CHAPTER V

EXTENSIONS FROM THE SAMPLE-STUDY

5.1 The Labour Impact

Because of the general progressiveness imparted to agriculture by irrigation, a major feature of agricultural development is the creation of labour demand. The sample survey elicited information from respondents on labour-use both in the pre-irrigation and post-irrigation situations. Although basic input-relations, of which labour is a part, have already been dealt within the previous chapter, the study can be fruitfully extended to an analysis of the labour-impact of irrigation, per se. In doing so the differential responses to labour absorption by scheme-category, are brought to light.

Patterns evinced in the labour-impact of irrigation, when studied in terms of incremental labour utilisation, possess two aspects. These are, namely, that additional man-days are created by the extension of cropping into the dry months, and that shifts in seasonal cropping patterns (also alluded to in the previous chapter) bring about shifts in labour allocation per crop, particularly between male and female labour. Since the study is by scheme-category, the findings are relevant to assessment of the total impact of energisation, and more specifically, electrification of the irrigated sector.

Data from the study is presented primarily in annual terms by means of seasonal aggregation although reference will be made to seasonal patterns in the analysis of labour shifts. It may, however, be noted that the annual crop-classification of 'Main','Trad','SubI' and 'SubII' is a theoretical construct made for convenience in aggregation and does not carry any specialised meaning beyond that. Thus a shift of labour from 'Trad' to 'Main' is the result of decrease in agricultural emphasis on the cultivation of indigenous crop varieties, concomitant to new emphasis on HYV types.

Actual figures for per acre incremental labour utilisation are presented in annual terms in Table 5.1. The table provides a break-up of labour utilisation for both male and female labour over the four classified crops, aggregated over the four agricultural seasons, i.e. boro, pre-kharif, kharif and rabi. Impact figures are provided in both aggregates (sum) and averages over the different respondent categories, with the Allscheme figures displaying total impact over the entire sample. Since the table is in difference terms (between pre-irrigation & post-irrigation periods), each set of figures can be positive or negative, depending on the direction of impact. Average impact per respondent is displayed in the average figures. Net labour absorption figures, both for males and females are obtained by summing the break-up figures by sex.

Table 5.1

Seasonwise Incremental Labour Utilisation

BORO					Male Labour Absorption				Female Labour Absorption						(per acre)			
IrrScheme		Wge/dayM	Wge/dayF		Main	Trad	SubI	SubII	Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLabCst
NB	avg	0	0	sum	0				0				0	0	0	0	0	0
				avg	0				0				0	0	0	0		
RLI	avg	6.50	4.86	sum	390				65				390	65	7080	885	455	7965
				avg	27.86				4.64				27.86	4.64	505.71	63.21	16.25	255.18
STW(d)	avg	6.35	4.70	sum	545				115				545	115	9850	1547	660	11397
				avg	27.25				5.75				27.25	5.75	492.50	77.35	16.50	249.13
STW(e)	avg	19.20	14.30	sum	820				165				820	165	15630	2323	985	17953
				avg	82.00				16.50				82.00	16.50	1563.00	232.30	49.25	799.75
DTW(e)	avg	13	9.38	sum	445				104				445	104	7725	1307	549	9032
				avg	55.63				13.00				55.63	13.00	965.63	163.38	34.31	489.31
STW+DTW(e)	avg	16.44	12.11	sum	1265				269				1265	269	23355	3630	1534	26985
				avg	70.28				14.94				70.28	14.94	1297.50	201.67	42.61	656.22
ALLSCHEME	Avg	6.95	5.14	Sum	2200				449				2200	449	40285	6062	2649	46347
				Avg	29.73				6.07				29.73	6.07	544.39	81.92	17.90	275.23

PREKHARIF

					Male Labour Absorption				Female Labour Absorption									
IrrScheme		Wge/dayM	Wge/dayF		Main	Trad	SubI	SubII	Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLabCst
NB	avg	8.45	6.05	sum	95	-89	-66	-451	12	101	-66	-42	-511	5	-6600	108	-506	-6492
				avg	4.32	-4.05	-3.00	-20.50	0.55	4.59	-3.00	-1.91	-23.23	0.23	-300.00	4.91	-11.50	-149.89
RLI	avg	10.57	4.64	sum	405	-131	-60	-345	31	12	-12	-13	-131	18	-1659	179	-113	-1480
				avg	28.93	-9.36	-4.29	-24.64	2.21	0.86	-0.86	-0.93	-9.36	1.29	-118.50	12.79	-4.04	-58.61
STW(d)	avg	12.90	6.05	sum	720	-445	260	-384	67	-16	42	7	151	100	1961	935	251	2896
				avg	36.00	-22.25	13.00	-19.20	3.35	-0.80	2.10	0.35	7.55	5.00	98.05	46.75	6.28	51.53
STW(e)	avg	11.10	6.10	sum	195	-210	65	-420	0	11	30	-21	-370	20	-5235	207	-350	-5029
				avg	19.50	-21.00	6.50	-42.00	0.00	1.10	3.00	-2.10	-37.00	2.00	-523.50	20.70	-17.50	-268.75
DTW(e)	avg	13.50	6.00	sum	230	-150	75	-135	21	0	33	0	20	54	265	498	74	763
				avg	28.75	-18.75	9.38	-16.88	2.63	0.00	4.13	0.00	2.50	6.75	33.13	62.25	4.63	19.94
STW+DTW(e)	avg	12.17	6.06	sum	425	-360	140	-555	21	11	63	-21	-350	74	-4970	705	-276	-4265
				avg	23.61	-20.00	7.78	-30.83	1.17	0.61	3.50	-1.17	-19.44	4.11	-276.11	39.17	-7.67	-136.88
ALLSCHEME	Avg	10.96	5.78	sum	1645	-1025	274	-1680	131	108	27	-57	-786	209	-10498	2059	-577	-8439
				avg	22.53	-14.04	3.75	-23.01	1.79	1.48	0.37	-0.78	-10.77	2.86	-143.81	28.21	-3.95	-78.47

Table 5.1

Seasonwise Incremental Labour Utilisation

BORO IrrScheme		Wge/dayM	Wge/dayF		Male Labour Absorption Main	Trad	SubI	SubII	Female Labour Absorption Main	Trad	SubI	SubII	NetM	NetF	(per acre) NLabCstM	NLabCstF	TLab	TLabCst
NB	avg	0	0	sum	0				0				0	0	0	0	0	0
				avg	0				0				0	0	0	0		
RLI	avg	6.50	4.86	sum	390				65				390	65	7080	885	455	7965
				avg	27.86				4.64				27.86	4.64	505.71	63.21	16.25	255.18
STW(d)	avg	6.35	4.70	sum	545				115				545	115	9850	1547	660	11397
				avg	27.25				5.75				27.25	5.75	492.50	77.35	16.50	249.13
STW(e)	avg	19.20	14.30	sum	820				165				820	165	15630	2323	985	17953
				avg	82.00				16.50				82.00	16.50	1563.00	232.30	49.25	789.75
DTW(e)	avg	13	9.38	sum	445				104				445	104	7725	1307	549	9032
				avg	55.63				13.00				55.63	13.00	965.63	163.38	34.31	489.31
STW+DTW(e)	avg	16.44	12.11	sum	1265				269				1265	269	23355	3630	1534	26985
				avg	70.28				14.94				70.28	14.94	1297.50	201.67	42.61	656.22
ALLSCHEME	Avg	6.95	5.14	Sum	2200				449				2200	449	40285	6062	2649	46347
				Avg	29.73				6.07				29.73	6.07	544.39	81.92	17.90	275.23

PREKHARIF

IrrScheme		Wge/dayM	Wge/dayF		Male Labour Absorption Main	Trad	SubI	SubII	Female Labour Absorption Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLabCst
NB	avg	8.45	6.05	sum	95	-89	-66	-451	12	101	-66	-42	-511	5	-6600	108	-506	-6492
				avg	4.32	-4.05	-3.00	-20.50	0.55	4.59	-3.00	-1.91	-23.23	0.23	-300.00	4.91	-11.50	-149.89
RLI	avg	10.57	4.64	sum	405	-131	-60	-345	31	12	-12	-13	-131	18	-1659	179	-113	-1480
				avg	28.93	-9.36	-4.29	-24.64	2.21	0.86	-0.86	-0.93	-9.36	1.29	-118.50	12.79	-4.04	-58.61
STW(d)	avg	12.90	6.05	sum	720	-445	260	-384	67	-16	42	7	151	100	1961	935	251	2896
				avg	36.00	-22.25	13.00	-19.20	3.35	-0.80	2.10	0.35	7.55	5.00	98.05	46.75	6.28	51.53
STW(e)	avg	11.10	6.10	sum	195	-210	65	-420	0	11	30	-21	-370	20	-5235	207	-350	-5028
				avg	19.50	-21.00	6.50	-42.00	0.00	1.10	3.00	-2.10	-37.00	2.00	-523.50	20.70	-17.50	-260.75
DTW(e)	avg	13.50	6.00	sum	230	-150	75	-135	21	0	33	0	20	54	265	498	74	763
				avg	28.75	-18.75	9.38	-16.88	2.63	0.00	4.13	0.00	2.50	6.75	33.13	62.25	4.63	19.94
STW+DTW(e)	avg	12.17	6.06	sum	425	-360	140	-555	21	11	63	-21	-350	74	-4970	705	-276	-4265
				avg	23.61	-20.00	7.78	-30.83	1.17	0.61	3.50	-1.17	-19.44	4.11	-276.11	39.17	-7.67	-136.06
ALLSCHEME	Avg	10.96	5.78	sum	1645	-1025	274	-1680	131	108	27	-57	-786	209	-10498	2059	-577	-8439
				avg	22.53	-14.04	3.75	-23.01	1.79	1.48	0.37	-0.78	-10.77	2.86	-143.81	28.21	-3.95	-70.47

KHARIF					Male Labour Absorption				Female Labour Absorption									
IrrScheme		Wge/dayM	Wge/dayF		Main	Trad	SubI	SubII	Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLab[illegible]
NB	avg	14.77	10.95	sum	50	-8	-65		12	149	15		-23	176	-369	2480	153	2[illegible]
				avg	2.27	-0.36	-2.95		0.55	6.77	0.68		-1.05	8.00	-16.77	112.73	3.48	-4.[illegible]
[illegible]	avg	14.93	7.86	sum	555	-390	85		109	8	55		250	172	4805	2357	422	71[illegible]
				avg	39.64	-27.86	6.07		7.79	0.57	3.93		17.86	12.29	343.21	168.36	15.07	177.[illegible]
STW(d)	avg	17.75	11.70	sum	860	-452	181		172	-23	96		589	245	11443	3595	834	15[illegible]
				avg	43.00	-22.60	9.05		8.60	-1.15	4.80		29.45	12.25	572.15	179.75	20.85	292.[illegible]
STW(e)	avg	16.20	13.50	sum	340	-405	16		107	-30	39		-49	116	-1060	1703	67	[illegible]
				avg	34.00	-40.50	1.60		10.70	-3.00	3.90		-4.90	11.60	-106.00	170.30	3.35	-47.[illegible]
DTW(e)	avg	17.13	12.75	sum	267	-290	0		99	-15	0		-15	84	-300	1239	69	[illegible]
				avg	33.38	-36.25	0.00		12.38	-1.88	0.00		-1.88	10.50	-37.50	154.88	4.31	-13.[illegible]
STW+DTW(e)	avg	16.61	13.17	sum	615	-695	16		206	-45	39		-64	200	-1360	2942	136	1[illegible]
				avg	34.17	-38.61	0.89		11.44	-2.50	2.17		-3.56	11.11	-75.56	163.44	3.78	-32[illegible]
ALLSCHEME	avg	16.05	11.11	Sum	2080	-1545	217		499	89	205		752	793	14519	11374	1545	2[illegible]
				avg	28.11	-20.88	2.93		6.74	1.20	2.77		10.16	10.72	196.20	153.70	10.44	1[illegible]

RABI					Male Labour Absorption				Female Labour Absorption									
IrrScheme		Wge/dayM	Wge/dayF		Main	Trad	SubI	SubII	Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLa[illegible]
NB	avg	3.95	1.86	sum	370	-185	-15		69	-15	0		170	54	2420	552	224	[illegible]
				avg	16.82	-8.41	-0.68		3.14	-0.68	0.00		7.73	2.45	110.00	25.09	5.09	5[illegible]
RLI	avg	15.00	8.14	sum	1535	-163	94		261	0	97		1466	358	21617	3695	1824	2[illegible]
				avg	109.64	-11.64	6.71		18.64	0.00	6.93		104.71	25.57	1544.07	263.93	65.14	78[illegible]
STW(d)	avg	14.65	9.60	sum	1960	-175	-255		250	0	145		1530	395	23870	4455	1925	2[illegible]
				avg	98.00	-8.75	-12.75		12.50	0.00	7.25		76.50	19.75	1193.50	222.75	48.13	60[illegible]
STW(e)	avg	13.60	8.50	sum	955	0	-55		123	0	45		900	168	13420	1780	1068	1[illegible]
				avg	95.50	0.00	-5.50		12.30	0.00	4.50		90.00	16.80	1342.00	178.00	53.40	67[illegible]
DTW(e)	avg	15.00	7.38	sum	895	0	110		156	0	12		1005	168	15105	1666	1173	1[illegible]
				avg	111.88	0.00	13.75		19.50	0.00	1.50		125.63	21.00	1888.13	208.25	73.31	95[illegible]
STW+DTW(e)	avg	14.22	8.00	sum	1850	0	55		279	0	57		1905	336	28525	3446	2241	3[illegible]
				avg	102.78	0.00	3.06		15.50	0.00	3.17		105.83	18.67	1584.72	191.44	62.25	80[illegible]
ALLSCHEME	avg	11.45	6.66	sum	5715	-523	-121		859	-15	299		5071	1143	75757	12148	6214	8[illegible]
				avg	77.23	-7.07	-1.64		11.61	-0.20	4.04		68.53	15.45	1023.74	164.16	41.99	51[illegible]

ANNUAL IrrScheme		Wge/dayM	Wge/dayF		Male Labour Absorption Main	Trad	SubI	SubII	Female Labour Absorption Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLabC
HB	avg	10.82	11.11	sum	515	-282	-146	-451	93	235	-51	-42	-364	235	-2401.60	3626.6	-129	1224.9
				avg	23.41	-12.82	-6.64	-20.50	4.23	10.68	-2.32	-1.91	-16.55	10.68	-109.16	164.85	-2.93	-49.
RLI	avg	15.81	11.42	sum	2885	-684	119	-345	466	20	140	-13	1975	613	31240.72	7060.765	2588	38301.
				avg	206.07	-48.86	8.50	-24.64	33.29	1.43	10.00	-0.93	141.07	43.79	2231.48	504.34	92.43	1137.
STW(d)	avg	16.23	11.50	sum	4085	-1072	186	-384	604	-39	283	7	2815	855	46104.71	10582.25	3670	56686.
				avg	204.25	-53.60	9.30	-19.20	30.20	-1.95	14.15	0.35	140.75	42.75	2305.24	529.11	91.75	1173.
STW(e)	avg	17.15	13.04	sum	2310	-615	26	-420	395	-19	114	-21	1301	469	22194.04	5970.818	1770	28164.
				avg	231.00	-61.50	2.60	-42.00	39.50	-1.90	11.40	-2.10	130.10	46.90	2219.40	597.08	88.50	1133.
DTW(e)	avg	15.71	11.69	sum	1845	-440	185	-135	380	-15	45	0	1455	410	22906.41	4753.939	1865	27660.
				avg	230.63	-55.00	23.13	-16.88	47.50	-1.88	5.63	0.00	181.88	51.25	2863.30	594.24	116.56	1457.
STW+DTW(e)	avg	16.51	12.44	sum	4155	-1055	211	-555	775	-34	159	-21	2756	879	45100.46	10724.75	3635	55825.
				avg	230.83	-58.61	11.72	-30.83	43.06	-1.89	8.83	-1.17	153.11	48.83	2505.58	595.82	100.97	1277.
ALLSCHEME	avg	14.61	11.59	sum	11640	-3093	370	-1735	1938	182	531	-69	7182	2582	120044	31994	9764	15203
				avg	157.30	-41.80	5.00	-23.45	26.19	2.46	7.18	-0.93	97.05	34.89	1622.22	432.36	65.97	828.

Source : Sample Survey

An assessment of labour cost is also made in the table by weighting the incremental man-days figures by the computed annual average wage-rate for males and females, respectively. It may be explained here that daily wage-rate tends to vary between seasons and between schemes, as a result of the extent of periodic labour demand vis-a-vis supply. Thus schemes that extend cultivation into the period of normal slack in the labour market are able to do so with relatively smaller wage-involvement for the duration of such cultivation,. The Allscheme average wage-rate is computed by similarly weighting respondent wage-data by season and by scheme-category.

However, computation of labour costs should properly exclude such respondents for whom labour-impact has been nil or negative, since the reduction in wage involvement for them is notional rather than actual. Such an adjusted labour cost has been computed for combined males and female labour under the heading 'TLabCst'. These figures provide an unbiased yardstick for comparison between schemes.

In the irrigated sector a dichotomous tendency is generally noticed between incremental utilisation of male versus female labour. Although positive labour-impact is found for 'Main' and 'SubI' crop-categories and negative labour-impact for 'Trad' and 'SubII', the proportional extent of negative labour-impact is greater for male labour than for female labour. This is, as will be presently seen, the result of a large-scale shift of male labour to the 'Main' crop, and a tendency to maintain some of the 'Trad' crop by utilisation of female labour, rather than going for drastic cut-backs in such acreage. Schematic comparison shows highest labour-impact on DTW(e), followed by RLI(d) and STW(d), very close to each other, and STW(e) at the lower end. However, higher average wage-rates in the case of STW(e) bring up its labour costs to closer proximity with RLI(d), and raises labour costs for STW(d) beyond that of RLI(d).

A study of differential labour-impact between males and females reveals relatively higher female labour absorption for STW(e), in contrast to male labour absorption, which is lower than that of diesel schemes. DTW(e) however shows highest labour creation for both categories.

As against this, labour absorption patterns for non-beneficiaries are radically different. Positive labour-impact for males only occurs in the 'Main' crop with high cut-backs in 'Trad', 'SubI' and 'SubII'. For females, however, positive absorption occurs in the 'Main' and 'Trad' crops with the labour-impact for the 'Trad' crop being so significantly high as to almost counter-balance the (negative) male labour-impact for this crop. The overall tendency for partial substitution of male by female labour is thus even more marked for the non-beneficiary category.

Table 5.2

Seasonwise Incremental Labour Utilisation

BORO	Male Labour Absorption				Female Labour Absorption				(in percentage terms)					
IrrScheme	Main	Trad	SubI	SubII	Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLabCst
NB	0.00				0.00				0.00	0.00	0.00	0.00	0.00	0.00
RLI	3.35				3.35				5.43	2.52	5.90	2.77	4.66	5.24
STW(d)	4.68				5.93				7.59	4.45	8.21	4.84	6.76	7.50
STW(e)	7.04				8.51				11.42	6.39	13.02	7.26	10.09	11.81
DTW(e)	3.82				5.37				6.20	4.03	6.44	4.09	5.62	5.94
STW+DTW(e)	10.87				13.88				17.61	10.42	19.46	11.35	15.71	17.75
ALLSCHEME	18.90				23.17				30.63	17.39	33.56	18.95	27.13	30.48

PREKHARIF	Male Labour Absorption				Female Labour Absorption									
IrrScheme	Main	Trad	SubI	SubII	Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLabCst
NB	0.82	2.88	-17.84	25.99	0.62	55.49	-12.43	66.87	-7.12	0.19	-5.50	0.34	-5.18	-4.27
RLI	3.48	4.24	-16.22	19.88	1.60	6.59	-2.26	18.84	-1.82	0.70	-1.38	0.56	-1.16	-0.97
STW(d)	6.19	14.39	70.27	22.13	3.46	-8.79	7.91	-10.14	2.10	3.87	1.63	2.92	2.57	1.90
STW(e)	1.68	6.79	17.57	24.21	0.00	6.04	5.65	30.43	-5.15	0.77	-4.36	0.65	-3.58	-3.31
DTW(e)	1.98	4.85	20.27	7.78	1.08	0.00	6.21	0.00	0.28	2.09	0.22	1.56	0.76	0.50
STW+DTW(e)	3.65	11.64	37.84	31.99	1.09	6.04	11.86	30.43	-4.87	2.87	-4.14	2.20	-2.83	-2.81
ALLSCHEME	14.13	33.14	74.05	96.83	6.76	59.34	5.08	82.61	-10.94	8.09	-8.75	6.44	-5.91	-5.55

KHARIF	Male Labour Absorption				Female Labour Absorption									
IrrScheme	Main	Trad	SubI	SubII	Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLabCst
NB	0.43	0.26	-17.57		0.62	81.87	2.82		-0.32	6.82	-0.31	7.75	1.57	1.39
RLI	4.77	12.61	22.97		5.62	4.40	10.36		3.48	6.66	4.00	7.37	4.32	4.71
STW(d)	7.39	14.61	48.92		8.88	-12.64	18.08		8.20	9.49	9.53	11.24	8.54	9.89
STW(e)	2.92	13.09	4.32		5.52	-16.48	7.34		-0.68	4.49	-0.88	5.32	0.69	0.42
DTW(e)	2.20	9.38	0.00		5.11	-8.24	0.00		-0.21	3.25	-0.25	3.87	0.71	0.62
STW+DTW(e)	5.28	22.47	4.32		10.63	-24.73	7.34		-0.89	7.75	-1.13	9.20	1.39	1.04
ALLSCHEME	17.87	49.95	58.65		25.75	48.90	38.61		10.47	30.71	12.09	35.55	15.82	17.03

RABI	Male Labour Absorption				Female Labour Absorption									
IrrScheme	Main	Trad	SubI	SubII	Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLabCst
NB	3.18	5.98	-4.05		3.56	-8.24	0.00		2.37	2.09	2.02	1.73	2.29	1.95
RLI	13.19	5.27	25.41		13.47	0.00	18.27		20.41	13.87	18.01	11.55	18.68	16.65
STW(d)	16.84	5.66	-68.92		12.98	0.00	27.31		21.30	15.30	19.88	13.92	19.72	18.63
STW(e)	8.20	0.00	-14.86		6.35	0.00	8.47		12.53	6.51	11.18	5.56	10.94	10.00
DTW(e)	7.69	0.00	29.73		8.05	0.00	2.26		13.99	6.51	12.58	5.21	12.01	11.03
STW+DTW(e)	15.89	0.00	14.86		14.40	0.00	10.73		26.52	13.01	23.76	10.77	22.95	21.03
ALLSCHEME	49.10	16.91	-32.70		44.32	-8.24	56.31		70.61	44.27	63.11	37.97	63.64	57.82

ANNUAL	Male Labour Absorption				Female Labour Absorption									
IrrScheme	Main	Trad	SubI	SubII	Main	Trad	SubI	SubII	NetM	NetF	NLabCstM	NLabCstF	TLab	TLabCst
NB	4.42	9.12	-39.46	25.99	4.80	129.12	-9.60	60.87	-5.07	9.10	-2.00	11.34	-1.32	0.81
RLI	24.79	22.11	32.16	19.88	24.05	10.99	26.37	18.04	27.50	23.74	26.02	22.07	26.51	25.19
STW(d)	35.09	34.66	50.27	22.13	31.17	-21.43	53.30	-10.14	39.20	33.11	38.41	33.08	37.59	37.28
STW(e)	19.85	19.88	7.03	24.21	20.38	-10.44	21.47	30.43	18.11	18.16	18.49	18.66	18.13	18.52
DTW(e)	15.85	14.23	50.00	7.78	19.61	-8.24	8.47	0.00	20.26	15.88	19.08	14.86	19.10	18.19
STW+DTW(e)	35.70	34.11	57.03	31.99	39.99	-18.68	29.94	30.43	38.37	34.04	37.57	33.52	37.23	36.72
ALLSCHEME	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source : Sample Survey

The data for labour-impact aggregates in Table 5.1 are presented in percentage form in Table 5.2. Percentage data facilitate easy comparison between schemes, while revealing which proportion of the total annual impact (i.e. Allscheme impact) is accounted for by each scheme-category, although some distortion has inescapably crept in on account of unequal number of respondents in each scheme for reasons relating to drawing of the sample, as mentioned earlier.

5.2 Inter-Seasonal Variations

The labour-shifts observed in the annual figures in the previous tables demand further scrutiny. This is because the the seasonal character in such shifts is largely concealed in case of annual data. Thus closer identification of labour shifts inevitably leads to consideration of incremental labour-utilisation by cropping season.

Table 5.3 presents inter-seasonal variations in labour creation in the form of a decomposition of the aggregate annual per acre figures of Table 5.1 into seasonal aggregates, over all schemes, for the boro, pre-kharif, kharif and rabi seasons. Labour-impact is indicated separately in both man-day and cost terms for male & female labour. Non-bracketed figures relate to seasonal aggregates, with seasonal averages being bracketed below. The table also provides a percentage inter-seasonal break-up of the labour-impacts and labour costs in relation to the annual average.

Differences in the labour-creation between males and females are immediately obvious. Whereas the bulk of additional man-days created for male labour fall in two crop seasons, namely, rabi and boro, with the positive labour increment of the kharif season almost concealing the negative increment of the pre-kharif season, the additional man-days created for female labour are more widely dispersed and positive for the different seasons. Analytically combining the two observed patterns, the directions of labour-substitution become apparent.

Enhanced labour-demand during rabi and boro seasons is explained by the fact that these seasons cover the dry months, to which cultivation has now been extended with the availability of irrigation. Boro, in fact, is entirely a post-irrigation introduction. Although incremental female involvement is fairly high during these seasons, in percentage terms it is proportionately smaller than in the case of males. In the kharif season a much higher proportion incremental man-days is created for female labour relative to male labour, indicating partial substitution of male labour demand by female labour demand. The reason is high prevailing wage-rates during the kharif season, when labour demand, including non-beneficiaries, reaches its annual peak. It should be remembered here that kharif cultivation is primarily rain-fed and thus least susceptible to irrigation-induced impacts. Thus available male labourers already being fully-absorbed, or nearly so, additional man-days during these seasons are filled to a high extent by females. Labour-impact percentages during the pre-kharif season present special feature. In this case, female labour-impact is opposite in direction to male labour-impact. It will be remembered, from analysis in the previous chapter that the large-scale preferences of STW(e) and DTW(e) for boro cultivation, there has been a corresponding wide spread cut-back in their pre-kharif acreage. In the case of STW(d), too, a partial shift has been remarked upon. In labour-impact terms replacement of the negative male labour increment by the positive female labour increment partially helps to maintain pre-kharif acreage to some extent, while also permitting shift of male labour to boro cultivation.

In labour cost terms, similar inter-seasonal patterns are observed for both male and female labour. However, comparison of labour cost percentages with labour utilisation percentages gives deeper insight into the phenomenon of inter-seasonal wage-competitiveness. Proceeding by season, it can thus be observed that percentage incremental labour cost are generally smaller than percentage incremental labour utilisation over rabi, boro and pre-kharif seasons, when slack prevails in the labour market because of low intensity dry-month cultivation with, consequently, depressed wage-rates. Conversely, in the case of high intensity kharif cultivation, percentage incremental labour costs exceed percentage incremental labour utilisation, because of the relatively saturated labour market situation, in which circumstance there is also a tendency for substitution of more expensive male labour by relatively cheaper female labour. Furthermore, keeping in mind the temporal overlap between boro and pre-kharif seasons, declining male involvement in pre-kharif cultivation is further encouraged by enhanced boro demand for male labour at the new higher boro wage-rate and, once more a tendency to substitute relatively cheaper female labour for male labour resurfaces. However, since the functions of male labour are not entirely duplicated by female labour, such substitution is not absolute.

The foregoing analysis of inter-seasonal labour shifts has been pursued independently of scheme characteristics and has revealed general aspects of inter-seasonal variation. However, since this study is more concerned with the evaluation of differential impact on the agricultural situation by scheme category, a more detailed analysis is called for. This is now undertaken with reference to the composite inter-seasonal table relating to incremental labour utilisation i.e. Table 5.4.

Table 5.3

Inter-Seasonal Variations in Labour Creation

	Maler Labour	Female Labour	Labour CostM	Labour CostF	Total Labour(M+F)	TotalLabour Cost(M+F)
BORO	2200	449	40285	6062	2649	46347
	(30.63)	(17.38)	(33.55)	(18.94)	(27.13)	(30.48)
PRE-KHARIF	-786	209	-10498	2059	-577	-8439
	(-10.94)	(8.09)	(-8.74)	(6.43)	(-5.90)	(-5.55)
KHARIF	752	793	14519	11374	1545	25893
	(10.47)	(30.71)	(12.09)	(35.54)	(15.82)	(17.03)
RABI	5071	1143	75757	12148	6214	87905
	(70.60)	(44.26)	(63.10)	(37.96)	(63.64)	(57.81)
AnnSum	7182	2582	120044	31994	9764	152038.6752
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Source : Sample Survey

Table 5.4

Incremental Labour Utilisation by Scheme

IrrScheme	LabM	LabF	LabCostM	LabCostF	TotalLab	TotalLabCost
NB	-364	235	-2401.60	3626.6	-129	1224.997
	(-5.07)	(9.10)	(-2.00)	(11.34)	(-1.32)	(0.81)
RLI	1975	613	31240.72077	7060.765	2588	38301.48
	(27.50)	(23.74)	(26.02)	(22.07)	(26.51)	(25.19)
STW(d)	2815	855	46104.71823	10582.25	3670	56686.97
	(39.20)	(33.11)	(38.41)	(33.08)	(37.59)	(37.28)
STW(e)	1301	469	22194.04415	5970.818	1770	28164.86
	(18.11)	(18.16)	(18.49)	(18.66)	(8.13)	(18.52)
DTW(e)	1455	410	22906.41657	4753.939	1865	27660.35
	(20.26)	(15.88)	(19.08)	(14.86)	(19.10)	(18.19)
STW+DTW(e)	2756	879	45100.46073	10724.75	3635	55825.21
	(38.37)	(4.04)	(37.57)	(33.52)	(37.23)	(36.72)
ALLSCHEME	7182	2582	120044	31994	9764	152038.6
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Source : Sample Survey

Table 5.4 presents in both aggregate and relative percentage terms, the schemewise seasonal break-up of annual per acre incremental labour utilisation and annual per acre incremental labour costs. Additional information in the table covers average seasonal wage-rates for both males and females incorporating schemewise variation thereof. The table thus offers, at a glance, a comparative view of schemewise and inter-seasonal variations in all aspects of incremental labour utilisation.

Figures for average wage-rates have to be interpreted taking cognisance of the process of averaging whereby they are computed. Since the total wage-involvement has been averaged over the number of respondents in each scheme-category, average wage-rate figures for particular crop season may appear unreasonably low in the event that a large number of respondents within the scheme category happen to be non-participants in that particular season. In such a case it is always advisable to use the computed seasonal wage-rates for the scheme with the highest participation in the season as representative of the wage-rates that actually prevail. Some distortion has crept in into the percentage figures because of unequal number of respondents in each scheme-category as a result of which diesel percentage figures appear inflated vis-a-vis percentage figures for the electrified schemes which have fewer participants. Thus in cases where the diesel schemes show higher percentage performances relative to electrified schemes, the actual differentials between them will not be as wide as suggested by the figures. Conversely, where percentage performances of electrified schemes predominate over those of diesel schemes, actual differentials would be wider than suggested by the figures.

Proceeding by season, it is seen that incremental labour utilisation of both male and female in rabi cultivation is highest among all schemes for STW(d) followed fairly closely by RLI(d). Electrified schemes show lower labour increments, although DTW(e) draws proportionately more of the males and conversely, for females, for STW(e). In the boro season highest incremental absorption of both male and female labour is displayed by STW(e) followed by STW(d), DTW(e) and RLI(d). Percentage figures, which are scheme-percentages on the aggregate annual increment, reveal these patterns more explicitly for both these seasons.

Schemewise incremental labour utilisation patterns for the kharif season are much more complex. It is noticed that a cut-back in male labour absorption is displayed by both the electrified schemes, namely, STW(e) and DTW(e), although positive increments in female labour utilisation suggest competitive substitution of one category of labour by the other, to an extent that the cut-back in male labour is more than compensated by the enhanced utilisation of female labour. The pattern for the diesel schemes is however different with positive labour-impacts for both male and females. STW(d) remains, by far, the highest creator of labour absorption during kharif season. Complexity, although of a different type, also prevails in the pre-kharif season, where male labour increments are negative for STW(e) and RLI(d) and positive for STW(d) and DTW(e), although only marginal for the latter. Female labour absorption, although positive for all schemes, is much higher for STW(d) and DTW(e) than for STW(e) and RLI(d).

Analytical reasons for the kharif patterns are fairly straightforward. Prior analysis of schemewise cropping has revealed greater retention of indigenous acreage by the diesel schemes, compared to the electrified schemes which are more prone to switching over to HYV in large measure. Since per acre labour requirements for the so-called 'Main' crop are lower than those for 'Trad' crops, incremental male labour utilisation during kharif are negative for STW(e) and DTW(e) and still positive for STW(d) and RLI(d). Pre-kharif patterns are largely attributable to temporal coincidence of this season with boro cultivation, at least as far as the electrified schemes are concerned, with their large participation in boro cropping. In the case of RLI(d), the pre-kharif pattern is the product of both switch over from 'Trad' to 'Main' and of a cut-back in subsidiary cropping. The non-beneficiary group is a non-participant in boro cultivation, which accounts for the zero figures therein in the table. The highest positive labour increment for this category has been during the rabi season, and the highest cut-back, as far as male labour is concerned, during pre-kharif. The negative labour-impact for males during kharif is due to partial switch over to HYV, though labour substitution of males by females does permit retention of indigenous acreage.

In sum, therefore, the results by analysis of incremental labour utilisation shows significant creation of labour capacities during rabi and boro seasons, both of which are non-traditional cultivation seasons largely supported by irrigation, as far as the study region is concerned. The more intrinsically interesting phenomena of labour shifts and the labour substitution attendant upon them is also revealed by inter-seasonal analysis. Although the irrigated sector as a whole accounts for most of additional labour creation, wide-ranging differentials exist between schemes because of the chosen cropping emphasis. The diesel schemes are generally more non-labour intensive than the electrified schemes, although some scheme-related variations between absorption patterns for males versus females are shown to exist. STW(e) is a case in point, and discounting percentage figure for the distortion introduced by unequal number of respondents per scheme-category would only enhanced its position on this score.

LAND

5.3 The Impact on Land

Because the analysis so far covered focuses on inter-scheme performance variation, some interest may thereby have arisen on the question of whether there are any intrinsic determinants that govern options regarding choice of scheme. *A priori*, it might be assumed that scheme-choice by optees is conditioned by their general economic circumstances, including their relative position on the agricultural-landholding scale. Specifically, it may appear reasonable to believe, for example, that cultivators in the non-beneficiary category might comprise only poor and marginal farmers, or that the STW schemes (both diesel & electric), which involve a higher level of private capitalisation-costs, would only be opted for the farmers of more solvent economic status. Since land assets held or rented provide some indication of the economic status of sample respondents, an analysis of these indicators is now made with the limited and pointed objective of distinguishing, if possible, between the classes of respondents in each scheme-category on the basis of their (land) asset-holding patterns.

Table 5.5

Schemewise Landholding & Land Transfer Pattaren

	NB	RLI(d)	STW(d)	DTW(e)	STW(e)	STW(e)+DTW(e)	TOTAL
	avg	avg	avg	avg	avg	avg	avg
TotalLand	4.42	5.65	5.98	6.45	6.50	6.48	5.57
TotalIrrigatedLand	0.03	3.81	3.99	4.02	4.52	4.32	2.85
TotalNon-IrrigatedLand	4.15	1.99	2.13	2.43	1.97	2.16	2.71
Lease-inIrrigatedLand	0.00	0.33	0.41	0.29	0.59	0.47	0.29
Lease-inNon-IrrigatedLand	0.05	0.00	0.00	0.00	0.00	0.00	0.01
Lease-outIrrigatedLand	0.03	0.00	0.00	0.00	0.00	0.00	0.01
LeaseOutNon-IrrigatedLand	0.34	0.10	0.14	0.36	0.17	0.24	0.22
NetLand	4.52	5.57	5.85	6.52	6.07	6.26	5.49
NetIrrigatedLand	0.06	3.48	3.58	3.74	3.93	3.85	2.58
NetNon-IrrigatedLand	4.45	2.09	2.27	2.79	2.14	2.41	2.92
LandTransfer	0.09	-0.09	-0.13	0.07	-0.43	-0.22	-0.08
AnnualIncrementAcerageSown	-0.82	3.34	2.91	4.05	3.55	3.76	2.08
Post-Irr.SownAcreBoro	0.00	0.73	0.90	1.94	2.96	2.54	0.98
Post-Irr.SownAcrePre-Kharif	1.41	2.03	1.90	1.58	1.04	1.26	1.63
Post-Irr.SownAcreKharif	3.75	5.32	5.42	5.76	5.89	5.84	5.00
Post-Irr.SownAcreRabi	0.24	2.41	2.38	2.51	2.16	2.31	1.73
AnnualAcreagePost-Irrigation	5.40	10.48	10.60	11.79	12.06	11.95	9.34
Pre-Irr.SownAcreB	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pre-Irr.SownAcrePre-kharif	1.57	1.69	1.76	1.75	2.74	2.33	1.82
Pre-Irr.SownAcreKharif	4.47	4.80	5.07	5.28	4.95	5.09	4.85
Pre-Irr.SownAcreRabi	0.18	0.64	0.87	0.70	0.81	0.77	0.60
AnnualAcreagePre-Irrigation	6.22	7.14	7.70	7.73	8.51	8.19	7.26

Table 5.5 above, presents information on land-holdings, leasings (-in & -out) and resultant land transfers of irrigated, non-irrigated and total holdings of land in average terms, for all respondent categories, and for the entire sample. It can be seen from the table that very clear differences in land-holding patterns distinguish respondents in the diesel scheme from those in the electrified schemes, with a minimum separation of nearly half an acre in total-holding terms, e.g. between STW(d) & DTW(e) in the table. However, somewhat conversely to a priori expectations, total land-holdings in the NB category are not too far removed from the diesel schemes vis-a-vis those from the electrified schemes under STW(e) schemes. Manifestation of this can be seen if the above distribution of each category are considered in ratio terms. Whereas these ratios (i.e. irrigated:non-irrigated land) evaluate as 1.91 & 1.87 for RLI(d) & STW(d), respectively, which are relatively close, a very wide gap separates them from STW(e) for which the ratio is as high as 2.29. DTW(e) however does not fall into the pattern, registering a ratio of 1.61, which is the lowest in the irrigated scheme categories. No logical explanation can, however, be attributed for this, beyond noting that the relatively inflexible feeder-network of the DTW(e) schemes could conceivably be responsible in rendering their more distant holdings inaccessible to irrigation water. For the NB category the ratio is dismally low at 0.07, for obvious reasons. Whatever little irrigation is available to them is rudimentary and comprises dugwells & handpumps, usually domestic.

Very interesting insights can be gleaned from the data on leasings in the table. It can be seen that all schemes in the irrigated sector lease-in irrigated land. The conceptual implication is not, of course, that the land leased in was irrigated to start off with, but that land of non-irrigated nature is leased-in by them to utilize fully any spare or idle pumping capacity that persists after the irrigation needs of self-owned land have been taken care of. The logic behind this draws its substance from observation that no respondent is a lessor-out of irrigated land, whereas all of them, to smaller or longer degree, do lease-out non-irrigated land. Keeping in mind the earlier observations on flexibility of the smaller STW irrigation schemes relative to the larger schemes, the reasons behind the observed patterns becomes evident. In the case of STW(d) & STW(e) the freedom to move the location of the same pumpset to different borings on their land obviously leads to their much higher inward leasing of irrigated land. In the case of STW(e), this is even higher than for STW(d), which seems to bolster the earlier conclusion during PC-analysis that STW(e) makes the most intensive use of land resources.

For the larger schemes leasings-in are relatively lower in both scheme categories but a differential pattern again emerges, as far as leasings-out of non-irrigated land are concerned, in the case of DTW(e); for this particular scheme-category leasings-out are substantially higher and even exceed leasings-out by the NB category, which may seem paradoxical considering that the scheme also leases-in a substantial amount of land. Once again the inflexibility of the scheme comes into the picture as an explaining-factor. The fact that the same limitations do not seem to effect RLI(d), the other large scheme, may seem to be a little contradictory. Moreover scheme differences between RLI(d) & DTW(e) are technical in origin, and thus resolution of the contradiction is postponed till the next section of this chapter which deals with the more abstruse technical aspects of scheme classification. Besides technical considerations, the peculiarities in leasing behaviour of DTW(e) scheme-holders would imply that their leasings-in consist of the leased-out lands of other cultivators that happen to be contiguous to their spouts whereas they prefer to lease-out outlying lands to those scheme-holders who can make better use for them. This explanation adds consistency to the earlier comment regarding the ratio of irrigated to non-irrigated land applicable to DTW(e). For the NB category the leasing pattern is as expected with high leasings-out of non-irrigated land.

Other rows in the table pertain to land personally held by the cultivator i.e. holdings net of leasings-in but including leasings-out. Patterns here more or less echo the earlier observation on the total land-holding pattern. Average land-holdings in the electrified sector are substantially higher than those of the diesel sector. The non-beneficiaries have a net land-holding that again exceeds a priori expectations. Among all respondent categories DTW(e) has the highest net landholding and RLI(d) the lowest.

As leasings-in by the irrigated sector was seen to comprise irrigated land, much in excess of their leasings-out of non-irrigated land (except for DTW(e), which is somewhat of an exception) the net land holding figures show that the irrigated:non-irrigated ratios will be lower for all irrigated categories. Land-holding patterns also have a dynamic dimension, in the sense that lands presently leased (-in or -out) are eventually permanently transferred through outright purchase or sale. Such land acquisitions, over a dynamic time-frame, are substantially a result of agricultural performance which provides the incentives behind them. Although sample data on land was acquired against a cross-sectional rather than dynamic time frame, an indication of the trends that may eventually lead to such acquisitions is provided by the row of figures against 'LandTransfers'. The figures there show that irrigated schemes, in general, exhibit inward transfers (except for DTW(e), which is subject of out-transfer of a magnitude similar to the out-transfer in the case of non-beneficiaries). Among the other irrigated schemes, smaller schemes show higher inward transfer, which in the case of STW(e), reaches an average level as high as 0.43 acres; this result is an indicator of, and substantiates, their better agricultural performance.

EFFICIENCY OF ENERGY-USE

5.4 Technical Factors in Scheme Efficiency

In an analysis of scheme-efficiency and performance of energised irrigation, some comment on energy-efficiencies is inescapable. While such comment has necessarily been kept to a minimum to avoid too wide a digression from the subject matter of the present thesis, all salient technical aspects that are found to have a bearing on the general findings of the study are presented in this section.

Insofar as irrigation schemes in the energised sector are concerned, they all serve the common purpose of providing supplementary water-source for agriculture in the general economic decision-making framework. However, in their technical aspects, wide differences in technology characterise each scheme, which have a bearing on the questions of energy efficiency. Since the full costs of energy used in irrigation do not always devolve upon the scheme-beneficiary, his investment behaviour may be technology-insensitive. However, an evaluation of the comparative aspects of irrigation schemes classified by energy source, such as is being attempted by this study, requires consideration of real rather than notional and physical rather than monetary costs, which then influence the ultimate recommendations of the study.

A primary technological divide between schemes is imposed by the nature of the pumpset configured into it. Whereas STW(d) and STW(e) use smaller capacity pumpsets of 5 HP rating, powered in the first case by diesel engines with a fuel consumption rating of one litre/hour, the latter use low-capacity electric motors with an electricity rating of 3 kwh. The larger schemes involve non-identically rated pumpsets of 17.5 HP (standard) for DTW(e) and 24.5 HP for RLI(d), although the new RLI(d) technology utilises a 20 HP* submersible pump, with a gravity-assisted channeling system that boosts energy-efficiency. Energy consumption for these schemes are 14 kwh, and 3 litres/hour, respectively. Water discharge achieved in STW(e) 100m^3/h for 5 HP pumps, 200m^3/h for 17.5 HP pumps, 200m^3/h for 24.5 HP pumps, and a higher 400m^3/h for the new technology 20 HP RLI(d) pumps. In the study region however, RLI(d) schemes covered utilise older technology and thus involve only 24.5 HP pumpsets.

Irrigation requirements per acre can be technically related to pump discharge capacities through recourse to an acre-inch transformation of water drawn and cropping-considerations; this is, in fact, the basis for fixation of scheduled water-rates by the West Bengal State Minor Irrigation Corporation Limited (WBSMIC)[1], in the case of RLI(d) & DTW(e) schemes. Similar transformations render the STW(d) & STW(e) water-drawings comparable. RLI(d) & DTW(e) schemes are multiple-user schemes with large area-networks. In their case pumping efficiency decreases geometrically with distance from spout and can lead to great divergences between rated and working pumping capacities. These technical features have already been subsumed into the computation of energy costs, earlier used in the PC-analysis.

As far as the question of scheme-efficiency is concerned, the smaller schemes are intrinsically different from larger schemes. In the case of the former, the entire scheme operation and water-drawal thereof devolves on the beneficiary, who thus decides when to switch on/switch off the pumpset and how long to run it. For the larger schemes this function is performed by delegated staff of the WBSMIC or the other government organisations concerned. The procedure to be officially followed is bureaucratic: it involves prior deposit of water-drawal charges with the block authorities, and certification of such deposit before the pump-operator opens the spout. In practice however, less official procedures are resorted to whereby the beneficiary has a private working arrangement with the operator and is guaranteed supply of water according to necessity on deferred payment if need be. Thus greater laxity seems to affect the efficiency of operation of RLI(d) and DTW(e) schemes. A second, more interesting feature is also observed in these schemes. Since diesel supply for powering the RLI(d) pumpset involves transportation and stockpiling operations by the irrigation authority, often over long distances, supply bottlenecks can result in stalling of pumping operations. This encourages closer monitoring of wastages and economy in the use of relatively-expensive diesel oil on the part of the operator and the committees served. The same economy concerns cannot be said to prevail in the case of DTW(e) which uses a cheaper energy-source, with electric supply available on tap, so to speak. Although the principle of efficient drawal of water rests on coordination of irrigation demand by all scheme-beneficiaries, this principle is often sacrificed on the grounds of expediency when non-simultaneous release of water to individual beneficiaries multiplies water wastage. On an efficiency scale therefore, DTW(e) is subject to larger overdrawal and wastages than RLI(d).

The privately operated STW schemes (both diesel & electric) have a much higher efficiency level than the larger schemes for the reason earlier noted. STW(e) & STW(d) beneficiaries are more cost-conscious than the salaried pump-operators of the larger schemes, and since they have to directly bear the brunt of the energy cost of irrigation at largely unsubsidised rates, they exercise greater prudence in trying to optimise the use of irrigation water. This is especially true of STW(d) scheme-beneficiaries, who have much higher per acre energy costs of irrigation, as earlier mentioned. The PC-analysis had already shown the influence on their investment behaviour, of these higher energy costs insofar as they are affected utilisation of other agricultural inputs. Similar reasons also defines their position on the efficiency scale, relative to each other.

STW(d) beneficiaries have to cope with the problems of securing and transporting (at their own cost), diesel oil to their pumpsets, as well as uncertainties in its supply. STW(e) beneficiaries are free from this onus. Another intrinsic differentiating feature between these scheme-categories is the system-difference that obtains - the diesel operator has to make a prior cash investment on his fuel requirements and thus finds incentive enough to make rational use of it. STW(e) operators are liable for costs of electricity drawn on the basis of two parallel remittance systems designed by he State

Electricity Board. The case of unmetered connections (which was overwhelmingly the case in the sample study), charges are levied at a computed average seasonal rate that adds up to a total liability of Rs.970 annually (now revised to Rs.1380 per annum). Holders of metered connections are billed at metered rates, on a quarterly basis.

It can thus be seen that STW(e) scheme-holders derive the dual benefit of paying electricity charges at the partly-subsidised rates that prevail in the country, and having the facility of deferred payment, which is tantamount to interest-free short-term credit. Between the two schemes, stronger entrepreneurial incentives exist for STW(d) leading to an a priori expectation of greater efficiency from them. The hidden soft-loan character of STW(e) billing leads to entrepreneurship of another sort from them : they are able to commit a greater amount of investible resources to other agricultural inputs, on the strength of the 'hidden credit' advanced to them by the State Electricity Board through the deferred payment system.

Table 5.6

Schemewise Technical Performance Characteristics for Irrigation Systems under Field Conditions

(Per Capita figure)

Irr.Schme.	NB	RLI(d)	STW(d)	STW(e)	DTW(e)	ALL(d)	ALL(e)
Average Land Holding	4.42	5.65	6.02	6.50	6.27	8.67	6.40
Average Irrigated Holding	0.03	3.81	4.07	4.52	3.81	5.84	4.21
Average Irrigated Acerage	0.47	26.22	16.23	58.66	28.14	20.34	45.10
Working Efficiency							
Electricity Consumed	**	**	**	81.71	336.48	**	153.02
Diesel Consumed	**	37.12	38.81	**	**	37.91	**
Adjusted Rated Efficiency							
Electricity Consumed	**	**	**	30	10.31	**	**
Diesel Consumed	**	2.206	20	**	**	**	**
Efficiency Ratio	**	14.44	1.94	2.72	26.49	**	**

Source: WBMIC, Sample Survey

Analysis of sample data in the light of the foregoing energy considerations has been made and the results presented in the above table. Figures relative to average land-holding and average irrigated-holding are indicated as identifying characteristics of the respondent-groupings by scheme, therein, and do not otherwise serve any analytical purpose. The purpose is served by the figures on incremental acreage irrigated. These figures represent the annual picture, inclusive of all cropping seasons and thus take into account all inter-seasonal variations in cropping patterns between schemes that had been observed earlier. It must be noted these figures are also weighted by the number of times each crop (by type) is irrigated, which explains the seeming divergence between them and figures on irrigated holdings. The small average acreage of 0.47 under the NB category is the result of manually-powered dugwell irrigation etc. and does not carry any significant energy implication. All figures in the table are in annual-average terms. Average per capita energy consumption (in litres for diesel schemes and kwh for electrified schemes) per unit incremental irrigated acre for each scheme-category, are then presented. A foretaste of the energy-efficient characteristics of smaller versus larger schemes is readily obtained by comparing the appropriate figures for DTW(e) versus STW(e), and RLI(d) versus STW(d). From this comparison it can be seen that in the case of the electric schemes DTW(e) is phenomenally more energy-inefficient than STW(e). While precisely the same thing can not be said to characterise the comparison between RLI(d) and STW(d), RLI(d) being, very marginally, more efficient, STW(d) performs very creditably in almost compensating for the severe operational handicaps imposed on it by its technical features i.e. its low-capacity high-consumption pumping system.

Further insight into the energy-efficiency characterising each scheme, and more particularly into the problem of wastages alluded to in the a priori comments, can be gained through a comparison of the working-efficiency (or operational-efficiency) of each pumping system, with its rated efficiency. In the latter, some technical adjustment has, however, to be made because of non-ideal field conditions, which is done by assuming that each pump operates at an arbitrary 75% of its ideal-rated capacity.

Wide divergences, as observed between the adjusted rated efficiencies and working efficiencies will, after derating, be accounted for mainly through losses connected with the delivery system rather than the pumping system itself. Evidence of the magnitude of such losses is provided by the efficiency ratios computed which are derived by dividing the working efficiency measure by the adjusted rated-efficiency measure. It is here that the full picture emerges. Ratios for the electrified sector are now fully amenable to comparison with the diesel sector. The difference between efficiencies of large & small schemes is abundantly clear. The efficiency ratio for the shallow tubewell schemes lies in the range 1.94 to 2.72, while the range in the case of the large schemes is much higher at 14.44 to 26.49. As expected, highest energy efficiency prevails in the case of STW(d) and highest inefficiency in the case of DTW(e), with STW(e) and RLI(d) occupying the intermediate position in this efficiency scale. Nevertheless, the shallow tubewell schemes constitute a distinct sub-group of the irrigated sector, on energy-efficiency concentrations.

It may be pertinent to explore the underlying reasons. RLI(d) and DTW(e), being networked schemes, have an extensive distribution system of delivery channels and individual spouts, under manual control. Because of unlined water channels a large amount of seepage loss takes place. Since the water delivered spans over much larger land areas, transpiration and evaporation losses also multiply. Rated capacities for the 17.5 HP and 20-24.5 HP pumps used by these schemes are nominal; the reality is that such capacities rapidly decline over the large operational network with attendant energy dissipation. STW(d) and STW(e) schemes are boring-oriented instead of network-oriented : it is often usual for the scheme-beneficiary concerns to have three or four borings, all located on his own land. While the STW(e) scheme-holder is somewhat restricted by the availability of a suitable electrical connection within striking range, STW(d) pumpsets are untethered and are trundled from boring to boring by the scheme-holder. This gives the STW(d) beneficiary an element of flexibility in irrigation operations that is the source of envy to all other scheme-beneficiaries; it also accounts for highly energy-efficient behaviour on his part. As to how much of this energy-efficiency is due to this flexibility, and how much due to higher cost-consciousness, this is a question still open, although it may be rationally expected that these two different incentives towards energy-efficiency complement each other.

*WBSMIC, Schedule of Rates,1989.