'Jalayagnam' and Bridging Regional Disparities

Irrigation Development and Distribution in Andhra Pradesh

Despite huge investments and numerous irrigation projects, Andhra Pradesh continues to face water scarcity, which results in regional disparities and political turmoil. Therefore, the government's irrigation policies should focus on alternatives for strengthening the resource base and enhancing the livelihoods in the fragile resource areas. This approach would provide the much-needed stability to the agriculture sector and minimise agrarian distress in these regions.

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I
Introduction

Irrigation consumes more than 70 per cent of the water utilised and continues to face shortages in quality as well as quantity terms. Water scarcity is resulting in regional inequalities and political turmoil. In other words, water, especially irrigation, has become the great divider across the communities and regions. Though genuine natural or environmental factors explain such a division, a policy-induced mismanagement of water is at the core of the water stress and conflicts. Of late, regional disparities in irrigation development are attracting attention at the political as well as policy levels. A case in point is Andhra Pradesh where distorted irrigation development has been central to the recent separatist movement in the state. In response, the new government has embarked on a massive irrigation development programme in the name of 'Jalayagnam' with an estimated cost of Rs 93,078 crore, of which Rs 46,000 crore for the 32 ongoing projects, Rs 20,078 crore for eight pending projects and Rs 27,000 crore for the four proposed projects. All these projects are expected to increase the gross area under irrigation from 44 per cent (57.97 lakh ha) to 90 per cent (117.55 lakh ha) with their completion through utilising the hitherto unutilised water in the state.[1]

Of the Rs 46,000 crore on the ongoing project works worth of Rs 30,000 crore have already been initiated. A lion's share of these investments is expected to be in the presently less irrigated regions of Telangana and Rayalaseema (Rs 20,812 crore). The majority of projects are expected to be completed by 2008-09, as per the state government's plans. The feasibility of translating these investments into tangible benefits (area under irrigation) in the long run calls for a critical validation of the approach. On the other hand, it would be interesting to examine the situation, if all the proposals and investments were to be carried out in a time frame. This paper examines the future scenario of regional distribution of irrigation in AP in the light of the past and present scenarios. Besides, the feasibility of some of the proposals is also reviewed.

Irrigation development or disparities are always viewed in a relative sense. Irrigation in a region is relatively developed or backward due to geographical/natural conditions and historical reasons. While policy initiatives can help correct these disparities to some extent, bringing a parity between the regions through any means, is a difficult task, as the efforts are needed to upset the geographical and natural conditions. High levels of irrigation are often associated with high rainfall aggravating the problems of water scarcity and environmental degradation.[2] The result is an imbalance in the distribution of and access to water resources across regions.

On the other hand, regional development can be taken up in an absolute sense through appropriate policy initiatives. In the case of irrigation development, it is envisaged that at least a third of the net sown area should be provided with protective irrigation in order to make agriculture sustainable [GoI 1976]. Therefore, in the context of agricultural development, the first priority should be to bring at least 33 per cent of area under irrigation. While it is absolutely necessary to apply this principle at the household level to ensure the livelihoods of the communities, this paper focuses at the feasibility of achieving this at the regional and sub-regional (district) levels.

This paper is based on the data obtained from various secondary sources like statistical abstracts, season and crop reports and the data published by the irrigation department. The historical data for the past 40 years are obtained from the statistical abstracts and season and crop reports. The data pertaining to the ongoing, pending and proposed irrigation projects in various categories and the expected area to be brought under irrigation are obtained from the irrigation department. The data are provided on a project basis with an indication of districts covered. We tried to distribute the area evenly in the case of projects that cover more than one district. This may result in an overestimation of area underirrigation in some districts and an underestimation in other districts but tends to nullify at the regional and state levels.

II
Irrigation Development and Distribution in AP

Past and Present

Historically, the major sources of irrigation in AP are tanks, canals and wells in the same order of importance. Till the early 1970s, tanks were the dominant sources of irrigation in the Telangana and Rayalaseema regions, while, canals were the main

source in the coastal Andhra region (Table 1). After the 1970s, well irrigation emerged as a major source in Telangana and Rayalaseema regions. Over the period of four decades the proportion of area under irrigation in the state has gone up from 27 per cent in 1963 to 40 per cent in 2002. The growth in the area under irrigation is more in the Telangana region (from 21 to 37 per cent between 1963 and 2002) when compared to the coastal and Rayalaseema regions, resulting in substantial decrease in regional disparities.[3] During this period the intra-regional disparities have also come down in all the three regions (Table 1).

Across the sources, the area under canals increased by three percentage points in coastal as well as Telangana regions, between 1963 and 2002. The coastal region experienced a 4 per cent decline in the area under canals between 1993 and 2002, which could be due to the severe scarcity of water in the major systems during the period ending 2002. After taking this into account, the increase in area under canal is more in the coastal region between 1963 and 1983 and stagnated after 1983. The picture is of stagnation or marginal improvement in the case of Rayalaseema. Inter as well as intra-regional disparities in area under canals have come down substantially over the period of 40 years.[4] While tank irrigation declined in all the regions, well irrigation gained more in Telangana comparatively in other regions. The increase in well irrigation is the main reason for the overall decline in disparities in the state.

Along with the area under irrigation, the composition of irrigation has changed over the period especially in the recent years. The proportion of the area under canal and tank irrigation has declined while the importance of well irrigation has gone up substantially (Table 2). Across the regions, Telangana and Rayalaseema have experienced drastic shifts in the composition of irrigation. By 1980s well irrigation had become the dominant source of irrigation replacing tank irrigation in Telangana and Rayalaseema regions. Though canal irrigation still dominates in the coastal region, well irrigation has replaced tank irrigation in second place. The relative shares of the three important sources in the net irrigated area indicate that well irrigation in Telangana has gone up from 12 to 64 per cent against an increase of four percentage points, i e, from 14 to 18 per cent, in the case of canal irrigation (Table 2). Even the coastal region recorded a fourfold increase in the area under wells, while area under canals has gone up from 46 to 55 per cent. The proportion of area under canals remained same at 19 per cent in Rayalaseema but it experienced an increase in well irrigation by almost three times.

Though well irrigation is more productive than the other two sources of irrigation, there is a major difference in terms of financial implications. The state is the sole owner and takes the responsibility of water resources development and management, but its role is limited to surface systems such as canals and tanks only and thus leaving the subsurface systems, well irrigation, to private development and management. Even with in the surface systems canal irrigation has been the most favoured sector to the neglect of tanks (Table 3). During the post-independence period, 87 per cent of the total irrigation expenditure was on major and medium irrigation projects creating 74 per cent of the total irrigation potential thus far created. On the other hand, minor irrigation attracted only 13 per cent of the expenditure creating 26 per cent of the potential. This bias is despite the fact that per hectare costs of creating potential in minor systems are less than half that of major systems.[5] However, this is not to argue that large systems can substitute the small systems. It is only to highlight how minor irrigation is neglected in the state. Geographically, while canal irrigation dominates the high rainfall regions, minor irrigation such as tanks and wells are the main

Table 1: Percentage Area under Irrigation (Net Irrigated Area/Net Sown Area) across Regions and Sources in Andhra Pradesh

Region	Triennium Ending 1963		Triennium Ending 1973		Triennium Ending 1983		Triennium Ending 1993		Triennium Ending 2002	
	Avg	CV	Avg	CV	Avg	CV	Avg	CV	Avg	CV
Canal										
Coastal	27	81	31	68	35	55	34	49	30	49
Rayalaseema	4	101	5	70	6	64	5	71	4	74
Telangana	4	178	4	123	6	131	7	99	7	105
AP	12	120	13	87	16	83	16	73	14	76
Tank										
Coastal	14	80	13	92	12	88	11	92	9	96
Rayalaseema	6	124	5	131	4	103	3	128	2	125
Telangana	12	52	6	63	9	60	7	74	5	82
AP	11	85	8	95	9	84	7	98	6	101
Well										
Coastal	3	76	5	96	6	107	9	93	12	79
Rayalaseema	5	109	7	98	8	92	12	70	16	77
Telangana	3	67	4	78	7	55	17	66	23	58
AP	4	84	6	91	7	85	13	76	17	71
Total										
Coastal	45	59	50	48	55	32	57	31	54	26
Rayalaseema	15	77	17	61	19	51	21	44	23	55
Telangana	21	60	16	66	23	54	32	57	37	51
AP	27	65	28	58	33	46	37	44	40	44

Notes: Avg = Average, CV = Coefficient of variation.

Table 2: Source-wise Area Irrigated (Area Irrigated by Source/ Net Irrigated Area) across Regions of Andhra Pradesh
(Per cent)

Triennium Ending	Canal			Tank			Well		
	Coastal	R Seema	Telangana	Coastal	R Seema	Telangana	Coastal	R Seema	Telangana
1963	46	19	14	24	32	49	05	24	12
1973	62	29	27	26	29	39	09	37	26
1983	63	31	27	23	21	37	12	44	32
1993	60	25	21	19	15	20	16	57	54
2002	55	19	18	17	09	15	22	69	64

Source: Statistical Abstract of Andhra Pradesh (various issues).

Table 3: Costs of Irrigation Development: Big vs Small Projects

Irrigation potential (IP) created	50.15 lakh hectares
IP created before 1950	27 lakh hectares
New IP created after 1950	23 lakh hectares
New IP created under major and medium projects	17 lakh hectares (74 per cent of the total)
New IP created under minor projects (including PR)	6 lakh hectares (26 per cent of the total)
No of schemes under major and medium irrigation	157
No of schemes under minor irrigation	14,253
No of schemes under PR department	70,474
Amount spent since 1950 up to 2000	Rs 10,087.65 crore
On major irrigation	Rs 8736.68 crore (87 per cent of the total)
On minor irrigation including PR schemes	Rs 1350.87 crore (13 per cent of the total)
Cost per hectare of potential in M and M projects	Rs 51,392
Cost per hectare of potential in minor projects	Rs 22, 514
Amount spent per year per scheme on M and M projects	Rs 112 lakh
Amount per year per scheme on minor projects	Rs 14,000
Amount spent per year per scheme on PR projects	Rs 1,000

Source: Note on Irrigation Sector in Andhra Pradesh, 1999, as quoted in NeeTi Samakhya (2003).

sources of irrigation in the low rainfall regions. Most of the tanks are located in the fragile resource regions, where groundwater is the major source of irrigation. The inter-linkages between these two sources coupled with the policy neglect have resulted in ecological problems, equity and sustainability of water resources.

In the absence of replenishing mechanisms, well irrigation becomes uncertain. Moreover, location specificity of the resource makes it concentrated in limited geographic boundaries. Despite the increase in area under irrigation, especially under wells, both Telangana and Rayalaseema regions have a majority of their districts with less than 33 per cent of area under irrigation (Table 4). The uncertainty in the availability of irrigation is reflected in the year-to-year changes in number of districts falling in this category over the years. On the other hand, in the coastal region only one district (Prakasam) was consistently in this category till 1983. This makes agriculture unsustainable in most of the districts in these regions.

The policy bias against minor irrigation continues though maintaining tank systems makes ecological as well as economic sense [Reddy 2004). While well irrigation is a remunerative option in the short run, its long-run sustainability is critically linked with replenishing mechanisms like tanks, watersheds, rainfall pattern, etc. Tank irrigation and well irrigation are treated as substitutes while the former compliments the latter. Perpetuation of these trends would be a recipe for ecological disaster. The signs of such ecological problems are already evident in a drying up of wells and well failure. Well failure has become a common phenomenon in the recent years, especially in the drought-prone regions. Perpetuation of these trends would adversely affect well irrigation. These impacts are visible in all the regions in terms of well yields [Reddy 2003].

Leaving groundwater exploitation to the private investments coupled with the absence of any effective regulatory mechanisms has resulted in severe economic and ecological stress in the regions of Telangana and Rayalaseema that house most of the drought-prone districts. This in turn is resulting in not only the economic inequalities, but also the ecological divide. For, the neglect of resource-poor regions in the provision of protective irrigation is further weakening their fragility. Even the recent policies in water management fail to take the needs of these regions into account. For instance, groundwater, the single most important source of irrigation, is totally left out of the purview of the water user association legislation. There are no efforts to integrate well and tank irrigation at the policy level.

Table 5: Ultimate Irrigation Potential and Achievement by Source in Andhra Pradesh

(Area in '000 ha)

	Major and Medium	Minor
1 Ultimate potential	5000.00 (5000)	6260.00 (4200)
2 Potential created till March 1992	2999.00	2877.34
3 Potential created till March 1997	3045.00	2901.87
4 Per cent of potential created to ultimate	60.90	46.36
5 Actual achievement till March 1997	2883.80	2687.16
6 Per cent achieved to the ultimate potential	57.68	42.93
7 Number of ongoing projects	28	21
8 Number of proposed projects	48	34

Note: Figures in brackets are estimated potential during the Eighth Plan.
Source: Planning Commission, Ninth Five-Year Plan, 1997-2002, Government of India. Government of Andhra Pradesh, Irrigation and CADA department, Strategy Paper on Irrigation, 2001.

III
Irrigation Development and Distribution: Future

The policy bias against the rainfed regions is not specific to Andhra Pradesh, as it is observed across the country. Only during the 1980s the need for addressing the problems of dryland agriculture was recognised at the policy level. It received a flip during 1990s with the realisation that development of these regions holds the key for future food security. As far as irrigation development is concerned, the attempt is to exploit the potential water resources by all means. Hitherto irrigation development was guided by economic rationality, as most of the existing projects are located at places that are technically convenient and cost effective. Further development would be increasingly unfavourable, technically as well as economically. Despite the unfavourable conditions, there is an urgent need for providing protective irrigation[6] to these regions in order to make agriculture viable and check the resource degradation. The irrigation development in these regions becomes imminent even from the socio-political point of view, as the communities from these regions are increasingly becoming articulate in making their demands.[7] How far the initiatives in irrigation development in these regions would address the distributional issues, in relative as well as absolute sense, is examined in this section.

As per the Ninth Five-Year Plan, the ultimate irrigation potential in AP is estimated between 92 lakh hectares and 112 lakh hectares, almost equally divided between major and medium and minor sources (Table 5).[8] Of this about 58 per cent of the major and medium sources and 43 per cent of the minor sources potential was realised till 1997 March.[9] Ongoing 49 projects at various stages of completion coupled with 82 proposed projects are expected to exploit this potential fully in the long run (Appendix). Once these projects are completed, the scenario of irrigation distribution would be different. The state government is keen to complete all the ongoing projects by 2008 and complete all

Table 4: Number of Districts with less than One-Third of Their Area under Irrigation across Regions

Region	Triennium Ending 1963	Triennium Ending 1973	Triennium Ending 1983	Triennium Ending 1993	Triennium Ending 2002
Coastal	1 (Guntur)	1 (Prakasam)	1 (Prakasam)	0	0
Rayalaseema	2 (Anantapur and Kurnool)	4 (Anantapur, Kurnool, Cuddapah and Chittoor)	4 (Anantapur Kurnool, Cuddapah and Chittoor)	4 (Anantapur, Kurnool, Cuddapah and Chittoor)	2 (Anantapur, and Kurnool)
Telangana	4 (Medak, Mahabubnagar, Khammam and Adilabad)	8 (Nizamabad, Medak, Mahabubnagar, Nalgonda, Warangal, Khammam, Karimnagar and Adilabad)	7 (Rangareddy, Medak, Mahabubnagar, Nalgonda, Warangal, Khammam and Adilabad)	4 (Rangareddy, Medak, Mahabubnagar and Adilabad)	4 (Rangareddy, Medak, Mahabubnagar and Adilabad)
AP	8	13	12	8	6

the proposed projects by 2010 [GoAP 2006]. Though the state is trying to generate the required financial allocations,[10] it is hard to visualise that the projects can be completed by 2010 given the history of irrigation development in the state and the country. Therefore, we assume that the ongoing projects would be completed by the year 2010 and the proposed projects would be completed by the year 2020. Along with the canal irrigation, the unexploited potential of groundwater and the existing tanks are also included in order to arrive at the ultimate achievable area under irrigation across the districts.

It is estimated that a total of about 30 lakh hectares can be added to the existing area under irrigation in AP with the help of ongoing, proposed projects and another 20 lakh hectares through well and tank systems (Table 6). This would mean that the total area under irrigation in the state would be about 73 lakh hectares when all the ongoing and proposed irrigation projects are completed. When the irrigation potential from wells and tanks are included (93 lakh hectares) it becomes close to the ultimate irrigation potential of 92-112 lakh hectares as per the Eighth and Nineth Plan estimates (Table 5). When the ongoing projects are completed the total irrigation potential exploited in the state would range between 45 and 55 per cent depending on the estimated potential (Eighth and Ninth Plan) taken into account. The expected potential exploited would range between 64 and 78 per cent when all the proposed projects are completed.[11] While the estimated costs of achieving these levels of irrigation are Rs 93,078 crore, a rough estimate of the expected benefits from these investments indicates the states GDP would go up by 1.9 per cent [GoAP 2006].

Of the additional irrigation, canals will account for 58 per cent and the rest tanks and wells. Of the expected potential under canals only 28 per cent will materialise with the ongoing projects. About 42 per cent of the potential created through the ongoing projects will be in the coastal region followed by Telangana (31 per cent) and Rayalaseema (27 per cent) regions. This indicates that completion of all the ongoing projects would further aggravate the regional inequalities. This could be due to the reason that coastal region seems to provide favourable sites for irrigation projects, as the ongoing projects are mostly finalised on economic rationality. In the case of proposed projects, 52 per cent of the expected potential will be in the Telangana region followed by coastal (29 per cent) and Rayalaseema regions. In the case of tanks and wells, the coastal region has a larger share in the unexploited potential as Telangana and Rayalaseema are already reaching saturation points. Besides, the composition of irrigation would reverse in the post-completion scenario. Canal irrigation would become the single largest source of irrigation in Telangana and Rayalaseema regions. This appears unbelievable but not impossible provided that these proposed projects materialise. This scenario is like a "dream coming true" and "too good to believe". On the whole, even after completing all the ongoing and proposed projects the regional disparities are likely to come down only marginally. Partly this could be due to the reason that in the case of some projects the potential created spills over district and regional boundaries, which we are not able to delineate exactly. However, this problem could be more in terms of intra-regional variations rather than inter-regional variations.

In terms of the proportion of area under irrigation across the districts, some of the districts and regions get more than 100 per cent of their net sown area under irrigation (Table 7). Though this could be due to the poor delineation of actual benefits between the districts, it raises doubts on the feasibility of the proposed projects in creating the expected irrigation potential. Moreover, the information on feasible wells and the future area is dynamic and keeps changing, depending on the extraction levels and replenishing mechanisms in a particular zone. The number of feasible wells and the area irrigated per well was estimated by the Groundwater Estimation Committee (GEC) in 1997 and projections are made for the year 2000 on the basis of these estimates [GoAP 2000]. Note that per well yields could change rapidly and vary across the regions with rainfall and the status of surface water bodies. Therefore, scenario-II becoming a reality could be a long shot and hence scenario-I could be a feasible option, though achieving percentage AI- 2020 of scenario-I could be difficult though not impossible. For, some of the ongoing projects are yet to receive the approval from the Planning Commission for one reason or the other. Only five of the 21 major and medium projects under the Accelerated Irrigation Benefit Programme received full clearance and the rest are pending approval [GoAP 2006].

As per scenario-I, Andhra Pradesh would bring about 52 per cent of its net sown area under irrigation by 2010 when all the ongoing projects are completed. This figure would go up to 73 per

Table 6: Distribution of Area under Irrigation across the Districts by the Years 2010 and 2020
(*Area in hectares*)

District	NIA -2002	Ongoing	Pro-posed	Future Total Canal	Future Wells+ Tank*	NIA-2010	NIA-2020
Srikakulam	180583	37261	23719	60981	131426	349270	372989
Vizianagaram	131223	13228	90657	103885	130634	275085	365742
Visakhapatnam	108551	22410	4721	27131	107613	238573	243294
East Godavari	276385	15624	150525	166149	169147	461155	611681
West Godavari	295991	93801	152039	245840	214442	604234	756273
Krishna	313846	224	14148	14372	62943	377012	391161
Guntur	369546	0	0	0	136317	505863	505863
Prakasam	199329	1048	102550	103598	93140	293518	396067
Nellore	233542	161936	84371	246307	130712	526190	610561
Coastal	2108996	345530	622731	968261	1176373	3630900	4253631
Average	234333	38392	69192	107585	130708	403433	472626
CV	37	143	88	87	33	31	34
Kurnool	170771	149734	16187	165921	64735	385240	401428
Anantapur	142046	27042	70483	97524	58201	227289	297771
Cuddapah	140792	38445	173408	211853	62208	241445	414853
Chittoor	170675	5151	138520	143672	98101	273928	412448
Rayalaseema	624284	220372	398598	618970	283246	1127902	1526500
Average	156071	55093	99650	154743	70812	281976	381625
CV	11	117	70	31	26	25	15
Rangareddy	75260	0	0	0	37019	112279	112279
Nizamabad	171697	22258	62558	84816	49026	242981	305539
Medak	135742	0	0	0	76842	212584	212584
Mahabubnagar	169566	41359	264260	305619	82771	293696	557956
Nalgonda	209191	131523	52508	184031	98458	439172	491680
Warangal	298881	22258	73686	95944	72502	393640	467327
Khammam	182125	27401	300648	328050	95987	305514	606162
Karimnagar	238304	0	231211	231211	71557	309861	541072
Adilabad	78073	10117	118796	128913	50235	138425	257221
Telangana	1558839	254916	1103668	1358584	634398	2448153	3551820
Average	173204	28324	122630	150954	70489	272017	394647
CV	42	146	93	80	30	40	45
Andhra Pradesh	4292119	820818	2124997	2945815	2094017	7206954	9331951
Average	195096	37310	96591	133901	95183	327589	424180
CV	40	134	91	74	45	38	36

Notes: NIA = Net irrigated area. * = Future area under tank is taken from the data on defunct tanks and the command area under them. Future area under wells is estimated using the data on the number of feasible wells in each district and the average area per well in each district.
Source: Compiled from the data published in WALAMTARI, 2004.

cent by 2020 provided all the proposed projects materialise. All the regions cross the threshold level of attaining irrigation to one-third of their net sown area. But, intra-regional disparities are likely to increase, as some districts tend to benefit more from the investments. This is reflected in the overall variations across the districts, which are higher (48-47 per cent) in 2010 and 2020 when compared to 2002 (44 per cent). Therefore, the disparities at the district level would increase, even after exploiting all the potential under canals. In other words, the existing regional disparities in irrigation development are not manifested in a deliberate neglect of specific regions, rather they arise of natural and geographic advantages/disadvantages of respective regions. This, however, could have been avoided to some extent, if irrigation development was not purely based on economic rationality or technical feasibility of the projects. In this context, focusing on providing the threshold level of protective irrigation (33 per cent of the net sown area) would have addressed the agrarian distress in these regions. This needs to be addressed at the district level rather than at the regional level. As the estimates of potential area to be brought under irrigation in 2020 under scenario-I show, though all the three regions cross the threshold level of irrigation, some of the districts continue to remain below this level. These are Anantapur in Rayalaseema and Rangareddy and Medak in Telangana. While targeting to implement the ongoing and proposed projects, these districts need a special attention. Special efforts are needed to divert or develop water resources in these districts. Though these efforts are going to be costly, the costs would be marginal when compared to that of implementing the proposed projects. Techincal feasibility and sustainability assumes paramount importance while economic feasibility[12] becomes secondary in implementing most of the proposed projects.

IV
Bridging the Disparities: Costs and Constraints

As mentioned earlier, the main reason for the regional disparities in irrigation development are natural, economic and technical in nature rather than purely political. The present thinking is to overcome the natural and technical hurdles irrespective of economic costs. The main aim of the proposed projects is the utilisation of unutilised Godavari waters (762 TMC). Utilising these waters is a daunting task technically, as the water has to be supplied to about 150-600 metres above the sea level in order to reach the fields even after constructing the reservoirs. For, most of the lands to be irrigated in Telangana are available at 200-650 metres above the sea level. This would mean that irrigation is possible only through lift irrigation from the reservoirs. It is estimated that the costs of energy would be around Rs 25,000 per hectare for kharif-wet crops [Rao 2003]. These costs are over and above the costs of providing irrigation through reservoirs. Added to this are the rehabilitation costs and environmental mitigation costs. The state government estimated that Rs 93,0780 crore is required to complete the ongoing, pending and proposed projects, i e, Rs 1,27,000 per hectare. Besides, the three lagging districts of Anantapur, Rangareddy and Medak need allocations in order to reach the threshold levels of irrigation. At the given level of average costs, Anantapur requires an additional allocation of Rs 1,600 crore in order to meet the additional requirement of above one lakh hectares, while Rangareddy and Medak districts require above Rs 300 and Rs 200 crore respectively. These allocations need to be at the top of the priority list. These investments need not be in the form of water diversion, they should go towards strengthening the resource base and improving the land productivity through systematic implementation of soil and water conservation (watershed) programmes, improving the water use efficiency through promotion of new technologies and cultivars, provision of alternative livelihood opportunities in animal husbandry, horticulture, etc.

More importantly, priority should be given to least irrigated areas/districts in order to reduce agriculture distress even in the short run. As mentioned earlier most of the ongoing projects are going to benefit the already developed coastal region. The new projects need to be initiated in the Telangana and Rayalaseema regions on a fast track, though most of the projects are medium or long-term requiring 10-20 years. The state government's approach of completing them in five years appears to be too ambitious and unrealistic.[13] Even within the regions, districts that need attention in the medium and long run should be taken up on priority basis. In the absence of proposed projects in these districts alternative investments, as mentioned above, should be

Table 7: Distribution of Percentage of Area Irrigated across the Districts by the Years 2010 and 2020

(Area in hectares)

District	Percentage AI-2002	Scenario-I Percentage AI-2010	Scenario-I Percentage AI-2020	Scenario-II Percentage AI-2010	Scenario-II Percentage AI-2020
Srikakulam	58	70	77	100	100
Vizianagaram	41	45	73	85	100
Visakhapatnam	33	40	42	73	75
East Godavari	64	68	100	100	100
West Godavari	63	83	100	100	100
Krishna	62	63	65	75	78
Guntur	58	58	58	79	79
Prakasam	35	36	54	52	71
Nellore	72	100	100	100	100
Coastal average	54	65	82	97	100
CV	26	41	42	35	37
Kurnool	20	37	39	45	47
Anantapur	14	16	23	22	29
Cuddapah	36	46	91	62	100
Chittoor	40	41	74	65	97
Rayalaseema average	23	35	57	49	70
CV	46	37	55	40	54
Rangareddy	26	26	26	39	39
Nizamabad	67	76	100	95	100
Medak	30	30	30	47	47
Mahabubnagar	20	25	56	35	66
Nalgonda	40	65	74	83	93
Warangal	59	64	78	78	92
Khammam	42	48	100	70	100
Karimnagar	61	61	100	79	100
Adilabad	15	17	39	26	48
Telangana average	37	46	71	61	87
CV	47	47	51	40	45
Andhra Pradesh average	40	52	73	74	95
CV	44	48	47	46	45

Note: Scenario-I = (Net area irrigated in 2002 + ongoing projects + proposed projects)/net sown area, Scenario-II = (Net area irrigated in 2002 + ongoing projects + proposed projects + future area under tanks and wells)/net sown area when ongoing and proposed projects are completed. Some districts and regions have shown above 100 per cent area under irrigation, due to lack of clarity in the actual benefits in each district or region. In order to avoid confusion we have rounded off all the above 100 figures to 100 per cent.

Source: Compiled from the data published in WALAMTARI, 2004.

made. For instance, districts like Anantapur and Rangareddy should be accorded highest priority in the short, medium and long runs; Adilabad and Mahabubnagar should be the priority in the short and medium runs; and Medak should be given a priority in the medium run.

Economic costs are no longer a bottleneck, as there is a universal agreement for irrigation development, especially in the backward areas, but technical feasibility could be a major constraint. For instance, it is estimated that the power requirement for irrigating one hectare of kharif crop is about 8,810 units [Rao 2003]. This kind of power requirement can only be met through establishing a separate hydel power project. This is possible through construction of four barrages and three reservoirs on Godavary (ibid). Therefore, hydel power projects should be integrated into the overall scheme of irrigation development. However, sustaining the irrigation projects is still a major concern due to the high running costs of irrigation. Generation of hydel power requires working capital. Farmers need to pay more per acre of irrigation, even after the government absorbs the capital costs of hydel power generation. This brings us back to the long-standing issue of irrigation water pricing on cost basis. The long-run sustainability of these projects would be critically linked to the pricing of water. Unless farmers are convinced and willing to foot the bill, it would be difficult to sustain the projects. This needs to be inculcated from the stage of designing the project. This would be easier provided effective pricing policies are implemented in the already irrigated regions. Pricing of water on volumetric basis in order to cover at least the operation and maintenance costs is necessary for efficient and productive use of water.[14]

While the efforts of the state government focusing on irrigation development to address the agrarian/rural distress are laudable, the feasibility of translating these investments into benefits (area irrigated), making the investments productive and sustaining the investments in the long run appears dubious in the present scheme of things. Here, we identify three critical issues that need to be addressed in order to make the allocations effective and sustainable. These include: (a) comprehensive water policy; (b) demand-side management; and (c) exploring the alternatives.

(a) *Comprehensive water policy:* Though Andhra Pradesh has some important legislations like Water User Associations (WUA) Act and Water, Land and Trees (WALTA) Act, they do not have a comprehensive water policy. Water policy should prioritise the uses and identify a particular approach like integrated water resource management or river basin or watershed management. In the absence of clarity on the approach, the proposed irrigation development in the state appears ad hoc. It only talks about irrigation development mainly through constructing major and medium projects. The proposals neither have plans on how to manage the created potential nor have involved the people in the process. The role and involvement of WUAs in water management is a showpiece at best [Reddy and Reddy 2005]. No attempts are made to strengthen them so that they can take the full responsibility of water management. The importance of water management is reflected in the extent of area that presently needs stabilisation, which accounts for more than 30 per cent of the irrigation potential created so far. Similarly, the groundwater, which is the single largest source of irrigation, is totally left to private initiatives resulting in inequity and degradation of the resource. The existing WALTA Act is inappropriate and ineffective in this regard. Efficient and sustainable water management calls for demand-side management practices that are totally missing in the present approach.

(b) *Demand management:* The demand management involves increased water use efficiency, recycling, promotion of water saving technologies, etc. Though supply is a major constraint in many cases, the major problem that leads to water shortages is the wastages through distributional and transmission losses. The demand management is the most cost-effective option for enhancing water availability through promotion of water use efficiency. Important strategies or measures in this regard include: (a) market/pricing/economic measures; (b) technologies; and (c) institutions. Note that these strategies may not be effective on their own and hence calls for judicious mix of these measures.

The present approach of state government is that it is relying entirely on traditional engineering approach of supply creation to the neglect of demand management. Artificially kept low water prices fail to provide any incentive to improve the systems, technically or institutionally, as the economics of transaction costs go against it. The present prices cover less than 10 per cent of the operation and maintenance costs of irrigation supply. There is no rationale for continuing these subsidies, as these subsidies go against benefiting the poor at whom these subsidies are targeted. The cost of irrigation goes up substantially with proposed projects. The costs would be prohibitive in the districts where water transfers from distance are planned. Adopting the full cost recovery method would asking too much from these poor regions, while the endowed regions enjoy the benefits at low due to their natural advantages. One option is cross subsidise (tax transfers) these farmers by collecting irrigation charges from the endowed regions, which are enjoying the fruits of irrigation for decades. Even at high costs these regions continue to be at the mercy of rain gods as they receive water when upstream demands are met. Second option is to develop alternative approaches like watershed development to protect and enhance the livelihoods in these regions.

Technological options can go a long way in enhancing the water use efficiency and water security in the fragile environments. It is estimated that sprinkler and drip systems can save 40-60 of water used for crops, apart from being energy efficient and productive[15] [Narayanamurty 2003]. Similarly, new methods of paddy cultivation such as SRI paddy can reduce water use by 40-50 per cent without affecting the yields [Reddy et al 2005]. These technologies and practices can double the water use efficiency and double the area under irrigation. These technologies and practices need to be promoted with proper mix of instruments such as economic, institutional, educational, extension network, etc. For example, the programme of distributing subsidised sprinkler and drip irrigation systems has not proved to be effective.

(c) *Exploring alternatives:* The feasibility of major and medium projects is questionable in all situations. The approach of the state is to expand the supply base through creating major and medium reservoirs. These projects not only result in huge environmental and human costs their viability in the long run is doubtful in the absence of environmental management, economic instrument and institutional arrangements. Experts have suggested a number of alternatives for the utilisation of Godavari waters and also for other projects like Pulichintala, which are more environment-friendly, with least displacement and sustainable manner [Rao 2003]. But these alternatives are neither discussed in public nor reviewed scientifically. The state seems to be believing and

following the linear approach of water resource development in mechanical manner. There is a need for bringing in harmony between major, medium and minor sources of surface water on one hand and groundwater on the other. Costs of providing surface irrigation could be prohibitive in some districts, hence need to improve the groundwater resources through rainwater harvesting and conservation.

In this context, the watershed development programme (WDP) has great potential in sustaining the rural livelihoods. It is observed that investment in watershed development is necessary, but not sufficient to enhance the rural livelihoods substantially in the drought-prone regions [Reddy et al 2004]. In order to realise the full potential of watershed development, pro-poor programmes that complement the benefits of WDP need to be introduced. These programmes include: horticultural and dairy development that would benefit from the improved resource conditions like in situ moisture, grazing lands, water bodies, etc. Though some of these activities are being introduced recently, their success is dependent on infrastructure (transport, storage, markets, etc) and credit (institutional finance) support systems apart from a conducive policy environment that is propitious for institutional (collective systems, self-help groups, etc) evolution and development. In the absence of an integrated view on resources-livelihoods-institutions-infrastructure these programmes may not fulfil the objective of sustainable rural livelihoods.

Completing the proposed irrigation projects need to be carried out in a systematic and planned manner rather than venturing in to adhocism. The process is complex in terms of meeting environmental and technical challenges, as most of these projects are located in difficult terrains. The social problems relating to human displacement need to be dealt carefully through evolving effective compensation packages. The hitherto followed cash compensation policies may result in creating an army of displaced people. Project designing should be least damaging to the environment. A number of small projects could substitute for a big one with less environmental and social costs, as suggested in the case of Pulichintala and Polavaram projects. Such options need to be explored before embarking on the large-scale projects.

V
Conclusions

Despite huge investments and numerous projects, regional disparities in a relative sense are likely to continue, although at a lower level. In fact, disparities between the regions decline only in the 2020 scenario-I, as they tend to increase in the 2010 scenario-I, i e, when all the ongoing projects are completed. While the disparities between the three broad regions are likely to decline once all the proposed projects are completed, the intra-regional disparities would increase in all the three regions by 2020. On the other hand, the ongoing projects would help reducing the intra-regional disparities only in Rayalaseema. The result is that some of the districts may not benefit substantially in relative terms. Therefore, the focus of irrigation development should be in terms of reducing the absolute disparities (achieving the threshold level of area under irrigation) at the district level rather than targeting the broad political regions. Reducing the absolute disparities is feasible in the medium term provided concerted efforts, financial or otherwise, are made in this direction, though the reasons are geographical and natural advantages/ disadvantages of particular regions or districts. There is a need for exploring alternatives for strengthening the resource base and enhancing the livelihoods in these areas. This approach would provide the much-needed stability to agriculture sector and minimise agrarian distress in the fragile resource regions.

The present approach, however, seems to be driving towards spreading the resources thinly over a number of ongoing and proposed projects in a supply-sided manner. This would delay the completion of the projects prolonging the time span of the ongoing projects as well.[16] In other words, no project will be completed if too many projects are initiated at the same time. Apart from financial constraints, there are limitations to spend huge amounts effectively on the part of irrigation departments. Therefore, prioritise the projects in terms of regions/districts with less than 33 per cent of their area under irrigation. This approach would not only facilitate speedy implementation, but also address the political concerns. More importantly, stabilising agriculture in these fragile regions is only possible through providing protective irrigation.

Even within the districts, ensuring minimum access to water at the household level is critical for achieving household level food security. Irrigation development in a majority of the drought-prone regions is biased in favour of large and medium farmers. This is mainly due to the dependence on groundwater in these regions. The capital-intensive nature of groundwater extraction makes it privy to a few large farmers. Even the availability of cheap technologies to small and marginal farmers is proving detrimental in event of resource depletion. In the context of watershed development, it was observed that: "In majority of the cases access to groundwater is limited to large and medium farmers. Marginal farmers do not usually have access to groundwater. While in the short run agricultural labourers' (landed as well as landless) benefit from the watershed programme, farmers,

Appendix Table : Number of Completed, Ongoing and Proposed Irrigation Projects across the Districts in AP

District	Completed Projects			Ongoing Projects			Proposed Projects		
	Major	Medium	Small	Major	Medium	Small	Major	Medium	Small
Srikakulam	2	1	12	0	2	3	1	0	5
Vizianagaram	1	8	15	0	1	3	1	2	5
Visakhapatnam	2	4	6	1	1	5	0	0	0
East Godavari	2	1	6	1	4	1	2	0	2
West Godavari	0	2	8	0	4	2	0	1	3
Krishna	2	1	4	0	0	0	2	0	6
Guntur	0	2	0	0	0	0	0	0	0
Prakasam	0	6	12	0	0	1	3	1	4
Nellore	1	1	2	3	0	1	3	2	5
Kurnool	3	1	0	2	0	0	0	0	0
Cuddapah	1	5	0	0	0	0	0	2	2
Chittoor	0	8	14	0	0	4	0	0	0
Anantapur	1	5	0	0	1	1	0	0	0
Adilabad	1	5	0	0	2	0	2	12	0
Nizamabad	1	3	0	2	0	0	4	0	0
Karimnagar	1	3	0	0	0	0	1	0	0
Warangal	1	5	0	0	0	0	0	0	2
Khammam	1	6	2	0	2	0	4	2	0
Nalgonda	0	2	0	1	0	0	0	0	0
Rangareddy	0	1	0	0	0	0	0	0	0
Mahabubnagar	1	2	0	1	0	0	3	0	0
Medak	1	2	0	0	0	0	0	0	0
Total	22	74	81	11	17	21	26	22	34

Source: Compiled from the data published in WALAMTARI, 2004.

especially those with access to groundwater, accrue the medium and long-term benefits" [Reddy et al 2004]. While canal and tank irrigation is more equitable when compared to groundwater, measures should be taken to ensure some access to groundwater to marginal and small farmers. For, most of the public investments in the form of watershed development, tank renovation may benefit the rich if the access to groundwater is distorted.

Management of the existing systems should be given high priority in the already existing systems, rather than initiating new projects in these regions. The approach of demand management should go in tandem with the supply augmentation in order to make the investments effective and sustainable. Strengthening the existing institutional arrangements like water user associations in terms of devolution of powers and moving towards self-management and cost-based pricing are critical for sustaining the systems. Treating irrigation water as an economic good through volumetric pricing is critical for sustaining the irrigation systems in the long run. This should be initiated in irrigated regions that are reaping the benefits over the past many years. This process is possible only through institutional strengthening. These institutions should inspire and serve as models to the new systems. In the absence of institutional strengthening, we may lose the existing command areas in the process of creating new areas. In order to facilitate volumetric pricing, a provision should be made at the designing stage itself. But, no such attempts are made in the case of new projects, either ongoing or proposed. Though this results in cost escalation marginally in the short run, it would be beneficial in the long run. EPW

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Notes

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1 Gross dependable yield from all the 40 river basins in the state is estimated at 2,764 TMC at 75 per cent dependability as per the interstate awards. Presently the state is utilising 1,700 TMC [GoAP 2006].

2 The rank correlation coefficient (0.49) is positive and significant.

3 Telangana recorded a growth rate of 3.1 per cent in the percentage of area irrigated as against 0.9 and 0.4 per cent growth in coastal and Rayalaseema regions, respectively. Most of the growth in Telangana took place during the period of 1985-2001[Vakulabharanam 2004]. This, however, is due to groundwater development. Even in the case of area under canals Telangana recorder higher growth of 1.2 per cent when compared to coastal (0.0 per cent) and Rayalaseema (-0.6 per cent) regions. And the growth in canal irrigation was mainly during the period 1970-85 (ibid 2004).

4 Even in the case of area under canals Telangana recorded higher growth of 1.2 per cent when compared to coastal (0.0 per cent) and Rayalaseema (-0.6 per cent) regions. And the growth in canal irrigation was mainly during the period 1970-85 (ibid 2004).

5 Note that not all the large projects generate hydel power. Even one includes the benefits from power generation; the cost of providing one hectare of irrigation of small systems will be comparable with that of big ones. Moreover, the environmental costs of large projects are often not fully assessed/not included in project appraisals.

6 Protecting the irrigated dry crops from water scarcity by providing one or two irrigations in the crop season, instead of providing irrigation on continuous basis.

7 Though there are potential alternative ways of enhancing the agricultural productivity with watershed development and improving the livelihoods through allied and non-farm activities, they require intensive efforts involving institutional innovation and social capital development [Reddy et al 2004]. The state is not keen to tread the difficult path as it is interested in quick results through technical engineering.

8 As per the estimates under the Jalayagnam the potential of major and medium projects is pegged at 59.44 lakh hectares [GoAP 2006].

9 No project was completed during the Nineth Plan period, i e, 1997-2002.

10 Budget allocations during the last three years are indicative. The allocations have increased from about Rs 15,000 crore in the 2003-04 budget (previous governments) to Rs 3,300 crore in 2004-05, Rs 6,500 crore in 2005-06 and to above Rs 10,000 crore in the 2006-07 budget.

11 Note that the potential exploited does not include the well and tank irrigation here.

12 Economic rationality arguments can no longer withstand the socio-political compulsions. Moreover, there is no choice other than making agriculture viable in these regions given the development scenario.

13 Given the track record of project clearance, even getting an environmental clearance, the rules of which are becoming stringent by day, may take longer time. Some of the major projects such as Polavaram are already embroiled in controversies and conflicts over rehabilitation and resettlement.

14 The details about how to go about implementing pricing policies are beyond the scope of this paper.

15 Recent research has shown that these technologies are being used on a wide variety of crops, including sugarcane, the most water-intensive crop [Narayanamurthy 2003].

16 This is one of the reasons for not adding a single hectare to the area irrigated in the state during the 1990s.

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