CHAPTER - VII

SUMMARY & CONCLUSION
Water is indispensable to cultivation, and in a state like Madhya Pradesh where agriculture is still a gamble in monsoon, an adequate and assured supply of water acquires greater importance than elsewhere. Area under irrigation will have to be increased by having many more minor and major irrigation projects, adequate maintenance of canals, efficient water management and developing a National Water Grid system so that water from surplus areas may be diverted to water deficit areas. A large untapped irrigation potential exists in Study Area. Research studies have shown that there is a considerable loss of water before it reaches the fields due to poor embankments and lack of proper maintenance.

Farm mechanization with the use of agricultural machinery has gained importance in the recent past. It includes tractors, power tillers, sprayers, thrashers, pumps, harvesters, etc. Introduction of machinery to agricultural operations increases agricultural output many folds. It has been estimated that in Russia, due to introduction of machines, productivity of labour in agriculture increased thrice in fifties as compared to the pre-revolution period. But since Study Area is a land of small and marginal holdings with ever increasing pressure of population on land, the use of machinery will have to be selective. Small-sized mechanical implements can always be used. These go a long way in improving the productivity of
farms without at the same time displacing farm labour. Such a strategy is ideally suited to our agriculture.

Improved seeds can do wonders in increasing productivity of agriculture. But unfortunately those farmers who do not enjoy irrigational facilities have not been benefited from those improved seeds since assured water supply is a pre-condition for sowing these seeds. The supply of improved seeds by the government agencies has to be stepped up to ensure its un-interrupted availability to all sections of farm population and of the right type. For this purpose, merely granting a subsidy is not enough, an efficient distribution system is greatly required.

It has been stated that people have very nearly exhausted their resources of additional land capable of being brought under cultivation; their efforts, therefore, are being directed to increase the yield per hectare. Improved variety of seeds which can yield higher output per hectare require heavy doses of fertilizers. The soil has been found to be deficient in many nutrients. In order to restore these nutrients and keep the fertility of soil intact, it is necessary that it is supplied with chemical fertilizers. Thus, serious efforts are needed to increase consumption and availability of fertilizers to improve productivity.

After the introduction of high-yielding seeds, plant protection has become an important measure for boosting farm output. Majority of the farmers being
illiterate, are unaware of many medicines, insecticides and pesticides being sold in the market. It is, therefore necessary that the Government through its extension staff carry out the spraying of insecticides and pesticides at subsidised rates.

Modern technology may also come in a big way in the development of land for agricultural purposes at a reduced cost. Tractor technology may be cited in this regard. Levelling of rugged surfaces and building roads has become not only less expensive but also time saving. Traditionally labour using devices have been used partly because modern technology was not known and partly because the opportunity cost of labour was low. If heavy machinery has to be diverted to land development, it certainly would be at a much higher opportunity cost and to justify such a diversion, the returns from land so developed should be sufficiently high.

New farm technology tends to decrease the unit cost of inputs without decreasing the output. New mechanical - biological technologies such as improved machines, seeds, fertilizers and pesticides etc. have resulted in enhanced crop output without increasing total inputs and have helped in improving input - output relationships.

The impact of new farm technology has not been sufficient to alter significantly the trend rate of growth
in crop output. This deplorable state of agriculture is
due to some major problems that agriculture of the Study
Area is faced. These problems are diverse in nature but
directly affect the performance of agriculture. These
problems are:

(1) Large diversity of crops
(2) Uncertain water supply
(3) Predominance of tiny farmers
(4) Little Commercial farming
(5) Existence of surplus labour
(6) Capital deficiency
(7) Low level of technology
(8) Property rights

Madhya Pradesh, is the largest State of the
Indian Union and embraces 443, 446 Sq. Km. of area with 52,
178, 844 persons in 1981. It lies mainly on the tableland
of the peninsular India and is characterized by rough
terrain, dissected plateaux and plains. The Narmada - Son
trough, walled in by the Vindhyan scarps on the north and
Satpura - Mahadeo - Maikal ranges on the south, runs
diagonally across the State in SW - NE direction. The
dissected Malwa plateau in the west and the Bundelkhand and
Baghelkhand plateaus in the east slope gently northward to
the Gangetic plain. The bowl shaped Chhattisgarh plain in
the south is hemmed in by the Maikal ranges and Surguja
uplands on the north and the low Bastar hills on the south.
The State has territorial jurisdiction over large catchment areas of hundreds of streams that flow out in all directions and is endowed with great water potential. The river Narmada is the largest river and also the lifeline of the State.

Though the large extent and diverse relief result in a diversity of climatic conditions, the dominant aspect is the tropical monsoon climate with rhythmic variation of seasons. The climate of the State is rather mild and healthy. The temperature ranges from a mean daily minimum of 10° C in January to a maximum of 40° C in May. Most of the rainfall (over 90 per cent) is received during the rainy season (June - September). The amount of rainfall decreases gradually from 210 cm in the south and south-east to 70 cm in the north-west.

Soils are varied in form and composition. Nearly one-half of the State is covered by black soils rich in potash and lime. Alluvial soils on the northern fringe and red and yellow soils of Chhattisgarh are the other important types. Nearly one-third area of the State is covered by forests which are commercially valuable, especially teak and sal. The State is the second largest producer of lac in India. The forest resources provide immense scope for the development of forest-based industries.
During last thirty years population of the State has just doubled from 26072 thousand in 1951 to 52178 thousand in 1981. There is no evident relationship between education and agricultural development.

Transport facilities play a very significant role in the development of a region and Madhya Pradesh provides a good example where economic growth has suffered on this account. The State’s physical features, forest regions, numerous small and large rivers etc. hinder the development of an efficient system of transport. Both the railway and road lengths per unit area in the State are much below the national figures.

With the increasing pressure of population marginal lands are brought under cultivation gradually with the help of the new farm technology. Land use at any given place and time results from decisions based on the interaction of five groups of factors: environmental, technological, economic, social and political. Generally physical factors have decisive influence land use in this State, where, with other things, the nature of terrain, soil and amount of rainfall determine the amount of area sown. The net area sown is very small (below 30.0%) where the land is high and intensively dissected presenting high slope. Such regions are the Satpura - Maikal range, Vindhyachal range, Bastar plateau, the Baghelkhand plateau and the hilly Bundelkhand plateau where soils are thin the poor in fertility therefore, instead of farm land, most of
the area is under forests. In contrast, higher percentage of net area sown (above 50.0 per cent) is found in almost level areas, such as the Malwa plateau, the Chhattisgarh plain, the lower Chambal valley and the Rewa plateau.

The forested area is found highest in Bastar district (62.60 per cent) during 1986-87. Land not available for cultivation is highest in Morena district (23.10 per cent). Other uncultivated land excluding fallow lands is observed very high (14.66 per cent) in Rajgarh and very low (0.68 per cent) in Sidhi district. The state having 9.6, 5.06, 4.65 and 3.82 per cent to total geographical area under culturable waste land during 1956-57, 1969-70, 1976-77 and 1986-87 respectively. It declined approximately by half in 1976-77. The main reason of this decrease is the reclamation of such lands for cultivation. High proportion of this land is recorded in Shivpuri (13.49 per cent) and very low in Sagar district (0.27 per cent). The proportion of fallow lands in this State is comparatively lower than the national average of 7.5 per cent. More than 192.09 lakh (43.21 per cent) of the geographical area is net sown, which is slightly lower than the national average of 46.9 per cent. It is found as high as 75.26 per cent in Ujjain district to as low as 21.53 per cent in Bastar district. There are 27 districts out of 45 in all recording higher percentage than the State average (43.21 per cent). Most of these districts are
scattered in the Mahanadi plain, Malwa plateau, Narmada valley and the Mahi-Chambal valley. State as a whole, total net sown area was 139.69 lakh hectare in 1950-51, which rose to 191.02 lakh hectare in 1986-87 period.

Area sown more than once was 11.02, 12.53 and 16.29 per cent of net sown area during 1969-70, 1976-77 and 1986-87 period. It is 7.0 per cent of the total geographical area in 1986-87 which is lower than the national average (12.4 per cent). It is found highest in Mandsaur (33.15 per cent) and lowest in Bastar (3.80 per cent). 19 districts have higher percentage than the State mean (16.29 per cent). In selected areas, the cropping intensity varies from 100.64 in Raisen to 135.67 per cent in Balaghat in 1969-70, 100.95 in Raisen to 133.65 per cent in Mandsaur in 1976-77 and 106.30 in Datia to 133.15 per cent in Mandsaur district during 1986-87 period. It is decline gradually in Jabalpur, Balaghat and Panna district.

Major function of irrigation is to mitigate the impact of irregular, uneven and inadequate rainfall with wide fluctuations from year to year. There are two main sources of water—underground water and surface water. Total underground water potential has been estimated at 5865304 hect. m. and total surface water has been estimated at 125777 crore cubic metres available in rivers and big nullahs of this State.

A sum of 1454 crores of rupees was earmarked for the Seventh Five Year Plan (1985-90). The Govt. had
made provision for 317.79 crores of rupees for the irrigation facilities during the financial year (1989-90).

Development of irrigation facility was as under: 1914 thousand hectares of land during Annual Plan Period (1979-80), 3935 thousand hectares of land during the Sixth Five Year Plan Period (1980-85) and 4773 thousand hectares of land estimated to be brought under irrigation during the Seventh Five Year Plan Period (1985-90).

In this State the sources of irrigation are largely affected by physical features. Presently, the State has different sources of irrigation viz., canal, well, tank and other sources. At present, well is first ranking means of irrigation inundating 42.7 per cent of irrigated area. The intensity of irrigation in the State as a whole in only 102.81, 103.45 and 103.32 per cent during 1969-70, 1976-77 and 1986-87 respectively. It is relatively high in Jabalpur, Balaghat, Damoh, Mandla, Gwalior and Bhind. While in the selected areas, it is 102.98, 103.98 and 103.75 per cent during 1969-70, 1976-77 and 1986-87 period. It is clear that area irrigated more than once are mostly found in the selected areas. Growth rate of irrigation is highest in Hoshangabad district (1964.92 per cent) during 1969-87 period.

Rainfall is almost sufficient for paddy and other kharif crops in Bilaspur, Durg, Raipur and Balaghat. However, to combat with the vagaries of rainfall sufficient
potentials were created during 1920's, thereby restricting the scope for further expansion. Wheat is first ranking irrigated crop in the State except irrigated tract of the Chhattisgarh basin and though rice is only major irrigated crop in the irrigated tract of the Chhattisgarh basin. Other crops, such as barley and gram in the Bundelkhand uplands and Madhya Bharat plateau, horticultural crops, sugarcane and cotton in the western Malwa and in the Narmada valley, opium in Mandsaur district and rape and mustard in Morena district are unique irrigated crops in the State. It proves that those crops which have high calorific as well as market values, are irrigated.

The Narmada Valley Development Project is expected to usher in agricultural and industrial development on a vast scale. It is expected to bring about a third (32 per cent) of the gross cropped area in the State under irrigation and is expected to result in an increase in agricultural output. The agricultural increase would lead to the growth of a number of agro-based industries viz. soyabean and oil seeds extraction plants and processing units for other commercial crops. The development of industries would get a boost from the development of electrical power. The project, when completed is expected to lead to the emergence of new towns near multipurpose project sites besides increasing the size of existing urban centres.
To increase crop output per unit area, new land has to brought under multiple cropping with improved quality of farm operation. Use of improved mechanical techniques primarily results in labour saving but simultaneously contributes significantly to increase yield per hectare by making possible more intensive cultivation and the application of modern biological techniques. Mechanization has also led to the proper utilization of inputs, like fertilizers, pesticides, water and high yielding varieties of seeds which can be achieved in field operations only through mechanization. The traditional implements - wooden plough, iron plough, cart, sugarcane crusher (operated by bullocks), ghanis and persian wheel are also indicative of adoptability of farmers and they present wide variation in their use. So they have also been described. In the selected areas the density of power operated sugarcane crusher is as high as 122.98 in Indore and as low as 3.7 in Jabalpur district in per lakh hectare of cropped area during 1986-87. It is higher than the State mean (36.85) in eleven districts namely Indore, Dewas, Gwalior, Morena, Shajapur, West Nimar, East Nimar, Chhatarpur, Balaghat, Ujjain and Datia. Its growth is found highest in Chhatarpur (19000.0 per cent) and lowest in West Nimar (0.69 per cent). Fourteen districts out of twenty-seven have higher growth than the State’s average (258.47 per cent). It is very high comparatively to bullocks operated sugarcane crusher. The density of oil
engines ranges from 1.38 per thousand hectare of cropped area in Indore district to 16.67 per thousand hectare of cropped area in Mandsaur district in 1986-87. Fifteen districts recorded higher density than the State mean (6.75 per thousand hectares of cropped area). Its growth ranges between 80.63 to 4382.46 per cent during 1969-87. It shows that there is high growth in oil engine. Eighteen districts out of twenty-seven have a higher growth rate than the State's average (410.71 per cent). The higher density of electric pumps is found mostly in the western and central part. It various from 70.61 per'000 ha. of cropped area in Indore to 2.03 per'000 ha. of cropped area in Shahdol district. Low and very low density is found in the eastern part because they are poor in canal irrigation. The growth of electric pumps is extremely high during 1969 to 87. All districts have recorded positive growth. It is highest in Chhatarpur (6719.08 per cent) and lowest in Indore (504.09 per cent). Fifteen district out of twenty-seven have higher growth rate than the State's average (1427.82 per cent). It is comparatively very high to oil engine. It is due to the electrification of rural areas. The density of tractors is found extremely high in Sagar, Gwallor, Satna, Morena and Raisen, very high in Bhind and Datia, and high in Jabalpur, Damoh, Indore, Mandsaur, Shivpuri and Hooghalanabad districts. These all districts have recorded higher density than State mean (196.11
per'00000 ha. of cropped area). Satna have recorded highest density of tractor (744.41 per'00000 ha. of cropped area) and Balaghat have found lowest (36.21 per'00000 ha. of cropped area).

Not all districts with low proportion of labourers have high density of tractors. It is concluded that there is not clearcut relationship between the density of tractors and proportion of agricultural labourers. All districts have recorded only positive growth. There is very high growth rate during 1969 to 87 period. It is as low as 188.89 per cent in Balaghat to as high as 15057.89 per cent in Morena district. Fifteen districts have higher growth than the State's average (1135.16 per cent). Damoh, Durg, Chhatarpur, Satna, Indore, Ujjain, Dewas, Morena, Bhind, Datia and Hoshangabad have very high growth (above 1500 per cent). The use of tractors depends mostly on size of holdings.

The higher level of adoption of mechanization than the mean is found in fourteen districts which are mostly in the central and northern part of the State. Districts with lower level of adoption of mechanization than the mean are found in the eastern and southern parts. It may be because of the preponderance of marginal and small holdings, high percentage of tribal and scheduled caste population, high pressure of rural population, inadequate network of institutions for supply of agricultural inputs and credit and low level of rural
literacy. Contrary to it, large size of holdings, commercialization of crops and urban influences have facilitated the mechanization of farming in northern and western areas.

In the State cropping pattern is dominated by the foodgrains (79.36 per cent of the total cropped area). In foodgrains, cereals and millets occupying 57.97 per cent of total cropped area; and remaining 21.39 per cent is under different pulses. It is found that soil, climate and socio economic conditions limit the concentration of certain crops to a few selected areas i.e. paddy in the southern eastern part of the State, wheat in Sagar - Damoh plateau, wheat and gram in middle Narmada valley, wheat-gram and bajra in Gird plateau, cotton and jowar in northern-western part of Malwa and maize in extremely west part of the State. Rice is the first ranking crop, occupies largest proportion (22.58 per cent of total cropped area) during 1986-87. It ranks first among all crops in five districts namely Raipur (69.16 per cent), Bilaspur (66.08 per cent), Raigarh (69.15 per cent), Balaghat (65.79 per cent) and Bastar (63.91 per cent). Wheat is the second most important crop occupies 15.69 per cent of total cropped area in the State in 1986-87. Jowar, kodon-kutki, maize, gram and cotton occupies 8.57, 4.81, 3.81, 9.94 and 2.34 per cent of total cropped area in 1986-87.
With exception of jowar-kharif (- 17.09 per cent), jowar-rabi (- 25.0 per cent), kodon-kutki (- 23.94 per cent), cotton (- 23.54 per cent), bajra (- 28.45 per cent), tur (- 10.27 per cent), barley (- 27.66 per cent) drugs and narcotics (- 30.00 per cent) and a few oilseeds which recorded decline in actual area, all other crops have gained. Total cropped area is also increased by 9.97 per cent (20.23 lakh hectares) during 1969-70 to 1986-87. Out of this 6.42 per cent is added to food crops. Area of oilseeds increased by 53.07 per cent. Rice, wheat, maize and gram increased 15.79, 4.62, 46.24 and 43.98 per cent.

The output of foodgrains are 97.85, 95.76 and 135.21 lakh tonnes during 1969-70, 1976-77 and 1986-87 respectively. The growth recorded 38.18 per cent (37.36 lakh tonnes) during 1969-70 to 1986-87. While area under foodgrains increased only 5.79 per cent. The higher rate of growth of output than of area under foodgrains apparently proves faster growth of yield rates. Among foodgrains, cereals have recorded much faster growth than pulses in output. This is in contrast of growth of area as pulses have recorded much faster growth in area than cereals. In cereals, maize (93.64 per cent) and wheat (85.96 per cent) have recorded high increase in output. It seems logical that new seeds could not do for rice that the Mexican hybrids did for wheat. There is much difference in yield rate of these two crops—rice 877 kgs and wheat 1271 kgs per hectare in 1986-87 for the State average.
crops as bajra, barley and kodon-kutki decrease their output remarkably. The first ranking pulse crop - gram increased 74.32 per cent (6.31 lakh tonnes). The growth of output of tur has recorded 33.23 per cent. Output of oilseeds, soyabean (6.77 lakh tonnes) and rape & mustard (1.47 lakh tonnes) increased. Groundnut (- 0.97), sesamum (- 0.39), linseed (- 0.11) and castor (- 0.01 lakh tonnes) have decreased their output. Cotton is gradually reducing in area and output. State's total crop output is 160.28 lakh tonnes in 1986-87. It is found highest (9.56 lakh tonnes) in Raipur district and lowest (1.31 lakh tonnes) in Bhopal district. Total crop output increased 41.38 per cent during 1969-87. Highest growth is found in Datia (146.32 per cent) district. The growth of output of rice recorded 29.56 per cent during 1969-87. It's highest growth is found in Morena (169.57 per cent) district. It is positive in all districts of the Chhattisgarh region. At present, it's (Rice) yield rate is extremely high in the Chambal region. It is found as low as 234 kg/hectare in Jabalpur district and as high as 1931 kg/hectare in Morena district. Average yield per hectare was 784 kg in 1969-70 which rose to 877 kg in 1986-87, recording increase of 11.86 per cent. Seventeen districts have recorded higher growth than the State average (11.86 per cent). Average yield of wheat per hectare was 714 kg in 1969-70 which rose 1271 kg in 1986-87, recording increase of 78.01
per cent. Out of 45, 24 districts recording higher growth in yield rate than the State average (78.01 per cent). Average yield per hectare of jowar rose from 605 kg in 1969-70 to 682 kg in 1986-87, recording increase of 12.73 per cent. Average yield per hectare of kodon-kutki was 221 kg in 1969-70 which decrease to 179 kg in 1986-87, recording decrease of minus 19.00 per cent. Highest growth is observed in Raigarh district (151.33 per cent). Average yield per hectare of maize and gram increase 31.68 and 21.01 per cent during 1969-87 period.

Changes in output are not corroborated with the changes in area. Neither of the districts with very high growth in output has corresponding increase in area, nor the vice versa. There are few districts where despite of reduction in area output increased. The product moment correlation co-efficient between changes in area and output is insignificant. Suggesting least influence of increasing land on increasing output. Correlation coefficient is direct and very high between changes in output and yield rate. It supports the view that increase in output is more dependent on yield rates rather than on the area. Higher proportion of commercial crops is in the western and northern parts of the State.

Productivity ranges from 60.1 per cent in Mandla to 162.3 per cent in Gwallor district of the State average. It is highest in the three district of Chambal valley, two districts of the eastern Malwa and two
districts are on the rice zone of the State. Contrary to it, districts with low and lower medium productivity are confined in the western Malwa, lower and upper Narmada valley, Satpura region, Vindhyan scrubland, Baghelkhand plateau, western Chhattisgarh and in the Bastar plateau.

The Study Areas are agriculturally backward. Like other developmental measures, development of irrigation is a localised phenomena. There seems to be no direct relationship between the amount of rainfall and intensity of irrigation. Percentage of irrigated area increased rapidly, where its intensity was low and very low in the initial year, i.e. in 1950-51. The expansion of net sown area and reduction of cultivable wastes cannot be ascribed safely to the development of irrigation. However, irrigation has played vital role in raising the yield rates of certain crops, such as rice, wheat and horticultural crops. This is made possible through the adoption of certain yield raising inputs, which are dependent to a great extent, on irrigation. Use of the high yielding variety of seeds and chemical fertilizers vary directly with the intensity of irrigated area and have significantly high positive correlation. The districts adopting these three measures, viz. irrigation, HYV of seeds and fertilizers also have high agricultural productivity per unit of cropped area. It may be summed up that the development of agriculture in the Study Area is tagged with
the development of irrigation. Only surface water resource is partially used for the purpose, leaving reserves of underground water resource untapped. Therefore, the use of water resource may be planned accordingly.

It is an admitted fact that farm mechanization increases the efficiency of labour as well as land and, therefore, raises the crop output per hectare and per worker. A number of field studies conducted to establish the relationship between mechanization and productivity have revealed that mechanization increases productivity to a greater extent. In the Study Area the correlation is 0.53 between them. New farm technology works better with mechanical inputs. With the help of machinery, farm operations can be completed in much less time than if they are to be performed manually. This increases intensity of cropping. It has significant direct correlation (0.51) with the mechanization. In words of I. Arnon, the possibility of replacing one-crop-a-year production pattern by multiple cropping is dependent on a shortening of the time involved in freeing the field from one crop and preparing it for the next one. This usually depends on the possibilities of mechanizing certain operations such as harvesting, threshing, land preparation etc.

Mechanization increases the efficiency of labour in agriculture and raises the crop output per worker. With the introduction of machines, the quantum of
labour required to produce a unit of output is greatly reduced. "Increasing mechanization has helped achieve miracles in the West. For instance, in the U.S.A. the amount of human labour required to produce 100 bushels of wheat dropped from 320 hours in the year 1830 to 108 hours in 1900, by 1940 a new series of improvements have reduced labour requirements to 47 hours."

Mechanization as it increases productivity of land and labour results in reducing cost of output. Further, since mechanization and large-scale farming go side by side, economics of large-scale production and higher yield per hectare help in reducing the cost. The experience of many developed countries shows that with the development, human and animal labour become costlier vis-a-vis the machines.

The study of C.H. Hanumantha Rao shows that the cause of increasing use of tractors and other machines in Punjab and Haryana is due to the fact that these machines are relatively cheaper inputs. Though it is believed that labour is cheaper in the eastern part of the Study Area.

Use of power in agricultural processes has been increasing and emphasis is shifting from animate to inanimate sources. Present pattern of mechanical power utilization in the Study Areas have direct relation with the agricultural productivity. On the basis of the sources
of power the Study Area is clearly divisible into two parts, viz. eastern and western. Eastern part, with high density of rural population and hence marginal and smaller size of holding, depends heavily upon human and animal power. These circumstances have inhibited the agricultural development in this part. It is pertinent to note that the productivity of agriculture per unit of power consumed and per worker can not be enhanced without drastic reduction in number of agricultural workers. In absence of other economic pursuits they are compelled to participate in farming. Contrary to it, western part with low pressure of population present deeper impact of industrialization and urbanization on crop structure. Comparatively larger size of holdings also facilitates commercialization of crops, use of modern inputs and requires larger amount of inanimate energy.

Mechanization has direct significant correlation (0.40) with the irrigation. Irrigated area has significant correlation with the output of rice (0.60) and output of wheat (0.66). But it has low correlation with the output of kodon-kutki (0.22) and output of cotton (0.25). Growth of irrigated area has not significant correlation with the output of jowar (0.18), output of maize (0.11) and output of gram (0.29).

Output of rice has significant correlation with the tractor (0.48) and oil engine (0.58). Output of wheat has low and negative correlation with the tractor
(0.26), oil engine (0.24) and electric pumps (- 0.12).

There is found positive correlation (0.35) between output of kodon-kutki and tractor. Output of maize has not significant correlation with the mechanization. Output of jowar and output of gram have negative correlation with the farm mechanization. But output of cotton has found low positive correlation with the electric pumps (0.25), tractor (0.14) and oil engine (0.12).