The Technical Potential for Increasing Labour Absorption in Agriculture

INTRODUCTION

On the basis of the existing production conditions in Pakistan's agriculture, we have estimated that in the Punjab alone, the labour requirement for crop production is 578.53 million man days per year. According to the 1972 Census of Agriculture there were 2.57 million farm households, (with 6.5 members per household). This means that the farm population in the Punjab in 1972 was being 'maintained' on the basis of 225.10 man days of labour per household, per year.

The existing technical conditions and the social organisation of agricultural production are such that the prevailing level of labour absorption is inadequate to maintain even the existing farm population at a minimum standard of living. Thus for example a field survey in 1978 showed that in 5 of the principal irrigated districts of the Punjab, 23% of farmers in the size class below 8 acres were unable to provide a subsistence income for their families and were obliged to obtain Consumption loans for achieving a subsistence level of consumption. If we consider the economic condition of the poor peasantry over time we find that in the period 1965 to 1978,

33% of farmers in the size class below 8 acres suffered a deterioration in the quantity of diet and 67% and experienced a deterioration in the quality of diet.' According to the study on rural poverty by Naseem, 74% of the rural households in Pakistan in 1971-72 had an income so low, that they were unable to consume even 2100 calories per day per household member. By 1979 this figure had reached 63%[2].

If the existing rural population is to receive adequate nutrition, and if the farm sector is to increase its capacity for labour absorption in the future two kinds of changes would have to be brought about:

(1) Realizing the considerable technical potential of Pakistan's agriculture in terms of:

increased crop yields;
reclamation of land within the existing canal- commanded area; and
increasing the farm gate availability of water through increased irrigation efficiency.

(2) Institutional changes in rural society designed to reduce the inequality in the distribution of land ownership, and to improve the access of the small farmers over agricultural inputs, in order to improve the distribution of agricultural income. Such changes may be particularly advisable in a situation where as we will show, large landowners tend to resume land formerly rented out to smaller farmers, for self-cultivation on large farms, using increasingly mechanized techniques. Such a tendency at the level of social organisation of

agricultural production may be reducing the labour absorptive capacity given the prevailing technical conditions in agriculture.

In this chapter we will discuss the technical potential of Pakistan's agriculture for increased production a labour absorption. In the subsequent chapters we will e, the social dynamics of Pakistan's agrarian structure and the implications for labour absorption.

SECTION I

THE POTENTIAL FOR EXPANDING YIELDS PER ACRE

The technical potential for increased agricultural production and labour absorption in Pakistan is based essentially on three factors:

(1) Pakistan's crops yields for each of the major crops are about one-third of the potential of the particular seed varieties being used. (See Table 2).

(2) There are 21.8 million acres of land in the existing canal-commanded area which can be reclaimed for irrigated cultivation. (See Table 3).

(3) There are about 38 million acre feet (MAF) of water that can be added to the present farm gate availability of 73 MAF, by n of Investment in canal remodeling surface storage and groundwater development.

In estimating the yield potential an acre of Irrigated being operated at the current average level of productivity (See Table 2, Column 'A'), is taken as the numeraire. In the case of unirrigated saline or waterlogged land investments in land reclamation and irrigation expansion would be required before such land can be converted into the numeraire. The yield potential is defined as the ratio of the median of upper range of the frequency distribution of yield per acre, to the weighted mean. Since the yield potential is defined in terms of the upper range of observed yields, it represents effective use of current technology, rather than employing some future technology.

Realizing the yield potential involves four 'technologies':

(a) The first level involves improved cultural practices.

(b) The second level involves using-high yielding varieties, fertilizer, water, pesticide inputs.

(c) The third involves using increased draft power (usually mechanical, given the imperfections of the labour market) to ensure increased cropping intensities.

(d) The fourth level involves increased use of fertilizer and water along with their timely application.

The three principal determinants explaining the difference between the yields in the upper and lower ranges of the frequency distribution are:

— fertilizer;

— water; and

— improved cultural practices.

Let us consider the yield response of each of these factors in the WAPDA XAES data, for wheat, maize and Cotton respectively.

TABLE 1

LABOUR ABSORPTION POTENTIAL IN CROP PRODUCTION IN PUNJAB UNDER EXISTING PRODUCTION CONDITIONS

(Millions of Man Days Per Year)

With Tractors at 1975 Use Level.			Without Tractors		
Irrigated acreage labour required-ment	Unirrigated acreage labour required-ment	Total Labour require-ment.	Irrigated acreage labour required-ment	Unirrigated acreage labour required-ment	Total Labour require-ment.
511.809	66.722	578.531	620.951	98.267	719.218

Source: i) Pakistan Census of Agriculture, 1972.

ii) Pakistan Census of Agricultural Machinery, 1975.

iii) WAPDA XAES Labour Coefficients, 1979.

Note: Estimates of labour requirement are based on the cropping Intensity, cropping pattern, yield/acre, landuse Intensity, Irrigated area and area covered by tractors, prevailing in 1972.

TABLE 2

POTENTIAL FOR INCREASING YIELDS OF MAJOR CROPS

	Weighted Mean (A)	Median of Upper Range (B)	Potential (B/A) x 100
	Maunds/Acre	Maunds/Acre	Percent
Wheat	15	50	333
Cotton Seed	7	18	257

Rice	20	55	275
Maize	15	45	300
Sugarcane	320	850	266

Source: Revised Action Programme for Irrigated Agriculture Main Report, Vol. II. Master Planning and Review Division WAPDA, May 1979, Page VII-55.

TABLE 3

STATUS OF RECLAMABILITY

(Million Acre Feet)

	Usable Groundwater.	Unusable Groundwater.	Total
Land requiring drainage.			
---Early Sub-Surface Drainage	7.3	4.2	11.5

---Later Sub-Surface Drainage	0.5	2.0	2.5
---Surface Drainage including rice area	---	---	7.8
Total	7.8	6.2	21.8

Source: Revised Action Programme for Irrigated Agriculture, 1979.

(1) It appears that the yield per acre continues to increase in the case of each of these crops even beyond an irrigation level of 20 inches, although the marginal product of water application beyond 20 inches is not as high as in the range 10 to 20 inches of irrigation.

(2) Table 4 shows the yield response to increasing application of fertilizer dosage at an irrigation level of 18 inches. It has been observed that fertilizer use levels are strongly Influenced by the availability of water supplies. Thus the total marginal effect of increasing water, supplies is significantly greater than the marginal effect of water alone. However, it is important to point out

that there are often institutional constraints to increasing fertilizer application in response to increased supply of irrigation. Given the impoverishment of the small farmer and his lack of social influence, he is often unable to mobilize the funds to purchase the fertilizer at the required time. Similarly in cases where he buys the tubewell water of a neighbouring large farmer, the small farmer finds his water application delayed as well. Thus the yield response to water-fertilizer application is likely to be lower in the case of poor peasants due to delayed application.

(3) Since cultural practices are constituted by a set of activities, estimating the marginal returns directly becomes problematic. Indirect evidence, however, indicates that the marginal value of improved cultural practices may be quite high. For example evidence from a Four Year Training and Visit System operating in Rajasthan, India, is shown in Table 5.

TABLE 4

MARGINAL PRODUCT OF FERTILIZER

Water Supply = 18 inches

Fertilizer Use Level	Marginal increase in fertilizer application	Marginal increase in crop yield Kg. / Acre.	Cop Yield fertilizer use ratio.

Kg. / Acre.			
	A	B	B/A
22	12	120	10
40	18	105	5.83
70	30	56	1.87

Source: Revised Action Programme of cit. Page VII-60.

TABLE 5

CROP YIELD INCREASES FROM IMPROVED CULTURAL PRACTICES (Rajasthan, India.)

	Maunds /Acre	
	1974	1978
Paddy	22.8	47.9
Sorghum	4.3	8.7
Wheat	13.0	25.0

Source: Revised Action Programme, Page VII-64.

An approximate doubling of yields over the 4-year period is attributed to the following efforts by the extension staff:-

i) Use f high-yielding varieties.
ii) Use of certified-seed.
iii) Seed treatment by saline water.
iv) Optimum plant densities.
v) Maintenance of optimum plant population by gap filling.

vi) Fertilizer use by criss-crossing.
vii) Plant protection.

SECTION II

ESTIMATED GROWTH RATE OF PRODUCTIVITY

The WAPDA-expanded A S gives figures for net value per acre at 1978 prices for each ample farm. The median value comes to Rs. 500 per acre, on the basis of present crop yields, cropping intensities, fertilizer use levels, water supply levels and cultural practices. Assuming that the levels of additional investments in irrigation improvements and technology adoption rates could be achieved by the year 2000, the average productivity could be raised to Rs. 1500. The growth path from the present Rs. 500 per acre to Rs. 1500 per acre was estimated by using a modified exponential function of the form: Y == K — Le $^{-ex}$. Two functions were derived. The first specifying the growth path of productivity of land requiring drainage/ recommendation from Rs. 150 to Rs. 500 to the target level of Rs.3500 per acre. The avenge growth rates over the 20-years period as shown in Table 6 is 5.3%, but the growth rates in the earlier years are substantially higher than growth rates for later rears. Introduction of new technologies or changes in cropping patterns during the growth process could prevent growth rate from slowing down in the later years. For pie In the case of Pakistan the introduction of high crops, the shifting of wheat to unirrigated regions, of dairying,

introduction of sprinkler irrigation significantly raise the estimated value in the year 2000, well above Rs. 1500 per acre. If such changes do occur then the estimated net value per acre in the year 2000 may well Uêf1ne the lower bound of the potential of agriculture.

TABLE 6

GROWTH RATES OF PRODUCTIVITY

No. of years from Base year (1980)	Productivity Level. Rs. Per (Acre)	Growth rate per Annum (Percent)
3	807	10.5
5	957	6.9
10	1200	3.0
15	1340	1.5
20	1415	0.8
Average growth rate: 1980 to200	------	5.3

Source: **Revised Action Programme of cit.**

SECTTON II

LAND EXPANSION POTENTIAL AND ADDITIONAL WATER SUPPLY POTENTIAL

1) LAND EXPANSION

In the following Table 7 'Land Requiring Drainage' includes saline land that can be reclaimed by leaching. The total amount of land that can be reclaimed under the 'maximum effort' estimated by WAPDA, comes to 21.8 million acres. This area lies within the existing canal command. Additionally 6 million acres of potentially irrigable land could also be brought under irrigation through canal extension and groundwater development in un commanded areas. Thus a total of 27.8 million acres of new land could be brought under irrigated cultivation by the year 2000, if investment is made in all the major modes of land development, i.e., tiles, tubewell drainage surface drainage, canal extension, and guiding and facilitating reclamation efforts.

2) *ADDITIONAL WATER SUPPLY POTENTIAL*

Apart from land reclamation, realizing the agricultural potential would also involve increasing the irrigation supply to the crop root zone. This could be done by increasing both the delivery and application efficiencies of irrigation.[4] At The present time water supply in the Indus Basin is 25% short of the optimal crop water requirements.[5] The major reason for this is that the irrigation efficiency of the irrigation system is less than 50% i.e. about one half of the gross into the canal

system is not used productively by Crops; more than half of these water losses (i.e. 25% of gross inflow) occur in watercourse commands. (See Table 8).

TABLE 7

LAND CONVERSION AND EXPANSION POTENTIAL

(Million acres)

	Present Status 1978	Developed by 1960	Developed by 2000 or after.
Land requiring drainage.	21.8	12	9.8
Outside command	6	2	4
Total:-	27.8	14	13.8

Source: Revised Action Programme.

*Note:-** That is converted form present status to normal irrigated land.

According to computer simulation studies done by WAPDA, an additional 38 maf of water can be made available at the farm gate on the basis of the following assumptions:-

i) The entire water potential is developed.

ii) The entire saline ground water watercourses are 50% lined.

TABLE 8

IRRIGATION EFFICIENCIES

	During	
	Rabi	Kharif
	%	%
I. DELIVERY EFFICIENCY		
All 61 watercourses	55	56
Punjab and NWFP	58	61
Sind and Baluchistan	45	44
II. APPLICATION EFFICIENCY		
All 61 watercourses	70	68
Punjab and NWFP	73	69
Sind and Baluchistan	64	65

Source: 21 Watercourse Survey, WAPDA cited in 'Potential for Irrigated Agricultural Development in Pakistan' South Asia Projects. July, 1981.

iii) Usable ground water zones are enabled to extract ground water on the assumption of full balanced recharge. It is estimated that 50% of the water potential could be developed by 1990 and the rest of the 50% of the water potential could be

developed by 1960 and the rest of the 50% by the year 2000.

SECTION IV

INVESTMENT REQUIREMENTS FOR REALI2ING THE P(YFENTIAL OF AGRICULTURE

When we examine the composition of public expenditure allocations to agriculture during the period 1970-75, almost 50% went into Irrigation and the Indus Basin Project. During the decade of the 1960's, drainage and reclamation investments In fresh groundwater were made on a priority basis, while flood works, watercourse improvements and rural Infrastructure and saline groundwater drainage were relatively neglected. During the 1980's there f a need to recognize the physical Interdependence between increased irrigation supply and drainage; and the conservation of present water supplies through conveyance system improvements, as well as canal expansion and remodeling, drainage works and additional storage capacity.

Table 9 presents projections for the water sector and development Plan up to the year 1984. The two principal assumptions in these projections are

i) An annual Increase of 20% in the level of resources allocated to the water sector; and

ii) Increases in the share of allocations to irrigation, drainage and reclamation. The relative allocation o Drainage and Reclamation would increase to 50% of the total for irrigation and water. A medium-term projection (up to 1990) of the structure of the agriculture and water sector invest ment plan Is given as Alternative 'B' in Table 10. The associated

annual growth of allocations to the water sector average 13%.

TABLE 9

WATER SECFOR DEV PLAN
(1919.M)

	Actual		Allocation		Projection[a]	
	1978-79	1979.80	1980.81	1981-82	1982-83	1988-84
	----------(Rs. Million) ----------					
Pakistan						
Tarbela/Indus Basin	1,081	886	1,007	1,116	948	200
Irrigation	619	491	798	885	1,180	1,880
Drainage & Reclamn	660	745	786	1,140	1,581	2,701
Flood Control	310	216	231	289	328	394
Other[b]	269	247	886	408	508	773
Total:—	2,779	2,585	3,158	8,183	4,540	5,448
Federal Only						
Tarbela/Indus Basin	1,031	886	1,007	1,116	948	200
Irrigation[c]	418	358	615	595	875	1,000
Drainage & Reclamation	687	712	701	1,000	1,391	2,41
Flood Control	181	147	202	239	261	284
Other	93	75	80	80	105	226
Sub Total:—	2,310	2,178	2,605	3,030	3,580	4,120
Provincial Colony						
Irrigation	101	133	178	240	305	380
Drainage & Reclamation	23	33	85	140	190	290
Flood Control	179	69	29	50	67	110
Other (incl. Water Management	166	172	256	323	398	548
Sub Total:—	469	407	548	753	960	1,328

a. Water Resources Section of Federal Planning Division in consultation with WAPDA (February 1981).
b. Includes water management, research, surveys and investigations.
c. Includes expenditure on the Chashma Right Bank Canal; other project dam
d. See Table 10 for details of projects.

Source: Potentials for Irrigated Agricultural Development In Pakistan op cit.

TABLE10

LABOUR ABSORPTION ASSOCIATED WITH REALIZING LAND EXPANSION AND WATER SUPPLY POTENTIAL IN PAKISTAN

Year	1972 (Present Status)	1980 to 1990 (Developed)	1980 to 1990 (Developed)
Many Days required to sustain one farm household (annual)	225.11	225.11	225.11
Labour requirement per acre of irrigated land for farming. (Many days per year)	24.76*	--	--
Area that can be potentially developed for irrigated agriculture (million acres)	27.8	14.8	27.8
Total labour requirement for land developed after 1980. (Many days per year)	--	366448000	688328000
Total Households on farm following land development.	--	1627934	688328000
Total population in farm households absorbed by land development	--	10582000	19877000**

Sources: i) Pakistan Census of Agriculture, 1972
ii) XAES Data WAPDA unpublished.
iii) Estimate mine.

* Note: This figure is estimated by combining WAPDA XAES data on labour requirement per acre for each crop, and the Agriculture Census data on irrigated cropped acreage for each crop. It is important to note that this figure assumes non-tractor farm operation and yields per acre prevailing in 1972.

** Note: This estimated is based on a labour requirement figure per acre (See note above) without tractors and at yield per acre for irrigated acreage prevailing in 1972.

SECTION V

CHANGES IN LABOUR ABSORPTION UP TO THE YEAR 2002 UNDER DIFFERENT POLICY ASSUMPTIONS

In the earlier Sections I to IV we have discussed the potential for increasing land productivity, land reclamation, water supply and the implications for labour absorption and investment. In this section we bring together the estimates and analysis of the earlier sections, to give a picture of changes in the labour absorption potential in crop production, under various policy alternatives.

Table 11 shows our estimates of changes in labour absorption in crop production under each of the four policy options, during the period 1981 to 2002. The critical determinants of changes in labour absorption are:

a) The pace of tractorization.

b) Realization of the potential for bringing 27.8 million acres under irrigated cultivation; and

c) Realizing some of the potential for increasing crop yield per acre.

Our estimates of the labour displacement effect of tractors are based on detailed crop-wise agriculture census data combined with monthly labour requirements data for %ach crop obtained from the WAPDA XAES. It is interesting that our estimate of the per tractor labour displacement comes to 3,842 man days per year, i.e., 10.53 full-time labourers. This is remarkably close to the earlier World Bank Sample Survey results reported in McInerney and Donaldson, “The

Consequences of Farm Tractors in Pakistan". They estimate the labour displacement effect per tractor to be 11 full-time labourers.[7]

The four policy alternatives on the basis of which the estimates of the table 11 are made are as follows:

Policy I: a) Growth rate of tractors and size of tractors in the period 1975 to 2002, are the same as in the period 1968 to 1975.

Policy II: a) Tractors adoption in the period 1975 to 2002 slows down to half the growth rate observed in the period 1968 to 1975, while tractor size remains unchanged.

b) The level of annual Investment In agriculture remains unchanged.

Policy III: a) Tractor adoption in the period 1975 to 2002 slows down to half the growth rate observed in the earlier period, while size remains unchanged.

b) A 18% increase annually in the water sector allocation, in order to bring 27.8 million acres under irrigated cultivations.

Policy IV: a) Tractor adoption slows down in the period 1975 to 2002, to half the growth rate in the earlier period.

b) A 13% annual increase in the water sector allocation, bringing 27.8 million acres under irrigated cultivation.

c) Realizing some of the potential for yield.

increases, leading to an increase of 25% in the per acre labour requirement for Input application, harvesting, and cultural practices.

Table 11 shows that if the existing trend in the growth of tractors continues, and no other policy measure is adopted, there will be a decline in labour absorption on crop production of about 241 million man-days per year. This amounts to a reduction in population absorption of approximately 7 million people by the year 2002. At the other end of the spectrum of policy options, under Policy IV, we estimate an increase in labour absorption in crop production amounting to approximately 710 million man-days / annum absorbing 20.5 million persons in the rural sector.

TABLE 11

PAKISTAN

ESTIMATED CHANGES IN LABOUR ABSORPTION LEVEL IN CROP PRODUCTION DURING THE PERIOD 1981 TO 2002 UNDER VARIOUS POLICY ASSUMPTIONS.

	Policy I	Policy II	Policy III	Policy IV
Change in labour requirement, (Man-days/year)	-240778140	-120392910	+567935090	+709918880
Change in total farm household	-1069650	-534842	+2523035	+3153793
Change in total population in farm household.	-6952725	-3746473	+16399727	+20499654

Source:
i) Pakistan Census of Agriculture, 1972.
ii) Pakistan Census of Agricultural Machinery, 1975
iii) WAPDA XAES Labour Coefficients. Unpublished data.
iv) Report of the Farm Mechanization Committee, Ministry of Agriculture & Works, Government of Pakistan, March, 1970.

Note (1): Estimates Ours.

Note(2)

Policy I	(a)	Growth rate of tractors and size of tractors in the period 1975 to 2002, samea s in the period 1968 to 1975.
	(b)	Level of annual investment in agriculture unchanged.
Policy II	(a)	Tractor adoption in the period 1975 to 2002 slows down to half the growth rate observed in the period 1968 to 1975, while tractor size remains unchanged.
	(b)	Level of annual investment in agriculture unchanged.
Policy III	(a)	Tractor adoption in the period 1975 to 2002 slows down to half the growth rate observed in the earlier period, while size remains unchanged.
	(b)	A 13% increase annually in water sector investment up to 1990, bringing 27.8 million acres under irrigated cultivation.
Policy I V	(a)	Tractor adoption slows down to half the earlier growth rate.
	(b)	A 13% annual increase in water sector allocation, bringing 27.8 million acres under irrigated cultivation.
	(c)	Realizing some of the potential for increased yield leading to a 25% increase in labour requirements per acre.

SECTION VI
1NCREASING LABOUR ABSORPTION IN THE RURAL SECTOR NON-FARM ACTIVITY IN THE AGRICULTURAL SECTOR

(1) *ABOUT THE CHOICE OF THE METHOD OF CALCULATION*

In the concept of employment used in the survey data in Pakistan fails to take account of the central feature of rural employment in the country, i.e. in the earlier Section view discussed the implications of sets of policy packages for labour absorption in farm production activity. In this section we will present our estimates of labour absorption in non-farm activity In the rural sector for the, same policy packages. This will help complete the picture of the overall labour absorption in the rural sector under different policy assumptions.

An accurate estimate of rural employment even at a point in time, on the basis of labour force surveys is not possible because of: a whole range of well-known limitations in the methodology of such surveys. For example:

(a) The concept of employment used by the labour force survey method of "those who are employed or looking for employment" is relevant to the advanced industrialized countries. The rates of "unemployment" derived in this way are hardly relevant in Pakistan where about 80% of the labour force is constituted by self-employed and unpaid family helpers.[8]

(b) The concept of employment used in the survey date in Pakistan fails to take account of the central feature of rural employment in the country, i.e. the seasonal and often informal nature of the employment, and also the frequent switching of jobs in the rural sector,

(c) Many family workers may be really dependents who have taken up "escape jobs" in the rural sector for lack of wage-paying jobs elsewhere in the economy. This would also understate unemployment.

(d) The use of "reference week" is liable to serious bias which could operate in either direction: Thus for example a person may be categorized as employed in the survey, even though he may be unemployed for the entire year except the reference week. Conversely, a .person may be unemployed during the reference week, but employed in other periods of the year.

Apart from the above problems of Population Census e of rural employment, an estimate of off-farm employment based on an estimate of the rural labour force would be subject to a basic conceptual problem: An estimate of non-farm labour absorption based on a subtraction of on- farm labour absorption from the rural labour force figure of the 'Population Census, would give a residual figure. To regard this figure as an estimate of non4arm rural employment would be more hazardous than

heroic and could not even serve as a 'guesstimate'.

Given the above problems in an estimate of non-farm rural employment based on Population Census data, we decided to use instead the WAPDA XAES estimate of the ratio of non-farm to farm employment. We applied this ratio to our estimate of on-farm labour absorption under each policy package, to get estimates In terms of man-days per year. These were divided (In each case) by our estimate of man-days per year required to sustain a family with the standard of living of poor peasants in 1975, and wage rates prevailing in the rural sector in that year. The resultant figure gave a rough estimate of non-farm households under each policy assumption. This figure was multiplied by the 1972 Agriculture Census figure of the number of family members per-non-farm rural household, to get an estimate of non-farm population absorption under different policy assumptions. It Is Important to point out that our estimates of non- farm population absorption are in the nature of "guestimates". Since they are critically dependent on the WAPDA XAES ratio of farm to non-farm employment, the estimates of non-farm population would be subject to the biases inherent in a ratio, that assumes as temporally constant the economic relationship prevailing between the farm and non- farm sector, in 1977. This estimate however may be better than the one based on simply subtracting from the rural labour force figure the estimate of labour absorption in the farm sector: In contrast to the latter estimate

which is a mere residual, our estimate is at least based on considering the economic relationship between the farm and non- farm sectors of the rural economy.

(2) *POPULATION ABSORPTION ESTIMATES FOR THE YEAR 2002 IN THE NON-FARM RURAL SECTOR*

Table 12 shows that with policy package IV an increase In non-farm population absorption of 4.458 million persons can be achieved by the year 2002, i.e., if the potential for increased yields and land reclamation is achieved along with a slowing down of the current rate of tractorization. With policy package III, where the additional land is reclaimed and tractorization slowed down without a significant yield / acre increase, the population absorption in the non-farm sector is estimated at 3.565 million persons. Under policy packages II and I, given the relationship between farm and non-farm activity, a decline in farm population would result in a decline in the absorption level of the non-farm sector. This of course assumes that activity in the non-farm sector is the consequence of activity in the farm sector. This of course would not hold if an autonomous rural industrialization process begins during the period 1981 to 2002. We shall in the following sub-section indicate some of the possible lines along which a dynamic growth process in the non-farm rural sector could be generated.

ALTERNATIVE SOURCES OF EMPLOYMENT GENE1 IN THE NON-FARM IWRAL SECTOR

We have argued in this paper that although at a technological level, considerable potential e for increasing labour absorption (through for example, land reclamation and improved irrigation) this may to. some extent be under mined by the economic and social processes operating in the farm sector. For example the tendency for

labour displace ment associated with rapid tractorization and the changes in the size distribution of farm resulting not only in the eviction of tenants, but also changes in cropping patterns, which could adversely affect the labour absorption potential of the farm sector. (See Chapters 8 and 9). Given these tendencies in the social organization of agricultural production, if the pace of land resumption by bigger landowners and the pace of tractorization Is not slowed down; and a large increase in land reclamation and irrigation availability is not achieved, there could be an absolute decline in the ability of the farm sector to absorb population. It is important therefore to consider measures for increasing the labour absorption in the non-farm sector of the rural areas of Pakistan.

The notion that farmers will spontaneously engage in off-farm activities if adequate price incentives for processed goods are provided, ignores the financial and social constraints In which the majority of farmers are operating For example, 88% of the farms, are below 25 acres, most of them providing an income which is not eve bare subsistence. According to the ILO,'° 74% of the rural households have an income so low that they are unable to consume even 2100 calories a day "per member. Moreover, most of the small farmers are tied to the big farmers through a nexus of debt and social dependence. This means that an overwhelming proportion of farmers are not in the financial position to invest in rural industries. The very small number of large farmers who are generating large incomes show a high propensity to consume. -according to a recent field survey for a doctoral thesis, large farmers (above 150 acres) in the period 1960 to 1978 have a per farm expenditure on consumer durables that is higher than their per farm expenditure on farm implements (including tractors and tubewells) in the same period.[11] (The per farm expenditure being Rs. 119,970,00 while that on farm Implements was Rs. 111,656,00).

Even if large farmers were to undergo a psychological transformation and develop the propensity to save rather than consume, their investment in non-farm activities, as well ma that of urban entrepreneurs cannot be expected without the government provision of a whole range of marketing transportation infrastructure and the establishment of technical, financial and managerial facilities. Apart from this a policy of careful selection of product and location would have to be formulated to ensure that the rural industries actually set up have forward and backward linkages in the rural sector so as to maximize the secondary multiplier effects of investment. Some examples of non-farm productive activity in the rural sector which could be considered are[12]:

(1) Poultry, meat and egg production. For this purpose small hatcheries for broiler and layer chicks could be established. These would have to be supported by a collection, inspection and rapid transportation system, and a marketing infrastructure.

(2) Milk collection and cooling centres could provide additional cash income to farmers who own live stock and also generate employment.

(3) Fruits and vegetables are currently marketed with large differentials between farm and retail prices. Cold storage facilities together with a marketing infrastructure would generate additional employ ment in the non-farm sector, and also induce surplus farmers to invest in these labour- intensive crops.

(4) Choice of appropriate technology in rice mills can also generate off-farm employment. For example the two tons per hour labour-intensive mills could be set up intead of a smaller number of the large 15 tons per hour capital-intensive ones.

(5) Construction industry in the rural areas based on indigenous material can play two important roles. It can be a source of non-farm employment and also serve to increase the secondary multiplier effect of investment in finished goods industries in the rural areas.

Table12

ESTIMATED CHANGES IN LABOUR ABSORPTION LEVEL IN NON-FARM ACTIVITY WITH IN THE AGRICULTURAL SECTOR DURING THE PERIOD 1981 TO 2002, UNDER VARIOUS POLICY ASSUMPTIONS.

	Policy 4	Policy 3	Policy 2	Policy 1
Change in labour requirement in on-farm activity (million of man days per year	709.919	567.935	-120.393	-240.778
Change in labour requirement in on-farm activity (million of man days per year	161.862	129.489	-27.450	-54.897
Change in total non-farm households in agricultural sector (millions)	0.719	0.575	-0.122	-0.244
Change in total non-farm population in agricultural sector (millions)	40458	3.565	-0.756	-1.513

Source:

i. WAPDA Master Planning and Review Division Revised Action Programme for Irrigated Agriculture, Vol. 1. Draft Report, Pages 1-9.

ii. Pakistan Census of Agriculture All Pakistan Report, Page 24

Note:

i. Estimates: Mina

ii. For details of Policy Packages 1 to 4. See footnotes to table 11.

APPENDIX
TABLE 1(A)
PUNJAB
ANNUAL LABOUR ABSORPTION POTENTIAL WITHOUT TRACTORS IN EXISTING IRRIGATION CROPPED ACREAGE UNDER EISTING CROPPING PATTERN OF MAJOR CROPS.
(In Thousand of Man Days).

Size Class	Wheat	Rice	Cotton	Sugarcane	Maize	Oil-Seeds	Pulses	Fodders
Less than 7.5	L 23,207,4 H 30,136.2	8,844.4 11,140.7	14,976.7 18,882.5	6,053.6 7,188.0	3,655.7 4,467.8	535.7 643.1	349.8 508.8	13,305.6 15,614.6
7.5 to 12.5	L 33,237.1 H 43,160.4	12,847.1 16,182.5	23,089.8 39,111.5	9,377.5 11,134.8	4,040.9 4,938.5	1,137.0 1,364.9	734.5 1,068,3	19,000.7 22,298.0
125 to 25	L 48,911.1 H 63,514.1	15,816.9 19,923,4	38,012.0 47,925.2	14,056.4 16,960.4	5,234.4 6,388.7	2,187.9 2,626.5	1,752.9 2,549.6	28,572.6 33,531.1
25 to 50	L 30,301.1 H 39,347.8	9,932.7 12,511.5	24,973.1 31,485.9	7,890.3 9,369.0	2,704.2 3,304.9	1,586.4 1,904.5	1,275.6 1,855.4	16,740.1 19,645.2
50 to 150	L 17,026.3 H 22,109.7	5,970.7 7,520.8	15,100.2 19,038.2	3,422.8 4,064.2	1,296.4 1,581.6	888.3 1,066.4	631.8 919.0	7,675.6 9,007.6
150 & above	L 5,487.1 H 7,125.3	1,679.2 2,115.2	6,439.0 8,118.3	713.4 847.0	307.5 375.8	243.6 292.5	159.2 231.6	1,652.6 1,939.4
Total each crop	L 158,170.1 H 205,393.5	55,091.0 69,394.1	122,590.8 154,561.6	41,514.2 49,293.4	17,239.1 21,057.3	6,578.9 7,987.9	4,903.8 7,132.7	86,947.2 102,035.9
Total for major crops	L 493,035.0							776,310.0
(Thousands of Man Days)	H 616,756.6							971,132.0

Source:
Pakistan Census of Agriculture, 1972
WAPDA XAES Labour Coefficients in the WAPDA data

Note:
The Labour Coefficient for fodder is taken as the average of Kharif and Rabi fodder coefficients in the WAPDA data
L refers to labour absorption estimates based on current yields

APPENDIX

TABLE 1(B)

PUNJAB

ANNUAL LABOUR ABSORPTION POTENTIAL WITHOUT TRACTORS IN EXISTING UNIRRIGATION CROPPED ACREAGE UNDER EISTING CROPPING PATTERN AND EXISTING CONDITIONS PRODUCTIONS.

(In Thousand of Man Days).

Size Class(Acres)	Wheat	Cotton	Sugarcane	Maize	Oil-Seeds	Pulses	Fodders
Less than7.5	6,767.84	179.25	91.41	1,640.98	455.21	875.25	1,579.41
7.5 to 12.5	8,097.28	253.23	145.66	667.20	618.43	1,634.25	2,265.10
12.5 to 25	11,018.86	410.14	196.01	510.08	945.09	3,427.06	3,663.56
25 to 50	6,924.24	268.59	161.30	259.32	620.80	5,190.50	3,070.85
50 to 150	3,956.35	234.25	118.78	109.78	277.28	5,881030	2,499.01
150 and above	793.51	77.06	26.40	29.49	50.57	1,444.52	588.23
Total each crop	37,558.08	1,422.52	739.56	3,216.92	2,967.38	18,453.42	13,666.16

Source:
Pakistan Census of Agriculture, 1972.
XAES data for labour coefficients (unpublished data)

APPENDIX

TABLE 1 (C)

P U N J A B

ANNUAL LABOUR REQUIREMENT FOR IRRIGATED CROPPED ACREAGE WITH TRACTORS (1975 USE LEVEL)

(BY MAJOR CROPS)

Crop	Cropped acreage (irrigated)	Cropped Acreage covered by Tractors (irrigated)	Man-Days Requirement for Tractorized Acreage.		Man-Days Requirement for non- Tractorized Acreage.		Total man days Requirement
			Per Acre Requirement	Total Requirement	Per Acre Requirement	Total Requirement	
	1	2	3	4	5	6	7
Wheat	9482599	1631067	12.5	20388450	16.5	129558000	149946450
Rice	1829041	314588	23.8	7487194	29.8	45117200	52604394
Cotton	4337962	746136	23.9	17832650	27.9	100216800	118049450
Sugarcane	839181	144308	42.9	6190813	48.9	33985500	40176313
Maize	756758	130204	18.5	2408774	22.5	14107500	16516274
Oil-Seeds	547335	94084	7.9	743264	11.9	5390700	6133964
Pulses	550363	94600	4.4	416240	8.8	4012800	4429040
Fodders	4979791	856560	13.3	11392248	17.3	7127600	18519848
							406375733

Source: i) Pakistan Census of Agriculture, 1972.
ii) Pakistan Census of Agricultural Machinery
iii) XAES data

APPENDIX

TABLE 1 (D)

P U N J A B

ANNUAL LABOUR REQUIREMENT FOR UNIRRIGATED CROPPED ACREAGE WITH TRACTORS (1975 USE LEVEL)

Crop	Cropped acreage (irrigated)	Cropped Acreage covered by Tractors (irrigated)	Man-Days Requirement for Tractorized Acreage.		Man-Days Requirement for non- Tractorized Acreage.		Total man days Requirement
			Per Acre Requirement	Total Requirement	Per Acre Requirement	Total Requirement	
Wheat	2279005	173204	7.5	1229030	11.5	24216711	25515741
Cotton	50957	3872	12.4	48012	19.4	913449	961461
Sugarcane	15134	1150	28.1	32315	34.1	476854	509169
Maize	142897	10860	11.7	127062	15.7	2072981	2200043
Oil-Seeds	249981	18999	5.3	100695	8.3	191715	292410
Pulses	2096988	159371	5.8	924351	7.8	15113412	18037763
Fodders	792242	60210	7.2	433512	9.6	7027507	7461019
							52977606

Source: i) Pakistan Census of Agriculture, 1972.
ii) XAES data

NOTES

1. See: A. Hussain: Impact of Agricultural Growth on Changes in the Agrarian Structure of Pakistan. D. Phil. thesis 1980. University of Sussex, page 369, Table 6.

2. S.M. Naseem: Rural Poverty and Landlessness in Pakistan in Poverty and Landlessness in Rural Asia, ILO Geneva, 1977.
For 1979 figure See:
IFAD: Agricultural Policy and Rural Poverty in Pakistan. Report of the Special Programming Mission to Pakistan. Jan, 1984.

3. The estimates of the technical potential for increased agricultural productivity are drawn from the Expanded Agricultural Economic Survey (WAPDA) and their report entitled 'Revised Action Programme for Irrigated.

4. Delivery Efficiency: is defined as the 'ratio of flow at the point of delivery to the flow at the head of the watercourse.
Application Efficiency; is defined as the ratio of water stored in the crop root zone to water applied in the field.

5. Potential for Irrigated Agricultural Development in Pakistan. Agricultural Division 'A'. South Asia Projects. July, 1981, page 23. (Computer Simulation Studies, WAPDA),

6. These figures are obtained from:
Potential for Irrigated Agricultural Development in Pakistan. op. cit. Tables L and M.

7. John P. Mc and Graham F. Donaldson:
The Consequences of Farm Tractors in Pakistan.: World 8ank Staff Working Paper Number 210 Feb. 1975, page 52.

8. International Labour Organization. Employment Strategy — Pak/ 75/051. Project Findings and Recommendations. Geneva 1977, page 1.

9. M. Ghaffar Chaudhry: Rural Employment in Pakistan: Magnitude and some Relevant Strategies. Pakistan Institute of Development

Economics, Islamabad October, 1981, page 17.

10. See Naseem op. cit.

11. A. Hussairi: The Impact of Agricultural Growth on Changes in the Agrarian Structure of Pakistan. D.PhiL Thesis, Sussex University, 1980, pages 339 & 340.

12. 12, See: Jerry Eckert et a). An Employment Strategy for Rural Areas. Islamabad :May, 1973.