1.30 to 3 PM

Chairperson – Madam Susan Buck

9B

Second Annual Conference of International Association for the study of Common Property, (September 26-29, 1991, University of Manitoba, Winnipeg, Canada).

"Myopic View, Vested Interest, Underdevelopment: Case of Public Management of Ground Water Resources in Bihar"

by

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The study area, i.e. the state of Bihar, lies between 21° 58' and 27°31' north latitudes and 83°20' and 88°17' east longitudes. It covers an area of 174 thousand sq. kilometres and contains a population of 86 millions. The state is very rich in ground water resources. A major part of the state covering over 54 per cent of its geographical area and containing 75 per cent of its population and 77 per cent of the cultivated area, lies in the central Ganga plain which forms one of the best groundwater reservoirs in the world. The ultimate irrigation potential through groundwater in the state has been estimated at 7.2 million hectares which is almost sufficient to irrigate one crop over its entire net sown area. The groundwater is of excellent quality and is available at shallow depths below the ground level, requiring very low lifts. If properly developed and utilised, this invaluable resource can go a long way towards bringing the agriculture of the state from the morass of backwardness and vagaries of rains. There has been significant development of ground water in the state over the plan period, especially since

the mid-sixties. The area irrigated through ground water has expanded from 0.26 million hectares in 1950-51 to 1.79 million hectares in 1988-89. The percentage share of groundwater in the total irrigated area has increased from 12.65 to 42.09 over the same period. Besides promoting the growth of open wells and private tubewells by providing subsidies, easy credit and infrastructural facilities in terms of rural electrification and provision of cheap power, the Government has also played a direct role in this regard by installing and operating its own tubewells (i.e. state tubewells) for providing irrigation to the farmers of the state. In fact, Bihar has been one of the pioneering states (next only to U.P.) in India in this field and presently it has about 5000 state tubewells which come to about 9 percent of such tubewells in the country. In Bihar, irrigation through public tubewells has preceded that through private tubewells and accounted for over 70 per cent of the area irrigated through tubewells (public + private) in the state till the beginning of the sixties. Over time , however, these state tubewells have been victims of gross mismanagement on account of myopic administration, inefficiency and vested interest with the result that while there has been a rise in their number, there has been a drastic decline in their irrigated area. And, they depict an unprecedented gap (of about 90%) between their created potential and utilisation. As a result, these public tubewells which represent a total capital investment of about Rs.4000 millions at present (1990-91) prices are proving a big drain not only to the public exchequer but to the state economy as well.

I

Study Area:

The study area, i.e. the state of Bihar, lies between 21°58' and 27°31' north latitudes and 83°20' and 88°17' east longitudes. It bounded on the north by the Himalayan Kingdom of Nepal, the state of Orissa on the south, the states of Uttar Pradesh and Madhya Pradesh on the west, and the state of West Bengal on the east. The state, covers an area of 174 thousand sq. kilometres and contains a population of 86 millions (1991 census) which amount to 5.2 and 10.23 per cent of the total area and population of India respectively. It is one of the eastern states of India and is densely populated, the average density of population per sq. kilometre being 497 as compared to 267 for India. The economy is predominantly agricultural with over 86 per cent of the total workers being engaged in agriculture as compared to 76 per cent for India. Though the entire state constitutes a humid zone with annual normal rainfall of 1272 mm which is generally sufficient for kharif crops, the occurrence of the rains is extremely erratic and seasonal in character. The monsoon often starts late and recedes early. Then, there are significant time gaps between rains causing droughts and severe damage to crops. The consequences become very serious in a state like Bihar where paddy is the most important crop covering over 66 per cent of the net sown area. This crop is highly sensitive to droughts. The entire crop may fail for want of one or two critical waterings. The most pertinent point in case is the severe drought of 1966-67 when the production of food grains went down by 51 per cent, i.e. from 7.4 million tonnes

300
22
600
600
660

period, the production of rice in the state fell by 70 per cent, i.e. from 4.84 to 1.45 million tonnes. Here in lies the significance of irrigation to protect the crops against the droughts and to impart an element of dynamism to it by facilitating multiple cropping and enhanced use of modern inputs. And yet, around 60 per cent of the cropped area in the state continues to be rain-fed. Thus, the agriculture of the state is caught in the morass of backwardness with very low yields. The per hectare yield of foodgrains during 1989-90 in the state amounted to 1257 kg. as compared to 3417 kg in Punjab (the most prosperous state in India). On account of this and nigh density of population, there is widespread poverty. Over 40 per cent of its population is below the line of poverty as compared to 29 per cent for India. On the other hand, the state has abundant groundwater resources which, if properly harnessed, can go a long way towards improving the lot of agriculture and the people in general.

40% People poor

II

Ground Water Resources and Development: A major portion of the state, covering over 54 per cent of its geographical area and containing 75 per cent of the population and 77 per cent of the total sown area lies in the central Ganga Plains which constitute one of the richest groundwater reservoirs in the world.[1] The area has been formed out of thick alluvial deposits which at places extend up to 2500 metres below the ground level.[2] A good part (19 to 42%) of this alluvial thickness consists of porous and granural materials, such as sand, gravel and boulders, which are the main repository of ground water and are capable of yielding good water supplies.[3] In most cases, a bed of sand forms the main

source of water supply.[4] The thickness of major aquifers varies from less than 10 to as high as 60 metres. As there are extensive beds of sand in the subsoil of almost all places in the plains, they contain practically inexhaustible stores of water for irrigation. Thus, Bihar plains form only 2.86 per cent of the country's geographical area but contain 5.26 per cent of its annually utilisable groundwater resources. Similarly, the state accounts for 5.29 per cent of the geographical area but 6.83 per cent of the annually utilisable groundwater resources for irrigation. In terms of irrigation potential, the ultimate irrigation potential through groundwater in the state has been assessed at 7.2 million hectares which is almost sufficient to raise one crop over its entire cultivated (net) area.

Groundwater occurs in this alluvial fill both under water-table and confined conditions, often with artesian pressure. It has also been indicated that ground water exists under full artesian conditions in very deep aquifers (1500 metres below the ground level) over a large area in North Bihar. These aquifers are recharged from the Bhabar zone. Water supplies developed from deep aquifer systems will be a net increment to the total water supply.[5] At places, the impervious clay layers overlying aquifers are highly resistent to weathering and act as suitable roofs for the construction of cavity tubewells which are very cheap. This is the reason why most of the private tubewells in the state are without strainers. Both aquifers and water level rest at shallow depths. An analysis of the depth of aquifers in the Gangetic plains in the state suggests that in most places, suitable aquifers with sufficient yield to sustain small private tubewells exist at

depths of less than 60 metres below the ground level.[6] In fact, in the majority of places, exploitable aquifers exist at depths of less than 30 metres below the ground level. This is evident from the depths of private tubewells which are mostly less than 100 feet deep. The depth of the water level below the ground level amounts to less than 2 metres during the post-monsoon months and 2-5 metres during the pre-monsoon months in North Bihar. The same in South Bihar plains amounts to 2-5 and 5-10 metres during post and pre-monsoon months respectively. The average annual fluctuation in water level amounts to 1-3 and 3-5 metres in North and South Bihar plains respectively.

At the beginning of planning in the country, the full extent of groundwater potential was not known. The availability of pumping equipments and the energy needed to operate them were also limited. On the other hand, the nation had the history of suffessful big canal systems served by river diversion works for over a century. Accordingly, our planners decided to go in for large surface works in the field of irrigation. Thus, irrigation planning in India, including that in Bihar, came to be characterized by an emphasis on large surface irrigation projects which often have flood control as a joint objective[7]. A sum of Rs.27.12 billion has been spent on major/medium irrigation schemes in Bihar over the plan period till 1989-90 which comes to 79.49 per cent of the total outlay on irrigation. Accordingly, the percentage share of government canals in the total irrigated area in the state has gone up from 19.68 in 1950-51 to 35.35 in 1988-89. It was as high as 40.87 per cent in 1970-71. Surface irrigation projects are, however, mostly rainfed and are often affected by the vagaries of

rains. They often fail during periods of prolonged rain failures when irrigation is needed most. The most pertinent case in point is the failure of the canal water to reach the tail-ends of the command in the Sone canal system during the 1979-80 drought. They are also beset with major distribution problem and exhibit large gaps between their potential and utilisation. Thus, the actual utilisation as percentage to the created potential of major and medium irrigation schemes in Bihar during 1984-85 stood at 75.58 only. They also involve large gestation gaps and huge costs in terms of water logging, salinity and gross wastage of water through seepage

Table - I

Gross Irrigated Area in Bihar

in '000 hectares

Year	Canal	Tank	Tubewell	Open Well	Other Sources	Total
1950-51	663	251	N.A.	259	876	2048
1956-57	614	241	10	212	708	1785
1960-61	651	323	55	206	826	2062
1967-68	958	194	295	279	736	2461
1970-71	1119	181	516	222	696	2733
1976-77	1278	141	1214	249	669	3551
1980-81	1397	118	1001	243	873	3632
1985-86	1373	141	1240	132	934	3819
1988-89	1500	114	1670	116	843	4243

Source: Directorate of Statistics and Evaluation, Bihar, Patna.

and percolation. On the other hand, ground water provides an assured and dependable source of irrigation free from the vagaries of rains. It has very little gestation gaps and helps in controlling water logging and salinisation in the canal commands by lowering the groundwater table and vertically draining the soil.[8] This is of immense value in a region like North Bihar which contains a huge amount of water-logged/locked land. In the Eastern Kosi Canal Command alone, such lands have been estimated at 1.82 lakh hectares which come to 36.55 per cent of the gross command area.

On account of these factors, there has been growing emphasis on ground water development in the state after the third plan. Thus, as is shown in table I, the share of ground water in the gross irrigated area in the state has gone up from 12.68 per cent in 1960-61 to 42.09 per cent in 1988-89. The state experienced an unprecedented drought during 1966-67 which exposed the weakness of surface irrigation works and their utter vulnerability to droughts. The resultant food crisis gave added urgency to tubewell investment programmes and schemes of energisation of open wells which are relatively immune from the vagaries of rainfall. There is less fluctuation in groundwater supplies than in precipitation because of the buffering effect of underground storage.[9] These were expected to give substantial and immediate returns because of their short gestation period. These programmes aimed mostly to encourage private investment in small diametre wells and tubewells, powered where possible, by electricity. The unprecedented rise in the prices of foodgrains provided the farmers both the means as well as the incentive for large scale investments in tubewells and open wells. The government also paid high subsidies on them. These were also necessitated by the

increased application of science and technology to agriculture. The mid sixties marked the advent of Green Revolution in India which act only pressed the need for improved irrigation but also provided the requisite incentive and resources by enhancing the return on agriculture.[10] The use of the new technology in agriculture requires adequate and controlled supply of water. Ground water provides these. The stepping up of the programme of rural electrification and the provision of cheap credit facilities have been additional contributory factors. Finally, there was expansion and technical progress in the domestic pump industry which brought cheaper and lower capacity equipments on the market, enabling more and more smaller farmers to capture the benefits of private irrigation.[11] All these have led to rapid development of ground water extraction structures, especially private tubewells in the state. As contained in table-2, the number of open wells has risen from 225 thousand in 1968-69 to 316 thousand in 1986-87, i.e. by 40.44 per cent. The number of public tubewells rose from 1468 to 4953, i.e. by 237 per cent. Over the same period, the number of private tube wells rose from 12 to 409 thousand, i.e. by 33 times.

Table - 2

Development of Groundwater Extraction Structures in Bihar.

(No. in '000)

Year	Open Wells.	Public Tube wells.	Private Tube wells		
			Electric	Diesel	Total
1950-51	105	0.180	NA	NA	2.0
1960-61	140	0.978	NA	NA	3.4
1968-69	225	1.468	NA	NA	12.0
1973-74	265	2.677	NA	NA	73.0
1976-77	282	3.511	89.45	100.44	189.89
1980-81	345	4.606	50.93	153.65	204.58
1985-86	337	4.953	47.20	319.90	367.10
1986-87	316	4.953	43.68	363.32	408.90

Source: Central Groundwater Board, New Delhi for open wells and Private Tubewells till 1973-74. Minor Irrigation Department, Government of Bihar, Patna, for Public Tubewells. Directorate of Agricultural Census, Bihar, Patna for 1976-77, 1980-81 and 1985-86. Minor Irrigation Census, Directorate of Statistics and Evaluation, Bihar, Patna for 1986-87.

III

Public Tube Wells: Among the two major means of groundwater development open wells and tubewells, the former is losing its popularity in the state, particularly in the plains, on account of their high costs, failures during droughts, and generally low yield of water to sustain modern means of water lifting like pumpsets. Thus, tubewells remain the only means of large scale development of groundwater in the state. The tubewells are of two broad types:

state (deep) and private (shallow). While the state tube-wells tap deep seated aquifers (more than 100 metres below the ground level), are large in size and are fitted with high powered water lifting pumps, say of 22.5 H.P. capacity; the private tubewells tap shallow aquifers (less than 30 to 60 metres below the ground level), are small in size and are fitted with small powered water lifting pumps, typically of 3 to 5 H.P. capacity. The average discharge of a deep tube-well in the state comes to 150 cubic metre per hour, while that of a private tubewell comes to 30 to 40 cubic metre per hour. The average cost of a state (deep) tubewell in the region at 1990-91 prices will come around Rs.800 thousand while that of a private electric tubewell will come around Rs.20 thousand. The cost goes up by Rs.2 thousand in the case of a diesel tubewell. The average irrigation potential (command) of a state tubewell is kept at 100 hectares while that of a private tubewell comes to 10 hectares. Thus, deep or large tubewells are not suited for the majority of farmers in Bihar who are mostly poor and their land holdings are very small (the average being 0.87 Hect.) and fragmented. About 88 per cent of the holdings in the State are marginal/small (of less than 2 hectare) accounting for above 47 per cent of the total area. Holdings above 10 hectares number only 0.45 per cent of the total number of holdings and account for only 7.70 per cent of the area. Thus, the farmers in the region can neighter arford to install such costly tubewells nor make full use of them, since their holdings are not only small but also divided and fragmented into several pieces. Of course, the state can install and administer such large tubewells in its own sector for the collective use of the farmers. A good number (60,000) of such tubewells have

been installed in the state sector in several states, including Bihar. In fact, Bihar has been one of the pioneers in this field. Thus still 1950-51 U.P. and Bihar together accounted for 100 per cent of the state tubewells in the country. Even now, the state accounts for about nine per cent of public tubewells in India.

Myopic Development: The development of public tubewells in the state, however, has not been systematic and well planned. On the country, as is clear from table-3, it has been sporadic, mostly as a response to drought and other crisis situations in the state. In Bihar, the history of tubewell irrigation began with public tubewells when in 1937 the idea of mechanical lift irrigation was tried in the form of some inexpensive tubewells in some parts of central Bihar. The scheme was undertaken as an experimental measure in 1939-40 and it was formally opened on August 1, 1940. The scheme was, however, not pursued to any appreciable extent till 1943 when food shortages started threatening the country. Some 180 such tubewells were installed in the state before the beginning of the Five Years Plans in 1951-52. The country and the state faced a series of droughts and food shortages during the beginning of the fifties. As a response to that there took place rapid expansion of public tubewells which rose from 180 in 1950-51 to 947 in 1955-56. After that the expansion process slowed down till the end of the Third Plan in 1965-66. There was again an unprecedented drought and food crisis in the state during 1966-67. The drought compelled the government to put emphasis on the development of ground water resources, including that through public tubewells. Consequently, there took place a rapid rise

Sporadic Development

in the number of these tubewells which rose from 1025 in 1965-66 to 4941 in 1984-85. After that the process has again slowed down. When the problem is probed deeply, it clearly emerges that the development of public tubewells has been myopic It has not taken into account the development, taking outside in the economy. Their rapid development took place after the Third Plan onward, i.e. after 1965-66. This period also saw the phenomenal development of private tubewells (table-2). Private tubewells now account for over 98 per cent of the total number of irrigation tubewells (private+Public) and cover 96.50 per cent of the area irrigated through them, thus reducing the historic relevance of public tubewells as a means of irrigation. Again, the public tubewells in the state are electrically operated. Hence timely and adequate supply of electricity is of crucial importance for their proper functioning. The development and supply of electricity in the state, however, has not kept pace with the development of tubewells. The electricity supply to irrigation became quite erratic and inddequate by the end of the sixties. Thus, the average consumption of irrigation electric connections in Bihar came down from 4990 kwh in 1961 to 831 kwh in 1973. Their average daily working hours came down from 3.59 to 0.79 over the same period. The planners of public tubewells, however, appear to have overlooked this basic constraint, and kept on the process of expansion. As a result most of these tubewells came to be installed at a time when the overall electricity supply situation in the state had already become quite dismal.

Table - 3

Development of Irrigation through State Tubewells in Bihar

Year	No. of State Tube-wells(Energised)	Total Irrigated Area (in'000 hect.)	Average Irrigated Area per T.W. (in hect.)
1950-51	180	16.19	89.94
1955-56	947	34.80	36.75
1960-61	978	77.70	79.45
1965-66	1025	89.44	87.26
1968-69	1468	140.43	95.66
1973-74	2677	129.60	48.41
1976-77	3511	184.60	52.57
1980-81	4606	78.40	17.02
1984-85	4941	32.70	6.62
1985-86	4953	27.00	5.45
1986-87	4953	41.40	8.36
1987-88	4957	40.94	8.26
1988-89	4960	58.59	11.81

Source: From 1951 to 1969 - Irrigation Department, Bihar, from 1974 to 1986 - Bihar Water Development Corporation, Patna. From 1987 to 1989 - Bihar Tubewell Project, M.I. Department, Patna.

Table - 4

Physical Progress of Public Tubewells in Bihar

As on end	Number of State Tubewells			
	Drilled	Energised	Provided with Channels	Working
1.	2.	3.	4.	5.
1973-74	2999	2o77	1246	2491
1974-75	2999	2741	1915	2491
1975-76	3440	2991	2386	2882
1976-77	4284	3511	2811	3124
1977-78	4690	3744	2971	3260
1978-79	4980	3968	3087	3365
1979-80	5143	4419	3167	3837
1980-81	5221	4606	3331	3469
1981-82	5311	4652	3351	3364
1982-83	5311	4853	3411	3452

1.	2.	3.	4.	5.
1983-84	5311	4930	3442	2812
1984-85	5311	4941	3417	2167
1985-86	5311	4953	3493	1818
1986-87	5316	4953	3493	1627
1987-88	5371	4957	3493	2337
1988-89	5394	4960	NA	2671

Source: Bihar Water Development Corporation, Patna, and M.I. Dept., Bihar, Tubewell Project, Patna.

Table-5

Irrigation Electric Connections in Bihar

Year (ending March).	No. of connections.	Connected Load (MW).	Consump. (Million kwh)	Average consumption (kwh)	Average working hours.
1958	2251	9.84	13.4	5953	3.73
1960	3416	13.52	18.3	5357	3.71
1961	3916	14.92	19.54	4990	3.59
1965	6386	24.78	22.45	3515	2.48
1966	10556	40.65	29.10	2757	1.96
1967	24568	79.29	48.82	1987	1.69
1970	56712	167.31	70.56	1244	1.16
1971	65336	190.60	67.62	1035	0.97
1973	87115	252.29	72.35	831	0.79

Source: Bihar State Electricity Board, Patna.

Then, there has been lack of coordination between the tubewell organisation and the state electricity Board which energises these tubewells. As a result, there have been significant gaps between the numbers of tubewells drilled and energised. As shown in table-4, at the end of 1988-89, for instance, while the number of drilled tubewells stood at 5394 that of energised stood at 4960, the remaining being unenergised and hence lying idle. Some of drilled tubewells have not been energised

even after a period of ten years. Again, there is lack of proper coordination between the minor irrigation department of the Government which ultimately owns these tubewells and the tubewell organisation which actually installs and manages them. Very often, the department does not release adequate fund in time for their proper development and working, with the result that there have been big gaps between the number of tubewells energised and that of those provided with channels. Thus, as on end 1987-88, as many as 1464 energised tubewells were without channels which came to about 30 per cent of total energised tubewells. Some of the energised tubewells have not been provided with field channels even after a period of twelve years. For the same reason, i.e. lack of fund, there have been very little expenditures on their repair and maintenance. While there have been rapid increases in the number of these tubewells, there have been rapid declines in expenditures on their maintenance and repair. As shown in table-6, the maintenance and repair expenses have come down from Rs.25.8 million during 1975-76 to Rs.0.20 million during 1985-86. The declining expenditure on maintenance and repairs is another case of myopic administration, since these expenses constitute a small portion of total, annual expenses but are of crucial significance for their working.

These state tubewells, also, suffer from some other major handicaps. Like the canals, they also suffer from distribution problems and their water often fails to reach the tail-ends of their commands. Secondly, in the case of a private tubewell if any part goes out of order, the owner (farmer) loses no time in getting it repaired. On the other hand, in the case of state tubewells,

Table-6

Purpose-wise Distribution of Expenses of Bihar Water Development Corporation, Patna (in Rs.Lakh)

Year	New Works	Repair/Maintenance.	Salary, etc.	Losses
1974-75	378.00	134.37	80.69	N.A.
1975-76	292.45	258.25	100.52	N.A.
1976-77	150.00	260.51	95.76	825.00 Upto 76-77.
1977-78	200.09	270.85	144.54	403.00
1978-79	121.80	280.68	162.97	395.00
1979-80	33.00	245.92	246.73	598.00
1980-81	253.62	210.78	321.05	318.00
1981-82	165.00	38.38	375.69	383.00
1982-83	175.00	08.36	432.73	504.00
1983-84	100.00	40.96	443.18	480.00
1984-85	-	2.01	365.10	500.00
1985-86	-	2.00	569.78	400.28
1986-87	-	N.A	772.05	1181.80

Source: Bihar Water Development Corporation, Patna.

there are often inordinate delays in repairs due to departmental procedures and indifference and indiscipline on the part of tubewell operators. The consequences become serious during periods of keen demand. Thirdly, the construction of field channels through the lands of different owners often leads to feuds and troubles in efficient irrigation of lands. Some times, they remain closed on account of feuds among farmers as to who should benefit first. These state tubewells are invariably powered throggh electricity whose supply is extremely erratic in Bihar at present. Then, there are delays in rectification of electrical faults, replacements of burnt transformers and replacement of conductors due to theft. The worst happened in 1985-86 when over 66 per cent of the public tube-

wells became inoperative for complete want of repairs. Sometimes there is vested interest of the public tubewell bureaucracy in the breakdown and non-operation of these tubewells. If these tubewells are out of order, their operators will not be required to remain with them. They will remain, instead, in their homes and do their personal work without any cut in their salary. Again only when the tubewells are out of order, the engineers will get the opportunity to prepare the bill for their repairs and thereby make money. On account of these factors, the state tubewells in the state are highly undependable, inefficient and exhibit large gaps (around 90%) between their potential and utilisation. Thus, the average irrigated area per public tubewell in the state during 1986-89 amounted to 9.48 hectares only as compared to an average command of 100 hectares. This decline in the efficiency of state tubewells has led to retardation rather then development of groundwater in the state. Thus, the total irrigated area through public tubewells in the state have come down from 185 thousand hectares in 1976-77 to 59 thousand hectares in 1988-89.

Public Vs. Private Tubewells: Private (shallow) tubewells, on the other hand, because of their small size suit the holding structure in the region. On account of their low cost, they are also more likely to fall within the means of farmers in the area. Again, on account of their high capital and other fixed costs and gross inefficiency, the economic cost of irrigation through state tubewells appears to be higher than that through private tubewells. Table-7 contains data depicting the cost of irrigation through state and private tubewells in the region. Thus, the actual cost of irrigation through state tubewells in Bihar presently comes to Rs.16.81 thousand per hectare which is much higher than that through private

tubewells: electric Rs.1667 and diesel Rs.2464. The cost differential will still be higher if one accounts for the gestation lag which is not insignificant in the case of state tubewells and which is practically absent in the case of private tubewells. Sometimes, it is argued that state tubewells cater to the needs of small/marginal farmers who can not afford to have their own tubewells. However, it is difficult to conceive the idea of a state tubewell catering exclusively or largely to the needs of small/marginal farmers. There is no practical way to prevent other farmers from taking water from the state tubewells. In fact the reverse is often true. During periods of scarcity, it is the relatively better off and strong farmers, not the weak and small ones, who corner the major portion of the limited but highly subsidised irrigation provided by public tubewells. Again, even if we assume that state tube-wells are exclusively meeting the requirements of small/marginal farmers, it appears to be a very costly proposition at the rate of Rs. 10.8 thousand per hectare. There is a market in irrigation water which is cheaper than the cost of irrigation through state tubewells. The average price of water for a 5 H.P. diesel tubewell comes to Rs.16 per hour and at most 125 tubewell-hours will be needed to irrigate (5 waterings) a hectare of crop. Thus, the cost of irrigation by purchasing water per hectare of the cropped area will come around Rs.2000 which will be much less than that through state tube-wells. Thus, socially it will be cheaper to send money orders or bank draft to the small/marginal farmers and ask them to get their land irrigated by purchasing water from the market rather than to provide them irrigation through state tubewells, as they are working today in the area. Even if the level of efficiency of these tubewells is raised from the present 10 per cent to 40 per cent, the

irrigation per hectare will come to Rs.4.71 thousand which is much higher than that through private tubewells. In Bihar the gross value

Table-7

Economics of Public and Private Tubewells in Bihar
(at 1990-91 Prices - in Rs.'000).

	Public Tubewell		Private Tubewell	
	10% efficiency.	40% efficiency.	Electricity	Diesel
I Salient Features				
1. Project cost	800	800	20	22
2. Irrigation Potential in hect.	100	100	10	10
3. Effective Life in years	20	20	20	15
4. Capacity in B.H.P.	22.5	22.5	5	5
5. Discharge in metre^3/hr.	150	150	36	30
6. Annual Working Hours	333	1333	500	600
II Annual Charges				
1. Capital cost				
a) Depreciation	8.80	8.80	0.22	0.502
b) Maintenance	7.00	7.00	0.30	0.500
c) Interest	112.00	112.00	2.80	3.080
2. Cost of Operator	21.60	21.60	1.112	1.334
3. Establishment	12.00	12.00	-	-
4. Energy @Rs.1.20 per kwh and Rs.7/-per hour for 5 H.P. Diesel T.W.	6.70	26.84	2.237	4.200
III. Irrigation per Tubewell in hectre	10	40	4	4
IV. Total Annual Charges	168.10	188.24	6.669	9.616
V . Per hectare cost of	16.81	4.706	1.667	2.404

In Bihar the gross value of irrigated crop output per hectare at 1990-91 prices will hardly come to Rs.10 thousand. This falls short of the cost of irrigation per hectare through public tubewells at their present level of efficiency. Thus, not only the state exchequer but the economy of the state as such stands to be a net loser through the operation of these tubewells as they are working at the moment. In this background, therefore, there is absolutely no case for further expansion of public tubewells in the state. Only the existing ones deserve, to be made more efficient and viable. Ignoring all these hard facts, however, the public tube-well bureaucracy has seen to it that they expand further, since their in lies their vested interest. Only when these tubewells expand, there will be more investment and thereby more opportunities for making money and promotions. For this, they have succeeded in securing a loan from the World Bank worth Rs.1296 millions, when there was dearth of funds with the state government. Besides rehabilitating and modernising the existing ones, the purpose of the loan is also to install 500 new tubewells which appears to be case of misperceived priority on economic grounds. The same end could be achieved cheaply and in a better way by supporting the development of private tubewells by providing adequate electric power and subsidies on tubewells and pumpsets.

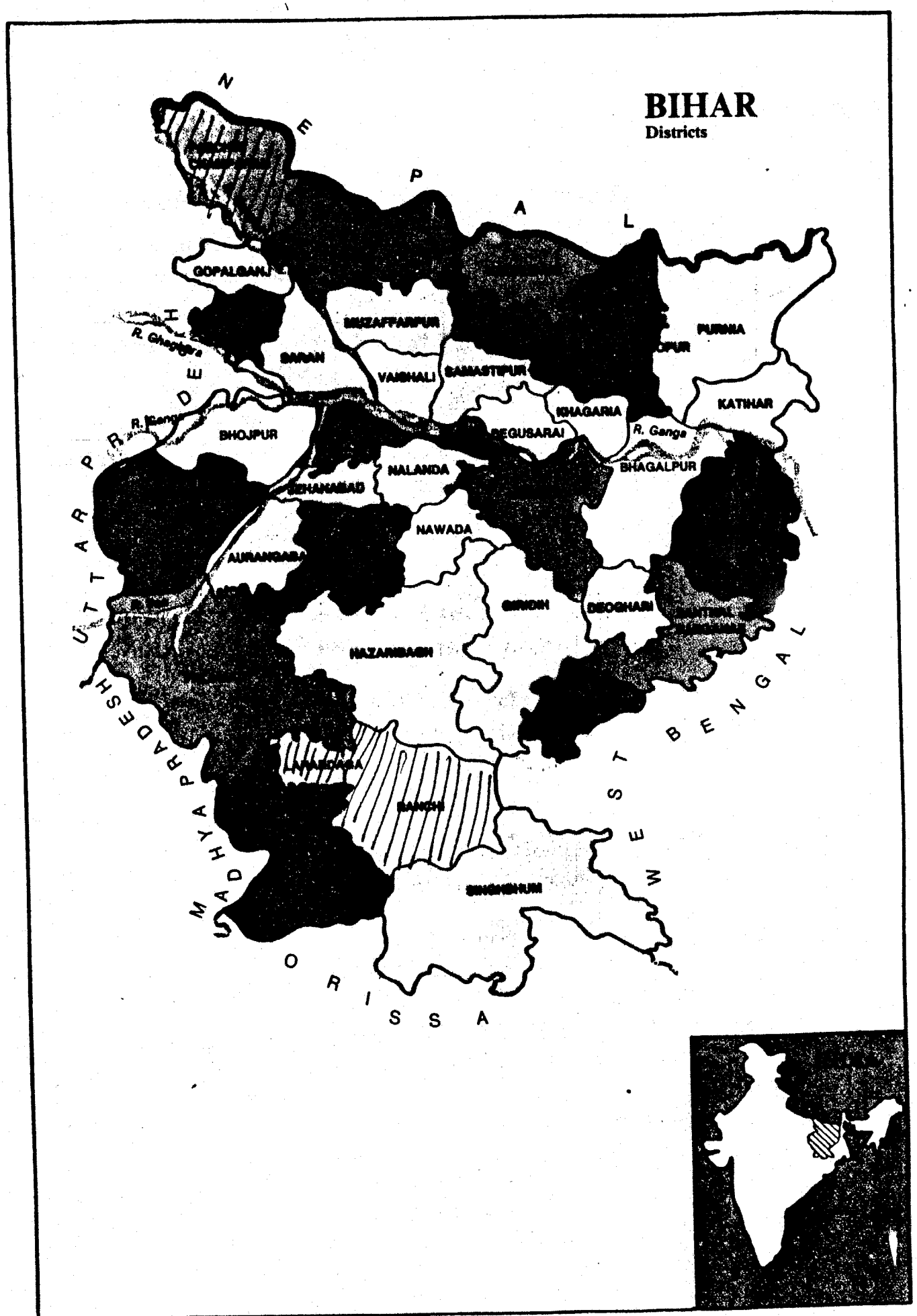
Conclusion:

There has been significant development of state tubewells in Bihar over the plan period. However, these tubewells have been suffering from gross mismanagement and depict gross inefficiency. Presently, their level of operating efficiency as reflected in the

actual irrigated area in relation to their irrigation potential is not even ten per cent. As a result while they have risen in their number, they have declined in their irrigated area, both average as well as total, which is their ultimate goal. Thus, they have led to an underdevelopment or retardation, rather than development, of groundwater resources in the state for the last one decade. They are incurring huge annual losses and thus draining the state exchequer. At the present level of efficiency, their average cost of irrigation comes to over 16 thousand rupees which exceeds the gross value of output per hectare in the state. Thus, they are draining not only the public exchequer but the economy as a whole as well. Even if their level of efficiency improves substantially and goes up to 40 per cent from the present ten per cent, their per hectare cost of irrigation will be mugh higher than that through private tubewells. Hence the goal of providing irrigation to the farmers can be achieved more efficiently and cheaply if the money provided for the development of state tubewells is used to promote the development of private tubewells. But the deeply entrenched vested interest of the tubewell bureaucracy is seeing to it that they expand further, irrespective of their consequences on the state exchequer and the economy.

REFERENCE:

1. Pathak, B.D. Hydrology and Ground Water Potential of Uttar Pradesh, Central Ground Water Board, Northern Region, Lucknow (Mimeo), p.12.
2. Government of India, Ministry of Water Resources, C.G.W.B., Eastern Region, Calcutta, Technical Report Series "D" No.4, Monitoring of Ground Water from Hydrogeological and Chemical Date of National Hydrograph Network Stations in Bihar (1976-85), 1986, p.43-44 (Mimeo).
3. Government of Bihar, M.I. Department, Report on Bihar Public Tube Well Project prepared by Agricultural Finance Corporation, Bombay, August 1985, P.101, Annex; 1, p.11.
4. Government of Bihar, Irrigation Department, The Irrigation Manual Vol.III, 1956, Secretariat Press, Patna, 1960, p.9.
5. World Bank, South Asia Region, Deep Aquifer Exploration Project, Upper Gangetic Plain, by P.H. Jones Hydrogeology, Inc., Baton Rouge, Louisiana, U.S.A., January, 1986,p.18.
6. Sharma, I., Some Aspects of Shallow Tubewells and Ground Water Development in the Gangetic Basin, A.N.S. Institute of Social Studies, Patna, 1984, p. 28.
7. Clay, E.J., "Choice of Tecnniques: Case Study of Tubewell Irrigation", The Kosi Symposium, (ed.) Joy and Everitt, Institute of Development Studies, Sussex, 1976, p.211.
8. Saksena, R.S., "Ground Water Potential of India and Present Status of Development", Proceedings of the Seminar on Ground Water Development, IWRS, Roorkee, 1983, p.99.
9. Gasser, W.R., Survey of Irrigation in Eight Asian Nations, U.S. Department of Commerce, Washington, D.C., 20250, 1981, p.14.
10. Government of India, Ministry of Agriculture, Report of the National Commission on Agriculture, (1976), Part V, p.20.
11. Leslie Abbie, James Q. Harrison and John W. Wall, Economic Returns to Investment in Irrigation in India, Washington D.C., USA, 1982, World Bank Working paper No.536, p.8.


BIHAR
Districts
NEPAL
UTTAR PRADESH
MADHYA PRADESH
WEST BENGAL
ORISSA
GOPALGANJ
MUZAFFARPUR
SARAN
VAISHALI
SAMASTIPUR
PURNIA
KATIHAR
KHAGARIA
BEGUSARAI
BHOJPUR
NALANDA
BHAGALPUR
NAWADA
GIRIDIH
DEOGHARI
HAZARIBAGH
RANCHI
SINGHBHUM
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