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Trends in the costs of irrigation across different states in India: The case of major and medium projects

by
A. Rajagopal
A.Vaidyanathan

Madras Institute of Development Studies
79, Second Main Road, Gandhi Nagar
Adyar, Chennai 600 020

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Trends in the Costs of Irrigation Across Different States in India: The Case of Major and Medium Projects

A Rajagopal
and
A Vaidyanathan

Abstract

This paper is an attempt to estimate trends in the real costs of major and medium irrigation projects in different states in India. It is based on all India Cost of Construction Index of Central Water Commission (CWC) adjusted for variations in labour cost in different states. The trends are estimated based on both plan data on irrigation and land use statistics by Directorate of Economics and Statistics from different states. It also attempts to study the lag effect between investment and area irrigated. In addition, the cost estimates are related to productivity of irrigation in different states to get an idea about the economic viability of irrigation projects.

Introduction

This paper attempts to estimate for the country as whole and for a selected number of states, trends in the real cost of large surface irrigation works constructed by the government. Rising costs, inordinate delays and poor utilisation of facilities are among the problems frequently cited both in official documents and in academic literature on irrigation. And yet, surprisingly there have been a few attempts to examine these aspects rigorously. The Eighth Plan Working Group on major and medium irrigation (GOI, 1989) gave, for the first time, estimates of the average cost per hectare(constant) of additional potential created by major and medium works. According to them, the cost per hectare at 1970-71 prices rose from about Rs.3300 in the first and second plans to Rs.5400 in the seventh plan. The cost indices and the basis of their construction are not indicated. The increase is also much less than a subsequent estimate by the Central Water Commission (GOI, 1990), according to which the per hectare cost at constant price rose nearly three and a half times between the third and the sixth Plan (Table 1).

Table 1: Compar son of investment per ha of potential estimated by Working Group on Major and Medium projects and estimates based on indices of CWC.

Plan Period	Investment per ha (Rs.at 70-71 price)	
	Working Group Estimation	Estimation based on CWC indices
I Plan	3340	NA
II Plan	3300	NA
III Plan	3940	3475
Annual Plans (66-69)	3440	3150
Fourth Plan	4310	4446
Fifth Plan	3470	3781
Annual Plans (78-80)	4590	5444
Sixth Plan	5790	12043
Seventh plan	5380	NA

Sources: GOI, 1989 and 1990.

The above CWC study seems to be the only systematic attempt at constructing a cost index for large surface irrigation works. It was done only in 1990 and relates only to river valley projects for the country as a whole, and covers the period 1970 to 1989. The cost index divided the works involved in such projects into the following five categories:

1. Earth work by manual labour ; 2. Earth work by machinery ; 3. Stone Masonry in Cement morter; 4. Reinforced cement concrete; and 5. Mass concrete.

Each of these is further broken down into materials, machinery, fuel and labour used. The total value of each of these inputs in this category of projects as a whole together with what are called `non-variable costs' (which is left undefined but presumably includes costs of administration, management and other overheads of project execution) form the basis for the relative weights accorded to various components of the costs. The publication gives price indices for each of the cost-inputs, but assumes the `non-variable' part to remain constant (in absolute terms).

The CWC index suffers from some serious limitations:

1. The basis on which the weighting diagram has been built is not spelt out. There is no indication of the nature, number or basis of choice of the projects whose input composition has been analysed.
2. It is doubtful whether river valley projects correspond to, and are representative of, the category of all "major and medium" projects.

3. "Non-variable costs" are assumed to remain unchanged. If this represents the `overheads', the assumption is clearly questionable. as salaries have increased much faster than the general price level.
4. Since the input composition varies across space and projects, and changes in the prices of all inputs may not be uniform across states, the national index is not a reliable basis for assessing the trends in real investments in the states and regions.

For construction of state specific indices of construction costs, it would be necessary to have (a) weighting diagrams reflecting the relative importance of different inputs for a representative sample of major and medium projects in each state; b) the price indices for each input by state; and c) data on overhead costs and changes therein.

The relevant data on (a) and (c) are not readily available by states. Pending compilation and analysis of data based on a properly selected sample of projects - which the CWC is in the best position to undertake - we use the national weighting diagrams constructed by the CWC for estimating the cost indices uniformly for all states. In order to eliminate the bias introduced by the (obviously incorrect) assumption about "non variable costs" being fixed, `non variable' costs have been excluded from the calculation. The original CWC weights and the revised weights are shown in Table 2.

Table 2: Details about the weightages assigned by Central Water Commission and revised weightages for different elements of construction

Sl.No.	Input elements	Assigned weight[1]	Revised weight
1	Cement and Steel	30	40.0
2	All commodities	10	13.3
3	Labour	25	33.3
4	Fuel and Lubricant	10	13.3
5	Non-variable part	25	---
	Total	100	100.0

Source: 1.Cost bulletin on river valley projects, Central Water Commission (CWC), Government of India, 1990.

Data on prices of various material inputs entering construction are not available for individual states. It is perhaps reasonable to assume that in respect of commodities like cement, steel, fuel and lubricants, the state level prices are likely to move more or less in step with the national index.

This assumption would not be valid in the case of bricks, stones (for mixing concrete) and other local materials and of construction labour. Index of construction wages (and more specifically labourers working on Public Works Department contracts) are not available. They should be in the files of the PWD but have not been compiled into a series. We have therefore used the movements of wage rates of male agricultural labourers as approximation of the movements in construction wages. There is clearly room for refinement here also.

The composite index of material costs (viz cement, steel, all commodities, fuel and lubricants) has been estimated by using the revised weights [Table 3]. The weighting pattern for this part of the cost index is taken to be the same for all states. As regards wages, the index of agricultural wages with 1970-71 as base has been compiled for each state on the basis of series compiled by Jose (1974 and 1988) [Table 4]. This has been weighted uniformly (at 33.33%) in all states and added to the weighted index for materials to get the overall index for each state (Table 5).

Table 3: Composite index of construction materials with revised weights

Year	Weights				
	Cement	Steel	Fuel	Others	Weighted index of all materials
	--------40--------		13.3	13.3	66.6
1964	73	69	68	68	47
1965	81	74	71	73	50
1966	89	77	80	83	55
1967	89	85	86	92	58
1968	90	89	88	91	60
1969	96	93	92	95	63
1970	100	100	100	100	67
1971	105	103	104	106	70
1972	110	121	105	116	76
1973	112	156	122	140	89
1974	148	193	214	175	120
1975	171	203	225	173	128
1976	174	208	231	177	131
1977	177	208	231	186	133
1978	197	241	243	186	145
1979	229	315	237	218	169
1980	233	324	351	257	193
1981	270	402	455	281	233
1982	365	470	476	289	269
1983	422	493	504	316	292
1984	464	539	507	338	313

Note: 1. Indices from 1970-1984 taken from GOI(1990). For earlier years, the index has been back dated using the whole sale price index for each input category.

2. For computing the weighted index, the combined weight for materials (cement, steel, fuel and others) has been applied to the single aveage of the price index for all the materials.

Table 4: Index numbers of agricultural wages for selected states, 1964-1984

Year	Andhra Pradesh	Gujarat	Karnataka	Madhya Pradesh	Maharastra	Punjab Haryana	Tamil Nadu	Uttar Pradesh
64-65	67	65	81	64	67	51	73	52
65-66	71	67	72	71	67	65	74	65
66-67	80	74	73	81	81	64	83	74
67-68	90	83	79	83	87	81	89	83
68-69	91	85	79	89	90	98	95	85
69-70	99	87	91	94	100	108	98	89
70-71	100	100	100	100	100	100	100	100
71-72	102	111	106	104	104	104	106	105
73-74	117	113	133	137	111	117	129	140
74-75	138	122	140	157	122	137	174	154
75-76	149	153	162	176	120	143	179	189
76-77	160	191	191	187	120	157	157	192
77-78	176	188	210	191	130	162	158	184
78-79	186	200	203	196	145	168	172	196
79-80	202	208	218	202	162	179	206	213
80-81	223	220	231	217	165	191	235	228
82-83	297	281	262	308	218	213	269	289
83-84	344	336	293	366	288	245	299	353
84-85	386	410	298	397	333	284	349	388

Source: Jose A.V. 1974 and 1988.

Table 5: Overall cost of construction index for major States

Year	Andhra Pradesh	Gujarat	Karnataka	Madhya Pradesh	Maharastra	Punjab Haryana	Tamil Nadu	Uttar Pradesh
1964	69	68	73	68	69	64	71	64
1965	74	73	74	74	72	72	75	72
1966	81	80	79	82	82	76	83	79
1967	88	86	85	58	87	86	88	86
1968	90	88	86	89	90	92	91	88
1969	95	92	63	94	96	99	95	92
1970	100	100	100	100	100	100	100	100
1971	103	106	105	104	104	104	113	105
1972	124	123	126	128	123	124	129	128
1973	128	126	133	134	126	128	131	135
1974	166	161	166	172	161	166	178	171
1975	177	179	182	186	168	176	187	191
1976	184	194	194	193	171	183	183	195
1977	191	195	202	196	176	187	185	194
1978	206	211	212	210	193	201	202	210
1979	237	239	242	237	224	229	238	240
1980	267	266	269	265	247	256	271	269
1981	320	318	314	322	300	300	305	321
1982	368	363	356	372	341	340	358	365
1983	407	404	390	414	388	374	392	410
1984	442	450	413	446	424	408	430	442

Note: Derived from tables 3 and 4; the weight for labour costs 33.3% and the weighted labour cost is added to the weighted index of material cost as given in table 3.

Year-wise actual outlays on major and medium projects during the period 1964 to 1984 for 9 major states are given in Table 6. The series for each state is deflated by the indices for that state to get the magnitude of real investments. The latter are set out in Table 7. It needs reiterating that this procedure in effect captures only the effect of differential wage movements, it doesn't allow for differential movements of material prices and more importantly the differences in input components and nature of projects. The inter-state differences in cost trends are therefore likely to be considerably more than suggested by Table 7.

Table 6: Capital outlays on major and medium projects across states for the period 1964 to 1984, current prices

(Rs.in lakhs)

Year	Andhra Pradesh	Gujarat	Karnataka	Madhya Pradesh	Maharastra	Orissa	Punjab Haryana	Tamil Nadu	Uttar Pradesh
1964	2443	910	1042	1399	1476	885	1106	1088	1965
1965	3355	1033	1066	1714	1988	886	924	1074	2452
1966	2831	1058	1149	1323	1706	846	523	836	2155
1967	2022	1669	1579	1246	2226	1059	1356	725	1758
1968	2453	2378	1914	1410	2384	1279	1194	758	3104
1969	2509	2001	2506	1516	3137	957	1432	816	3337
1970	2640	2112	3124	1810	3384	1317	1615	915	3230
1971	2978	2667	3398	2353	3831	398	2568	1007	4516
1972	2383	3759	3093	2976	5166	996	4052	1069	6437
1973	2253	3855	3210	3605	6721	1777	4101	1139	8945
1974	3586	4342	3960	5109	6041	2602	2945	691	9613
1975	6011	4456	4552	5434	7901	2897	3230	1244	8151
1976	8117	5213	6106	9274	11343	3392	6261	1931	11794
1977	11683	7936	7688	9579	13683	4974	7009	1342	12771
1978	14040	7302	10128	11130	14484	6201	6164	1562	15228
1979	13877	9307	11522	13177	17052	8253	7751	1643	19970
1980	13503	11150	11091	14188	18573	11090	9326	1666	21222
1981	13689	12656	11638	14305	42881	11769	11335	2028	42690
1982	14654	16135	12608	16566	25513	12608	12344	3636	21695
1983	15358	18299	13783	19602	33445	12723	9088	4200	21945
1984	20318	18663	15697	23538	32196	14523	10747	4039	22299

Source: Unpublished data from Planning Commission, Government of India, New Delhi.

Table 7: Real investments in major and medium projects across states for the period 1964 to 1984 at 1970-71 prices

(Rs. in lakhs)

Year	Andhra Pradesh	Gujarat	Karnataka	Madhya Pradesh	Maharastra	Orissa	Punjab Haryana	Tamil Nadu	Uttar Pradesh
1964	3560	1339	1420	2061	2150	1169	1740	1536	3076
1965	4550	1415	1440	2328	2744	1129	1290	1438	3418
1966	3474	1322	1447	1616	2085	972	687	1013	2712
1967	2285	1941	1864	2130	2545	1242	1585	823	2037
1968	2719	2702	2226	1575	2659	2141	1292	829	3522
1969	2627	2175	4000	1611	3268	1527	1453	858	3615
1970	2640	2112	3124	1810	3384	1317	1615	915	3230
1971	2878	2516	3243	2257	3674	382	2466	960	4318
1972	1868	3056	2454	2330	4213	799	3259	831	5038
1973	1358	3059	2414	2683	5347	1383	3215	865	6617
1974	2021	2697	2379	2964	3762	1569	1779	389	5608
1975	3388	2489	2506	2915	4708	1601	1840	664	4276
1976	4411	2687	3144	4805	6645	1727	3424	1055	6056
1977	6114	4070	3796	4880	7785	2531	3754	724	6589
1978	6800	3461	4772	5303	7505	2946	3073	773	7253
1979	5861	3894	4761	5565	7627	3429	3385	690	8306
1980	5057	4192	4117	5355	7505	4178	3638	615	7899
1981	3723	3955	3703	4445	14289	3697	3781	644	13299
1982	3603	4445	3542	4459	7476	3493	3633	1015	5945
1983	3476	4529	3535	4734	8618	3132	2431	1072	5353
1984	4599	4147	3803	5283	7587	3290	2635	940	5040

Source: computed.

Estimates based on Planning Commission Data

In order to estimate unit costs, we need to relate the volume of real investments to the increments in area irrigated.

The Planning Commission compiles, on the basis of information furnished by the Irrigation departments of various states, the extent of the additional irrigation potential created by major and medium projects and the extent to which the potential is actually used (both are in terms of gross irrigated area). These figures are however available only for each plan period [Table 8].

Table 8: Details of Potential and Utilisation of Irrigation from Major and Medium projects during plan periods.

State	Potential created ('000 hectares)					Potential Utilised ('000 hectares)				
	1966-68	69-73	74-77	78-79	80-84	1966-68	69-73	74-77	78-79	80-84
Andhra Pradesh	78	190	213	154	331	350	217	175	149	171
Gujarat	99	182	302	150	234	120	89	100	28	186
Karnataka	132	42	161	66	195	57	79	235	99	24
Maharashtra	119	266	286	112	465	32	77	163	35	217
Madhya Pradesh	187	45	264	186	360	115	111	210	37	262
Uttar Pradesh	142	497	1368	557	784	180	343	535	542	572
Punjab	60	184	109	56	153	74	196	108	56	140
Tamilnadu	65	30	50	1	65	180	343	535	542	572

Source: Planning Commission, Government of India, New Delhi.

The cost per hectare of potential created and utilised for each plan is estimated on the assumption that additions to potential and utilisation in a particular plan period are the result of investments undertaken during that plan [See Table 9]. It can be seen that there is haphazard movement in the cost per ha of both potential created and utilised in almost all the states. This erratic pattern may be due to the following limitations in our data and assumptions:

Table 9 : Cost per hectare at 1970-1 prices of potential/utilisation from Major and Medium projects

State	Cost per hectare of Potential created (Rs.)					Cost per hectare of potential utilised (Rs.)				
	1966-68	1969-73	1974-77	1978-79	1980-84	1966-68	1969-73	1974-771	978-791	980-84
Andhra Pradesh	10799	6299	7684	8180	6316	2407	5515	9352	8454	12225
Gujarat	6092	7455	3988	4920	8867	5026	15244	12044	26355	11155
Karnataka	4218	36471	7440	14444	9311	9768	19390	5097	9629	75648
Maharashtra	6150	7851	8076	13518	9369	22869	27123	14171	43259	20076
Madhyapradesh	2777	15185	5844	5852	6550	4515	10210	7485	29416	9000
Uttarpradesh	5839	4930	1649	2806	4458	4606	7143	4216	2884	6111
Punjab	4576	2546	3451	4519	4567	3710	2390	3483	4519	4991
Tamilnadu	4083	15273	5680	145641	6603	3686	10909	6927	29128	7153

Source: Estimates based on Table 5 and 8.

First of all there is divergence between actual irrigated area reported by revenue agencies and the planning commission's estimates of potential/utilisation. For the country as a whole the utilisation figures compiled by the Planning commission are higher to the extent of about 2-3 million hectares than the figures of actual irrigated area as reported by the Directorate of Economics and Statistics. The problem is found to be important especially in Uttar Pradesh, West Bengal and Orissa.

Second, there are also several limitations to the estimates of both potential and utilisation: "Part of the problem lies in ambiguities in the definition of the guidelines; and the lax systems of monitoring and verification of reports. Also there are defects in the assumptions regarding the likely water availability, the water requirements of crops and the extent of losses in conveyance and application of water" (Vaidyanathan,1987).

Third, since it takes several years to complete major and medium projects and starts and completions of projects are not evenly distributed over the years, it is not correct to consider the potential created and utilised in a plan period as the function of investment during the same period.

Fourth, not only do we need to allow for lags but also for variations in the extent of this lag over time. The tendency to spread limited resources available for irrigation thinly over many projects tend to increase the time taken to complete all projects. The magnitude and impact of this phenomenon is however unlikely to be uniform across states or over time.

Estimate based on Agricultural Statistics

Given these problems in the estimation based on plan data on potential/utilisation, we have tried an alternative estimate based on data on the actual irrigated area as reported in the landuse and crop area statistics. These data only give source wise estimates of net irrigated area. In order to estimate gross area irrigated by major and medium projects, we have assumed tha (a) net irrigated area under canals to be roughly equal to the net area irrigated under major and medium projects; and (b) the ratio of gross to net irrigated area under canals is the same as the ratio for irrigated area from all sources. (These assumptions are obviously crude but refinements should be possible if relevant data become available). The annual series on the gross area served by major and medium works so derived is the basis for estimating the increment in gross area irrigated by these projects from year to year [Table 10].

As already noted, the investment in irrigation adds to irrigated area with a lag effect. Since the magnitude of the lag is not known we have fitted the following function with varying assumptions as to the lag: $Y^t = a + bI_n$ - (1)

Where Y^t = cumulative additions to gross area irrigated by canals from year 1 to year t

I_n= Cumulative investment upto year `n', which is given values ranging from t to t-5. Based on R^2 values corrected for auto correlation, the value of n which gives the best fit indicates the average lag in each state [Table 11].

Table 10 : Estimated gross irrigated area under canal in different states (1963-84)

('000 ha.)

Year	Andhra Pradesh	Gujarat	Karnataka	Madhya Pradesh	Maharashtra	Punjab Haryana	Uttar Pradesh
1963	1568	103	296	502	285	2911	2409
1964	1554	142	393	555	290	3022	2499
1965	1455	144	383	472	287	3167	2590
1966	1555	174	437	480	283	3334	2738
1967	1679	320	478	568	324	3239	2323
1968	1855	318	500	651	313	3173	2711
1969	1938	369	453	688	354	3246	2812
1970	2004	257	501	731	337	3077	2898
1971	1916	248	532	797	365	3431	2854
1972	1723	218	505	810	297	3524	2872
1973	1895	275	535	749	359	3498	2885
1974	2099	257	569	706	407	3614	3096
1975	2146	321	610	841	431	3798	3182
1976	1941	344	621	900	453	3773	3359
1977	2136	370	686	1011	495	3866	3495
1978	2159	380	697	1108	504	4068	3709
1979	2158	394	673	952	511	4154	3478
1980	2116	429	672	1086	538	4223	3814
1981	2251	493	708	1127	564	4122	3908
1982	2231	503	732	1196	579	4411	4092
1983	2391	481	806	1245	503	4500	4096
1984	2300	473	860	1315	539	4365	3990

Source: 1. Estimates based on data on NIA canal obtained from various volumes of Agricultural statistics, department of Economics and Statistics, Government of India. The equation (GIA/NIA)* NIA canal) is used for such estimation.

Table 11: Estimated Values of best fitting regression

State	Identified lag period	R^2	'B' Co-efficient*	D.W.	Cost/ha Rs.
Andhra Pradesh	2 year	0.81	0.0000977	1.67	10,235
Gujarat	2 year	0.82	0.0000459	1.85	21,786
Karnataka	2 year	0.95	0.0000602	1.65	16,611
Maharashtra	3 year	0.89	0.0000241	1.71	41,494
Madhya Pradesh	4 year	0.93	0.0000949	1.72	10,537
Uttar Pradesh	1 year	0.95	0.0001504	2.09	6,649
Punjab - Haryana	3 year	0.96	0.0002816	2.03	3,477
Tamilnadu	None of the five equations significant.				

* Significant at 1% level

Note: 1. using the equation $y_t = a + b\, I_n$ with n taking values from t to t-5

The results given in Table 11, show that a) in seven out of eight states the average lag between investment and increase in irrigated area lies between 1 and 4 years; (b)the real investment per hectare of gross area irrigated by these projects varies widely across states - from Rs.3477 in Punjab-Haryana to Rs.41,494 in Maharashtra. It can be noticed that in a number of states (viz. Andhrapradesh, Madhyapradesh, Uttarpradesh, Punjab, Haryana) the per hectare cost is significantly lower than the average of all states. In states like Gujarat, Karnataka and Maharashtra the cost per ha is significantly higher.

Alternatively, we regressed the increment in GIA canal in each year (estimated as above) as the function of incremental investment in earlier years under different assumptions regarding the lag.

$$Y_t = a + bI_n \qquad - (2)$$

Where

Y_t = Increment to GIA canal in year t

In = Investment in year 'n', 'n' being given values ranging from t to t-5.

The regression results however do not show any consistent or strong relation between investment and increase in irrigated area with the range of values assumed for 'n'. This suggests that additions to irrigated area under major and medium projects seems to be affected not by investment made in a particular year alone, but by cumulative investment made over a period.

Changes in time lag and average cost per hectare

A major distortion in the investment on major and medium projects came into being from around the fifth plan when a sizeable number of new projects were taken up in most of the states. This position continued in the successive plans also resulting in thin spreading of limited resources over many projects (GOI, 1989:11). In order to understand the effect of this factor on time lag and per unit cost across different states, we have divided the period into two:

i) 1964-65 to 1973-74

ii) 1974-75 to 1984-85

For each period we estimated (using Equ.1) the investment/ha and gestation lag separately for the two periods. The regression results are given in [Table 12]. It is seen that (a) in 4 out of 7 states, for which we could make estimates, time lag between investment and increase in irrigated area is longer in the second period (starting from V plan) than the earlier period; and (b) the per unit cost (at constant price) of developing irrigation under major and medium projects in second period is everywhere much higher when compared to the first period. This suggests that the spreading of limited available resources more thinly over several projects since fifth plan has resulted in larger time and cost over runs in many states.

Table 12 : Estimated co-efficients for the periods 1964-73 and 1974-84

State	1964-73						1974-84					
	Lag years	R^2	Value of 'b'	D.W.	Significance	cost/ha (Rs.)	Lag years	R^2	Value of 'b'	D. W.	Significance	cost/ha (Rs.)
Andhra Pradesh	1	0.53	0.0001974	1.89	0.03	5066	3	0.73	0.000090	1.99	0.01	11,110
Gujarat	3	0.43	-0.00006	1.99	0.01	(?)	2	0.93	0.000057	1.62	0.00	17,446
Karnataka	1	0.66	0.000052	1.71	0.01	19069	5	0.97	0.000025	2.62	0.00	38,536
Madhya Pradesh	2	0.77	0.0002478	1.73	0.01	4036	5	0.98	0.0001424	2.06	0.00	7,022
Maharashtra	1	0.35	0.000020	2.42	0.09	49383	2	0.45	0.000010	1.50	0.05	93,284
Punjab-Haryana	4	0.69	0.0003379	2.73	0.04	2959	1	0.89	0.0002368	2.25	0.00	4,223
Uttar Pradesh	3	0.51	0.0002911	2.21	0.02	3435	1	0.89	0.0001276	2.37	0.00	7,837

Note: (?) The negative `b'value for Gujarat is due to significant reduction in GIA during 1970-77

Cost and productivity of irrigation

The relationship between cost and productivity of irrigation is important for the economic viability of the projects. Based on the estimates of overall productivity of irrigation, it is seen that in states like Gujarat, Karnataka and Maharastra, where cost of developing irrigation is higher, the productivity impact of irrigation is also found to be higher (Table 13) whereas in Andhra Pradesh, Punjab and Haryana though development cost of irrigation is low, productivity impact of irrigation is seen to be high. In other states like Madhya Pradesh and Uttar Pradesh both cost and productivity are found to be low. However these inferences should be treated with great caution: the productivity impact of different classes of irrigation works is not the same and since their relative importance also varies, valid comparisons require estimates of productivity impact only for major and medium projects. Unfortunately such data are not available at present.

Table 13 : Impact of Irrigation (difference in output per hectare of irrigated and unirrigated area) in different states (Average for the period 1979-80 to 83-84)

State	Output per hectare of Gross area (Rs.)		Difference (Rs.)
	Irrigated	Unirrigated	
Gujarat	6353	2714	3639
Karnataka	6825	2297	4528
Maharashtra	7415	1603	5812
Andhra Pradesh	6689	2282	4407
Punjab	5998	2628	3370
Haryana	4500	1293	3107
Madhyapradesh	3391	1856	1735
Uttarpradesh	3875	2320	1555

Source: Vaidyanathan and Rajagopal (1992).

Summary and Conclusions

Study of per unit cost of developing irrigation under major and medium projects and trends in it across different states assumes importance in the context of huge public investments made on these projects. However, so far no rigorous attempt has been made either by policy makers or by academic researchers on this. Construction of state indices on cost taking into account the state specific changes in prices of construction materials and labour is difficult as published data on most of these items are not available. The problem is further compounded as year wise data on additional area brought under irrigation under this category of projects are not available. This paper has attempted to construct state level cost indices on the basis of the all India Cost Index of Central Water Commission as adjusted for variations in labour cost in different states. These indices have been used to deflate the annual capital outlays on major and medium projects in each state to get a series on real investment. Further refinements are clearly needed and possible.

On the basis of the plan data on irrigation potential created and utilised, no clear trends were seen in the per ha cost in almost all states. As an alternative, we have taken NIA canals as reported in land use and crop area statistics adjusted for irrigation intensity. On this basis, the lag between investment and irrigated area is seen to vary across states ranging from 1 to 4 years. The average cost/ha for the period from 1964 to 1984, ranges from Rs3,477 to Rs.41,494. Separate estimations for the periods 1964-74 and 1974-84 reveal that generally there was an increase in both time lag and cost per ha from the fifth plan compared to the earlier period. Here again there are variations across different states.

This exercise is admittedly a crude and unsatisfactory first step towards estimation of state/region specific investment cost indices and cost per hectare of additional irrigation. The necessary refinements include (a) a state-wise analysis of the input composition of a representative sample of major and medium projects to get at the weighting diagram appropriate to each state; (b) compilation of state-wise indices of unit prices of various inputs including local construction material in different categories of labour employed in constructing irrigation works; and (c) improvement in the estimate of gross area irrigated by major and medium works. It is arguable that costs should be related not only to the area irrigated but also to the volume of water delivered and available for use of crops. This would however call for more information (on water deliveries, irrigation and application efficiencies) than is available. A long term programme to improve these basic data for meaningful estimate of costs is imperative.

References

1. Government of India (1989) : **Report of the Working Group on Major and Medium Projects for the Eighth Plan (1990-95)**, New Delhi.

2. Government of India (1990) : **Cost bulletin on river valley projects**, Central Water Commission, New Delhi.

3. Jose, A.V. (1974) : 'Trends in Real Wage rates of agricultural labourers', **Economic and Political Weekly**, Vol.IX, No.13.

4. Jose, A.V.(1988) : **Agricultural Wages in India**, ARTEP - ILO, New Delhi.

5. Vaidyanathan, A. (1987) : **Irrigation and Agricultural Growth in India**, presidential address, 47th conference of Indian Society of Agricultural Economics, Bombay.

6. Vaidyanathan, A.and Rajagopal A.(1992) : **Growth and Fluctuations in the Productivity of Irrigated and Unirrigated Crops - A State-Wise Analysis** (mimeo), Madras Institute of Development Studies (MIDS), Madras.

7. Vaidyanathan et al., (1994): 'Impact of Irrigation on Productivity of Land' in **Journal of Indian School of Political Economy**, Oct-Dec.1994.