Vol XLV
No. 3

ISSN 0019-5014

CONFERENCE
NUMBER

JULY-
SEPTEMBER
1990

INDIAN JOURNAL OF AGRICULTURAL ECONOMICS

INDIAN SOCIETY OF
AGRICULTURAL ECONOMICS,
BOMBAY

Ind. Jn. of Agri. Econ.
Vol. 45, No 3, July-Sept. 1990

SUBJECT II

AGRO-CLIMATIC ZONAL PLANNING AND REGIONAL DEVELOPMENT

Agro-Climatic Planning and Regional Development*

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This paper attempts to portray the current state of agro-climatic planning, which has been accepted by the Planning Commission and the Government of India as the principal method of agricultural planning. It sets the backdrop in the Mid-Term Appraisal of the Seventh Plan and the Framework Action Plan for 1988-90, which brought out the urgency of the need for improved planning methodology (see Dandekar and Wadia, 1989 for a historical discussion). We then discuss the issues related to regionalisation and illustrate the plan for three 'typical' regions - a very backward plateau region, a hill region and a river delta. The different nature of agricultural planning for India that emerges is then discussed to show the vitality of the approach. Finally, there is a discussion of institutional and policy issues and the need to have a sense of urgency in implementation.

FRAMEWORK ACTION PLAN

The revision in agricultural input targets at the time of the Mid-Term Appraisal of the Seventh Plan was done in the context of a re-examination of the basic parameters of agricultural planning. Efficiency of water planning and management, a more realistic assessment of resource requirements, greater co-ordination at district levels and improved policies for credit, seeds for alternative crops and alternate delivery systems were features underlined as requirements in the short run. The Framework Action Plan (see Alagh *et al.*, 1989; Government of India, 1988 *b*) was a method to operationalise this. In the long run each region had to plan for production potential build up on a sustainable basis. This required the agro-climatic regional approach discussed subsequently.

TABLE I. PARAMETERS OF AGRICULTURAL PLANNING IN INDIA

Sr. No.	Variable	Fifth Plan	Sixth Plan	Seventh Plan	
				Original	Revised
(1)	(2)	(3)	(4)	(5)	(6)
1.	Additional irrigation utilisation (million hectares)	9.11	13.80	10.90	9.50
2.	Additional cropped area (million hectares)	6.04	11.74	10.00	7.60
3.	Elasticity of GCA to GIA	0.20	0.26	0.31	0.24
4.	Agricultural output growth target (per cent annual)	3.94	4.00	4.00	4.00
5.	Yield growth target (per cent annual)	3.24	2.65	2.90	3.19

Source: Government of India (1987*a*, p. 77).

The Mid-Term Appraisal (Government of India, 1987 *a*, pp. 77-80), targetted that expansion of area would account for a much lower proportion of the targetted agricultural growth as compared to the original Seventh Plan. Investments and policies were therefore required for raising yields faster. The irrigation target was kept as in the Seventh Plan, but growth in area was reduced. Thus the emphasis was on additional input provision.

* Keynote paper.

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As Table I shows, the irrigation target in the Seventh Plan was lower than in the Sixth Plan. Yet a high growth target was maintained by postulating that the elasticity of cropped area (GCA) to irrigated area (GIA) would go up to 0.31 as compared to 0.26 in the Sixth Plan and 0.20 in the Fifth Plan. Meanwhile, in fact, area growth was not taking place at all. Thus the original Seventh Plan was very unrealistically optimistic in the technical sense, in its agricultural growth target and required to be modified at the time of the Mid-Term Appraisal (Government of India, 1987 *a*, p. 71).

The Framework Action Plan, therefore, noted that the Seventh Plan's irrigation targets were not being met and provided for detailed funds at the project/district level to achieve potential. Thus the original target of increase in irrigated area was kept (Tables I and II), but in the light of experience the postulated expansion of cropped area was reduced. Thus irrigated area (GIA) was to go up from 60.6 million hectares to 71.4 million hectares and funds for tubewells and completion of projects were provided, but the expansion of cropped area (GCA) would vary from 10 million hectares to 7.6 million hectares (Table II). The cropping intensity target was reduced. This meant that additional funds had to be provided for inputs and credit. The revised profile of production was as given in Table II.

TABLE II. SELECTED VARIABLES/PARAMETERS OF FOODGRAIN PRODUCTION AT ALL-INDIA LEVEL (AGRICULTURAL SUB-MODEL

Variable\Parameter	1984-85		1989-90		
	Plan	Revised Base	Plan	Revised	
				Alternative I	Alternative II
(1)	(2)	(3)	(4)	(5)	(6)
NSA (million hectares)	143.0	143.0	143.0	143.0	143.0
GIA (million hectares)	60.5	60.6	71.4	71.4	70.3
GCA (million hectares)					
(a) All crops	180.0	180.0	190.0	187.6	186.9
(b) Foodgrains	130.3	126.7	137.8	132.8	132.4
Cropping intensity	1.26	1.26	1.33	1.31	1.31
GIA under foodgrains (million hectares)	46.0	45.2	53.5	52.1	51.4
Percentage area irrigated					
(a) All crops	33.6	33.7	37.6	38.1	37.6
(b) Foodgrains	35.3	35.7	38.8	39.2	38.8
Fertiliser consumption (million tonnes)	8.4	8.21	13.75	12.3	12.0
Rice					
(a) Area (million hectares)	41.2	41.2	44.0	43.2	43.0
(b) Production (million tonnes)	60.0	58.3	74.0	72.7	71.7
(c) Yield (kg./ha)	1,456	1,417	1,682	1,682	1,667
Wheat					
(a) Area (million hectares)	24.6	23.6	28.0	27.3	27.0
(b) Production (million tonnes)	45.0	44.1	56.5	55.1	54.1
(c) Yield (kg./ha)	1,829	1,870	2,018	2,018	2,004
Other cereals					
(a) Area (million hectares)	41.0	39.2	40.1	38.1	38.3
(b) Production* (million tonnes)	32.0	31.2	34.5	32.8	32.9
(c) Yield (kg./ha)	780	795	860	860	860
Pulses					
(a) Area (million hectares)	23.5	22.7	25.7	24.2	24.1
(b) Production† (million tonnes)	13.0	12.0	15.5	14.6	14.5
(c) Yield (kg./ha)	553	526	603	603	603
Foodgrains					
(a) Area (million hectares)	130.3	126.7	137.8	132.8	132.4
(b) Production (million tonnes)	150.0	145.5	180.5	175.2	173.2
(c) Yield (kg./ha)	1,151	1,149	1,310	1314	1,308

Source: Government of India (1987 *a*, pp. 79-80).
* Productivity assumed is 876 kg./ha for alternative I and 862 kg./ha for alternative II.
† Productivity assumed is 603 kg./ha.

AGRO-CLIMATIC PLANNING

The Framework Action Plan had initiated the approach of considering agricultural development potential in a sub-regional context. The Special Foodgrain Production Programme which implemented it was specified at the level of 169 districts. Water development projects, both surface and groundwater were area specific and so were the specific foodgrain technology packages aimed at. Yet the approach was both short run and partial. It was short run in three aspects: Firstly, the plan was prepared quickly and with easily available data. In January 1988 it was decided to operationalise it by March 1988, so that no crop season would be missed for action for accelerating the pace of agricultural growth. Secondly, the plan profile was for the remaining two years of the Seventh Plan and hence short gestation. Opportunities were only searched for and considered. Thirdly, while institutional matters were considered, for example, the need to ensure remunerative prices for the farmer and problems of tenural insecurity affecting investment decisions of tenanted peasants, wider questions of organisational, institutional and infrastructure support for more enduring and broad-based agricultural development programmes were not considered. The approach was also partial. Only those areas were isolated for development, where reasonable potential could be identified for development. The 169 districts chosen were not the richest ones - but neither were the most poorly endowed areas selected. Again while selecting the grain crops, alternative uses were looked at, for example, oilseeds, but the plan was only for grains and also non-crop based agriculture was ignored.

Objectives

Given the uneven nature of agricultural development documented (Bhalla and Alagh, 1979; Bhalla and Tyagi, 1989), it was quite clear that a more comprehensive long-term approach would be required. The basic objective would be faster and more balanced growth of output and employment from the agricultural sector. In operational terms the objectives of the exercise would be (*a*) to prepare a land and water development strategy for the resource base of each region. This would in particular examine the possibilities of sustainable development; (*b*) to examine the crop and non-crop based development possibilities for the resource endowment of the region and to choose the more promising and rewarding options; (*c*) to develop investment proposals for such development, both for public infrastructure and land and water development programmes and for private investment and the required banking and institutional support policies; (*d*) to detail the institutional, marketing, agro-processing and infrastructure support required for the more promising patterns of development; and (*e*) to examine the phasing and feasibility questions of the planning exercise from the initial stage so that operational viability was kept into account.

Regionalisation

The present author and later the Planning Commission attempted a regionalisation of India for agricultural planning purposes (Alagh, 1988; Government of India, 1988 *a*).

(The Planning Commission examined earlier attempts at the regionalisation of the agricultural economy. Dr. Ashok Mitra on behalf of the Census of India, Dr. Galina Sdasyuk and Miss P. Sengupta also on behalf of the Census of India, the Planning Commission Resource Development Division, National Commission on Agriculture, ICAR and other professional bodies and scholars, had earlier attempted the regionalisation of the Indian

agricultural economy. Soil characteristics, climate, rainfall and water availability were the principal characteristics used for regionalisation.)

There was agreement in the three schemes of classification mentioned above, as also among regional geographers generally, that the primary regional division of India has to be on the basis of topography, and the following five primary or major natural regions have to be distinguished: (*i*) The Himalayas and Associated Hills; (*ii*) The Northern Plain consisting of the area of the Indo-Gangetic Plain included within India; (*iii*) The Peninsular Plateaus and Hills; (*iv*) The East Coast Plains; and (*v*) The West Coast Plains.

There was agreement also on the following further points: (*i*) that the Himalayan area has to be divided into two regions, western and eastern; (*ii*) that the division of the Northern Plain has to be made primarily on the basis of differences of rainfall, because rainfall is the single most important variable within the Plain; and (*iii*) that the West Coast Plain has to be divided into two regions, a per-humid southern region and a drier northern region. Based on these considerations, 14 resource development regions were distinguished on the mainland of India - two in the Himalayan area, five in the Northern Plain, four in the Peninsular Plateaus and Hills, one in the East Coast Plain and two in the West Coast Plain. The fifteenth region consisted of the islands - Andaman and Nicobar in the Bay of Bengal, and Laccadive, Minicoy and Amindivi in the Arabian Sea.

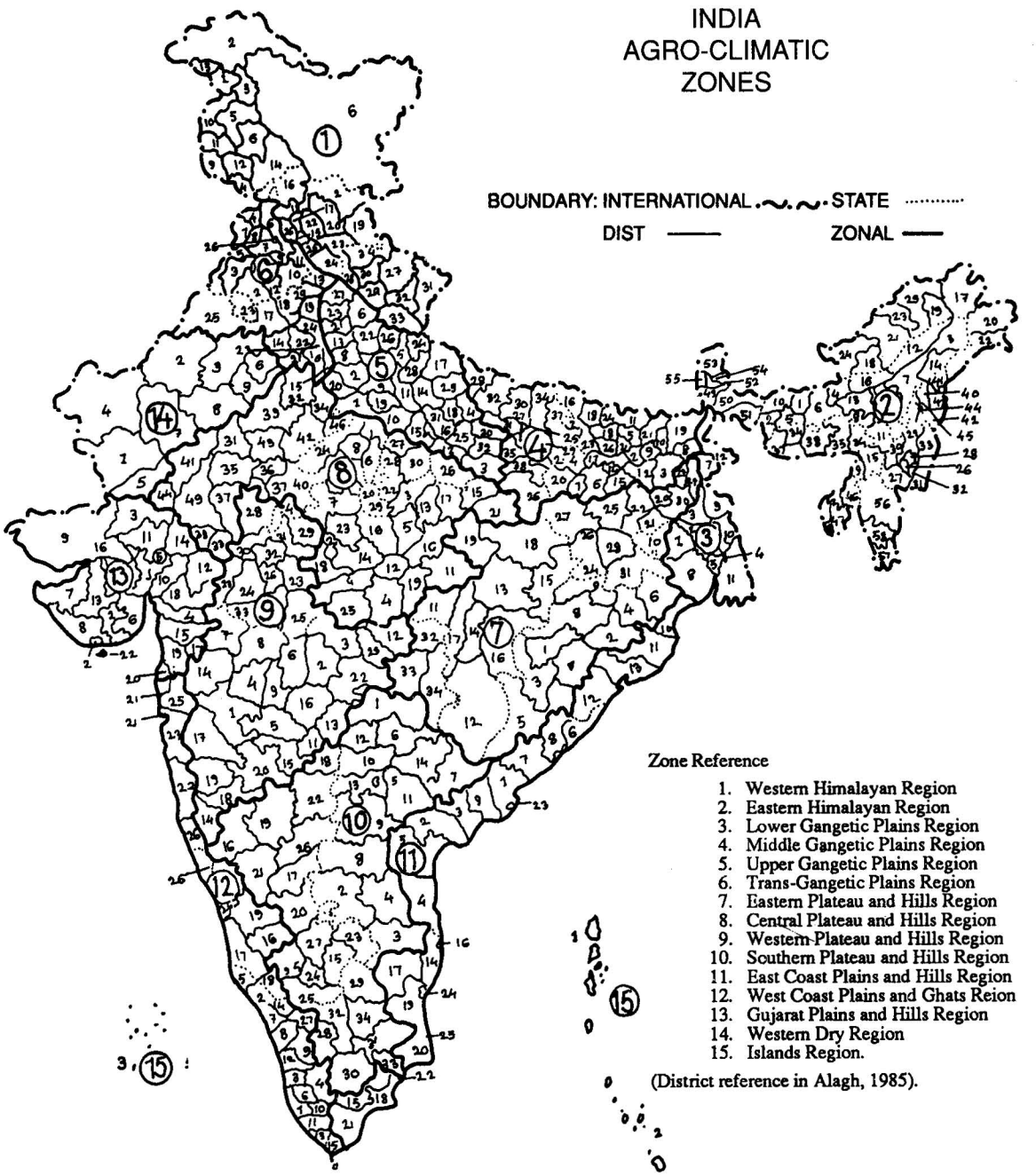
In the light of these studies, the Planning Commission decided to accept the following regionalisation of the national agricultural economy:

(1) Western Himalayan Region
(2) Eastern Himalayan Region
(3) Lower Gangetic Plains Region
(4) Middle Gangetic Plains Region
(5) Upper Gangetic Plains Region
(6) Trans-Gangetic Plains Region
(7) Eastern Plateau and Hills Region
(8) Central Plateau and Hills Region
(9) Western Plateau and Hills Region
(10) Southern Plateau and Hills Region
(11) East Coast Plains and Hills Region
(12) West Coast Plains and Ghats Region
(13) Gujarat Plains and Hills Region
(14) Western Dry Region
(15) Islands Region.

These agro-climatic regions are shown in Map I.

Planning teams were set up for each zone (ZPTs) consisting of experts, voluntary organisations, representatives of financial institutions and the concerned civil servants. They were headed by the Vice-Chancellor of an Agricultural University of the region and serviced by the Director of the Agro-Economic Research Centre. A National Co-ordinating Committee was set up under the Member (Agriculture) of the Planning Commission, with the concerned Secretaries to the Government of India as Members and this was serviced by a small expert Agro-Climatic Regional Planning Unit (ACRPU) set up by the Planning Commission at the Sardar Patel Institute of Economic and Social Research at Ahmedabad.

Map 1


INDIA
AGRO-CLIMATIC
ZONES
BOUNDARY: INTERNATIONAL
STATE
DIST
ZONAL
Zone Reference
1. Western Himalayan Region
2. Eastern Himalayan Region
3. Lower Gangetic Plains Region
4. Middle Gangetic Plains Region
5. Upper Gangetic Plains Region
6. Trans-Gangetic Plains Region
7. Eastern Plateau and Hills Region
8. Central Plateau and Hills Region
9. Western Plateau and Hills Region
10. Southern Plateau and Hills Region
11. East Coast Plains and Hills Region
12. West Coast Plains and Ghats Reion
13. Gujarat Plains and Hills Region
14. Western Dry Region
15. Islands Region.
(District reference in Alagh, 1985).

This committee prepared and sent guidelines for agro-climatic planning to the ZPTs in 1988 (Government of India, 1988 *a*).

The Guidelines first asked the ZPTs to sub-regionalise each zone.

> "The principles used for this sub-regionalisation should be those which relate intrinsically with the character of the agricultural economy, namely, soil type, climate (particularly temperature and its variation and rainfall and its variation), other agro-meteorological characteristics considered relevant, and water demand and supply characteristics including quality of water and aquifer conditions.
>
> At this stage of the exercise, it is better to concentrate on agro-climatic characteristics rather than bringing in other social and administrative criteria for regionalisation" (Government of India, 1988 *a*, p. 2).

The ZPTs were asked to build up a systematic computer compatible data set at the sub-zonal level. Agricultural land holding, workforce and population, employment and living standards were emphasised, but the major emphasis was on agricultural development levels and trends.

> "A district level classification may be made of levels of development and rates of growth of different agricultural indicators. This would include area, production and productivity growth for the agricultural sector as whole, the foodgrain sector and different sub-components, percentage area irrigated and rates of growth of irrigated area, cropping intensity and irrigation intensity at different periods of time, indicators like rate of growth of fertiliser consumption, fertiliser application per hectare, rates of growth and levels of tractorisation per hectare, pesticide use per hectare, number of pumpsets per hectare, agricultural credit and farm business investment per hectare" (Government of India, 1988 *a*, p. 3).

Special care was to be taken to collect data on non-crop based agriculture, high value crops and agricultural infrastructure. The purpose of this exercise was not just data collection, but an attempt to condition the planners on successes, failures and possibilities. Thus:

> "The purposes of these exercises will be to understand the basic characteristics of agriculture in the region, its achievements, recent changes and some preliminary projections of the boundaries within which agriculture operates. While the statistical data collected could be stored in a computer, the emphasis would be on analytical presentations of constraints and possibilities, as perceived from data, as indications of potential and performance" (Government of India, 1988 *a*, p. 4).

The major strategic directions were to prepare a land use and a cropping plan. The question of land and water development was emphasised and detailed guidelines discussed on management of surface water systems, groundwater exploitation and watershed development. Since these strategies are illustrated with empirical examples below, details from the guidelines are not discussed here (see Alagh *et al.*, 1989). The cropping patterns were to be worked on the basis of land, water and infrastructure development strategies separately for irrigated, unirrigated and dryland areas. Non-crop agriculture was to be emphasised. The guidelines gave detailed examples of methods to introduce behavioural constraints into these exercises - but asked the planners to spell out the institutional and infrastructure development required to realise resource-based and techno-economic potentials. Institutional and financial constraints were to be fully considered - but within these limits the plans were to be specific and detailed. Thus: "Once the details outlined above have been worked out, an attempt can be made to isolate the input and programme content of the plan from the various

projections made."

It is probably sensible to suggest radical changes in cropping pattern and land use if considered necessary only in a modulated manner and after working out details of requirements on the field and off-farm support. One approach would be to work out pilot level schemes initially and to suggest phasing of rapid replication of successful experience. Regional, national and international markets as demand constraints and opportunities, would also need to be looked at. The Planning Commission's Agro-Climatic Regional Planning Unit could work out details in consultation with the Perspective Planning Division.

The input and technological support required would need to be carefully projectised or integrated into programmes. The representatives of the banking institutions would need to participate fully to underscore the economic viability of schemes to be finally implemented.

Technological options will need to be considered in considerable detail. A number of issues would need attention. Use of modern methods for resource inventorying particularly for land and water will need to be explicitly considered. Space technologies, thematic mapping and computer related options will need to be explored. Crop husbandry research options will need to be systematically explored and constraints in operationalising benefits identified and resolved. Fresh research programmes will need identification. New approaches, *e.g.*, biotechnology or exotic crops should be looked at. On the input side, detailed examination of technological options will be important. Water management questions have been underlined. Newer nutrients and pesticides, which are safer and less toxic should also be looked at. Outside crop husbandry, the research lags are even greater, The topics listed here are illustrative. The exercise in agro-climatic planning must be science- and technology-based.

An attempt could be made after the preliminary analysis is completed to suggest within the financial constraints any rearrangements considered necessary for the public sector support programmes for 1989-90. The Planning Commission's Agro-Climatic Regional Planning Unit should give the amount sanctioned for the region/sub-region in 1988-89. A safe assumption would be to project this for 1988-89 with say a 10 per cent growth factor. More radical changes could be worked out for programmes in the Eighth Plan. It would be prudent for the period 1990-95 to assume a growth rate of say 8 per cent annual in plan expenditure. However, as regards the financial institutions, only the viability and bankability of projects should be the criteria.

The employment implications of the proposed programme should be worked out. As regards crop and non-crop based land sectors, data sets like crop-cutting surveys, NSS, etc., could be used for working out person-day labour time requirements. The employment implications of land and water development plans will also have to be worked out.

The employment implications of the development of agro-processing and agro-support activities will need to be worked out, particularly at the level of taluka and district level centres.

> "Improved technology and management needs to be designed for improving delivery systems for agricultural services and inputs. Beginnings have already been made in trying to design more appropriate policy frameworks for the delivery of inputs like pesticides and agricultural credit in the Action Plan for Agriculture. The agro-climatic regional project will aim at a more diversified agriculture which, in addition to crop husbandry, will concentrate on areas like aquaculture, animal husbandry, poultry farming and dairying. Agro-processing projects would need considerable emphasis and the financial institutions must be involved in the viability exercises for these. The

Planning Teams may also attempt some preliminary location exercise for such activities and integrate with the employment exercises indicated above" (Government of India, 1988 *a*, pp. 9-11).

Based on these Guidelines, the Agro-Climatic Regional Plan for India was ready in its first draft form in July 1989. We illustrate its essential method by describing the Plan for three different regions, a dry region, a hill region and a high rainfall region. (Details of each region are given in Government of India, 1989, Chapter 3.)

ILLUSTRATIVE PLANS

Eastern Plateau and Hills Region (Zone VII)

The Eastern Plateau and Hills Region (Zone VII of the Planning Commission's agro-climatic regional planning project) is one of the most backward and poor regions of India (see Table III). It consists of the Plateau and Hill areas of the eastern district of West Bengal (Puruliya), nine districts of Orissa (including Kalahandi, Koraput, Keonjhar, Bolangir and Mayurbhanj), nine districts of Madhya Pradesh (including Bastar, Durg, Bilaspur, Sarguja and Shahdol), twelve districts of Bihar (including Giridih, Palamu, Lohardaga and

TABLE III. DISTRICTS FALLING IN EASTERN PLATEAU AND HILLS REGION (ZONE VII)

State/District	State/District	State/District	State/District
West Bengal	Madhya Pradesh	Bihar	Maharashtra
1. Puruliya	11. Balaghat	20. Deogarh	32. Bhandara
Orissa	12. Bastar	21. Dhabad	33. Chandrapur
2. Bolangir	13. Bilaspur	22. Giridih	34. Gadchiroli
3. Dhenkanal	14. Durg	23. Godda	
4. Kalahandi	15. Raigarh	24. Gumla	
5. Keonjhar	16. Raipur	25. Hazaribag	
6. Mayurbhanj	17. Raj Nandgaon	26. Lohardaga	
7. Koraput	18. Sarguja	27. Palamu	
8. Phulbani	19. Shahdol	28. Ranchi	
9. Sambalpur		29. Sahibganj	
10. Sundargarh		30. Santhal Pargana	
		31. Singhbhum	

Singhbhum) and the western districts of Maharashtra (Bhandara, Chandrapur and Gadchiroli). Table IV illustrates the poverty and low productivity of this area. It is a plateau region with undulating hills and slopes. While its population densities are lower than the national average and so is the cropped area, a part of the recorded forest area, according to satellite pictures, is now lost. Its agricultural input and productivity levels are much lower than the national average.

This is the kind of agro-climatic regime, for example, in which an emphasis on crop planning and extension, which is traditional in agricultural planning methods or a partial approach would fail. Land and water development strategies of an appropriate kind were advocated such that the schemes should be completed in all respects during the Eighth Plan to avail of anticipated benefits in time.

Minor irrigation works include renovation of existing tanks and excavation of new tanks in sub-zone 1 of Orissa Inland and MP East, sub-zone 2 of Orissa North and MP East and sub-zone 5 of Chhatisgarh and South-West Orissa Hills. The contribution of tank irrigation to total irrigation in these sub-zones was about 55 per cent, 31 per cent and 37 per cent

respectively. The integrated watershed development programme included water harvesting/storage structures aimed at rainwater conservation to be used for life saving irrigation which has been found to make a tremendous difference in output in dryland crops. It was suggested that 1.05 lakh hectares be covered under such irrigation (Table V).

TABLE IV. CHARACTERISTICS OF EASTERN PLATEAU AND HILLS REGION AND WESTERN HIMALAYAN REGION

Sr. No.	Characteristics	Eastern Plateau and Hills	Western Himalayan Region	India
(0)	(1)	(2)	(3)	(4)
1.	Geographical area (000 sq.km)	395.0	245.0	3,195.0
2.	Population density (persons/sq.km)	136.0	62.0	215.0
3.	Net sown area (per cent)	35.9	18.2	47.0
4.	Forest (per cent)	35.2	45.3	19.3
5.	Cultivable land (ha/person)	0.32	0.20	0.26
6.	Cropping intensity	127.	143.0	123.0
7.	Gross irrigated area (per cent of GCA)	15.5	23.0	28.3
8.	Tubewells (member/000 ha)	3.7	2.1	36.7
9.	Fertilisers (kg./ha)	15.0	23.0	47.0
10.	Agricultural credit (Rs./capita)	17.0	43.0	42.0
11.	Rice (qtl./ha)	9.1	19.3	13.9
12.	Wheat (qtl./ha)	9.6	11.3	18.7
13.	Land productivity (Rs./ha)	960.0	3,516.0	1,873.0
14.	Poverty (per cent)	49.8	20.4	38.1
15.	Literacy (per cent)	28.0	-	36.0

TABLE V. AREA PROPOSED TO BE COVERED UNDER MINOR IRRIGATION AND NUMBER OF WELLS TO BE DUG IN THE EASTERN PLATEAU AND HILLS REGION

Sr. No.	Sub-zone	Area to be covered under minor irrigation (000 ha)	Number of dug wells (000)
1.	MP East and Orissa Inland	38.0	33
2.	Orissa North and MP East	24.0	18
3.	Chhotanagpur North and East Hills and Plateau	7.5	9
4.	Chhotanagpur South and West Bengal Hills and Plateau	13.0	6
5.	Chhatisgarh and South-West Orissa Hills	22.5	34
	Total	105.0	100

A large number of tanks, beels and pools existed in the zone, particularly in the sub-zone of MP East and Orissa Inland. A full scale operation on desilting, strengthening of bunds, providing engineering structures, field channels and afforestation of forest areas was required. However, even desilting by itself could increase storage capacity of such tanks. The total area irrigated by tanks was 22.34 lakh hectares and the entire operation of disilting could be taken up during the Eighth Plan at a cost of Rs. 2,000 per ha. The works would need to be taken up departmentally involving local labour, and after renovation the tanks should be retained by Block Development Authorities to be operated through the Panchayats for maintenance, supply of water and collection of water charges from the users.

Dug wells had several advantages in this zone: (*i*) They were a boon to small, marginal and tribal farmers. (*ii*) In the construction of a dug well, local labour component created employment for the family. (*iii*) Dug wells in major and medium irrigation ayacuts could draw on seepage from canals for conjunctive use with canal waters. (*iv*) They induced raising of cash crops such as vegetables and enhanced the income of small farmers. The plan suggested during the Eighth Plan is shown in Table V. These one lakh new wells will generate additional irrigation potential of 85,000 hectares, adding a return of about Rs. 8.5 crores per

year.

Once a more optimal land and water development strategy was developed, a new cropping pattern could be envisaged. Cropping intensity could increase, if the 50" to 80" of rainfall was conserved. The requirement of a single crop was usually less than 25" of water in the rootzone. The new crop production strategy envisaged a more rational cropping system in place of present day traditional cropping, largely of rice. The following action points were proposed:

(*a*) Seed supply was to be strengthened so as to cover large areas with quality seeds of high-yielding variety (HYV). The seed replacement rate should be at least 10 per cent for rice, wheat, *tur* and 100 per cent for hybrid maize.

(*b*) In upland rainfed areas high value crops of pulses like *tur* and oilseeds like groundnut and soyabean could be taken up.

(*c*) Crops like *urad*, castor and groundnut in *kharif* and mustard and vegetables could be taken up under irrigated areas.

(*d*) The proposed cropping sequences based on research findings are shown in Table VI.

TABLE VI. PROPOSED CROPPING SEQUENCES IN THE EASTERN PLATEAU AND HILLS REGION

Cropping sequence	Suggested for sub-zones
Irrigated conditions	
Rice-rice/gram	1,2
Rice-wheat/beans	1,2,4,5
Rice-vegetables/groundnut	1,3
Rice-mustard/maize	2,3
Groundnut-wheat/gram/vegetables	1
Maize-winter rice-potato/wheat	4
Ragi/maize-wheat/mustard/gram	4,5
Unirrigated conditions	
Ragi/*kodo*/maize/*tur*-gram/niger	1,2
Groundnut-gram/vegetables	1,5
Rice-vegetables/safflower	1,2,3
Rice/wheat/forage (in bunded areas)	2
Tur-linseed	2,3
Soyabean-safflower/gram	4,5
Rice+*tur*	4,5
Maize/groundnut+*tur*	4,5
Castor+*tur*	5

The scope for extension of fruit plantation existed in all sub-zones. A unit of 40,000 hectares of mixed fruits like mango, citrus, guava, sapota, ber, pineapple and pomegranate with a gestation period ranging from one to five years was proposed for each sub-zone, at the rate of Rs. 2,000 per hectare. Adequate provision would need to be made for institutional support for planting material and scientific extension support. A forestry, animal husbandry and fishing programme was suggested. The new land regime would allow reforestation and fodder crops. Tanks, etc., could be used for fish seed programmes.

Western Himalayan Region (Zone I)

The Western Himalayan Zone consists of the three district sub-zones of Jammu & Kashmir, Himachal Pradesh and the hills of Uttar Pradesh. Its characteristics are described

in Table IV. These sub-zones have the following features:

Jammu & Kashmir (sub-zone 1)

(*a*) Low altitude sub-tropical region of southern plains with altitude range of 215 to 360 m.
(*b*) Mid to high altitude intermediate region with average altitude of 750 m.
(*c*) Mid to high temperate region of Kashmir valley and higher reaches with altitude of 1,500-2,000 m.
(*d*) Cold arid region of Leh above 2,000 m.

Himachal Pradesh (sub-zone 2)

(*a*) Sub-mountainous and sub-tropical uplands of Chamba, Kanga, Solan, Hamirpur, Sirmour and Bilaspur districts.
(*b*) Mid-hills and sub-humid parts of Chamba, Kangra, Mandi, Solan, Shimla and Sirmour districts.
(*c*) High hills, temperate wet parts of Chamba, Kangra, Mandi, Sirmour, Shimla and Kullu districts.
(*d*) High hills, temperate dry parts of Chamba, and Kinnaur, Lahaul and Spiti districts.

Uttar Pradesh Hills (sub-zone 3)

(*a*) Valleys
(*b*) Mid-hills
(*c*) High-hills

Forest area is declining and is lower than as shown in revenue records. Cropping intensity is highest in Himachal. Rice, maize, millets, wheat and barley are the lead crops. Productivity of crops is low. There is a large animal population which exceeds the carrying capacity of the area. Table VII gives sub-zonal variations in principal characteristics in Zone I.

TABLE VII. INITIAL CONDITIONS FOR DEVELOPMENT IN THE SUB-ZONES OF ZONE I

Sr. No.	Sub-zone	Forest area (per cent of reporting area)	Net sown area (per cent of reporting area)	Rainfall (mm)	Major crops	Yield level (kg/ha)	Annual growth rate (per cent)
(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Jammu & Kashmir	27.7	30.1	1,003	Rice	2,076	1.36
					Wheat	925	0.37
					Maize	1,298	2.11
2.	Himachal Pradesh	26.7	28.1	1,201	Rice	1,094	0.66
					Wheat	893	2.25
					Maize	1,738	0.10
3.	Uttar Pradesh Hills	64.9	11.6	1,525	Rice	2,193	1.36
					Wheat	1,864	0.69
					Maize	1,223	3.85

The core strategies suggested for development of Zone I are: (*i*) soil and water conservation; (*ii*) land use; (*iii*) fruits crop development; (*iv*) high value crops; and (*v*) transport and communication. This should be supplemented with (*a*) marketing and storage; (*b*) water management; (*c*) agro-processing; (*d*) livestock production; (*e*) social forestry; (*f*) seed production; and (*g*) fisheries.

An integrated development of soil and water through land treatment and plantation of

trees and crops according to topography was suggested. The whole area may be covered in 15 years. The cost of project formulation and implementation (watershed management) for the entire area of three sub-zones has been estimated at Rs. 5.2 crores.

Land suitable for agriculture/horticulture/pasture/forestry should be demarcated. Agro-silvi-hortico-pastoral planning is proposed as (*a*) agriculture to be restricted up to 30 per cent of slopes. (*b*) Land having 30 to 50 per cent of slopes to be used for horticulture/fodder development. (*c*) All lands above 50 per cent of slopes be brought under tree cover. The unirrigated fields of slope over 30 per cent should be converted into orchards and fodder trees and blank areas between 30 and 50 per cent of slopes be managed for fodder grasses and maintained as pastures.

This Zone (I) offers excellent opportunities for fruit crops development. The components of the fruit production programme could be: (*a*) availability of better quality planting material to the fruit growers; (*b*) adoption of high density plantation technique; and (*c*) development of fruit processing industry including alternate products like beverages (wine/brandy from apple).

The temperate climate in a large part of this zone is quite favourable for growing temperate vegetables, flowers, quality seed production for horticulture crops for national and world markets and crops like ginger and saffron. These are crops of low volume and high value. The irrigated areas should be especially brought under such crops. In Uttar Pradesh hills, the valleys with irrigation facilities having rice-wheat cropping could switch over to vegetables and flower cultivation. Jammu & Kashmir is growing saffron on 1,322 hectares, producing 6,000 kg. of saffron annually. The seed cost of saffron is high and hence tissue culture technique could be developed. Use of plastic green houses for seed production of high value crops in Ladakh region can pay rich dividends. A plan to produce vegetable seeds in plastic houses in Ladakh region over an area of ten hectares can be contemplated, and could be integrated in the Action Plan for plasticulture development initiated in 1989-90.

In order to overcome the major constraint of transport of perishable commodities like fruits, flowers and vegetables in hills, rope trollies have been recommended. One kilometre of such ropeway costs one lakh of rupees and many areas can be connected by such ropeways and link roads for easy transportation. The Uttar Pradesh hills region has possibilities for 93 km. of ropeway in six districts in 19 locations. The high cost of transport, high prices of packing material (boxes) and exploitation by intermediaries are major bottlenecks. Establishment of terminal markets at strategic points was therefore considered necessary. Manufacturing of good quality rainproof cartons is very necessary. The co-operative structure should work as the main purchaser of fruits and vegetables so as to give protection to small producers. Establishment of grading-cum-packing centres and cold storages is needed. Technology to reduce unit costs in scaled down processing facilities would diversify location of agro-industry to processing centres and reduce transport cost.

In Himachal Pradesh (HP) and Uttar Pradesh (UP) hills, rainwater run-off should be collected in tanks and more area brought under irrigation. Construction of tank for one hectare irrigation costs around Rs. 10,000. As water is scarce in HP and UP hills, tank irrigation could invariably be done with water saving devices like drip and sprinkler systems, the former for orchard plants and vegetables, and the latter for vegetables and field crops. In Jammu & Kashmir, canal system improvement is important. Modernisation of canal system of 186 km. has been identified, with cost estimation of Rs. 3.72 crores. Development of land under command areas and construction of field channels are also important in Jammu & Kashmir. An area of 0.48 lakh hectares needs to be completed to deliver water to the farmer (the cost estimated is around Rs. 19.2 crores).

Processing of fruits in this zone is vital to sustain and extend fruit production. At present, only two processing units, one in Himachal Pradesh and another in Jammu & Kashmir are

functioning. The capacity is 30,000 tonnes/year. There is no processing facility in UP hills which produces about one lakh tonnes of apple. With the contemplated expansion of horticultural development in this zone, the production of fruits may touch 8.40 lakh tonnes. This calls for large expansion of processing facilities during the Eighth Plan and beyond. The cost of setting up a processing unit of 20,000 tonnes capacity per year is estimated at Rs. 11 crores. Alternate use of apple in beverages is proposed by Himachal Pradesh.

A large part of area under marginal and sub-marginal land on slopes of 30 to 50 per cent should be developed as grasslands. Such areas can prosper as milksheds. Cross-bred cattle with exotic breed can prove suitable, once adequate fodder is assured. Enhancing cross-breeding programme of sheep and goat and organised collection of produce are required.

In order to meet with the requirement of fuel and fodder, prevent further degradation of forest and preserve the eco-system, social forestry development was listed for high priority. Considering the fuelwood requirement at 0.55 tonne per capita per year in this zone, the fuelwood requirements and the area required to produce these are given in Table VIII.

TABLE VIII. FUELWOOD POTENTIAL IN ZONE I

Sr. No.	Year	Fuelwood requirement (million tonnes)			Area required for fuelwood production (sq.km.)		
		Jammu & Kashmir	HP	UP Hills	Jammu & Kashmir	HP	UP Hills
(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	1991	4.18	2.87	2.58	8,368	5,745	5,165
2.	2001	5.39	3.50	3.15	10,790	7,006	6,301
3.	2011	6.96	4.27	3.84	14,005	8,548	7,687

The total area of 30,240 sq.km. required by 2011 could be afforested in the next 10 to 15 years. The fuelwood planting of one sq.km. area is estimated to cost about Rs. 2.21 lakhs. A target to cover 2,000 sq.km. for each year can be fixed (estimated cost would be Rs. 44.5 crores). *Populus* and *Selix* species were recommended for dry temperate region. Apart from fuelwood requirement, wood requirements for packing also have to be met, and this was estimated at 4.12 lakh cubic metres by 1996.

Lower Gangetic Plains Region (Zone III)

The West Bengal Lower Gangetic Plain was sub-divided into four sub-regions: the Barind Plains, the Central Alluvial Plains, the Alluvial Coastal Saline Plains and the Rarh Plains. The main features of each are given in Table IX.

TABLE IX. INITIAL CONDITIONS FOR DEVELOPMENT IN SUB-ZONES IN ZONE III

Sr. No.	Sub-regions	Percentage of groundwater utilised	Yield of rice	
			Yield level (kg./ha)	Annual growth (per cent)
(0)	(1)	(2)	(3)	(4)
1.	Barind Plains	16.6	1,157	2.54
2.	Central Alluvial Plains	23.1	1,511	1.00
3.	Alluvial Coastal Plains	41.9	1,342	1.20
4.	Rarh Plaints	7.8	1,479	0.83
	Total	20.7	1,424	1.18

This Zone (III) accounted for about 12 per cent of rice production of the country. A rice mono-cropped area, in which sesamum, jute, mustard and potato were also grown. Mustard and potato were emerging as high value crops.

Per capita NSA of the zone was only 0.095 ha, as compared to the national average of 0.223 ha in 1981, reflecting the intense pressure of population on land and the major

constraints faced in agricultural development were seen as water management and drainage or (*i*) floods and inundation of lands in Barind and Central Plains; (*ii*) excessively deep waterlogging in large areas of Coastal Plains; (*iii*) run-off and water scarcity in Barind and Rarh Plains; (*iv*) low productivity of crops; (*v*) inadequacy of quality seeds, and (*vi*) shortage of forage.

Strategies suggested were as follows:

Sr. No.	Strategy	Relevant (Y) to sub-zones			
		Barind Plains	Central Alluvial	Coastal Alluvial	Rarh Plains
(0)	(1)	(2)	(3)	(4)	(5)
1.	Water management	Y	Y	Y	-
2.	Canal regulations	Y	Y	Y	-
3.	Minor irrigation	Y	Y	-	Y
4.	Rain water management	Y	-	Y	Y
5.	Crop planning	Y	Y	Y	Y
6.	Fisheries	-	Y	Y	-
7.	Animal husbandry including poultry	Y	Y	Y	Y
8.	Sericulture	Y	Y	-	-

Water management called for attention to:

(*a*) Proper control of irrigation systems and regulating supplies of irrigation water.

(*b*) Increase in conjunctive use of canal and groundwater to check waterlogging in ayacut areas.

(*c*) Raising of embankments in naturally depressed spots to serve as reservoirs to collect rainwater and control inundation. This approach was suggested for the districts of Malda, Nadia, Howrah, Hooghly, Burdwan, Midnapur and 24 Parganas.

(*d*) Congested water in southern part of the zone needed consideration for development of a drainage system that could discharge this excess water in Kangsabati system and water in Malda-Murshidabad to Mayurakshi system.

Development of irrigation potential was vital in the sub-regions of Barind and Rarh Plains and the following action needed to be taken:

(*a*) Excavation of about 1.50 lakh dug wells to generate irrigation potential of about 51,000 hectares and generation of employment potential of 11 million man-days during the Eighth Plan in Rarh Plains;

(*b*) Deepening of about 10 lakh small tanks to add to their storage capacity. Deepening of these tanks by about 3 ft. will harness about 1.1 million acre-feet of additional water, adding about 2.22 lakh hectares of net irrigation potential; 1.52 lakh hectares will come under *rabi* cultivation. The deepening of tanks will also help in alleviating inundation of surrounding areas. This area was subject to floods; 1.1 million acre-feet of water, which currently creates flood havoc, would be stored and used in the *rabi*, when in many years there was a rainfall failure. This programme had a capacity to generate employment potential of about 92.1 million man-days directly and 83.7 million man-days indirectly.

Once the drainage, flood and irrigation problems were attended to, the crop production strategy envisaged diversification from rice monoculture in most of the areas. Thus:

(*a*) Area under HYV *kharif* rice and *rabi* maize should be enhanced by 15 per cent.

(*b*) In Upland rainfed areas, instead of rice high value crops like groundnut and *arhar* should be introduced, especially in Rarh Plains.

(*c*) Crops like *mung* and groundnut in *kharif* and gram and peas in *rabi*, under irrigated conditions, should be increased in Uplands.

(*d*) Large scale introduction of sugarbeet in the Coastal Saline Plains during *rabi* should be examined, as this crop had the potential to yield 35 tonnes per hectare, equivalent to 5 tonnes of sugar.

(*e*) Evolution of early maturing varieties of rice would make areas available in time for mustard cultivation. Sunflower and safflower in rice fallows were more suitable for saline areas.

In rice cultivation, selectivity with reference to land capability would be an important element of the development strategy for this zone.

The scope for extension of fruit plantation in Rarh and Barind Plains in Bankura, Birbhum, parts of Midnapur and Burdwan and Malda districts was high and needs to be attended to by expansion of area under fruits like mango, citrus, banana, etc., and by increase in the productivity of existing orchards by proper management and new high density plantings.

A seed programme, fisheries for the aquatic resources of the area and improvement of animal husbandry including lamb and ducks were looked into and programmes suggested for support.

The purpose of the listing of programme priorities for the three different zones was to emphasise that land, water, infrastructure, processing and extension support systems for the regional agricultural systems in India are very different and require alternate approaches. The Economic Survey (1989-90) sums up the strategy as follows:

> "Land and water development strategies and cropping patterns suitable for each region have been worked out as also non-crop based agricultural activities like forests, animal husbandry and fisheries have been taken into account. Agro-processing activities are to be emphasised. An attempt is being made to develop a package of more appropriate projects for each region, as also involve the financial institutions more directly in the agricultural planning process. The studies/surveys undertaken in these zones would be the basis for the formulation of 8th Plan" (Government of India, 1990, p. 33).

INVESTMENT PLANNING, POLICY FRAMEWORKS AND INSTITUTIONAL ISSUES

The description of agro-climatic plans for three different agronomic conditions should not be seen as a techno-economic exercise alone. The only point in describing these details was to show that a crop-based approach or an approach which treats the country as a single unit would not address the major issue for agricultural development in different conditions. Watershed development, or alternately drainage, flood control and conjunctive use of surface and groundwater or again a more appropriate management of hill and forest-based agriculture are alternative regimes. Each would have a different investment and policy support strategy. In fact, one advantage of agro-climatic planning is that it builds up investment and infra-structure options for alternative agricultural and farming systems and thus removes the shortcoming of a favoured crop/region approach, say, wheat based on canal irrigation. Also the locked up resource potential of different regions which can be released with marginal investments, for example, improvement of existing canal systems or traditional irrigation structures becomes feasible. Yet the central question is not the listing of possibilities, but consideration of feasibility and this requires organisational, institutional and economic policy issues to be discussed.

The mindset underlying theorising on agricultural development consists of three kinds of alternative approaches. In one approach, the issue is considered as that of spreading available technologies for agricultural development through the implementation of an

'appropriate' (?) framework of institutions and adjustment to incentive prices. In this view, this process can be thought of as that of operationalisation of the framework of neoclassical economic rules. The peasant is essentially rational and if institutions are developed which permit him to respond to economic stimuli, he quickly internalises the available technology and the gains are shared between those who have access to land and those who sell their labour. Technical innovations lead to labour absorbing change and employment opportunities rise fairly rapidly. In a more extreme version of this view, international markets and adjustment to changing international prices provide the stimuli to trigger off such development. In another view, rural development is conceived essentially as a facet of estatist planning. Institutions and economic incentives play a part of such a view and yet the problem is conceived as that of operationalising the impact of agricultural and rural development technology at the farm/village level and that of setting up para-statal and other institutions which support the extension of technology to this level as also agricultural marketing and processing. In such a view, a benign State plays a role of energising different components of the growth process both in terms of input complementarities arising from technology and adjustment to wider factors like economy level or international demands. In an alternative to this view, the role of the State and/or other forms of political action is important but arises from the class nature of the principal agents in rural societies. In this view, feudal modes of production have first to be destroyed before economic incentives and economic organisations can play a role in transforming rural society.

In actual fact, in many rural areas, examples of successful agricultural development or rural development experience particularly under somewhat difficult resource endowment conditions of the kind described earlier, tend to follow a very different experience path. If sufficient irrigation water is available and the soil regime is suitable for a crop for which technology is well known like wheat or paddy, market oriented prescriptions have great possibilities of success, since almost all the pre-conditions of this paradigm are fulfilled in terms of the atomistic nature of peasant proprietorship and the response of the peasantry to economic incentives. Thus in many countries, including India, thinking took place in a somewhat 'linear' direction. The emphasis was on irrigation and the new biotechnology and in many cases only on this (Alagh, 1986).

In many parts of the country, however, the problem is far more difficult, as seen, for example, in the Eastern Plateau and Hills Region and the Himalayan Region cases described earlier. Land and water resources are meagre. Population pressure is rising. Commercialisation in many cases tends to lead to the short-term exploitation of resources and costs of soil degradation and water erosion are not fully reflected in market prices. Traditional, socio-economic systems working at low levels of equilibrium are collapsing and newer methods of sustainable development are not jelling.

There are, on the other hand, a number of successful experiences where the basic problems of food and energy requirements of poor rural communities have been resolved through the application of state-of-the-art scientific knowledge and technology at the cutting edge of the interface of man with land and water. Following the Guidelines discussed earlier, in the programme of work designed on agro-climatic planning, an attempt was also made as a part of the development of such plans to document success and failure stories in land and water management and more optimal land use and cropping patterns. Such success stories were thus studied under alternative agro-climatic regimes which include low rainfall areas where, for example, the level of water availability on an average is 50 cm. and the coefficient of variation is 40 to 60 per cent (the Dry Regions of India-Region XIV). In other words, in

some years the water availability could be less than 8 inches. A second kind of agro-climatic problematique was that where the availability of water was greater, say around 1,000 mm. but the variation is again 40 to 60 per cent (Zone VII described above). But the problem, as we saw, is set within the context of a hill slope and a valley. Unregulated commercialisation invariably means that soil erosion and precipitation instead of becoming a blessing becomes a curse, since it flows down the hill, erodes the land base of the region and leads sooner or later to a collapse of the socio-economic system in terms of food and energy. A third problematique can be one where past development of an unplanned type or of a badly planned type has led to resource loss. President Mikhail Gorbachov, in his speech on 'Soviet Agriculture' pointed out that the loss of land through waterlogging almost equalled the additions to irrigation in the Soviet economy over a period of decades. Waterlogging and soil salinity are examples of this kind (Regions III to VI of the Gangetic Plains included large examples of this kind).

Invariably, the technology to overcome these problems is well known. It is also generally well known in university and research environment not very far away from the area where the particular problematique exists. The interesting point is that just as there are a number of failures of development efforts to resolve such problems of the interaction of the society with a scare resource endowment, there are also many examples of success. These are no longer pilot projects in the sense of designed attempts on amelioration by the State or by international agencies, but where interestingly almost invariably attempts at local level solutions of problems have been evolved at the level of the community itself. The Planning Commission has had studies initiated on a set of these experiments by independent social science institutions. The results of these and other studies are interesting in terms of the paradigms involved (Chopra *et al.*, 1990). These experiments have a set of common characteristics. First, they invariably involve effort at the level of a community but the basic technology is well known. In the case of a dry area, the question is that of water harvesting techniques. Resuscitation of traditional practices of storing water now requires larger economic incentives, since the cost of community labour has gone up on account of commercialisation. Areas with better endowed rainfall required watershed development. This means soil conservation which stops soil from erosion like contour bunding, ridge ploughing and also water harvesting like gully plugging on the soil slopes and the use of village and percolation tanks. Once the land development and water harvesting are done, an optimal crop combination is possible, as we saw in the agro-climatic examples. The land reclamation problem invariably involves more complex technology including pumping of water and the use of soil amendments. Since it involves application of the technology at the level of an aquifer, the community aspect is important (for details, see Singh and Bajaj, 1988).

The second aspect of these success stories is invariably the importance of leadership. There is no uniform pattern of this leadership. In cases like Sukhomanjri in the Punjab and the *Pani Panchayats* (water collectives) at Ralegaon Sidhi, voluntary organisations mattered. In others, it was some concerned official who could initiate the process. Generally, the leadership groups involved younger people, say below 45 years of age. All those who succeeded had an experimental and scientific and technological training, at least a university degree in the sciences. Also initial successes were sustained and replicated.

The third feature of these kinds of success stories is the high rate of measurable 'economic' return and at the same time lack of profitability in market prices of each one of these successful experiments (Table X). In all the success cases participative methods mobilised the labour resources of the community. At 1986 or 1987 prices when these experiments

were evaluated, the investment costs varied between Rs. 9,000 and Rs. 11,000 per hectare for land which was made available for agricultural or orchard crops after reclamation and between Rs. 2,500 and Rs. 4,000 per hectare for social forestry purposes. As far as the economics was involved, between 38 and 53 per cent of these resources were bankable once

TABLE X. SELECTED CHARACTERISTICS OF WATERSHED DEVELOPMENT PROJECTS

Sr. No.	Name	Land/Water development (Cost/ha) (Rs.)	Current input (Rs./ha)	Return (Rs./ha)	Return Annual (per cent)	Remarks
(0)	(1)	(2)	(3)	(4)	(5)	(6)
1.	Naigaon	11.364	2,809.56	212		1984-85
2.	Sukhomanjri	22.221		7,979	19	1986-87
						Benefits include those to villages and government. Agriculture, dairying, fisheries, fodder, etc., Col(5) refers to IRR.
3.	Samithed	1,500	N.A.	N.A.		Returns are in terms of plantations, rise in water table and fodder in 312 acres of land, 78,000 saplings.
4.	Ralegaon Sidhi	9,689	N.A.	N.A.		Drinking water available within 100-150 metres of each household.
5.	Tejpura	4,246	Additional 816.8	3,764		Doubling of bajra and jowar yields; 70 cross-bred cattle: plan for 2 lakh trees.
6.	Mittemari	2,030	N.A.	N.A.		Incremental income at the rate of Rs. 2,540 per household as compared to control village.
7.	Sikanderpur and Kotpurva	11,220	10,825	255 days of grain requirement for a family plus 400 days of fodder for a pair of animals		Usar Reclamation Project

Source: Society for Promotion of Wastelands Development (1988); For row 7, Singh and Bajaj (1988, pp.181-187).
N.A. = Not available.

the community was involved because many of these efforts were labour intensive, particularly the investments in land development and water management. The internal rates of economic returns to these investments were in the range of 18 to 27 per cent per annum, making them some of the most socially profitable investments in the Indian economy. Yet at going market prices, many of the families ended up in making losses. A counterpart to these losses was a deficit in energy/food requirements of many of the families involved. There is, therefore, no guarantee that with the given structure of international or national markets financially viable development will result. The paradigm question in this kind of development is of an important nature. None of the received methods of thinking correctly interfaces with the available institutions in the kind of development being described. Decentralised working of markets is important and yet they do not necessarily provide

automatically for the application of the available technology towards sustainable development in terms of the interface of man with the scare resources of land and water. Also the income levels generated at existing prices may not meet subsistence requirements. A measurable kind of intervention is necessary in the economic or social context and yet it has to be of a kind which does not lead either to the suffocation of local initiatives, or to a neglect of the great vitality of rural markets.

The question of socio-economic rules which permit this participatory kind of development is a very complex one. It is quite clear that estatist type of co-operation does not solve the problem. Neither does a technocratic regime which relies on the so-called transfer of technology paradigms through centralist auspices. For example, land development projects financed through international financial institutions have led to low rates of returns also. Perhaps the answer lies in social control on a part of the resource endowment. When water is harvested in a watershed, a set of community rules has to be evolved. For example, the *Pani Panchayats* give rights even to landless labourers on a part of the harvested water. Yet the peasant does not have to give up his rights to land. Socialisation and co-operative institutions do not have to be holistic or either/or propositions with individual initiatives. It is possible for individuals to co-operate for limited and well defined purposes.

MARKET FUNCTIONING: LIMITS AND OPPORTUNITIES

It is being suggested that in many rural/agricultural situations in our country, the application of state-of-the-art technology to develop the slender resource base of the area requires community organisation at the level of, say, watersheds or aquifers. However, such requirements can be for limited purposes and the 'institutions' challenge is to mesh such community requirements with the advantages of factor and commodity markets working essentially with functioning atomistic peasants. Such community *requirements* are a *precondition* for better use, for example, of lands in hill slopes or sandy areas with dune formation or at the level of an aquifer, either for reclamation of, say, saline land or the development of water harvesting or aquifer exploitation methods.

Will an overall policy framework set in the context of competitive domestic and international markets be consistent with and support the kind of developments discussed earlier? In other words, how will community-based systems which meet the technical requirements of resource use relying on the labour endowment of the area interface with the rest of the economy. Experience tends to suggest that at ongoing market prices, many of these experiments are financially unviable at least for those peasants who have a slender resource base. These losses have been estimated both as calorie/fuel gaps from a minimum biologically determined requirement for a section of the labour force (8 to 17.5 per cent) or financial losses if labour costs of development are fully accounted for (13.2 to 27 per cent). The nature of such 'losses' can help in appreciating the interface of markets with labour institutions. First, such losses can be minimised by development of domestic and international markets. These help by raising the value of agricultural/forest/residue produce and also by reducing input costs. The price of a modern water harvesting/energy saving technology may be lower than a domestic substitute, for example, an energy efficient pumpset, a modern seed or pesticide, a more efficient sickle, seed drill or power tiller, or the use of photovoltaics for providing energy in remote regions. Second, it has to be appreciated that in many cases, initial costs may be high and so the case for selective non-market forms of intervention may be good, since capital markets are poorly developed. Consider that in many land development/reclamation schemes, generally particular crop combination cycles are technologically

recommended for soil consolidation/improvement. For example, a fodder crop or a tree crop may require to be grown in reclaimed land to avoid relapse into degradation. At going market prices, such a crop may be unprofitable. Again invariably under such conditions in initial years, input rates are high, for example, the number of waterings required, seed rates or soil amendment requirements will decline, as the organic composition of the soil improves. Thus initial subsidies/public intervention mechanisms may be required.

The conventional theoretical answer to such 'low' carrying capacity of land features is to suggest migration and transfer of populations to the non-agricultural or urban sectors. While useful as a long-term guideline, the immediate relevance of such advice is not very clear. Also improvement in land productivity is anyway a pre-condition of such a desirable outcome and in any case if soil improvement is a dynamic process, excessive migration may be the wrong answer. The upshot is that market oriented rules need considerable modification when applied to realistic rural development possibilities. In fact, so-called 'sub-optimal' policy alternatives, for example, preference to input subsidies over output subsidies, may need to be experimented with, given the fragmented nature of labour markets. Having said this, however, two guidelines are important and may be stated firmly. Generally markets are efficient methods of getting across to farmers and other things remaining the same, should be used as the preferred form of delivery of inputs or output collection and processing. Second, development of markets and communication and processing infrastructure must get high priority for rural reform. In fact, the heart of institutional reform is to evolve a policy regime which uses fiscal and investment packages which unleash the power of properly functioning markets for generating higher incomes and employment and wherever necessary, use direct intervention methods also.

To sum up, therefore, the direct involvement of village level beneficiary oriented organisations is required since:

(*i*) the experience is that totally officially sponsored schemes have limited effectiveness (around 40 per cent as per the Concurrent Evaluations of Indian rural development scheme);

(*ii*) a part of the cost of land and water development schemes becomes bankable and this really means that through the kind of mechanics described earlier, the labour assets of the community, instead of being a drag on employment, lead to asset creation;

(*iii*) it becomes easier to channel structured subsidies to poorer beneficiaries through this method. Such subsidies are required for land development, water harvesting methods, and also for vegetative and crop cover on such lands. At going market prices of outputs and inputs, studies show that such schemes are not financially viable. Instead of accepting such 'market failures', the challenge is to channel public funds to energise the community to also contribute its bit and foster such schemes on a larger scale;

(*iv*) such organisational changes lead to the very exciting possibilities that assetless persons can share in the rewards of possible community efforts. For example, in the *Pani Panchayat*, landless labourers have a share of the water saved and in a number of watershed schemes, energy entitlements are given to all. No wonder, in a number of such cases, we are in the somewhat happy state that practice is running ahead of theory, and the practitioners are explicitly unhappy with the social scientist and the planner.

The kind of agricultural development discussed would require very detailed link up with technological and industrial progress. The process of rapid growth of non-agricultural employment opportunities in rural areas has to be hastened more. Agro-processing and input supply to the agricultural sector through development of marketing and service centres will need to complement a diversified planning strategy.

NEW INVESTMENT STRATEGIES

When this new kind of planning is done for each region of India, new investment and policy strategies emerge for the country as a whole. Features like watershed development, soil conservation, accelerated groundwater development and tank irrigation are initiated. Operational targets are described below.

As Integrated Watershed Development Programme (IWDP) is based upon a multi-disciplinary approach, the organisation implementing this programme will also have to be structured accordingly so that the desired results are achieved. The beneficiaries covered in a micro watershed should be involved right from the planning stage ensuring active involvement. They should also share the cost. The Employment Programmes like the Jawahar Rozgar Yojana require to be integrated with watershed development programmes. It has been suggested that for structures to be constructed on Government land, which will be benefiting the community, they may be funded by the Government. Planting of fuelwood trees on watersheds in upper ridges might also fit into this category. Soil conservation, planting of fruit trees and grasslands will be on individuals' fields. A part of the total cost of land and water development could be met by the beneficiary, a part could be raised through institutional finance and the balance could come from the Government(s). Considering zones, the Plateau and Dry Zones VII to X and XIII for IWDP, the picture that emerges is shown in Table XI. If an annual target of four million hectares is kept, 20 million hectares could perhaps be covered by 1994-95 and the balance 24 million hectares in the Ninth Plan.

TABLE XI. AGRO-CLIMATIC ZONAL TARGETS FOR INTEGRATED WATERSHED DEVELOPMENT

(area in lakh ha)

Sr. No.	Particulars	Zone					
		VII	VIII	IX	X	XIII	Total
(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Geographical area	395	370	331	395	196	1,687
	Net sown area	174	169	159	189	98	789
	(per cent of geographical area)	(44)	(46)	(48)	(48)	(50)	(47)
2.	Area needing soil/water conservation measures	158 (40)*	128 (34)	132 (40)	158 (40)	107 (54)	683 (40)
3.	Area likely to be treated by the end of Seventh Plan (cumulative)(assuming 20 per cent)	31	25	26	32	21	135
4.	Area remaining to be treated	127	103	106	126	86	548
5.	Assuming 20 per cent will be attended by farmers themselves	25	21	21	25	17	109
6.	Balance remaining	102	82	85	101	69	439

* Per cent of geographical area.

Extensive areas in some zones suffer from soil problems such as salinity, alkalinity and acidity. These problems are natural as well as having arisen out of human intervention. Some soils have natural salinity or acidity due to their formation from basic material having proportionately high clay content and sodium salts. On the other hand, because of imprudent use of irrigation water or saline groundwater, secondary salinity develops. All these situations badly constrain the achievement of higher yields possible through the application of improved technology. Physical targets and associated benefits as worked out in the agro-climatic plan are shown in Table XII.

TABLE XII. AGRO-CLIMATIC ZONAL TARGETS FOR SOIL RECLAMATION

(area in lakh ha)

Sr. No.	Particulars	Zone					
		V	VII	XI	XII	XIII	Total
(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Estimated area under problem soils	9.91	95.32	4.32	0.37	8.2	118.02
2.	Time frame for implementation (years)	5	25	5	5	5	
3.	Cost of work (Rs./ha) (tentative)	1,500	600	1,500	1,500	1,500	
4.	Returns estimated as additional yield after soil conservation (per cent)	30	25	30	30	30	
5.	Average yield (kg./ha)	1,993 (wheat)	743 (wheat)	1,905 (rice)	727 (jowar)	996 (bajra)	
6.	Value of additional production per ha (Rs.)	1,166	363	1,985	338	463	

The Planning Commission has approved a State Government project for reclamation of *usar* (sodic) land in ten districts of Uttar Pradesh, eight of which fall within Zone V. Such projects, taken up for improving land capabilities and as a system of land and water development, will be eligible for funding under the Jawahar Rozgar Yojana, provided the majority of the beneficiaries are small and marginal farmers. Saline water is encountered in large areas.

A regular programme to sink wells/shallow wells, wells/tubewells is required in various hills and plateau region zones where the stage of groundwater development is on low key and run-off problem is more acute. In terms of numbers, the largest potential of sinking additional tubewells lies in Zones IV and V. Under the Small and Marginal Farmers Programme (SMFP), priority was given to the programme of sinking wells in these two zones but the pace needs to be kept up in Zone V and stepped up in Zone IV, with the objective of bringing at least three million hectares under well irrigation during the Eighth Plan. A target to sink new wells at the rate of two lakh wells each year for plateau regions in Zones VII to IX, a target of one lakh wells for Zones X to XIII and a target of about 0.25 lakh for Zones I, II and XIV have been recommended. This programme should be under public/co-operative sector as well as private sector and liberalised institutional finance should be linked making this a bankable proposition. A suggestion meriting attention in strengthening the groundwater development programme is that the beneficiaries be encouraged to form into groups and be financed by the banks for group irrigation. Many lift and other irrigation co-operatives have successfully demonstrated this approach. The other dimension which merits attention is the proper enforcement of regulations in regard to exploitation of groundwater. This would be of urgent importance in some of the zones (*e.g.*,

Zones VI and XIII) where there are already signs of over-exploitation. The high priority given to groundwater development in recent years will have to be continued. It is expected that a considerable part of the groundwater potential of the country will be utilised in the next decade or so. Special studies have been mounted to develop integrated management systems of groundwater aquifers. Particular attention needs to be paid to saline areas, coastal belts subject to salinity ingress and other special problem areas in order to promote optimum conjunctive use. Satellite imagery in conjunction with further ground surveying can be used to update available information relating to groundwater. The existence of groundwater markets will have to be recognised and the institutional and procedural constraints that inhibit advantage being taken of this development removed. Where the non-ownership of the land by share-croppers precludes their access to institutional credit, a way must be found to overcome this difficulty in cases in which the existence of a groundwater market ensures the viability of an individual proposal. Similarly, for the purpose of funding by financial institutions, the viability of a groundwater installation should not be assessed on the assumption that its command is restricted to the holding of the prospective owner if a market for groundwater exists or is possible. Where groundwater markets have not developed and any institutional system acts as a constraint, the State will have to play a more direct role in meeting the requirements of small and marginal farmers.

TABLE XIII. TANK IRRIGATION TARGETS IN AGRO-CLIMATIC ZONES

(area in lakh ha)

Sr. No.	Particulars	Zone				
		III	VII	X	XI	Total
(0)	(1)	(2)	(3)	(4)	(5)	(6)
1.	Estimated area irrigated by tanks	2.00	22.34	7.30	10.50	42.14
2.	Estimated time for complete restoration of tanks (years)	2	20	7	10	
3.	Cost of restoration (tentative)(Rs./ha)					
	(*a*) Desilting	2,000	2,000*	2,000*	2,000	
	(*b*) Complete package	20,000	-	-	20,000	
4.	Total cost (Rs.crores)	400	446.80	146	2,100	3,092.8
5.	Present average yield (kg./ha)(rice)	1,255	763	2,012	1,905	
6.	Estimated additional output at the rate of 40 per cent of average (rice)(kg./ha) each year	502	305	805	762	
7.	Value of added (Rs./ha) output at the rate of Rs.190/ha (tentative)	954	579	1,529	1,448	

* The ZPTs have proposed desilting only.

Tanks are an important source of irrigation in the Southern Plateau Region and the Coastal Region of Eastern India. A large concentration of tanks as irrigation sources is in Zones III, VII, X and XI (sub-zones 2 and 6). This system has degenerated over the past decades both in terms of area irrigated and stability in supply due to silting up of tanks, weakening of bunds and weirs and as a result of encroachment for cultivation. Restoration of these irrigation tanks should be taken up as such a step has a potential of not only substantially increasing agricultural production but also of uplifting the levels of living of lakhs of small and marginal farmers. Components of tank restoration are: (1) Desilting and using the excavated earth for augmentation of fertility of fields. (2) Strengthening of bunds and raising of embankments. (3) Afforestation of foreshores. (4) Improvement of water courses. The Zonal Planning Teams (ZPTs) have suggested tank restoration as one of the strategies to augment irrigation in Zones III, VII, X and XI. In order to deal with this programme, a

suggestion is also made to develop a suitable organisational frame for implementation of programme, maintenance and distribution of water, collecting water charges, etc. The magnitude is shown in Table XIII. A similar approach to include other traditional methods of water storage in the village needs to be adopted.

CONCLUSION

Indian agricultural planning and policy have to meet a number of challenges in the years ahead. After a distinct de-acceleration of output growth and investment efforts in the mid-eighties, the end of the Seventh Plan again saw greater priority being given to the sector both in terms of resource allocation and policy focus. These priorities have to be maintained since the sector has a razor's edge quality in relation to India's development objectives. A number of feasible investment strategies have been developed for alternative agro-economic profiles. These have now to be implemented. The investment packages for different regions are different and the development strategy has to provide for this differential focus. The land and water development strategies will require a multipronged approach using alternative management strategies most suited to each region. Traditional water harvesting structures, canal improvement systems and improved planning procedures have been established, but need to be implemented. Successful experiences in land management in watersheds and difficult ecological regimes need to be duplicated faster in terms of community organisations, interfaces with local governmental institutions and subsidies and market support. Economic policies have to address the question of reform of delivery systems.

It is of some importance that these programmes are implemented with a sense of urgency. In October 1989, the Government of India had announced:

> "During the next five years, irrigation waters will be made available on an assured basis to an additional one crore hectares of land in the command areas of canal projects. The authorities concerned will be held responsible for reaching water to farmers in assured quantities and at the right time. Also, ten lakh tubewells and dugwells are to be constructed every year. And five lakh hectares will be covered annually for the programme of desilting and maintenance of village tanks, beels, bunds and ponds. Second, the productivity of unirrigated land is to be enhanced through effective watershed development and *in situ* moisture conservation. This programme will extend to 50 lakh hectares during the Eighth Plan.
>
> Third, 25 lakh hectares of usar and barani land will be reclaimed at the rate of five lakh hectares a year. We need not wait for the commencement of the Eighth Plan to take up these projects. A beginning should be made this year itself" (Extracts from Statement on Agriculture Package made in Parliament on October 12, 1989).

There were also announcements on agricultural credit, ICAR, mechanisation fund and support for agro-processing of the kind discussed earlier. The new Government had very correctly decided to review major policies but now that the agro-climatic planning approach has been accepted for the Eighth Plan, it is important not to lose any more agricultural working seasons and to implement it expeditiously.

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