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Impact of Irrigation on Migration and Work Participation : A Case Study of an Irrigation Project in India

IN both macro and micro studies, where the type, nature and the process of development are not explicitly brought into analysis, the causal linkages between population and development get blurred. Hence the importance of exploring causal linkages between population and development by examining in detail a specific development project with reference to the proximate socioeconomic changes induced by this project and also the consequent changes in demographic behaviour.

In India a number of development projects have been completed or are under way. These projects usually have unintended demographic consequences. Case studies of the demographic consequences of large scale projects would throw light on the causal linkages between population and development, and also inform the planners about the need of taking into account its demographic implications in planning for development. The present study accordingly examines how the creation of irrigation facilities leads to certain economic changes which in turn influence migration and work participation. The results of this study are based on a field survey conducted in 1981 in two villages irrigated by the Hirakud Project Canal and two dry villages, covering about 2,550 households in all.

Previous Studies

Five of the available studies on canal irrigation have examined, to a limited extent, the effects of irrigation on migration (Gadgil 1948, Epstein 1962, Jha

1967, Maida 1982 and Roy 1983) and one study, their effect on the changes in work participation (Srikantan *et al,* 1978).

According to Gadgil's study, 53 per cent of the "farm servants" or agricultural labourers in the irrigated villages were migrants, while in the unirrigated villages all were residents (Gadgil 1948. Table 10). Epstein (1962) observed migration into as well as out of a wet village though the extent of such migration is not known. Jha's study (1967) reported that outmigrants constituted about 7 per cent of the population in wet villages as compared to 6 per cent in dry villages, but provides no data on inmigration. According to Roy's study (1983) inmigrant households constituted 22 and 2 per cent in irrigated and dry areas respectively. Maida's study (1982) found evidence of heavy inmigration into the irrigated tracts and none in the dry areas also no outmigration from either the wet or dry villages. In sum, these studies were focused mainly on socio-economic changes from irrigation and accorded limited space to the discussion of the inter-relationship between irrigation and migration.

Srikantan's study (1978) compares work participation rates among three areas : irrigated settlements, settlements to be irrigated and rainfed (or control) settlements. Though there are variations in work participation rates among the three areas, the pattern of variation is not very consistent with the availability of irrigation facility. His findings are somewhat contrary to the expectation that prosperity associated with irrigation would result in increased schooling and less work participation among children, and for reasons of status, female participation, at least among some castes would decrease in the irrigated areas.[1]

Scope of the Study

The present study examiaes the extent and the type of inmigration caused by irrigation and the nature of the impact such migration had on the host community. The focus here is on permanent migration i.e., inmigrants who have settled in the irrigated areas. However, limited analysis is presented on seasonal migration also.

Secondly, we examine the nature and the extent to which work participation differs between the irrigated and unirrigated areas. Work participation rates of children and females may be influenced by better economic conditions following irrigation, and also by the caste composition and land ownership status of residents and inmigrants.

The linkages between irrigation, migration and labour force participation

1. The terms "earner" and "work participation" are used interchangeably. "An earner is one who obtained remuneration in cash or kind for productive work in agriculture, household industries, trades and services or one who is an unpaid worker in the household enterprise". See Srikantan *et al.,* 1978, p. 6. It appears as if the unpaid family workers in agriculture are not considered as workers.

are examined in terms of changes in crop intensity, yield per acre and in the demand for labour.

Analytical Framework

Availability of irrigation water need not necessarily result in the immediate shift from dry to wet farming. Farmers may take time to be familiar with the techniques of wet farming with modern inputs. Secondly, they, especially the small and marginal farmers, may not have adequate financial resources for change over to canal irrigation. Fear of water logging and salinity could deter some farmers from easily changing to wet farming. The strength of these factors obviously vary from place to place, but the point is that, these factors may give rise to inmigration of farmers who are familiar with wet farming and are prepared to pay attractive prices for the land. Hence, depending upon the local conditions, wet farming is taken-up by the local farmers, or by the inmigrant farmers initially and later by the local farmers.

With the spread of wet-farming in the newly irrigated areas, farmers start preparatory works such as constructing field channels, levelling of plots and enlarging the size of plots . . . etc. These operations increase the demand for agricultural labour. More importantly, irrigation facilitates double cropping and more iiftensive cultivation involving greater use of fertilisers, and high yielding seeds. There is an increase in the number of agricultural operations for a given crop as well as in the number of man-days required per operation. This raises the demand for labour. How much would the additional demand for labour vary according to the type of crop is not clear. For paddy the increase in demand for labour could be substantial. So, agricultural workers who would have otherwise out migrated in search of work, find scope for employment in their own places. In addition, agricultural labourers from outside would inmigrate into the newly irrigated areas. It becomes also possible for seasonal migrants to find work at the time of transplanting, weeding and harvesting.

Certain changes in work participation are expected as a result of the better economic conditions in the wet villages. In the absence of dire economic need to do so work participation of children and adult females may tend to decrease. However, these changes would depend on the economic and caste composition of the households in the wet and dry villages, as well as among the inmigrant households.

Methodology

The interrelationship between irrigation, migration and work participation could be ideally examined through a longitudinal survey—before and after the advent of irrigation. However, due to time and budget constraints the present

study is based on a cross-section survey of two experimental or irrigated villages and two control or non-irrigated villages. The cross-section study could be taken as a good approximation to the longitudinal study provided the experimental and the control villages do not differ much with respect to factors, other than irrigation, such as proximity to urban centres, presence of industries and other non-agricultural sources of employment, which could influence migration and work participation. These factors have been kept in view while selecting the villages.

The Hirakud Project and the Sample

Of the several multi-purpose river valley projects in India, the Hirakud project in the state of Orissa was selected for study mainly because of our familiarity with the language of this area for conducting field work. The main Hirakud dam was completed in 1957-58 and by 1959 about 311 thousand acres of land had been officially brought under canal irrigation, though the actual use of water for irrigation had varied from place to place within this large area.

The Hirakud dam brought canal irrigation to Sambalpur and Bolangir districts of Orissa; in fact Sambalpur has 75 per cent of the area irrigated by these canals. Before the construction of the dam, cultivation in Sambalpur district depended mostly on rains and partly on tanks and wells. Because of inadequate and irregular monsoon, water was hardly adequate for one crop a year. The four villages selected for the study are located in the Sambalpur district.

Taking into consideration the relevant factors Bargarh taluk and within this taluk the Attabira and Bargarh Police Stations[2] were selected. Dry villages depending on rainfed cultivation were relatively more in Bargarh Police Station than in Attabira Police Station. Hence, the two wet villages were selected from Attabira Police Station and the two dry villages from Bargarh Police Station.

To ensure that the selected villages are comparable, the data, of the 1961 census, which closely followed the release of canal water, on population size, area under cultivation, extent of non-agricultural activity, proximity to urban centres etc. were used for selecting the villages. By and large, the selected wet and dry villages are comparable with respect to factors other than irrigation.[3]

2. Police Station is an administrative division smaller than a taluk which is smaller than a district.

3. In 1961, the population in the selected two wet villages was 580 and 2800, and in the dry villages, 970 and 2090. Population density was 123 and 138 per Km^2 in the dry, and 62 and 191 in the wet villages. The per cent of workers in non-agricultural activities, mainly weaving, was 15 to 20 in the wet and around 15 in the dry villages. The area under cultivation ranged from 75 to 90 per cent and paddy was the predominant crop. During preliminary visits to the area and discussion with the local people, it was confirmed that there was no canal for irrigation before 1957 in the wet villages, and that the dry villages continued to depend on rain-fed cultivation. There were no industries nor was there any evidence of mechanisation in farming. The nearest urban centre, Attabira is about 15 Kms from the wet and the Bargarh town is 12 Kms away from the dry villages. Each of the four villages had at least one primary school; and other amenities such as post offices, roads and drinking water supply were generally similar.

Data

Two sets of questionnaires were canvassed, one for all the households and the other for a sample of households. Questions about land ownership and cultivation, source of irrigation, year of use of water from the canals, place of birth and usual residence, main activity. . . etc. were asked to all the households; while data on crop production, labour inputs, use of modern agricultural inputs and related aspects were collected from a sample of households. For selecting the sample, the households were arranged according to land ownership and the required number of households were selected systematically. Field work was conducted during January-March 1981. The total number of households interviewed are 1738 in wet and 816 in dry villages, and the sample households are 214 and 170 in wet any dry villages respectively.

Economic Effects of Irrigation

In both the wet and dry villages paddy was the predominant crop, though pulses were relatively more important in dry villages. Irrigation did not lead to any significant change in the cropping pattern. However, crop intensity, yield per acre and demand for labour differed considerably between the wet and dry villages.

Crop Intensity and Yield Per Acre

Data on cropping and yield were directly obtained from the farmers. In the wet villages, double cropping during Kharif (July-November) and Rabi (December-March) seasons is common, while only the Kharif crop is possible in the rainfed dry villages. As a consequence, crop intensity in wet villages is almost double that of the dry villages (Table 1). In the state of Orissa as a whole, crop intensity during 1970-71 was of the order of 1.26; and in some of the irrigated districts of Cuttack, Puri and Ganjam it varied from 1.48 to 1.56 (Agricultural Census Commissioner, 1975). The yield per acre, of paddy, is also much higher in the wet than in the dry villages. Over time there was little increase in yield in dry villages, while in the wet villages the increase was about three to four times. The higher yield in Rabi season is due to the dwarf (high yielding) variety of paddy suitable for sowing during this season.

Demand for Labour

Detailed questions were asked of the sample households about the number of family and hired workers used as well as duration of work for specific operations in the cultivation of paddy. From these data, the number of man-days of work per acre was estimated and this is used as an index of demand

TABLE 1— CROP INTENSITY AND YIELD PER ACRE, PADDY

	Wet	*Dry*
1 Crop Intensity	1.97	1.0
2 Yield Per Acre :		
(a) Before irrigation :		
Kharif	3.3	2.9
Rabi	Nil	Nil
(b) After irrigation :		
Kharif	9.9	3.1
Rabi	12.9	Nil
Sample Farm Households	111	133

Note. 1. Crop Intensity = Gross area cultivated/Net area cultivated.
2. Yield per acre in quintals (100 Kgs.) of paddy.
3. Before and after irrigation refers to canal irrigation in wet villages.
4. Kharif and Rabi are summer (July-November) and winter (December-March) crops respectively.

for labour. It is possible that some farmers did not get as many workers as they desired during the peak seasons in particular, and so the number of man-days per acre may underestimate the demand for labour to a certain extent. Since labour inputs vary according to the size of farm and the farm-size distributions differ somewhat between the wet and dry villages, the number of man-days in dry villages have been standardised on the basis of the farm-size distribution in wet villages, and these are shown in Table 2.

TABLE 2-NUMBER OF MAN-DAYS PER ACRE BY TYPE OF LABOUR, PADDY

	Wet		*Dry*	
	Number	*Percent*	*Number*	*Percent*
Family Labour	13.4	27	12 8	58
Casual hired labour	18.4	38	4.0	18
Fixed hired labour	17.1	35	5.4	24
All	48.9	100.0	22.2	100.0
Sample farm households	111		133	

Note. 1. The number of man-days is based on equal units for adult male and female, and half-a-unit for child worker. In the surveyed villages adult male and female Workers were paid equal wages while child workers got one-half of adult wages.
2. The figures for dry villages are standardised on the basis of the distribution of cultivated area according to farm size in the wet villages.

The total number of man-days per acre is much higher in the wet villages, at 49 as compared to 22 in the dry villages. Family labour inputs are similar, while the hired labour inputs are substantially higher in the wet villages. Nearly 58 per cent of labour inputs in dry villages are contributed by family labour, while more than 70 per cent of the work in the wet villages is done by the hired labourers (Table 2).

The number of agricultural operations is the same in the wet and dry villages, except for watering which, of course, is not relevant in the rainfed dry villages. The major operations, such as transplanting, weeding, harvesting and threshing account for a similar per cent of the total labour inputs—75 in wet and 74 in dry villages (Table 3). The main reason then for the increase in the demand for labour in the wet villages, is the more labour-intensive nature of the

TABLE 3—NUMBER OF MAN-DAYS PER ACRE BY TYPE OF AGRICULTURAL OPERATIONS, PADDY

	Wet		*Dry*	
	Number	*Percent*	*Number*	*Percent*
Ploughing	4.0	8	3.6	16
Manuring	3.9	8	2.2	10
Transplanting/Broadcasting	120	25	4.3	20
Weeding	7.4	15	3.4	15
Watering	4.4	9	Nil	—
Harvesting	10.0	20	4.4	20
Threshing	7.2	15	4.1	19
All	48.9	100	22.2	100
Sample farm households	111		133	

operations. For example, labour inputs in transplanting, weeding, harvesting and threshing are substantially higher in the wet than in the dry villages (Table 3). In the wet villages transplanting is done more systematically and weeding more thoroughly, thereby raising labour inputs. Due to higher density of plants per unit of land and more paddy per sheaf, harvesting and threshing require more manpower in the wet villages. In these four operations, hired labour accounts for 65 to 82 per cent in wet, as compared to 42 to 48 per cent in dry villages. In sum, the overall higher demand for labour in the wet villages is reflected in the comparative excess of hired labour inputs in transplanting, weeding, harvesting and threshing.

Migration

From responses to questions on place of birth and duration of stay in the sample villages it is possible to identify the inmigrant households at the time of survey and the periods during which they moved into the sample villages. It was, however, difficult to obtain estimates of outmigration. From all the 2554 households interviewed in the four villages, a question was asked if any member of the household had outmigrated in the past to settle elsewhere. In addition, to take care of outmigration of entire households, it was enquired whether they knew of any households in the village that had outmigrated. From the responses to these questions a rough idea about out-migration is obtained.

Individual outmigration is negligible in the wet or dry villages, while there is some evidence of household outmigration. It is observed that in the wet villages about 113 households (constituting 7 per cent of the households at the time of survey) had moved out of the wet villages some time during 1975-81. All these households were inmigrant households and they went back to their places of origin. The reasons for such cut-migration are not clear. In the dry villages, on the other hand, there is surprisingly very little outmigration —only 8 households had moved out to settle elsewhere. One of the reasons for this negligible outmigration could be that initially it was expected that the Hirakud project canals would be extended to these dry villages also and that more work would be available. But later, when this expectation was not realised, there was not much scope for outmigration since the nearby wet villages had already been settled by inmigrant households. However, there is seasonal outmigration of households from the dry villages in search of work.

As could be expected, there is not a single inmigrant household in the dry villages, while the wet villages have 603 inmigrant households, constituting 35 per cent of the households, at the time of the survey. In addition, during peak seasons of labour demand there is considerable amount of seasonal inmigration into the wet villages.

Inmigrant Settlers

When the Hirakud Dam and the canals were being built, labourers were brought not only from within the district of Sambalpur, but also from the neighbouring Bolangir district and the adjoining states of Madhya Pradesh and Andhra Pradesh, since outside labour was cheap. When this work was completed, some of these labourers settled in their places of work or nearby villages. The others who went back to their places of origin were important sources of information about irrigation and the possibility of more work in the newly irrigated areas, thereby facilitating the process of inmigration.

Though water was released for irrigation in 1957, it was not used till about

1961 or so, mainly because many of the local farmers were not familiar with wet-farming. Around 1961, some farmers from the East Godavari district of the neighbouring state of Andhra Pradesh, moved into the wet villages, purchased land and started wet-farming.

This movement was influenced by conditions at the places of both origin and destination. These farmers, with a long tradition of wet-farming had relatively small plots of irrigated land in their places of origin and were well aware of the economic gains through intensive farming that would accrue to them in the newly irrigated areas. In addition, they could purchase lands in the wet villages at prices higher than the prevailing rate, but much cheaper than in their places of origin. The lands purchased by them were from the erstwhile marginal farmers and partly from the large farmers.[4] Though these Andhra farmers were small in number, they were dynamic enough to start wet farming which was later taken-up by the resident farmers on a large scale. As the scale of operations increased, the demand for labour increased leading to the inmigration of non-farm (labour) households.

It can be seen from Table 4 that most of the farm households inmigrated during 1961-71 while the bulk of the labour households moved in, after a brief interval of time, during 1965-75. As stated earlier, at the time of survey in 1981 these inmigrant farm and labour households together constituted 35 per cent of the households in the wet villages. Data from the 1961 and 1971 censuses indicate that this inmigration is well reflected in the population growth of these villages. The population of the wet villages increased by 89 per cent during 1961-71 and 31 per cent during 1971-81. The population of the dry villages, on the other hand, increased only marginally, by 14 and 6 per cents during the respective decades.[8]

Among the inmigrant farm households nearly 70 per cent are from the East Godavari district of Andhra Pradesh, while the remaining 30 per cent are from

4. Selling of land after the provision of canal water, though surprising, took place due to some reasons. Initially, many farmers did not have adequate knowledge about wet farming with modern inputs. Even if they knew, the small and marginal farmers did not have financial resources required for switching over to wet farming. Secondly, the inmigrant Andhra farmers, well aware of the potential income from irrigated lands, offered attractive prices for purchase of land. Thirdly, holdings in this part of the area were rather scattered and some of them Were at "inconvenient" places or at a slightly higher plateau which the farmers were easily willing to dispose of for higher prices. Because of these factors, about 170 households in both the wet villages sold all or part of their holdings. Among them, 80 households of marginal farmers sold all their small plots and became agricultural labourers since they had neither the motivation nor the resources to go for wet farming.

5 Higher population growth is not peculiar to the selected wet villages. In the 140 villages in Attabira and Bargarh Police Stations, population growth was generally high in the irrigated tracts : 30 to 45 per cent during the 1961-71 decade in villages partly or wholly irrigated by canals, and around 20 per cent in the unirrigated tracts. Nine villages in the unirrigated tracts bad negative growth.

TABLE 4—INMIGRANT FARM AND LABOUR HOUSEHOLDS : PERCENTAGE DISTRIBUTION BY PERIOD OF ARRIVAL, WET VILLAGES

Period of Arrival	*Farm Households*	*Labour Households*	*Total*
1957-61	. .	2	3
1961-65	50	15	17
1965-71	33	49	47
1971-75	. .	22	21
1975-81	..	12	12
Number of inmigrant households	48	555	603

Note. 1. . . frequency less than 10.
2. Labour households are those landless and engaged in agricultural labour.
3. Percent ages rounded off to the nearest decimal.

the Sambalpur and Bolangir districts. In the case of inmigrant labour households, nearly 80 per cent are either from within the same district or from the neighbouring Bolangir, mostly from the drought prone areas of these two districts where adequate work is not available for more than 4-5 months in a year.

Inmigration has affected the economic activity, caste composition and the literacy levels of the host community. Inmigrants are mostly agricultural labourers, scheduled castes/tribes and illiterates. It can be seen from Table 5 that the proportions of farm households and labour households in the dry villages and among the residents in the wet villages are identical. However as a result of inmigration, the distribution in the wet villages has changed considerably in favour of labour households. The caste composition has also changed in the wet villages, with a decline in the proportion of Vaishyas and a corresponding increase of scheduled tribes. The effect of inmigration has been to depress the literacy levels of the wet village, though the levels are still higher than those in the dry villages.

Seasonal Migrants

In addition to the inmigrant settlers, streams of seasonal migrants move into the wet villaged during the periods of peak labour demand. These seasonal migrants are important for the economy of the wet villages and sometimes agricultural operations are postponed till the arrival of these labourers. Since these seasonal migrants were not present at the time of survey, information about

TABLE 5—INMIGRANTS AND RESIDENTS : SELECTED CHARACTERISTICS

	Wet			Dry
	Inmigrant	*Resident*	*Total*	
1 Economic activity :				
Percent of households				
Farming	S	77	53	78
Agricultural Labour	92	23	47	22
2 Caste : Percent of Households :				
Vaishya	15	50	38	30
Scheduled Caste	24	28	27	33
Scheduled Tribe	56	18	31	35
Others	5	4	4	2
3 Per cent of Population Literate:				
Male	16	53	42	33
Female	5	23	18	7
Households	603	1135	1738	816
Population	2500	5869	8369	3678

Note. 1. Percentages rounded off.
2. Generally, Vaishyas are economically and socially more forward than the scheduled castes and tribes.

them were obtained indirectly from the interviewed farm households. These migrants move in households and have been visiting the wet villages since 1965 or so. Their number is approximately 250 households and they make six visits an year at the time of transplanting, weeding and harvesting, during both Kharif (July-November) and Rabi (December-March) seasons. They are mostly from the dry belts of the neighbouring areas such as Patnagarh taluk of Bolangir district, and the Padampur, Sohella, Melchamunda and Ghasilate Police Stations of Sambalpur District. Some of them come from the neighbouring states of Madhya Pradesh and Andhra Pradesh. Most of these households belong to scheduled castes/tribes and do not own land. Many of them live in camps at the outskirts of the villages and some of them are attached to the farm households—a pattern similar to that observed in the Tungabhadra project area in Karnataka (Maida, 1982).

The economic effects of irrigation and the inmigration of agricultural labour-

ers have affected the work participation of children and adults in the wet villages. These are examined in the following section.

Work Participation

A question was asked, about the nature of activity of the members of all the households in the four villages. Those engaged in economically productive work, whether paid in cash/kind or unpaid, are treated as workers. The adult non-workers are mostly those engaged in household work and those unwilling (e.g. young literates looking for better jobs) or unable to work. Among children, some of the non-workers attend school, while the others are engaged in neither work nor studies.

The effect of irrigation on Work Participation Rate (WPR) would be positive or negative depending upon the social and economic position of the households. Higher demand for labour could normally lead to higher work participation. At the same time, the rise in household income of the farm as well as the labour households could discourage the "additional worker" who would otherwise have participated in work force at times of dire economic necessity. In addition to economic factors, there are certain social factors which inhibit work participation among certain castes. Thus, the wet-dry differentials in WPRs have to be examined in the light of the relationship between caste, land ownership (as a proxy for economic status) and the necessity to work, particularly among the females and the children.

In upper caste Vaishya households, in both wet and dry villages, women work as labourers in their own farms, if that becomes necessary. Generally, for reasons of social status, they do not work as hired labourers in others' farms, nor do they prefer to work along with hired labourers in their own farms. Hence, when the households have farms that became economically viable after irrigation and when the farms engage in hired labourers, they are likely to withdraw from the work force. This tendency is observed among the scheduled castes and tribes as well, but to a lesser extent. With increasing income, some of these scheduled caste and scheduled tribe women from farm households do not participate in labour force, while some others engage themselves in supervisory work, leaving the hard work to hired labourers. For the scheduled caste/tribe women from the labour households (not owning land), the need to work could be marginally lower in the wet than in dry village, due to higher wage income in the wet than in the dry villages.

For the same reasons of social and economic status, children from Vaishya households or from farm households, would be less prone to work and attend school in larger proportions, as compared to those in scheduled caste/tribe households or labour households. By and large, we could expect that the depressing effect of high caste and land ownership on work participation would operate in both the wet and dry villages, but more so in the former because of

the prosperity brought in by irrigation. In other words, economic prosperity could increase the already existing caste-differentials in work participation.

The analysis here is based on data from 2467, Vaishya and S.C. and S.T. (Scheduled Castes and Scheduled Tribes) households, 1664 in the wet and 803 in the dry villages. This excludes 74 households in the wet and 13 in the dry areas belonging to 'other castes'. These 'other castes' are not considered since they are numerous and very much heterogenous with respect to land ownership and other factors. Though there are some differences between the scheduled caste and scheduled tribes they are pooled together since as a group they are distinct from the Vaishyas and it also ensures adequate cell frequencies.

Work Participation and Schooling of Children

Working children aged 5-9 are very few, about 2 per cent in dry areas and almost nil in the wet areas (not shown in table). One-half of children in this age group in the wet area attend school while the rest are otherwise engaged. In the dry area only about one-third attend school.

Among children aged 10-14, thirty per cent or more engage themselves in economic activity (Table 6). The proportions of child workers are higher in the dry villages, marginally for the female and substantially for the male children. School attendance is relatively higher in the wet than in the dry areas, particularly in the case of girls.

TABLE 6—PER CENT DISTRIBUTION OF CHILDREN AGED 10-14 ACCORDING TO ACTIVITY IN WET AND DRY VILLAGES

	Boys				*Girls*			
	In School	*Working*	*Neither*	*No. of children*	*In School*	*Working*	*Neither*	*No. of children*
Wet	61.6	29.6	8.8	524	53.6	30.2	34.2	500
Dry	42.5	38.8	18.7	240	12.0	31.6	56.4	250

Comparison of caste-specific rates between wet and dry villages indicate that the Vaishyas' WPR is lower in the wet than in the dry areas, for both boys and girls (Table 7). Among the SC and STs however, the WPR among boys does not differ much, while among girls it is higher in the wet areas. Sex-wise comparison indicates that WPRs among the Vaishyas are lower for girls than for boys in both the areas. In the case of SCs and STs however, the rates in the dry area do not differ much between boys and girls, while in the wet area, girls have higher WPR.

As stated earlier, Vaishyas as a caste are socially advanced than the SCs and

TABLE 7—WORK PARTICIPATION RATES OF CHILDREN AGED 10-14 BY CASTE IN WET AND DRY VILLAGES

	Wet	*Dry*
Boys:		
Vaishya	11.1	30.1
S.C. and S.T.	44.6	43.3
	29.6	38.8
No. of children	524	240
Girls :		
Vaishya	4.2	11.9
S.C. and S.T.	54.0	41.6
	30.2	31.6
No. of children	500	250

Note. 1. Work participation Rates : Number of workers as per cent of children aged 10-14 in respective categories.
2. S.C. and S.T. scheduled castes and scheduled tribes.

STs and much value is attached to education. Vaishya children are generally put to school unless economic necessity demands their participation in work. Vaishya girls are less inclined to work if economic conditions are not desperate. Among SCs and STs, on the other hand, importance of education is not as much, and they are also less inhibited by social status. Economic conditions do play a part among them but not as much as in the case of the Vaishyas. Because of these reasons, WPRs among Vaishya children are lower than those of SC and STs; and lower in the wet than in the dry areas.

The relative effects of caste and land ownership on WPRs of children could not be examined satisfactorily because of inadequate cell frequencies in certain groups. However, data from the farm households indicate that caste has some effect on WPRs given comparable economic conditions. It can be seen from Table 8 that among the farm households WPRs among the Vaishya boys and girls are lower than those of SC and STs in wet as well as dry areas. And within each caste, WPRs are higher in the dry than in the wet area (except among SC and ST girls).

In sum, prosperity brought in by irrigation in the wet area has generally led to a decline in the WPRs of children. This tendency is more pronounced among the Vaishyas than among the SC and ST because of caste differences in attitud-

TABLE 8—WORK PARTICIPATION RATES AMONG CHILDREN AGED 10-14, IN FARM HOUSEHOLDS BY CASTE : WET AND DRY VILLAGES

	Wet	*Dry*
Males		
Vaishya	7.7	27.6
S.C. and S.T.	29.3	41.5
	16.1	36.5
No. of children	341	211
Females		
Vaishya	Nil	6.8
S.C. and S.T.	39.1	35.7
	11.8	25.8
No. of children	305	213

Notes. 1. Rates per hundred children in respective categories,
2. Farm Households own land and cultivate, while the labour households are landless and are engaged only in agricultural labour. The WPRs among SC and ST in labour households in the wet area are : 57.7 among boys and 62.1 among girls. Similar data for Vaishyas in the wet and for both the castes in dry areas are not presented because of inadequate observations.

es and outlook towards work, status and education, and also because the Vaishyas are a landowning community. However, the higher WPRs among girls than boys among the SC and ST in the wet, and also the higher rates in the wet than in dry villages, among the SC and ST girls are rather unexpected. These are probably due to less value attached to girls' schooling and also the sex specific nature of work available in the wet area.

Work Participation Among Adults

The overall WPRs in 15-64 age group are 92.8 and 94.8 in wet and dry villages respectively for males, and 56.2 and 66.5 respectively for females. These rates are the net result of certain relationship between caste and land ownership status.

The economic effect on WPRs can be seen by comparing the farm and labour households within and between the wet and dry villages. Within each set of villages, the rates are higher in the labour than in the farm households, particularly for females. For example, among females, the rates are 42 per cent

higher in the labour than in the farm households in the dry villages, and nearly three times as high in the wet villages (marginals in panels *d* and *e,* Table 9).

TABLE 9—WORK PARTICIPATION RATES IN 15-64 AGE GROUP IN FARM AND LABOUR HOUSEHOLDS BY CASTE : WET AND DRY VILLAGE

Sex, Caste and Farm/ labour Households	*Wet*		*Dry*	
	WPR	*N*	*WPR*	*N*
Males				
(a) Labour Households :				
Vaishya	90.7	143	91.5	40
SC and ST	95.5	962	96.8	158
	94.8	1105	96.1	198
(b) Farm Households				
Vaishya	88.3	941	93.6	382
SC and ST	96.2	517	95.4	605
	91.0	1458	94.7	987
(c) Farm and Labour Households combined				
Vaishya	88.7	1084	93.4	422
SC and ST	95.7	1479	95.8	763
	92.8	2563	94.8	1185
Females				
(d) Labour Households				
Vaishya	78.2	121	71.2	49
SC and ST	91-1	847	93.1	163
	89.4	968	87.8	212
(e) Farm Households				
Vaishya	4.7	846	21.7	320
SC and ST	77.8	497	83.9	607
	31.5	1343	62.0	927
(/) Labour & Farm Households Combined				
Vaishya	14.0	967	26.9	369
SC and ST	86.2	1344	86.0	770
	56.2	2311	66.5	1139

Note 1 WPRs (No. of workers per 100 population are standardised for males and femaes separately, the standard population being the age distribution of the combined population in wet and dry villages.

2. *N* - Population in 15-64 Age group.

Among males, though the labour households have higher participation rates, the differences are not that large (marginals in panels *a & b).* A similar pattern of lower participation among economically better-off groups can be observed by comparing the wet and dry villages, the only exception being the slightly higher rates among females in the labour households of wet villages.

Caste differentials in WPRs are quite marked, Vaishyas having lower participation than SC and STs. These differentials are relatively large in wet than dry villages, in farm than in labour households, and among females than males (Table 9). Among the SC and STs, whether they are in farm or labour households, in wet or dry villages, male or female, the range of variation in WPRs is relatively small, 78 to 97 per cent as compared to the Vaishyas among whom the range is from 5 to 94. Among the male SC and STs the range is negligible, 95 to 97 per cent. A similar pattern of relationship emerges when WPRs are compared by the size of farm and caste. As a matter of fact the Vaishya-SC and ST differentials in female WPRs increase with decrease in farm size, particularly in wet villages (Table 10).

TABLE 10-WORK PARTICIPATION RATES IN FARM HOUSEHOLDS BY FARM SIZE AND CASTE : WET AND DRY VILLAGES

Land Owned in Acres, Sex	*Wet*		*Dry*	
	Vaishya	*SC and ST*	*Vaishya*	*SC and ST*
Males				
Less than 2.5	94.8	98.6	99.1	98.3
2.5-4.9	89.4	96.2	96.3	96.6
5 +	81.6	93.1	82.7	92.9
Females				
Less than 2.5	7.9	88.4	25.5	89.1
2.5-4.9	5.4	73.2	23.8	84.6
5 +	1.1	55.8	10.4	75.9

In sum, even before irrigation, caste differentials in WPRs were operating : more among females than males, and more among the rich than the poor households. With the advent of irrigation and the resultant prosperity, particularly among the farm households, the caste differentials among the females have widened considerably. The fact that the Vaishya-SC and ST differences in female WPR increase with decrease in farm size, and that the Vaishya households own more land than the SCs and STs, particularly in the wet villages, have contri-

buted to a large extent in depressing the overall female WPRs in wet as compared to dry villages.

A question arises whether the lower WPRs among females in farm households in the wet villages, are due to withdrawal from labour force after irrigation or due to their non-participation from the beginning. In case of non-participation in labour force (unaffected by irrigation), the WPRs in wet villages would have been somewhat similar to those observed in dry villages. It is less likely that some factors other than irrigation would have depressed the rates in the wet villages. Though, no data were obtained on the extent and the time of withdrawal, informal enquiries at the time of survey reveal that withdrawals did take place after irrigation, in the farm households. Such withdrawals on the part of females took place more among the Vaishyas than the SC and STs. The main reason stated by them was that their economic position had improved after irrigation and hence there was no need to work.

Summary

The impact of irrigation on migration and work force has been examined in two wet and two dry villages in the state of Orissa. In the wet villages, water for irrigation from the Hirakud Project Canals, was released in 1957. It took some time for the shift from dry to wet farming. In this process, a small but enterprising group of inmigrant Andhra farmers acted as catalysts. The spread of wet farming (mostly paddy) with modern agricultural inputs, raised yield per acre and crop intensity and increased the demand for agricultural labour. This in turn led to the inmigration of agricultural labour households most of which belonged to Scheduled Castes and Scheduled Tribes. The effect of irrigation on work force is to depress the work participation of children, and adult females particularly among the land owning Vaishya households. The Vaishya as well as the Scheduled Caste and Tribe women are less prone to work if household economic conditions improve. This tendency is particularly strong among the upper caste Vaishya females in farm households, for reasons of social status. These caste differentials in female work participation among farm households, have further widened with the advent of irrigation and the increase in farm incomes.

The policy implications of this study are rather restrictive in view of the limited number of villages covered. However, the demographic impact of irrigation, or for that matter the rural development projects, have important implications for policies relating to urbanisation and rural outmigration, and possibly to fertility and mortality. The present study could be considered as a pointer to the need for more such investigations of the demographic impact of specific development projects in India.

References

.1. Aggarwal, P. C., 1973, The Green Revolution and Rural Labour : A Study in Ludhiana, New Delhi : New India Press.
2. Agricultural Census Commissioner, 1975, Report an Agricultural Census of Orissa, 1970-71, Government of Orissa.
3. Basu, D. N., Roy, R. L. and Pallavi, Nikhil, 1978, Impact of Agricultural Development on Demographic Behaviour : A Pilot Study, ORG, Baroda.
4. Connell, John, Das Gupta, Biplab, Laishley, Roy and Lipton, Michael, 1976, Migration from Rural Areas : The Evidences from Village Studies, Delhi : Oxford University Press.
5. Director of Economic Research, Orissa, 1964, Studies in the Economics of Farm Management in Sambalpur District (Orissa), Report for the year 1958-59.
6. Epstein, T. S., 1962, Economic Development and Social Change in South India, Manchester : Manchester University Press.
7. Food and Agricultural Organisation, 1977, Population and Agricultural Development : Selected Relationships and Possible Planning Uses, Rome.
8. Gadgil, D. R., 1948, Economic Effects of Irrigation : Report of a Survey of the Direct and Indirect Benefits of the Godavari and Pravara Canal, Gokhale Institute of Politics and Economics, Poona : Aryabhushan Press.
9. George. P. T. and Raju, K. V., 1981, Absorption of Human Labour in Command Area : A Case Study in the Nagarjuna Sagar Left Bank Canal Command Area, National Institute of Rural Development, Hyderabad : Ramakrishna Press.
10. Jha, Divankar, 1967, Evaluation of Benefits of Irrigation : Tribeni Canal Report, New Delhi : Orient Longman Press.
11. Maida, Iwao, 1982, Recent trends in the socio-economic structure of villages in the Central Karnataka. In Kenzo Fujiwara (ed.), Geographical Field Research in South India. 1980. Hiroshima : Yamawaki Printing Co. Ltd.
12. Muller, Eva, 1975, The impact of agricultural change on demographic development in the Third World. In Leon Tabah (ed.), Population Growth and Economic Development in the Third World. Brussels : Ordina.
13. Roy, T. K. 1983, Impact of Rajasthan Canal on Social, Economic and Environmental Conditions, NCAER, New Delhi : Allied.
14. Srikantan, K. S., Narayan, B. K. and Vasudeva Rao, D., 1978, Female and Child Work Participation in the Integrated Development of a Command Area, Institute for Social and Economic Change, Bangalore : W. O. Judge Press.