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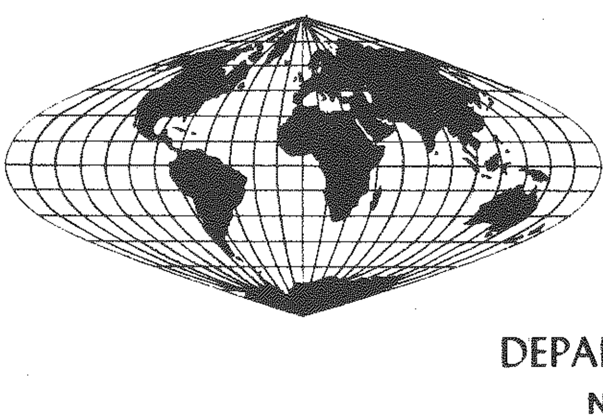
THE SCOPE FOR INCREASING LABOR ABSORPTION IN PAKISTAN AGRICULTURE

by Iqbal Hussain



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It is a pleasure to introduce Iqbal Hussain's monograph "The Scope for Increasing Labor Absorption in Pakistan Agriculture." This study, as many before it, had its genesis in a paper submitted for my Fall term course, "Food, Population, and Employment." It is suggestive of the quality of work now being done by students in Cornell's program in International Economics and Development.

Of the many challenges confronting the developing world, far and away the most important is the need to provide productive employment for the growing labor force. It is difficult to exaggerate the magnitude of this task. Between 1970 and 2000 it is expected that the LDC labor force will double--from one to two billion people. The billion new jobs that must be found are roughly twice the number presently existing in the industrialized countries. Since it is unreasonable to expect that industrialization will proceed at a pace sufficient to absorb such numbers, many will perforce remain in agriculture.

Mr. Hussain's analysis indicates that in Pakistan, at least, the potential for new agricultural employment is substantial. The key to realizing this potential is to increase the area commanded by tubewells. The greater cropping intensity that would result would generate not only new jobs and greater productivity, but would be central to controlling the growing problem of soil salinity. But Mr. Hussain notes that tubewell construction has so far been confined to the larger farms. If smallholders are to participate and further inequities be avoided, substantial modification in the government's credit and land tenure policies are in order.

Mr. Hussain is a former officer in the civil service of Pakistan's Sind Province. He attended Cornell in 1980-81 under the Hubert H. Humphrey North-South Fellowship Program.

We are indebted to Lillian Thomas for typing the manuscript and to Joseph Baldwin for preparing the graphics.

Thomas T. Poleman

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THE SCOPE FOR INCREASING LABOR ABSORPTION IN PAKISTAN AGRICULTURE*

By Iqbal Hussain

I. THE CASE FOR A RURAL EMPLOYMENT-ORIENTED STRATEGY

As policy makers increasingly realize that industrialization in less-developed countries has not generated sufficient employment to meet the needs of a large and growing labor force, they search for measures that can generate increased incomes and employment within the rural sector in the hope that this may stem the avalanche of rural-to-urban migration. Although the long-run relative importance of employment in the manufacturing sector is not in doubt, it is generally recognized that the absolute numbers dependent on agriculture will continue to grow (5). This much is also clear from the population projections for Pakistan (Chart 1). This paper, while recognizing the importance of industrialization, is concerned with short-run policy measures that can generate increased incomes in the rural sector and create the capacity whereby the rural sector is able to provide gainful employment to increasing numbers over the short to medium term. It is hoped that by providing more opportunities for rural residents, the potentially explosive problem of greater urban unemployment may be avoided.

Before dealing with the analytical issues relating to enhanced labor absorption, some background on the physical parameters constraining agricultural productivity in Pakistan is in order.

The Importance of the Agricultural Sector

Agriculture is the mainstay of the Pakistan economy, generating about 35 percent of the GDP, employing about 50 percent of the labor force, and contributing, directly or indirectly, to 60 percent of foreign exchange earnings (8, p. 78).

The Role of Irrigation

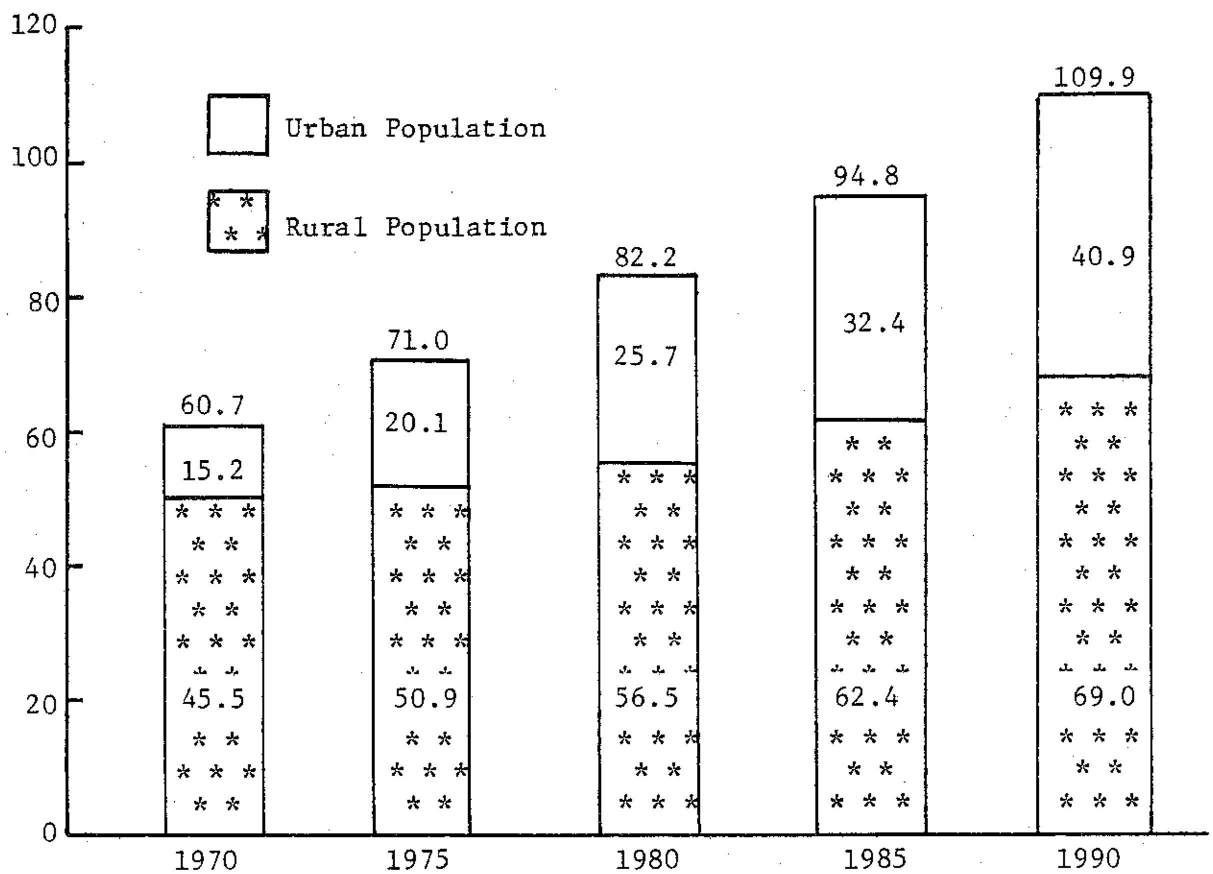
The river Indus is the lifeblood of Pakistan's agriculture.[1/] It is only by diverting the waters of the Indus through one of the largest

*This paper was first submitted, in slightly modified form, as part of the requirements for Agricultural Economics 660, "Food, Population, and Employment," Fall Term 1980/81.

1/ Pakistan and its agricultural resources are discussed in greater depth in the Annex.

CHART 1. PAKISTAN: POPULATION BREAKDOWN BY RURAL AREAS, 1970-1990

(millions)



Source: United Nations, Food and Agriculture Organization, Report of the Seminar on Agricultural Perspective Planning (Islamabad, 1977).

NOTE: FAO projections are predicated on assumption that rural-urban migration occurs at a "high" rate equal to 22 percent of annual increase in total population.

irrigation networks in the world that widespread crop cultivation is made possible in what is basically an arid climatic zone. Although rainfed (barani) agriculture is significant in terms of total cultivated acreage--about 14 million acres--the irrigated tracts of the Indus basin are far more important, both relatively and absolutely, in terms of their contribution to total agricultural value added and in share of cultivated acreage (33 million acres). Our focus in this paper will be confined to the irrigated tracts of Punjab and Sind because the bulk of the agricultural and rural labor force is concentrated in this zone.

Of the total cultivated acreage of 47.5 million acres, the cropped acreage is estimated to be 43 million acres, giving a cropping intensity of 91 percent (9, p. 9). Of course, this is an average figure for Pakistan as a whole, and intensities are far higher in irrigated areas than in the wholly rainfed areas (71 percent). Nonetheless, the present cropping intensities in the irrigated areas could be much higher with greater installations of tubewells.

There are two cropping seasons in a year: the winter or "rabi" season which extends from November to May and the summer or "kharif" season lasting from May to November. The major crops of Pakistan are wheat, rice, cotton, and sugarcane. These four crops account for around 60 percent of the cropped area (8, p. 1); another 15 percent is devoted to fodder which is an indication of the importance of livestock in the agricultural sector. Wheat is the major winter season crop and is followed either by cotton or rice depending on the zone. Sugarcane is a perennial crop.

There is one aspect of Indus basin agriculture that is absolutely critical to its future development and this is the fact that land is not the major constraint--water is. This constraint facing Pakistan's agriculture will be stressed repeatedly during the course of this paper.

The Waterlogging and Salinity Threat to Productivity

Although water is the major constraint in Pakistan's agriculture, a lot of water is lost to the underground aquifer because the canals are not lined. This continuous seepage has meant that the underground water table has risen consistently over the past, giving rise to perhaps the most serious problem confronting Pakistan's agriculture--the "twin menace" of waterlogging and salinity. A rise in the water table leads to salinity in the soil through capillary action of the salts present in the ground water. The other way in which soil salinity can increase is through continuous underwatering. It has been pointed out that in a situation of overall water scarcity it may make economic sense for the farmer to underwater in order to maximize output from total acreage operated (9, p.46). Unfortunately, continuous underwatering leads to deposition of salts in soil surface as farmers repeatedly fail to apply sufficient dosage of water that may enable soil salts to be leached and carried under the root zone of the plant.

The impact of salinity on crop productivity has been studied under experimental conditions. High concentration of dissolved salts inhibits productivity in three ways: (a) they increase osmotic pressures against absorption of moisture by roots of the plant; this increases the moisture stress even when water is relatively abundant; (b) high concentrations of exchangeable sodium affect the permeability of the soil and, therefore, the extent to which desirable mixes of water and air are available in the root zone; and (c) high salt concentrations are liable to cause nutritional imbalances in some plants so that nutrient deficiency symptoms become apparent (9, p. 27).

The control of waterlogging and salinity is the most dire problem facing policy planners in Pakistan. Although vertical drainage schemes by the Water and Power Development Authority (WAPDA) under the title of "Salinity control and reclamation programs" have met with some success, it is also at the level of the farmer that the problem needs to be tackled if the results of public schemes are not to be negated by individual actions. One of the ways that the salinity problem can be combatted is by maintaining a downward flow of salts through the soil throughout the year. This can be done through increases in the intensity of cropping and, since multiple cropping exerts a highly favorable impact on employment, as we shall see a little later, the fundamental strategy for maximizing employment (as suggested in this paper) has an important bearing on the alleviation of one of the critical physical parameters inhibiting the productivity of irrigated agriculture in Pakistan.

The strategy aimed at promoting employment seeks primarily to increase the access of small farmers to tubewell irrigation water which should exert a highly favorable impact on employment through increases in multiple cropping. Secondly, it is proposed that a livestock development program be pursued with the objective of generating higher productivity from the existing livestock population. Such a program would be highly beneficial from an employment and income distribution oriented development strategy in view of the fact that the distribution of livestock is less skewed than is the distribution of other productive assets in the rural areas. Finally, we shall argue that rural industrialization is an integral part of any employment strategy as it could build upon the "linkages" that increased incomes among the farming population would engender.

II. SCOPE OF THE EMPLOYMENT PROBLEM

There are various methods to gauge the extent of underemployment in the agricultural sector. Perhaps the simplest and most widely used is to estimate the number of people who work less than a certain number of days per year or hours per week. Another way of measuring underemployment would be to look at the stock of labor available and compare it to the requirements of cultivated acreage in the agricultural sector after making some assumptions about the total labor requirements per unit of cultivated area. This is what is termed the "surplus labor" approach.

Neither of the above approaches is concerned with the productivity of labor time. Since employment is but a means of earning a living, perhaps the most fruitful way to look at the underemployment problem would be to examine the extent to which employment in the rural areas fails to provide an adequate income. Since our concern is with enhancing employment that simultaneously leads to increased income, the productivity or income approach to estimating underemployment will be subscribed to in this paper.

While underemployment is considered a serious problem in Pakistan agriculture, statistical evidence to support this belief is sketchy. Gaps in our knowledge relating to underemployment are exacerbated by the fact that the usual figures available for Pakistan rely on the "surplus labor" approach. In the absence of direct evidence, we shall look at certain factors in the rural landscape that can perhaps shed a qualitative light on the dimension of and trends in underemployment.

To get some insight into the scale of the problem, we shall look at the following factors: (a) trends in rural poverty; (b) trends in landlessness, and (c) trends in real wages.

Trends in Rural Poverty

An exercise geared to determine trends in rural poverty in Pakistan has been conducted by S. M. Naseem as part of an International Labour Organization (ILO) cross-national endeavor (16). Using data from the household income and expenditure surveys of 1963-64, 1966-67, and a series from 1968-69 to 1971-72 (after which they were discontinued), he estimates daily per capita calorie intake for each income group included in the sample. He then deflates the per capita monthly consumption expenditure for each of the income groups in the various surveys so that all expenditures can be expressed in 1959-60 values. By regressing per head daily calorie intake of each income group on per capita (group) monthly expenditures he derived a threshold expenditure level--an expenditure level just adequate to enable a particular income group to purchase the stipulated norm of 2100 calories per head per day. All households falling below the threshold per capita expenditure level are then classified as poor for each of the periods under consideration. Naseem's results are presented in Table 1.

Under the less extreme case of assumption I, it appears that the proportion of poverty-stricken households first declines and then increases continuously. When poverty is defined in a more extreme fashion (either 92 percent of 90 percent of the stipulated nutrition norm of 2100 calories) no trend can be discerned. The proportion of the households and population defined as poor seems to have been essentially unchanged. Of course, as population growth proceeded apace over this period, the absolute numbers of poor must have increased.

TABLE 1. INCIDENCE OF POVERTY IN RURAL PAKISTAN

(percentage)

Year	Below Poverty Line I (95 percent of minimum of 2100 calories)		Below Poverty Line II (92 percent of minimum of 2100 calories)		Below Poverty Line III (90 percent of minimum of 2100 calories)	
	Households	Population	Households	Population	Households	Population
1963-64	79	72	62	54	53	45
1966-67	73	64	63	52	55	44
1968-69	74	64	63	53	56	46
1969-70	76	68	56	46	45	36
1970-71	79	71	58	47	48	38
1971-72	82	74	65	55	54	43

Source: S. M. Naseem, "Rural Poverty and Landlessness in Pakistan," in International Labour Organization, _Poverty and Landlessness in Rural Asia_ (Geneva, 1977), p. 46.

Even if we accept the best-case scenario presented in Naseem's analysis, i.e. that the proportions of poor households and population were unchanged over this time period, we can only conclude that the income distribution must have worsened significantly in view of the aggregate income and production increase that took place during the interim.

Trends in Landlessness

Evidence relating to landlessness is extremely important since it indicates the extent to which agriculture and nonfarm employment opportunities must be provided for that part of the labor force that is most susceptible to swings in the demand for labor.

There is reason to believe that the "Green Revolution" has resulted in the displacement of tenants as landlords resumed land for self-cultivation. The impetrus to self-cultivation was provided by the high governmental support prices for the new varieties of wheat and rice. What made self-cultivation by landlords a viable proposition was the mechanization process induced by a cheap credit policy favoring purchase of tractors.

A survey jointly conducted by the World Bank and the Agricultural Development Bank of Pakistan (ADBP) of farmers who had received ADBP loans to purchase tractors revealed that there was a 142 percent increase in the average size of such farms, from 45 to 109 acres (16, p. 54). The following information, taken from a World Bank survey, identified the percentage breakdown of the sources of increase in areas of a typical tractorized farm (20, p. 31):

Land previously uncultivated	22 percent
Land previously rented out	42 percent
Land newly rented in	24 percent
Land newly purchased	12 percent
TOTAL	100 percent

The final piece of evidence that clinches the issue concerning the increase in landlessness is the evidence from the Censuses of Agriculture. According to the 1960 Census of Agriculture there were 2.03 million tenant households in Pakistan; the corresponding number in the 1972 Census was 1.29 million--the displacement undoubtedly an effect of the "Green Revolution" that took place in the irrigated areas (9, p. 65).

Trends in Real Wages

Table 2 presents data on real wages in Pakistan over the period 1964-72. Examination of real wage data is important because it provides insight into the demand and supply factors affecting the rural labor force over time. From the data it appears that real wages have increased somewhat over time which would suggest that the demand for labor must have increased over the time period under focus. However, there is an alternative explanation for this phenomenon that is consonant with the

TABLE 2. PAKISTAN: INDEX OF REAL WAGES OF AGRICULTURAL LABORERS, 1964-72

(1965 = 100)

Year	Index
1964	103
1965	100
1966	105
1967	113
1968	113
1969	116
1970	125
1971	125
1972	130

Source: Asian Development Bank, Rural Asia, 1974.

proposition of increasing underemployment of labor. Since the data on real wages relate only to the wage rate and not to the total number of days worked, which, as is evident from inspection of Table 3, decreased with the advent of the new varieties, given the wholesale mechanization that took place in the 1960s, it is possible that the increasing real wage rate trend merely reflects an increase in the minimum daily payment needed to sustain the worker and dependents.

So far, the evidence that has been examined points to the severity of the underemployment problem which is reflected by the widespread poverty prevalent in the rural areas.

III. INCREASING LABOR ABSORPTION IN AGRICULTURE

Appropriate Technology for a Labor Abundant Economy

The problem then is to absorb more labor into agriculture but at higher levels of productivity. Perhaps the best way to approach the problem would be to look at the components of labor productivity and see what policy measures can help us to simultaneously attain both objectives. The basic identity for labor productivity is as under (2; 11):

$$Y/L = A/L \times Y/A$$

where Y = total output of agriculture
L = labor employed in agriculture, and
A = planted acreage

What this identity reveals is that labor productivity can be partitioned into two components: a yield component (Y/A) and an acreage per worker component (A/L). Thus, increases in labor productivity can occur through increases in the acreage that each worker cultivates (an increase in A/L) or through increases in the yield per acre (an increase in Y/A) or indeed through increases in both components.

Given a configuration of factor and product prices there is a certain combination of factors that produces maximum returns to the farmer. In countries where labor is relatively scarce, we would expect technological change directed toward minimizing the use of labor, while countries faced with a relative land constraint would tend to concentrate on increasing yields per unit of planted area. The historical experience of agricultural development in certain countries indeed indicates that this tends to be the case. Thus in the USA where labor was relatively more expensive vis-a-vis land, increases in labor productivity were effected through increases in the acreage cultivated per worker, while Japan, a land scarce economy, increases in the productivity of labor were correlated with increases in the productivity of land (11, p. 163).

Although it is often difficult to distinguish clearly the impact of an innovation, we can broadly identify, as Kaneda does, the impact of mechanical-engineering technology (such as tractor mechanization) with increases in acreage per worker while advances in biological-chemical

TABLE 3. PUNJAB AND SIND, PAKISTAN: LABOR EMPLOYED UNDER TRADITIONAL AND MEXI-PAK WHEAT VARIETIES; SELECTED FARMS 1971-72, BY DISTRICT

(man days per acre)

District	Local Variety	Mexi-Pak
Punjab		
Jhelum	81.1	32.0
Gujranwala	18.1	12.7
Sahiwal	10.3	5.1
Rahimyar Khan	32.4	35.1
Sind		
Jacobabad	8.2	8.6
Larkana	6.6	6.1

Source: Adapted from M. H. Khan, Economics of the Green Revolution in Pakistan (New York, 1975), p. 122.

technology (such as the high yielding varieties of wheat and rice) would operate through increasing yields per unit area.

Employment Potential of Multiple Cropping

There is, however, one particular technology that operates on both components of labor productivity and this is irrigation. By increasing cropping intensities, irrigation increases the area per worker and by allowing greater use of the new seed-fertilizer technology, it has a positive impact on yields.

To increase labor productivity by introducing tractor technology is obviously not a sensible strategy for a labor abundant economy; to increase it through biological-chemical technology necessitates the use of water. Thus irrigation would appear to be the most promising method of increasing labor productivity in a labor abundant economy.

What about the impact of irrigation on labor use? As Mehra points out in her paper on labor use in Indian agriculture, there are three ways in which irrigation exerts its effects on labor use: (a) depending on quality, irrigation increases cropping intensity; (b) since labor requirements of different crops vary, it has a bearing on the employment pattern by bringing shifts in the cropping pattern; and (c) it enlarges the scope for productive use of labor on certain crops (14, p. 3).

The positive relationship between increases in multiple cropping and increases in employment should be self-evident, although the strength of the positive impact on employment will depend on the intensity of cropping. The latter, in turn, will depend on the type of water supply.

An example of the impact that multiple cropping can have on employment is illustrated by the case of Taiwan. There the increase in labor input per unit area during this century has shown an amazingly close relationship with the increase in multiple cropping. The following pattern has been observed from Taiwan (4, p. 42):

Period	Index of Multiple Cropping	Index of Labor Input
1911-1915	100	100
1931-1935	113	114
1956-1960	156	155

Apart from having a positive impact on labor through multiple cropping, irrigation permits an increase toward crops that require adequate moisture but may also require greater labor input. A good example would be cultivation of vegetables that require large inputs of moisture and labor time. Finally, irrigation makes it more worthwhile for the farmer to expend more time on activities such as more frequent weeding as the returns to such activities are greatly enhanced. Of course, the kind of irrigation water that is available makes a great difference. From the farmers' viewpoint, canal waters have the disadvantage of being highly variable in supply since they are dependent on "run of the river" flows, which means that water may well not be available at the critical times in the growing cycle of plants. There is, then, from the farmers' viewpoint a more advantageous mode of irrigation--tubewell water.

Increased Importance of Tubewell Water

Underlying the Indus Basin is a rich resource--the underground aquifer. It was by tapping the underground aquifer that tubewells made the supply of irrigation water increase just prior to the advent of the "Green Revolution" in the 1960s (17). Indeed, were it not for the increasing reliance on tubewell water in the early 1960s, it is doubtful that the new varieties would have spread as fast as they did.

The impact of tubewells on cropping intensity can be seen in Table 4. The availability of tubewell water led to sharp increases in cropping intensity in both the rice and cotton zones of Punjab. Since shortages of canal water are particularly acute in the summer months, we may note the relatively greater impact on cropping intensities in the summer. In terms of the shift in cropping patterns, it is evident from this table that tubewell farmers concentrate relatively more on cash crops like fruit, vegetables, and sugarcane that also need greater inputs of labor. In fact, Kaneda and Ghaffar found from the same sample of farms that Table 4 refers to, that tubewell farmers used on average 57 percent more labor per unit of land than did nontubewell farms (17, p. 45).

As far as productivity of labor is concerned, this is also likely to increase as farmers apply greater amounts of complementary inputs, such as fertilizer, confident in the control over the water supply that tubewell ownership confers. Thus Table 5, which is derived from a linear programming exercise conducted by Gotsch, illustrates the impact of tubewell water on a farmer's net income (7, p. 246). It is evident, then, that availability of tubewell water has a positive impact on labor use through all three of the general factors relating to irrigation that have been alluded to earlier.

There is another aspect of policy concerning labor absorption that is reflected in Table 5. Some proponents of mechanization have argued in favor of the tractor on the basis that it helps alleviate labor bottlenecks at critical periods in the crop cycle such as at harvest time. However, as we have said earlier, water is the most binding constraint in Pakistan's agriculture. This fact is borne out by Table 5, which shows that in a "representative" farm of the Punjab it is not traction that constrains a greater efficiency of resource utilization.

In addition to their favorable productivity and employment implications, tubewells are optimal from the vantage point of the physical parameters constraining long-run productivity in the Indus basin. As was noted in the beginning of this paper, the water table is high and rising in a substantial part of the canal commanded zones. By tapping the aquifer in sweet water areas, tubewell use will help control the waterlogging

TABLE 4. PAKISTAN: PROPORTION OF CROPPED AREA UNDER SPECIFIC CROPS ON SAMPLED FARMS, 1966-67

Crop	RICE AREA		COTTON AREA	
	Farms Without Tubewells	Farms With Tubewells	Farms Without Tubewells	Farms With Tubewells
Summer				
Rice	17.5	41.0	.6	4.4
Cotton	4.9	1.8	19.8	31.6
Maize	1.0	.5	1.5	1.3
Fruit	.6	2.0	1.3	4.4
Sugarcane	4.8	7.6	3.1	6.0
Fodder	13.5	16.0	11.9	14.1
Vegetables	-	-	-	.5
Subtotal	42.3	68.9	38.2	62.3
Winter				
Wheat	45.5	42.9	27.1	39.1
Oilseeds	1.6	3.5	1.0	1.0
Gran	.5	.1	1.3	1.0
Vegetables	2.0	8.8	.1	1.9
Fodder	10.7	13.5	8.7	10.9
Fruit	.6	2.0	1.3	4.4
Sugarcane	4.8	7.6	3.1	6.0
Subtotal	65.8	78.4	42.7	64.3
GRAND TOTAL	108.0	147.3	80.9	126.6

Source: L. Nulty, The Green Revolution in West Pakistan (New York, 1972).

TABLE 5. PUNJAB, PAKISTAN: IMPACT ON NET FARM INCOME AND NET PER ACRE INCOME OF ADVANCED WHEAT AND RICE TECHNOLOGIES ON A "REPRESENTATIVE" 12.5-ACRE FARM (ACCORDING TO A LINEAR PROGRAMMING EXERCISE CONDUCTED BY GOTSCH)

(rupees)

	Net Revenue	Net Revenue per Acre
Traditional Technology		
Without Tubewell	2337	187
With Tubewell	3180	254
Advanced Wheat Technology		
Without Tubewell	2552	205
With Tubewell	3577	286
Advanced Rice Technology		
Without Tubewell	2415	193
With Tubewell	3231	259
Advanced Wheat and Rice Technology		
Without Tubewell	2652	213
With Tubewell	3678	294

Source: Adapted from C. Gotsch, "Relationship Between Technology, Prices and Income Distribution: Some Observations on the Green Revolution in Pakistan," in R. Stevens, H. Alavi and P. Bertocci, eds., Rural Development in Bangladesh and Pakistan (Honolulu, 1972).

menace by lowering the water table. In addition, higher cropping intensities permit salinity control by maintaining a downward flow of salts throughout the year. Hence, in addition to being privately profitable, greater reliance on tubewell water makes eminently good sense from the social and environmental point of view.

Private tubewell development in Pakistan took place largely unplanned and largely unnoticed. Few international or national analysts foresaw in 1960 that the private tubewell was going to prove Pakistan's most potent source of agricultural growth during the 1960s. Between 1960 and 1975 approximately 143,500 private tubewells were sunk (9, p. 48). Most of these wells had a discharge of 1.0 to 1.5 cusecs and an estimated life of five to seven years. But so profitable was their ownership that the output increase resulting from their use enabled the farmer to recover the full costs of installation in a period of two to three years (11, p. 172). It has been estimated that by 1976 these wells supplied about 22 million acre feet of water at the farm level--something like 25 percent of the total irrigation water (6, 9).

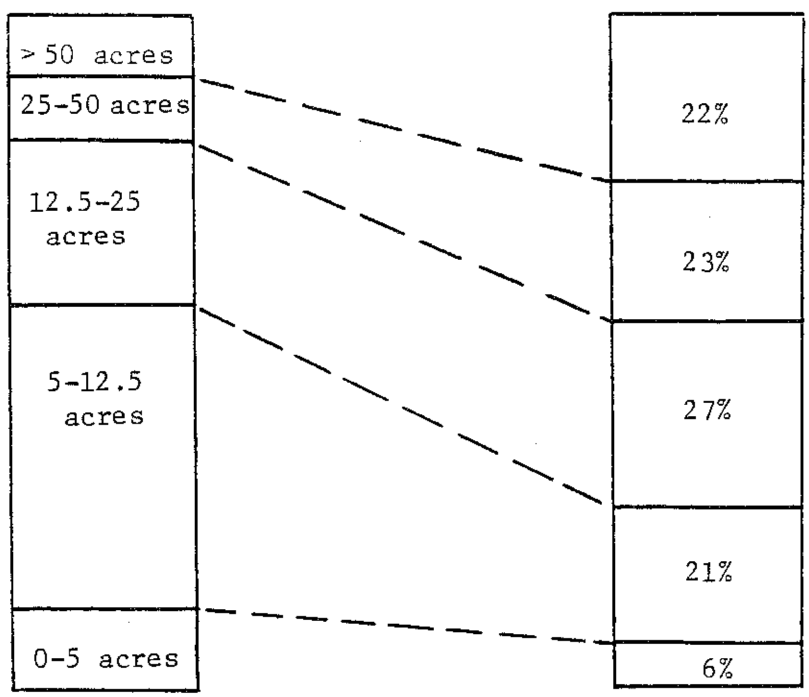
The main reason that this development took place unnoticed was that the public agencies did not conceive of farmers being able and willing to invest in a "lumpy" input like the tubewell. In the event, although larger farmers were more important as far as ownership patterns were concerned, smaller farmers managed, to a certain extent, to derive benefits from tubewell technology. The *modus operandi* in the case of small farmers was that four or five farmers would often pool their resources in order to install a tubewell and consequently share in the water (17).

Government and the Small Farmer

Chart 2 illustrates the pattern of tubewell ownership according to farm size in the Punjab. It is apparent from the table that tubewell ownership is concentrated mainly in the larger farms. Incidentally, one of the consequences of large farmer tubewell ownership has been an improvement in their cropping intensity relative to small farms, although small farmers still have an absolutely higher cropping intensity (9, p. 65).

The fundamental component of the employment strategy recommended in this paper is to allow smaller farms greater access to tubewell water. In this regard certain modifications to existing government policy are called for. Perhaps the most important policy instrument that needs reappraisal is the government's credit policy. At present the National Bank of Pakistan's (a government-owned institution) Supervised Rural Credit Program stipulates that the applicants for a tubewell loan must have at least 12.5 acres. This bias against smaller farmers excludes the possibility of tubewell ownership on more than 30 percent of the suitable cultivated land (9, p. 49). The few tubewells that were reportedly owned by the smaller farmers were probably jointly owned and operated. This tilt toward the larger holdings is also hampering the overall farm

CHART 2. PUNJAB, PAKISTAN: OWNERSHIP OF TUBEWELLS BY FARM SIZE, 1976-77



PERCENTAGE OF HOLDINGS BY SIZE - CLASSES

PERCENTAGE OF TUBEWELLS OWNED

Source: Government of Pakistan, Planning Commission, The Report of the Indus Basin Research Assessment Group (Islamabad, June 1978).

productivity of Pakistan agriculture. For, as the 1972 Census of Agriculture results show, holdings of less than 12.5 acres on average achieve cropping intensities 20 percent or so higher than those prevailing on larger farms (9, p.14). The improvements in water control brought about by tubewell ownership could bring about a significant increase in the productivity of irrigated areas. Perhaps then, a suitable credit program can be designed that relies on the possibility of lending funds to a group of small adjacent farmers who would agree to jointly repay the loan.

Another aspect of public policy that bears on the issue of access to tubewell water by smaller farmers is the possible role of a newer and more appropriate technology that reduces the cost of tubewell ownership. At present the most commonly available tubewell has a capacity of 1 to 1.5 cusecs. This capacity is far greater than what is required for a small farm of less than 12.5 acres--unless of course there is an intention to sell the surplus water or share it with adjacent farmers. Also, many tubewells studied have been found to be overpowered by a factor of two to three particularly in the case of diesel motors which are much larger than needed. Smaller diesel engines are especially suited to the fragmented land-holding situation in Pakistan such that they can be made mobile to serve several small wells in dispersed holding fragments. Thus there is a need to focus on appropriate technology that is better adapted to the socioeconomic conditions facing smaller farmers.

So far we have examined the technological side of the labor absorption issue. There are certain institutional factors bearing on the whole question of labor absorption--particularly those relating to land ownership patterns.

Agrarian Structure and Employment

Table 6 reveals the results from a sample survey relating to labor input usage according to size of holding. As is apparent from the data, larger farms tend to employ relatively less labor per unit area. This is undoubtedly a reflection of the greater mechanization on larger holdings that we have already referred to. The World Bank-ADBP survey of mechanized farms whose results have also been discussed earlier corroborates the pattern reflected in Table 6. The World Bank survey indicated that substantial reduction in man days of labor used had taken place on the mechanized (larger) farms. What is most interesting about the World Bank-ADBP survey results is the finding that while farms had increased their holding size, the cropping intensity was no higher than previously. In other words, tractorization was not associated with greater intensity of land use although this is one of the most frequently heard points made in favor of mechanization (20, p. 21).

Even aside from the question of tractorization there are sound *a priori* reasons that can be adduced to explain greater labor intensity on small farms. Typically, larger holdings have smaller family endowments of labor per acre and so must hire labor at market rates. This

TABLE 6. PAKISTAN: LABOR INPUT BY SIZE OF HOLDING IN MEXI-PAK WHEAT FOR VARIOUS DISTRICTS IN PUNJAB AND SIND

District	Farm Size	Total Labor
Gujranwala	<12.5	14.1
	12.5-25.0	15.7
	25.0-50.0	9.7
	>50.0	7.3
Sahiwal	<12.5	14.0
	12.5-25.0	8.0
	25.0-50.0	5.0
	>50.0	3.0
Lyallpur	<12.5	14.7
	12.5-25.0	16.8
	25.0-50.0	10.1
	>50.0	5.4
Rahimyar Khan	<12.5	34.4
	12.5-25.0	24.5
	25.0-50.0	20.1
	>50.0	32.6
Jacobabad	<12.5	N.A.*
	12.5-25.0	15.6
	25.0-50.0	11.1
	>50.0	4.8
Nawabshah	<12.5	27.2
	12.5-25.0	6.6
	25.0-50.0	5.7
	>50.0	2.8
Hyderabad	<12.5	21.1
	12.5-25.0	19.6
	25.0-50.0	16.0
	>50.0	12.6

*N.A. - Not available.

Source: Adapted from M. H. Khan, Economics of the Green Revolution in Pakistan (New York, 1972), p. 122.

behavior would contrast with that of smaller farmers who tend to apply labor until its marginal product falls below the prevailing wage. The net result is that larger farmers behaving according to the rules of profit maximization tend to apply less labor per acre.

It would appear, therefore, that a land redistribution policy would prove beneficial from the viewpoint of enhancing employment. But as our concern is with the productivity of all inputs it may well be asked if such a policy is detrimental to the goal of higher agricultural productivity.

Studies from various parts of the world have pointed to the inverse relationship between farm size and yields per acre. (In the case of individual crops physical yields are considered, while in the case of all cultivated crops gross productivity measured in money terms is treated as the dependent variable.) I do not intend to go into the reasons why this relationship holds since this is a subject itself deserving a separate study, but one may wish to know whether such a relationship is present in Pakistan agriculture. Khan's analysis indicates that it is not (13). He ascribes the higher productivity of land on larger farms to greater intensity of application of what he terms "nontraditional" inputs, such as fertilizer, machinery, and hired labor. There are two points about this analysis: (a) It does not treat cropping intensity as a factor to be reckoned with. This is surely a significant omission for, as was mentioned earlier, cropping intensities are up to 20 percent higher on smaller farms than they are on bigger ones. Although productivity per unit of cropped area may be higher on larger farms, the productivity per unit of cultivated area could reduce this differential or even eliminate it altogether. (b) Water is not included as an independent variable because of the multicollinearity problem caused by its correlation with another independent variable, acreage operated. It is likely to be the case that water is the critical input explaining the higher productivity of the larger farmers. As long as big farmers have command over better quality water which ownership of a tubewell confers, we must expect them to apply an input such as fertilizer more intensively. To reiterate, farmers need to be sure that water will be available in the critical growing stages of the plant. In the supply-oriented system of canal irrigation whereby farmers take turns irrigating their fields according to a fixed rotation agreed upon with the officials of the Irrigation Department, there is no such certainty. Water from the canals is made available according to the flows in the river, not when the farmer needs it most.

In view of the importance of tubewell water, one could well argue that differentials in intensity of nontraditional input use may well disappear. The smaller farmers need credit to facilitate their use of modern inputs including tubewells but this is an integral component of a soundly designed agrarian reform policy anyway. In addition, we would have the productivity benefits of more intensive use of land. All in all, a sound case can be made for land redistribution policies from the viewpoint of efficiency of resource use.

Employment Generating Potential of a Livestock Development Program

The employment strategy stressed in this paper has emphasized increasing incomes of the small farmer through more productive use of his labor. It has been argued also that there is no necessary conflict between the needs of equity and the argument for efficiency. Land redistribution is not necessarily disadvantageous from the efficiency viewpoint. But, as we all know, such measures are politically sensitive and are easier said than done. So one may well ask: Is there anything else that can generate additional employment and increase incomes of the bulk of the population? There is a way out and this is through designing appropriate policies for the livestock subsector.

Fodder occupies about 15 percent of the cropped area. This fodder acreage, primarily meant for rural livestock, gives us some idea of the importance of livestock in the rural sector. It has been estimated that about 30 percent of the value added in agriculture originates in the livestock subsector (9, p. 66).

The role of livestock in rural areas takes on various forms. In addition to providing farm power and transportation, animals are the source of milk and meat and their dung contributes significantly to household fuel and to soil fertility. For our purposes, the most significant point to note about livestock is that it is about the only productive asset in the rural areas that is relatively equally distributed (9, p. 68). Even the landless are likely to own a buffalo, mainly for the milk.

Mellor has cited evidence from India which indicates that the demand for milk is highly elastic with respect to increases in income both in urban and rural areas (15, p. 173). Although direct evidence for Pakistan is lacking, there is good reason to believe that a similar situation holds. Because the domestic marketing system for dairy products is deficient, such items are imported. The large and growing volume of powdered milk imports suggests that there is a potentially lucrative market for milk (9, p. 70). However, in the absence of any incentives to the local dairy industry, such imports are likely to have a depressive effect on rural incomes through reducing demand for local produce. It is therefore imperative that the government design a suitable policy toward livestock subsector that is in conformity with national requirements while having a positive impact on rural employment.

In addition to the fact that livestock ownership is relatively egalitarian, it may also be noted that dairy production is scale neutral. This latter fact is suggested by experience with dairy production in India (10).

The major constraint limiting income potential of livestock owners is to be found on the supply side. Productivity in terms of calving rates and milk production per animal is abysmally low for both cows and buffaloes. There is, therefore, an urgent need for an artificial insemination program that results in better breeds. The FAO's country perspective plan for Pakistan emphasizes also the importance of providing more and better feeds for livestock; they also recommend strongly the development of the livestock marketing system (6, p. B-197). A minimum purchase price of milk by the Government would be a good first step in the development of such a system.

Emphasis on livestock development will generate additional incomes and create added employment. It should be noted that farmyard manure is an important source of fertilizer in the rural areas. Inasmuch as farmyard manure requires more time to compost and apply, this should be an additional factor promoting labor absorption. Rawski has shown the importance of farmyard manure in enhancing labor absorption in Chinese agriculture (18). Such a spin-off of a livestock development program will be beneficial from the employment point of view in addition to its positive impact on soil productivity.

IV. RURAL NONFARM EMPLOYMENT PROMOTION

Identifying "Linkages" Between Agriculture and Industry

Side by side with increasing agricultural employment there is a need for increasing nonfarm employment in order to absorb those with little or no land holdings.

An important place to begin an examination of feasible policy measures toward the nonfarm sector is to look at those policies that are self-sustaining, and generate increasing incomes. This is the question of seeing in what manner we can best link nonfarm employment to increased farm employment. It was Hirschman who first argued that the "linkages" between agriculture and other sectors are quite weak. This would appear to be incorrect in view of the Pakistan experience. Kaneda has shown that a concomitant of rapid agricultural growth in Pakistan during the 1960s was the burgeoning of a small-scale engineering industry which supplies key durable good imports, mainly diesel engines, pumps and strainers, and also various farm implements to the agricultural sector (11, p. 175). The remarkable fact about this development was that it occurred without any official patronage whatsoever--no subsidies, no tax concessions, and no special credit arrangements. This small-scale industry has been an important vehicle for marshaling of indigenous savings and for training of skilled labor. The major centers of this tubewell related industry are, however, towns like Lahore, Dsaka and Gujramdala. Nevertheless, the important moral behind this development is that agriculture can and does generate "linkages" with industry. The planner's task is to identify those "linkages" that are most viable. It may be pointed out that a tubewell related employment strategy will provide an impetus for the further development and expansion of the local engineering industry with beneficial results for employment in the urban areas.

Fostering Small-scale Rural Industry

The question of which rural industries are most promising--from the labor absorption viewpoint as well as economic profitability--has been studied in depth by Mellor (15) and Chuta and Liedholm (3). Rebutting those who contend that rural nonfarm goods are "inferior" goods, they have argued that there is a "strong, positive relationship between rural income and the demand for rural nonfarm activities" (3, p. 23). In support of this thesis, Mellor, for one, has provided impressive evidence from budget surveys of rural areas in India which indicate that the income elasticity of demand by rural households for nonfood items is strong and, in most cases, exceeds unity. Mellor's data do not, however, distinguish between nonfood items originating in urban areas as opposed to rurally produced nonfood items. Chuta and Liedholm, however, have cited evidence from Sierra Leone which reveals that the rural expenditure elasticity for rurally produced nonfarm consumption goods exceeds unity by a significant margin (3, p. 23). If this type of consumption pattern is valid in the Pakistan context (and this will have to be ascertained by examination of recent budget surveys), then significant possibilities for creating employment in the rural sector exist insofar as increased agricultural employment and incomes make the creation of such rural industrial units economically viable.

In the absence of empirical evidence, perhaps one can make only tentative suggestions as to which industries are likely to be viable. Mellor's study of rural India suggests that small-scale leather industry and light textiles would be promising candidates for employment promotion (15, p. 165).

Two important issues relating to rural industry are (a) their labor intensity and (b) the efficiency with which they use capital. The evidence that we have pertains to small-scale industry in general and not to rural small-scale industry *per se*. Nevertheless, the supplementary data do suggest that any favorable characteristics of small-scale industry in relation to employment promotion and efficiency of capital use are likely to be accentuated in the particular instance of *rural* small-scale industry.

Labor intensity of small-scale industry. Table 7 illustrates data from four countries showing capital-labor ratios (fixed capital per worker) for different sized enterprises. The inverse of the capital-labor ratio would indicate that labor intensity is higher on small-scale industrial units.

These data do not, however, distinguish between rural and urban enterprises and thus, do not conclusively verify whether rural nonfarm activities are themselves more labor intensive. The only data that distinguish between small-scale industry by urban and rural location has been derived from a survey conducted in Sierra Leone. This study of small enterprises by location reveals that small-scale rural industries are at least twice as labor-intensive vis-a-vis small-scale urban units (3, p. 32).

Efficiency of capital use in rural nonfarm industry. It has been argued that small-scale, labor-intensive industries would be inefficient in the sense that they would possess lower output-capital ratios than would their larger counterparts. Hence it was argued that there would

TABLE 7. CAPITAL INTENSITY BY SIZE OF ENTERPRISE IN SELECTED COUNTRIES OF ASIA

(U.S. dollars)

Country (Year)	FIXED CAPITAL PER WORKER		
	Size of Enterprise:		
	1-10 Workers	11-50 Workers	>50 Workers
Japan (1966)	934	1040	4333
India (1965)	278 (small)	557 (medium)	2450 (large)
Malaysia (1968)	521	997 (20-29)	2671 (500+)
Philippines (1970)	1020 (small)	2850 (medium)	8000 (large)

Source: E. Chuta and C. Liedholm, Rural Nonfarm Employment: A Review of the State of the Art (Michigan State Univ., Rural Dev. Paper No. 4, 1979).

be a conflict between maximizing output and employment if such a condition did exist. Recent empirical evidence bearing on this issue has been examined by Chuta and Liedholm who cite evidence to show that smaller enterprises achieve a higher productivity of capital than do larger, more capital-intensive ones. For example, studies in Indonesia and Sierra Leone for rice processing indicate that both traditional hand pounding and small, rural rice mills were more labor intensive and generated more output per unit capital than the larger-scale mills (3, p. 38). Many observers of the Pakistan economy have noted the low rate of capital utilization in large-scale urban industry. Thus not only have such industries failed to generate adequate employment because of their reliance on capital intensive techniques, they have also failed to utilize the capital efficiently.

The stand taken here is that decentralization of small-scale industry is viable from the economic and social benefit point of view. The importance of rural industry as a mechanism for generating employment is apparent also from the experience of China (18). Such small-scale enterprises are likely to be better attuned to local demand conditions and can benefit from the increased incomes that more productive employment entails.

Official promotion of rural small-scale industry in Pakistan can best by done perhaps by providing the infrastructure which can stimulate the inception of private small-scale enterprise. Provision of electricity and roads would appear to be prerequisites in this regard. Also, credit assistance, although forthcoming in recent years, has not been matched by assistance that can resolve the technical problems faced by small entrepreneurs. An example of the need for government technical assistance has already been cited earlier whence it was argued that smaller diesel engines would be more suited to the socioeconomic circumstances of small farmers.

Meeting the Special Needs of the Landless

A useful component of any strategy aimed at alleviating underemployment among the landless would be a public works program. Evidence from several countries indicates that such programs can have a lasting impact on employment if they are seen as more than a means of doling out relief to the underemployed. Thus a properly designed public works program could have a lasting impact on employment if it were designed to build up the productive infrastructure of the rural areas. Thus, for example, feeder roads linking rural to urban markets should lead to enhanced employment by stimulating greater agricultural productivity. To take this example further, a road could help develop a transport industry that helps to convey surplus rural produce to the urban areas. In this manner, permanent employment opportunities can be opened by public works programs.

Thomas and his associates have examined thoroughly the history of rural public works programs in several countries (19). They advise that at least 60 percent of the total costs of a public works project must be spent on wages if the project is to make any dent whatsoever in alleviating rural poverty. They point out that the prime beneficiaries of any infrastructural improvements are going to be those who own productive assets--i.e. land--which indeed is the most productive of all rural assets. Nevertheless, as has already been mentioned, certain infrastructural improvements can definitely increase permanent employment opportunities for the landless and marginal farmers. Among the most important of these projects in the Pakistan context would be feeder roads to rural areas, flood protection schemes, and periodic desiltation of watercourses.

There is one additional point that needs to be kept in mind when designing a rural public works program and this is the question of timing. Several programs have failed because they neglected to address themselves to the question of proper timing. A project undertaken just before a harvest is likely to be detrimental to the welfare of all rural residents inasmuch as it attracts labor away at the peak harvest time. A poor harvest in turn means higher food prices which negates any positive impact the rural works program may have had.

The strategy recommended in this paper for promoting employment in rural areas is an integrated one. It seeks to increase incomes of rural residents both by direct methods and through secondary multiplier effects of an initial increment. Inasmuch as the strategy recommended promotes a higher absolute level of income and a more equal distribution of that income, it is perhaps the key to solving the long-term employment problem and this is the hastening of the demographic transition. In the short run greater agricultural employment is perhaps the only way to stem a tidal wave of rural to urban migration.

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ANNEX

Land Use

With a land area of about 200 million acres, Pakistan is nearly twice the size of the state of California. However, about two-thirds of this land area is comprised of mountains or deserts; another 25 million acres is covered by towns, villages, etc., and is also unsuitable for cultivation. Only some 25 percent of the total land area or some 50 million acres is actually cultivated.

Land use patterns are shown in Table I. Cultivated land with access to irrigation amounts to 33.5 million acres. About 14 million acres are cultivated under rainfed conditions principally in the northern districts of Punjab and the North Western Frontier Province. As is evident from Table I, cropping intensities are low, mainly reflecting the lack of adequate supplies of year-round water. Cropping intensity in the irrigated tracts is 99 percent while in the unirrigated tracts it is as low as 71 percent, giving an overall average for Pakistan of 91 percent.

Climate

The major characteristic of the climate is its dryness. The range of mean annual rainfall extends from less than four inches in Sind to about 20 inches in the foothills of the northern mountains. Annual evaporation, however, far exceeds this as most of the rainfall is concentrated in the monsoon months of July and August when mean temperatures over most of the country are well in excess of 100°F. Evaporation values for various areas in northern and southern Pakistan are shown in Figure I.

Water Constraint

As rainfall is so meager and unreliable, agriculture in the Indus Basin must depend on the availability of irrigation water harnessed from the River Indus and its tributaries: the Jhelum, Chenab, Ravi, and Sutlej. These rivers together carry a total of 190 million acre feet (m.a.f.) in an average year, more than ten times the annual flow of the Colorado River or twice the annual flow of the Nile. Of the total annual flow, some 150 m.a.f. is currently used by Pakistan through the largest irrigation network in the world, comprising about 38,000 miles of canals and more than 88,000 watercourses. The topography of the country as well as a delineation of the flow of the Indus and its tributaries can be seen in Figure II.

Underlying most of the Indus Basin is an extensive underground aquifer covering some 40 million acres. It has been estimated that in 1976 some 30 m.a.f. of irrigation water was being drawn from this aquifer by private and public tubewells dotted all over the Basin--about a third of the water available through surface water supplies. The location of tubewell irrigation is illustrated in Figure III.

Crops

Most of the agricultural production is located in the Indus Basin. About 60 percent of the total cropped area is devoted to four crops: wheat, rice, cotton and sugarcane. The share of wheat alone amounts to 36 percent of the total cropped area (Tables I and II). In terms of acreage cropped, fodder is another important crop occupying some 15 percent of the total cropped area.

There are two cropping seasons: the winter or "rabi" season, extending from November to April and the summer or "kharif" season, lasting from May to November.

Wheat and fodder are the major rabi season crops, while the most significant kharif crop is either rice or cotton, depending on the zone. Sugarcane is grown all year round.

Population

Using 1901 as a benchmark--when the population of the territories constituting present-day Pakistan was 16.6 million--we note that the population doubled to about 34 million by 1951. It has more than doubled since then, being estimated at 81 million as of July 1979. The intercensal trend in growth rate of population is evident in Figure IV.

Pakistan has yet to experience a decline in birth rates corresponding to the continuous fall in the death rate over the past few decades. Currently the crude birth rate is approximately 50 per 1000 (with a low estimate of 45), while the death rate is around 20 per 1000. The death rate is expected to fall further with improvements in health care and nutrition, but family planning programs have thus far been unable to make any significant impression on the birth rate statistic. If present trends continue, the total population of Pakistan is projected to increase to 170 million by the turn of the century.

Administration

Pakistan has a federal political structure with devolution of certain governmental functions to the provincial level. The four provinces are: Punjab, Sind, North Western Frontier Province (NWFP), and Baluchistan. The provinces are administratively subdivided into districts, which in turn are broken down into tehsils/talukas. The districts referred to in the main body of the text are illustrated in Figure V.

Punjab is the richest province as far as agricultural production is concerned; its contribution to total agricultural production of commodities such as wheat, cotton, grain, and fodder exceeds 75 percent. Sind ranks second in terms of its contribution to agricultural value added; NWFP follows Sind. Baluchistan is mostly rangeland.

About 60 percent of the total population lives in the Punjab; another 22 percent resides in Sind, 14 percent in NWFP, and only 4 percent in Baluchistan.

Irrigation Problems and Potential

The initial construction of the present irrigation system was undertaken before the arrival of the British in the subcontinent. The Moghuls and later the Sikh rulers of the Punjab had cut inundation channels to take water from the high flows in the river during the summer monsoons. These inundation channels were, however, highly seasonal in operation. They were fed from the cuts in the river bank and would therefore fill only when the river level was high, i.e. during the summer months. Further, irrigation by inundation channels was limited to areas fairly close to the river and its flood plain.

The development of the present system was initiated in the mid-19th century by British engineers. The first modern canal, the Upper Bari Doal Canal, which diverted water from the River Ravi, came into operation in 1861. By 1905, when the triple Canals Project was begun, the British had gained sufficient experience to design a project with the dual objectives of irrigation and transferring of water from rivers in spate in the Western Punjab to rivers with insufficient runoff in the Eastern Punjab. Incidentally, similar concepts were used 60 years later in the construction of link canals envisaged by the Indus Basin Treaty between India and Pakistan.

The British engineers constructed an irrigation network that commanded a vast area. The colonial authorities could thereby derive maximum revenue from sale of project lands, and subsequent taxation. But insufficient availability of water in the rivers meant that designed cropping intensities of the system were low--often about half the capability of the land.

The expansion of the irrigation network also disturbed the hydrological equilibrium of the aquifer. Prior to the advent of modern irrigation, the annual aquifer recharge was balanced by return flows to the river during the period of low flow and by evaporation from the groundwater surface such that a stable underground storage was maintained. The introduction of large-scale irrigation has entailed a rise in the water table as annual recharges exceeded annual withdrawals. Such a situation has exacerbated the threat to the productivity of the Basin by the "twin menace" of waterlogging and salinity.

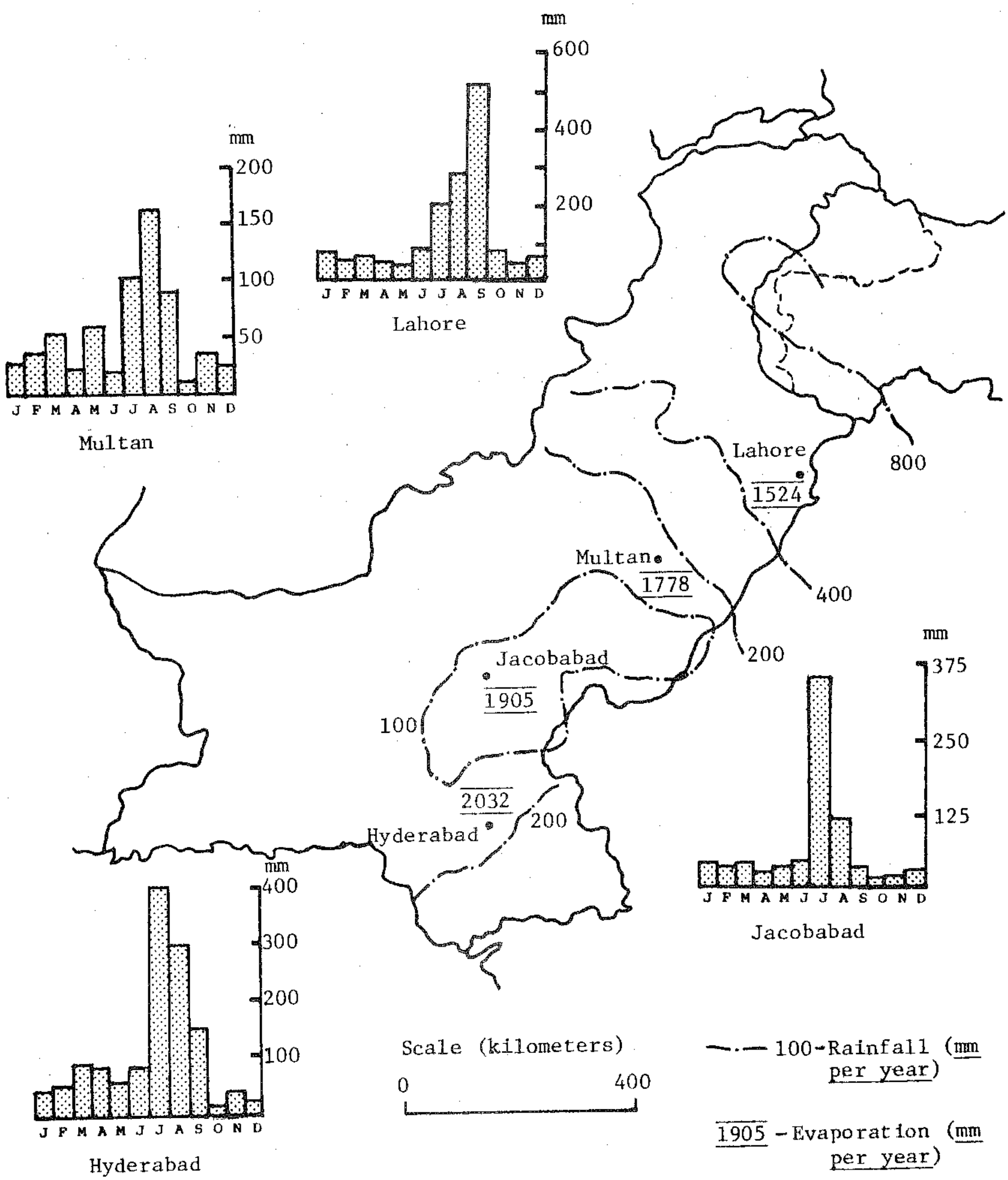
Waterlogging arises when water not used by crops nor evaporated accumulates as groundwater whose level rises to the surface thereby producing a swamp.

Closely related to the waterlogging problem is the menace of salinity. As the water table rises, the capillary movement of water to the surface and its subsequent evaporation leaves salt deposits behind. Salinity can also arise if farmers continuously underwater land. As water from each irrigation is insufficient to leach salts to the subsurface, there is a continuous buildup of salts in the soil surface.

More than 50 percent of the country's arable land is affected by waterlogging and salinity. This is seen by data in Table III. The problem is more severe in Sind than in the Punjab due to the fact that the farmer is a tail-end recipient of the irrigation water which typically has a higher silt load on its arrival in the southern reaches than it does in the northern reaches.

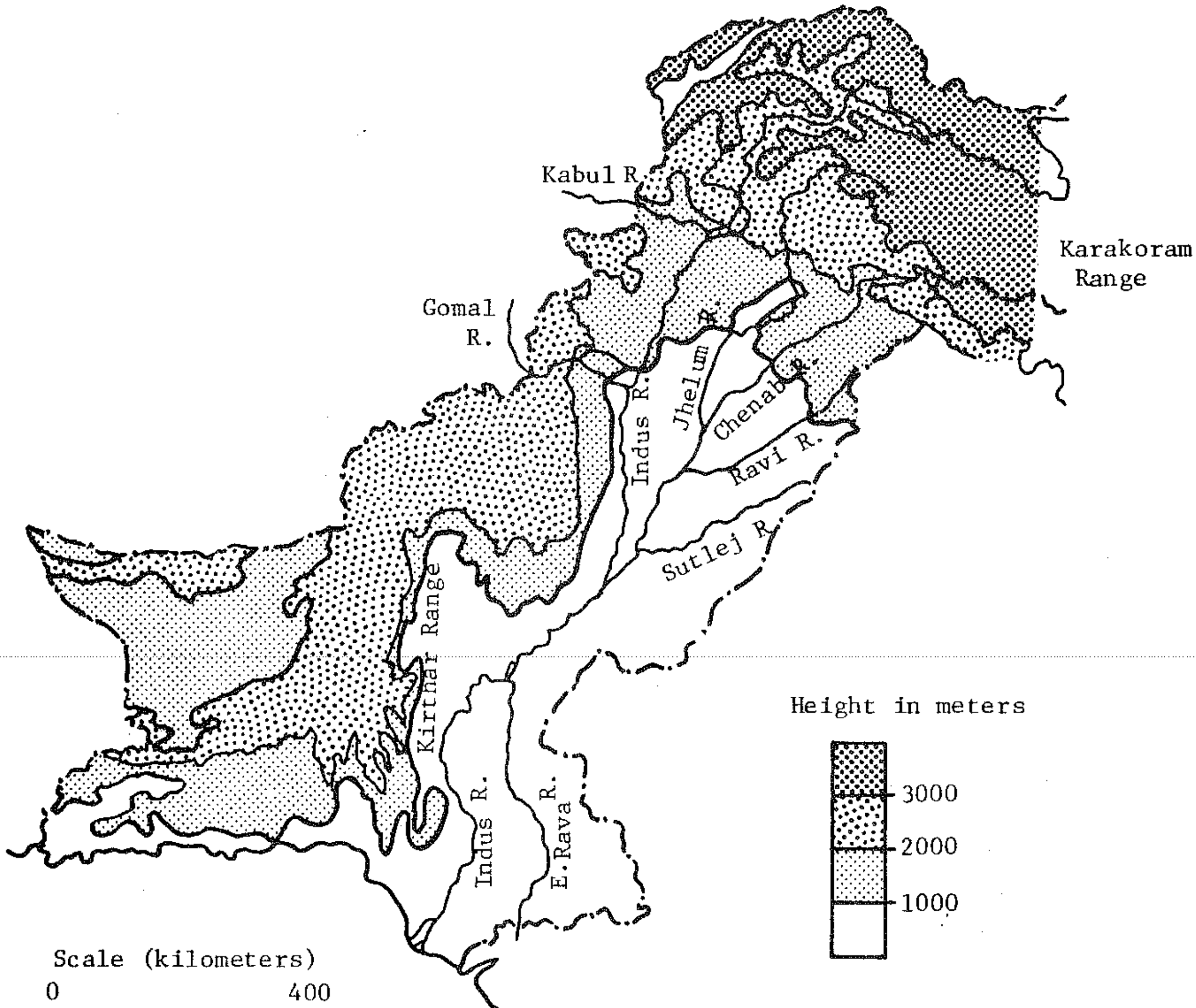
Where the underground water is fresh it can be a boon to farmers who install tubewells or dig wells and gain access to it. However, a significant proportion of the underground aquifer--particularly in Sind--is saline and perhaps only usable for irrigation after dilution with canal water. There is, nonetheless, considerable scope for expansion of irrigation water supplies through greater reliance on the underground aquifer. World Bank projections for cropping intensities in Pakistan's agriculture indicate a target of 126 percent by 1985 (up from the present 99 percent), rising to 142 percent by the year 2000. This target is to be achieved by greater availabilities of water, both by increasing the conveyance efficiencies of the present surface irrigation system and particularly through increasing withdrawals from the underground aquifer.

FIGURE I. PAKISTAN: ANNUAL RAINFALL, ANNUAL EVAPORATION AND MONTHLY RAINFALL DISTRIBUTION AT SELECTED STATIONS



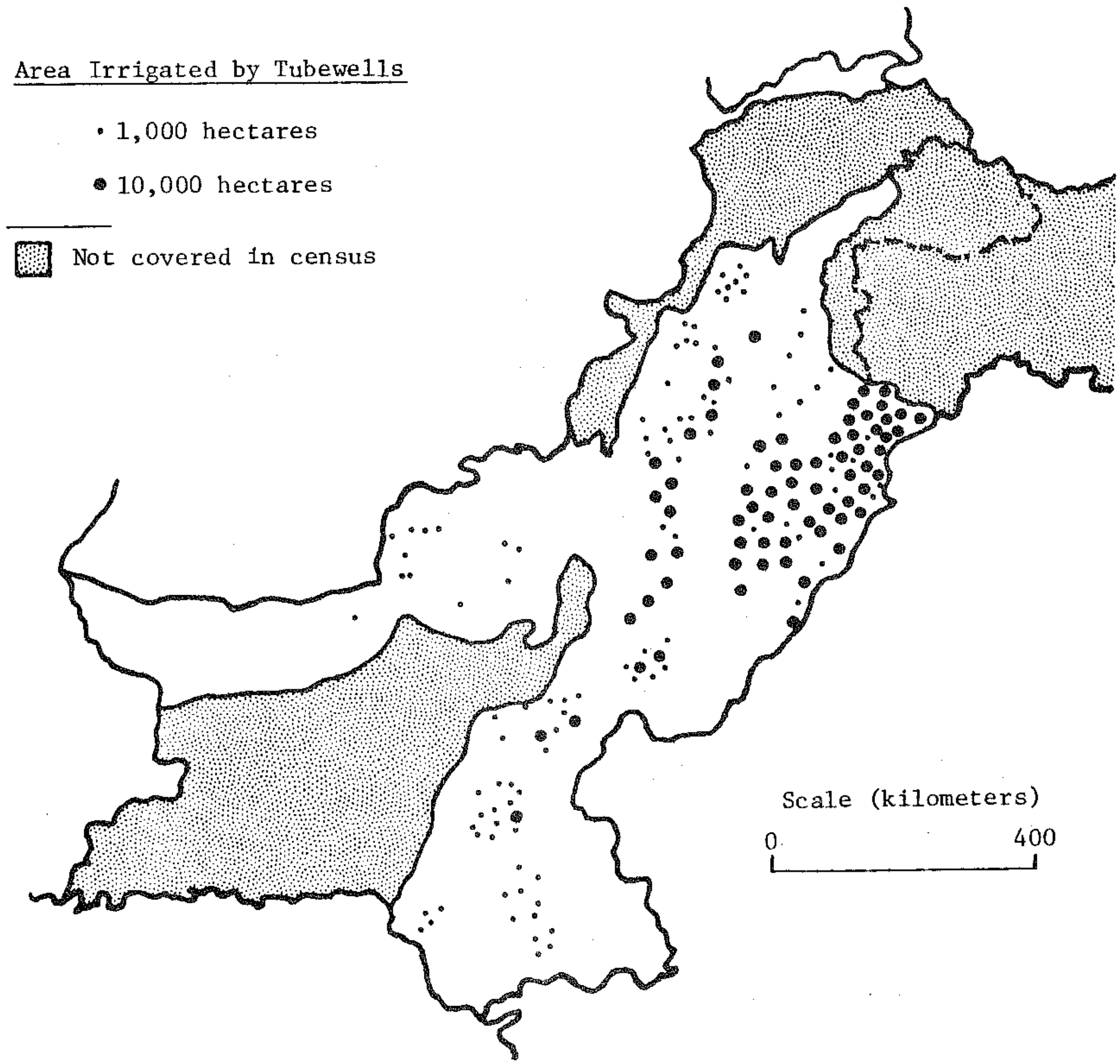
Source: Adapted from B. L. C. Johnson, Pakistan (Canberra, 1979).

FIGURE II. PAKISTAN: RELIEF AND RIVERS



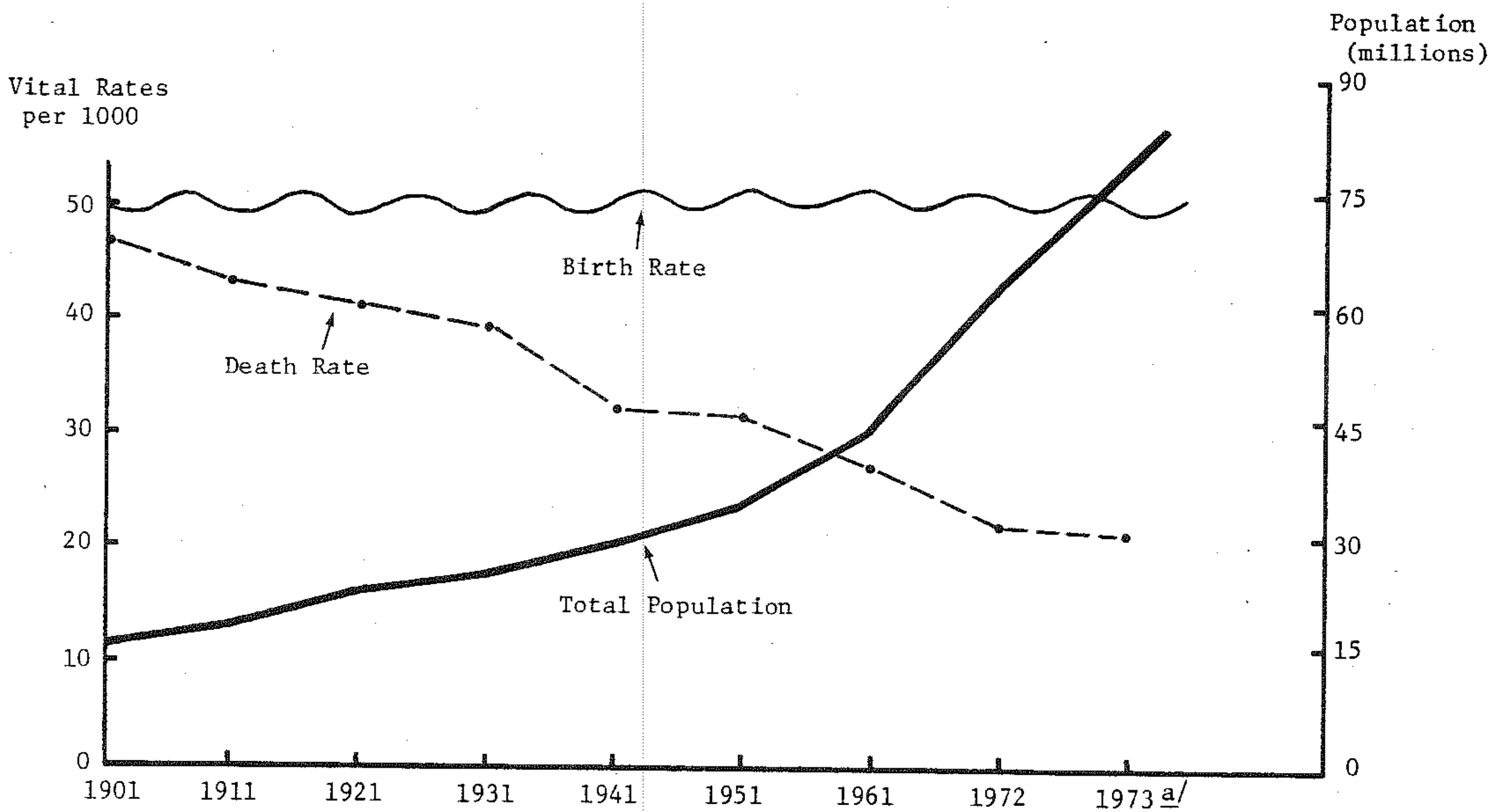
Source: B. L. C. Johnson, Pakistan (Canberra, 1979).

FIGURE III. PAKISTAN: TUBEWELL IRRIGATION, 1972



Source: B. L. C. Johnson, Pakistan (Canberra, 1979).

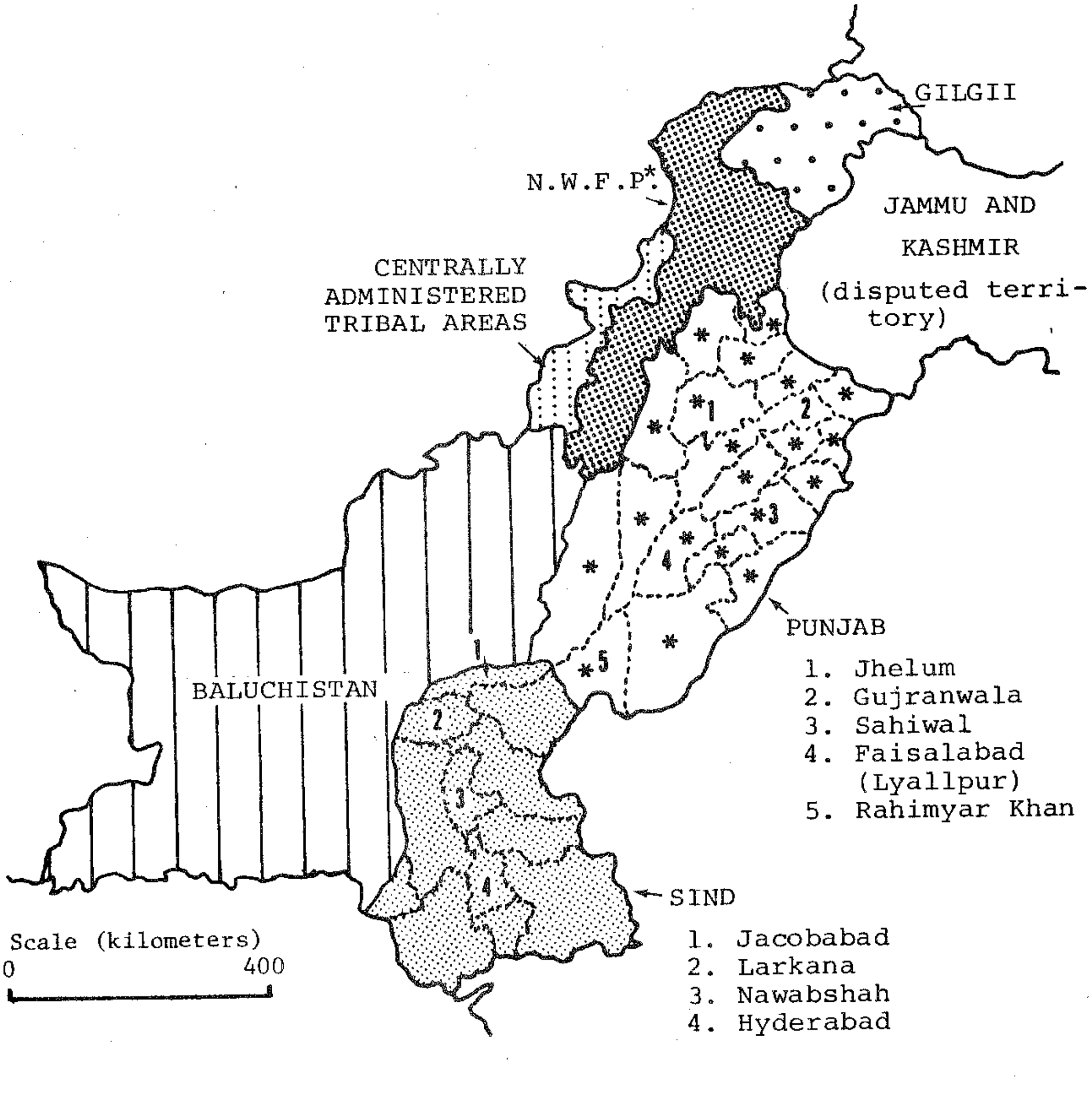
FIGURE IV. PAKISTAN: POPULATION GROWTH, 1901-1972



a/ Estimates, based on 3.2 percent increase per annum over 1972.

Source: B. L. C. Johnson, Pakistan (Canberra, 1979).

FIGURE V. PAKISTAN: DISTRICTS REFERRED TO IN TEXT



*N.W.F.P. - North Western Frontier Province

Source: B. L. C. Johnson, Pakistan (Canberra, 1979).

TABLE I. LAND USE AND CROPPING INTENSITY IN PAKISTAN 1975-76

(million acres)

Total Area	196.70			
Area not reported	64.41			
Reported Area		132.29		
Forest Area		6.41		
Not available for cultivation		50.30		
Other uncultivated land (excluding current fallows)		27.64		
Cultivated Area			47.94	
Net Area sown			36.18	
Current fallow			11.76	
Area sown more than once			6.28	
Cropped Area				42.46
Cropping intensity				0.88

Source: Government of Pakistan, Statistics Division, Pakistan Statistical Yearbook 1977, Table 4.1.

TABLE II. ACREAGE, PRODUCTION AND YIELD OF PRINCIPAL CROPS IN PAKISTAN

Crops	Acreage				Production				Yield			
	1974-75	1975-76	1976-77	1977-78 a/	1974-75	1975-76	1976-77	1977-78 a/	1974-75	1975-76	1976-77	1977-78 a/
	(---------- thousand acres ----------)				(---------- thousand tons ----------)				(---------- maunds per acre b/ ----------)			
Wheat	14,363	15,100	15,790	15,692	7,552	8,554	8,800	8,800	14.2	15.4	15.1	15.3
Rice	3,964	4,225	4,323	4,485	2,277	2,576	2,694	2,858	15.6	16.6	17.0	17.3
Millet	1,346	1,542	1,601	1,601	261	303	306	306	5.3	5.3	5.2	5.2
Sorghum	1,100	1,176	1,104	1,105	261	276	257	257	6.5	6.4	6.3	6.3
Maize	1,516	1,532	1,542	1,624	735	790	752	818	13.2	14.0	13.3	13.7
Barley	479	459	431	425	135	128	123	112	7.7	7.6	7.7	7.2
Sugarcane	1,663	1,729	1,947	1,986	20,906	25,143	29,057	28,972	342.2	395.8	406.2	397.1
Rapeseed & Mustard	1,115	1,162	1,321	1,305	244	263	292	308	6.0	6.2	6.2	6.4
Seasmum	56	70	75	n.a. c/	8	11	12	n.a.	3.9	4.1	4.4	n.a.
Cotton	5,019	4,576	4,608	4,490	625	505	423	560	3.4	3.0	2.5	3.4
Tobacco	134	116	124	n.a.	75	60	73	n.a.	15.3	14.1	16.0	n.a.

a/ Provisional. b/ One maund = 82.2 pounds. c/ n.a. - not available.

Source: Pakistan, Finance Division, Pakistan Economic Survey, 1977-78.

TABLE III. PAKISTAN: AREA AFFECTED BY SALINITY

(million acres; percent of area in parentheses)

Region	Arable Irrigated Area		Saline and/or Alkaline Soil Conditions: Total		Severe		Moderate	
Punjab	21.00	(100)	10.30	(49)	3.20	(15)	7.10	(34)
Sind[a]	8.30	(100)	7.00	(84)	2.50	(30)	4.50	(54)
N.W.F.P.[b]	1.40	(100)	0.10	(7)	0.03	(2)	0.07	(5)
TOTAL	30.70	(100)	11.67	(38)	5.73	(19)	17.40	(57)

a/ Includes some irrigated area in Baluchistan.

b/ N.W.F.P. - North Western Frontier Province

Source: FAO, Report of Seminar on Agricultural Perspective Planning, Islamabad, 10-19 January 1977 (Rome, 1979).

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