical Laboratory should be provided in the rural areas for soil testing. This will enable farmers to decide the amount and kind of chemical fertilizers to be used. They can also be advised about the cropping pattern most suitable to their farms.

(4) According to new technology, some of the seeds are suitable specially in dry areas. Therefore the techniques of the use of dry land farming which are more advantageous to these farmers should be encouraged.

(5) Essential infrastructure like, electric power, roads, watershed programmes, etc. should be provided. Services like cold storage, refrigerated transportation, etc. will create new employment opportunities in the rural areas. Hence the provision of these services promptly be encouraged.

(6) Rain harvesting techniques should be brought into practice by farmers even at each farm level. the farmers are required to be educated properly for the purpose. This would not only help to have additional source of water whenever needed, but also increase the water level in that particular region.

(7) Due to uncertainty of monsoon, farmers always face difficulties in timely farm operations like sowing etc. Therefore at least one remote sensing unit should be installed at a distance of 10-15 kilometer radius from the villages. Farmers can take advice immediately on telephones.
Those farmers who are solely dependent upon rains for cultivation, still rely on conventional crops which require supply of good quality of water. But there are some crops which require minimum amount of water. Such crops are fig trees, mushroom and other medicinal plants, like aloe vera. The farmers therefore must be encouraged to take these crops.

To reduce the imbalance of rains because of deforestation, incentives should be given to the farmers who implant trees near their farms.

To reduce the time of growth of such trees tissue-cultured seed plants must be given to farmers at free of cost. This would enable farmers to grow quality timber in the pieces of wastelands.

Water which farmers use for irrigation many times contain, such salts which are not helpful for growth of some of the crops, and do not match with soil. For this purpose and to avoid salination of soil, water samples from well and canal be tested.

This can help in tracing the track of land having similarities and their capacity to produce particular crop. This way such a mapping would help in planning also. This is also useful in preparing agricultural models.
EDUCATION & TRAINING -

Research in agriculture is a continuous process. New experiments are being conducted by many agriculture scientists. New inventions come out successfully. These new inventions, ideas and methods must reach to the doors of farmers. For this purpose it is recommended that training and education programmes like seminars, demonstrations must be conducted through government, educational institutes and private agencies and organisations. This will update the knowledge of new technology to the farmers. Establishing a special institute for such programmes would be the best effort.

Financial & Other Assistance -

Financial assistance is necessary for adoption and use of new agricultural technology e.g. efficient irrigation methods like drip irrigation needs expensive fittings with pipes and nozzles etc. for drip.

For this purpose, it is recommended that farmers should be given, medium or long term loans at low rate of interest to install above said systems or to buy agricultural machinery. At present, there are some schemes, with banks like Ahmednagar District Central Cooperative Bank but, these efforts should be intensified.

Subsidiary businesses -

(1) There is a vast scope in rural areas, specially in irrigated areas for having small scale industries like food processing. Processed food like
Ketchup, Jam and Pickles can fetch good prices. Such industries should be encouraged in these areas. The farmers shall be trained to start such small industries, so that the marketability of their crops can be increased.

(2) Small and cottage industries like sericulture can be most profitable in dry land farming, because production of raw silk does not require much irrigation and can fetch good price to the farmers.

**Marketing**

(1) Export zones should be identified. There is a large scope for exporting fruits, flowers, medicinal products, milk products etc.

(2) Large, medium and small size farmers, all approach to market yard in the nearby area, where they have to spend time and money to sell their produce at a much lower wholesale rate, to the adatiyas. This reduces profit margin of farmers.

To over come these problems, farmers must be encouraged to form cooperative societies of their own whereby they could negotiate properly with market yards.

**Others**

(1) **E-Choupal Model**

Considering the fast developing nature of the Ahmednagar district, e-choupal model is worth recommendation. This model is initiated by
I.T.C. on experimental basis in Andhra Pradesh. This model seeks to enhance farm productivity and income by aligning output with market demand through connectivity. In effect the e-choupal is potentially an efficient delivery channel, for rural development and an instrument for converting village population into vibrant economic organisations. 

(Business Today Jan 16 2005 Page 84) According to this model, an organisation or a corporation can establish a full fledged big departmental stores with both buying and selling activities, in the rural areas. Farmers can sell their produce to these stores which will be nearest to them; and can buy all types of house hold consumption goods including agricultural inputs from them.

There seems to be a vast scope for such model in Ahmednagar district.

(2) CONTRACT FARMING -

The Government of India’s National Agriculture Policy envisages that "Private Sector participation will be promoted through contract farming and land leasing arrangements to allow accelerated technology transfer, capital inflow and assured market for crop production, especially of oil seeds, cotton and horticultural crops". (Ref : "Spice" vol. 1 March 2003 Pub : National Institute of Agricultural Extension Management, Hyderabad. AP) Many times farmers have to throw their
produce away for want of buyers, as there exist no assured market for their produce to fetch remunerative prices. This is one side of the coin.

On the other hand, the agri based and food industry which requires timely and adequate inputs of good quality agricultural produce, but they do not get it. This underlying paradox of Indian agricultural scenario has given birth to the concept of contract farming.

Many corporates involved in agro commodity trading, processing, export etc. have attempted to establish convenient systems and models that ensure timely and consistent supply of raw material of desired quality and low cost.

Contract farming is defined as a system for the production and supply of agricultural and horticultural produce under forward contracts between producers / suppliers and buyers.

It is recommended that such a contract farming must be encouraged in the district of Ahmednagar. Some of the corporations like Pepsi Food Ltd. has already started this at Zahura in Hoshiarpur district. It is possible in Ahmednagar District to have food processing industry like tomato ketchup, pickles, and jams of fruits production etc. in this context.