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INTERACTIONS BETWEEN AGRARIAN STRUCTURE AND AGRICULTURAL INNOVATIONS IN PAKISTAN

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Interactions between Agrarian Structure and Agricultural Innovations in Pakistan

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Introduction

Given the rapid rise in population at 3 percent per annum and the growth rate of per capita income at 3 percent or so annually, the twin goals required of the agricultural sector of Pakistan are high growth rates of output and an annual rate of labor absorption (into agriculture) in excess of 2 percent.[1] Given also that very little additional land can be brought into cultivation, strenuous efforts would be required to intensify agricultural production essentially by introducing land-saving technological innovations that are accessible to the mass of farmers of the nation.

Issues surrounding technological innovations in agriculture do not exist in a vacuum. In Pakistan or elsewhere what makes these issues a subject of often heated debates is differences in understanding of technological possibilities and their suitability to agrarian structure characterized by the size distribution of farms and their tenurial relations. In the long-term perspective success or failure of technological innovations depends much on a given agrarian structure and its evolution, and the agrarian structure in turn would be affected by types of technological innovations adopted and fostered.

In the following I shall first direct my attention to the sources of productivity growth in Pakistan's agriculture since the

1950's, to the dawn of the Green Revolution in the late 1960's, and the constraints that became increasingly binding and caused the Green Revolution to lose its momentum in the 1970's. It is hoped that one can learn from the experience of Pakistan's agriculture in recent years some of the important interactions between agrarian structure and agricultural innovations in countries where land/man ratios are deteriorating.

The Sources of Productivity Growth in Pakistan's Agriculture

The sources of productivity growth in Pakistan's agriculture since independence can be studied perhaps most conveniently in three epochs of about a decade each. During the early 1950's since independence (and partition) of the subcontinent in 1947, the influx of refugees, the natural increase in population, and the state of urban/industrial development made the food supply problems increasingly serious. In spite of increases in planted acreage under crops, the land-man ratio continued to deteriorate during the 1950's, and the worsening land-man ratio in turn was not offset by a counterbalancing increase in annual output per acre. A poor crop in 1952-53 turned Pakistan into a large net importer of foodgrains. The next poor crop in 1955-56 accentuated the food deficits and fixed the country's position as a chronic net importer of foodgrains. What was once the granary of the subcontinent had become a net importer of foodgrains by the mid-1950's.

In contrast to the virtually stagnant rural environment in the 1950's, however, the agriculture of Pakistan made a remarkable

turn for the better in the 1960's. During the Second Five Year Plan period, 1960-65, for the first time, a rapid expansion of yields per acre (real output per acre per year) outstripped the growth in the agricultural labor force and more than fully compensated for the worsening land-man ratio. This striking turn of events and the subsequent, even better, performance during the second half of the decade can be attributed to the following three major factors: (i) the quantitative and qualitative improvements in water resource availability; (ii) a favorable change in the fertilizer supplies and the farmers' attitude toward the use; and (iii) the development and propagation of the short-stemmed varieties of wheat and rice that are responsive to heavy fertilization and better cropping practices. These factors were themselves reinforced by the marked improvement in the cost/benefit ratio of production supported by the agricultural policy, which in effect reversed the longstanding unfavorable terms of trade between agriculture and non-agriculture in Pakistan. Nonetheless, the encouraging performance during the second plan period was essentially a surprise, largely unplanned and unnoticed until it was well under way, since it had resulted mainly from a water-resource development in which private tubewells rather than government efforts were particularly important.

The key element in the agricultural development during the Third Five Year Plan period, 1965-70, lay in the shift of development priorities toward agriculture. Encouraged by the performance during the second plan period, and influenced

profoundly by the events following the war with India in mid-1965, the government of Pakistan introduced the so-called foodgrain self-sufficiency program in 1966-67 as one of the specific objectives for agriculture in the (revised) Third Plan. The government hoped to promote new farming techniques by its policies concerning the prices of inputs and outputs which enhanced farm profits. On the input side the most prominent were the subsidies on fertilizers, pesticides and irrigation water supplies. Important also were the government measures to grant tax and tariff exemptions to the imports of agricultural investment goods and to license imports at the artificially low official rate of exchange. On the output side, the key feature of the policy was price-support schemes on such commodities as wheat, corn, rice and peanuts. In addition, large investments had already been made in agriculture, particularly in the development of water resources, which now offered an opportunity for substantial increases in output if new technology was made available. It was in this combination of favorable circumstances that the availability of high-yielding varieties of wheat and rice opened up the possibility of a dramatic breakthrough. Since 1965 till the early 1970's acreage planted under crops increased faster than the agricultural labor force, and the annual rate of growth of real output per acre jumped to almost 5 percent. Better control of supplementary irrigation water by the farmers, increased availability of fertilizers and the new seeds combined to produce the dramatic result in foodgrain production, particularly since

the wheat harvest of 1968.[2] The green revolution appeared to have arrived to solve the foodgrain deficit problem of Pakistan as well as those in other developing countries.

The euphoric reception was rather short-lived. In contrast to the dramatic growth rate achieved by Pakistan's agriculture during the 1960's, its performance since 1970 has fallen sharply to the level below one percent per annum. This apparent faltering of the green revolution was not an isolated event in Pakistan. Elsewhere in the subcontinent and other parts of Asia observers contended that the green revolution had come to a halt, or at least, to have lost the momentum of the late 1960's. In Pakistan the proportion of acreage planted to high-yielding varieties of wheat remained virtually stable at below 60 percent after 1971-72. Since then high-yielding rice varieties failed to expand further beyond half the rice acreage reched in 1971-72. Of course, there were extenuating circumstances in the early 1970's. In the first place, the break-away of Bangladesh and the Indo-Pakistan war of 1971-72 were politically, militarily, and economically traumatic. Secondly, the floods of 1973, the first serious ones since 1962, caused unprecedented losses, particularly in the agriculturally-rich Punjab and Sind. Thirdly, the river flows were abnormal during the 1974 summer crop season, when canal flows were reported to have been 40 to 50 percent of the normal levels.[3] Finally but by no means the least important, the world-wise inflation and the spectacular rise in fuel costs and fertilizer prices impacted adversely the cost/benefit ratio of agricultural production and strained the government's development budget severely.

The Green Revolution in Pakistan, A Retrospect

The green revolution represented a highly successful process of international transmission of agricultural technology through the transfer of scientific knowledge embodied in key inputs such as fertilizers and high-yielding seeds. Its core element was the development and propagation of short-stemmed, fertilizer-responsive varieties of wheat and rice highly adaptable to local ecologies of a wide geographic scope. It enabled development agencies to finally shift their attention away from such institution-building approaches as traditional community development, cooperatives, and agricultural extension projects and to concentrate on providing high-yielding inputs. It was in essence the sine qua non of the agricultural strategy aimed at short-term, quick-gains in foodgrain production. The popularity of various package programs in the 1960's was derived from the premise that achieving higher yields, quickly and across farms of different sizes, was a matter of adequate and timely supplies of fertilizers, pesticides and better quality seeds, which would be, in theory, highly divisible and therefore neutral to the scale of farm operation. Small-scale peasant farms could adopt these innovations with relatively minor adjustments in contrast to technical innovations involving, say, tractors and combine harvesters. They could, therefore, be incorporated into the existing structural framework of agriculture without drasitc adjustments and interventions.

There was some disquiet among observers concerning this simplified approach even at the height of the green revolution.[4]

Table 1

Acreage, Output, and Yield of Wheat and Rice in Pakistan

Year	Wheat			Rice		
	Acreage (million acres)	Output (million tons)	Yield (kg per acre)	Acreage (million acres)	Output (million tons)	Yield (kg per acre)
Average of 55/56-59/60	11.63	3.62	311	2.65	.89	337
Average of 60/61-64/65	12.32	4.09	332	3.07	1.14	371
1965/66	12.74	3.85	303	3.44	1.30	376
1966/67	13.20	4.27	323	3.48	1.34	386
1967/68	14.78	6.32	427	3.51	1.48	420
1968/69	14.65	6.89	470	3.61	2.09	580
1969/70	15.39	7.18	466	4.01	2.36	588
1970/71	14.77	6.37	431	3.71	2.16	582
1971/72	14.32	6.78	473	3.60	2.23	619
1972/73	14.75	7.32	496	3.66	2.29	626
1973/74	15.11	7.51	497	3.74	2.42	647
1974/75	14.36	7.55	526	3.96	2.28	576
1975/76*	15.19	8.10	533	4.28	2.54	593

Source: Government of Pakistan, Pakistan Economic Survey, Various annual editions.

*Provisional.

The control of water in both quantity and timing was of utmost importance, the achievement of which was forthcoming neither quickly nor cheaply in large parts of the developing world. As the green revolution began to lose its momentum, there appeared an increasingly strong sentiment for a basic concern for impediments to diffusion of the improved technology in other directions. Diagnostic teams seeking to identify impediments to the adoption of the technology began to comprise social scientists as well as production scientists. Increasing concern was directed at innovating rural institutions and organizations in the face of existing agrarian structures.

Moreover, most international agricultural research centers began devoting increased attention to farming systems, including institutions and organizations that affect production and marketing of products. Fundamentally at issue came to be the grossly unequal distribtuion of cultivated land and the consequent unequal access to economic and public service inputs (e.g., water, power, extension and credit services) among different groups of farmers (landlords, cultivators of various sizes, tenants, and landless agricultural workers).[5] It became clear that the neutrality of the green revolution technology depended on the extent to which information and risktaking capacity are distributed among farmers as well as on relative access to more conventional inputs. If access to information and inputs is equal, then, large and small farms should share to the same extent in proportionate gains in output. There should be no difference

among different size farms with respect either to static efficiency or to dynamic efficiency (i.e., impacts of technological innovations). Whether or not their relative access is equal has become the question of paramount importance in judging the impacts of technological innovations on different size farms and their operators.

Changes in the Size Distribution of Farms in Pakistan

The first agricultural census of Pakistan took place in 1960. The second census was scheduled to be held in 1971-72 but was twice postponed due to general elections and the war with India. It was held finally in two phases, during January to June, 1972 in areas not affected by the war and during January to June, 1973 in areas affected by the war. As in the case of the first agricultural census, the second agricultural census took place on a sample basis. The second census expanded the statistical coverage (mainly input usuage) as well as the area covered.

Comparing the agricultural censuses of 1960 and 1972, the latter of which is available only provisionally, one is struck above all by a precipitous decline in the absolute number of farms between the two census years from 4.86 million to 3.76 million (Table 2). This is rather surprising, considering that Pakistan's agricultural labor force comprising family workers and hired permanent workers numbered 11.88 million in 1972, up from 7.57 million in 1961 and 6.19 million in 1951.[6]

The decline indicated by the two agricultural census in the number of farms contrasts with a slight increase (as expected) in

Table 2

Size Distribution of Farms and Farm Area in Pakistan
1960 and 1972

Farm Size in ha.	1960			1972		
	Number of farms ('000)	Farm area ('000 ha)	Average size (ha)	Number of farms ('000)	Farm area ('000 ha)	Average size (ha)
Up to 3	2,985	3,255	1.1	1,639	2,426	1.5
3 - 5	759	2,943	3.9	921	3,607	3.9
5 - 10	729	5,013	6.9	793	5,288	6.7
10 - 20	286	3,787	13.2	289	3,731	12.9
20 - 60	87	2,616	30.1	103	2,997	29.1
Above 60	14	1,958	139.9	16	1,815	113.4
Total	4,860	19,572	4.0	3,762	19,864	5.3
	(In percent of total)					
Up to 3	61.4	16.6		43.6	12.2	
3 - 5	15.6	15.0		24.5	18.2	
5 - 10	15.0	25.6		21.1	26.6	
10 - 20	5.9	19.3		7.7	18.8	
20 - 60	1.8	13.4		2.7	15.1	
Above 60	.3	10.0		.4	9.1	
Total	100.0	100.0		100.0	100.0	

Source: Pakistan Agricultural Census Organization, 1960 Pakistan Census of Agriculture: A Summary of West Pakistan Data. Original figures given in acres were converted at 2.5 acres = 1 ha.

Pakistan, Ministry of Agriculture, 1972 Pakistan Census of Agriculture (Provisional Data).

result of these opposing movements the average size of Pakistan's farms increased from 4 ha to 5.3 ha over the period. A closer examination of the number of farms and area by size of farm yields a more striking contrast between the two agricultural census years as revealed by the following tabulation of relative magnitudes with 1960 as the base:

Contrast of the Number of Farms and Farm Area by Farm Size in 1972 (1960=100), Pakistan

Farm Size (ha)	Up to 3	3-5	5-10	10-20	20-60	Above 60	Total
Number of Farms	55	121	109	101	118	114	77
Farm Area	75	123	105	99	115	93	101

It is immediately evident that the decline in the number of farms was concentrated in the smallest size group (up to 3 ha), which registered a 45 percent decline relative to the 1960 figure, and that all the other size groups (3 ha and above) did increase their respective numbers. In fact, of the 1.3 million farms that somehow got displaced from the smallest size group between the two census years about .2 million appear to have grown larger (and moved into higher size groups) and the remaining 1.1 million to have disappeared altogether (from the list of farms with operational holdings). As a result one observes that there are proportionally more farms of larger sizes in 1972 than in 1960 (Table 2). Whereas the smallest size group comprised 61.4 percent of the total holdings and occupied 16.6 percent of farm area in 1960 it constituted 43.6 percent of the holdings and operated only 12.2 percent of the farm area in 1972.

It is to be regretted that we lack sufficiently detailed data at this time to distinguish those farms that are genuinely "marginal" in size (say, less than 1 ha), small with 1 to 2 ha, and those with between 2 and 3 ha. Among these three sub-groups which was being displaced most? It would be instructive to study this subject with the use of a finer grouping. In the absence of such data, nonetheless, a presumption is strong that the small and marginal farms have fared worse. Our first hypothesis, by implication, is that the introduction of high-yielding varieties of foodgrains and the associated agricultural practices has not been uniformly beneficial to small and marginal farms relative to larger ones. The second hypothesis to be studied, then, concerns better access to economic and public service inputs enjoyed by larger size groups than by smaller ones. It is imperative to distinguish, in this connection, between those inputs that are divisible, at least in theory, and those that are not.

The Agrarian Structure and Input Use

Table 3 presents aggregate data concerning the use of agricultural inputs by size of farms in Pakistan and her two agriculturally most important provinces. For the present purpose the statistics of private tubewells, fertilizers, and tractors have been selected. If one takes the view that farm technologies embodied in inputs can be characterized as either biological-chemical, or mechanical-engineering and that divisibility and adaptability (to different factor proportions) varies from the former to the latter, fertilizers should be classified as

Table 3

Use of Agricultural Inputs by Size of Farms,
Pakistan and Provinces, 1972 Agricultural Census

Farm Size in ha.	Private tube-wells per 100 ha of Farm Area	Percentage of Farms using Fertilizers	Percentage of Cropped Area Fertilized	Number of Tractors per 100 ha Farm Area
Pakistan				
Up to 3	.61	44	40	.04
3 - 5	.51	55	43	.05
5 - 10	.64	58	43	.08
10 - 20	.77	53	41	.19
20 - 60	.76	45	41	.38
Above 60	.42	39	49	.26
Total	.64	50	43	.15
The Punjab				
Up to 3	1.03	46	43	.05
3 - 5	.79	57	43	.06
5 - 10	.89	61	43	.10
10 - 20	1.02	59	42	.24
20 - 60	1.09	54	43	.53
Above 60	.88	54	55	.49
Total	.95	55	43	.20
Sind				
Up to 3	.04	40	39	.02
3 - 5	.05	62	47	.01
5 - 10	.08	65	49	.02
10 - 20	.15	66	53	.08
20 - 60	.49	67	60	.34
Above 60	.36	74	72	.36
Total	.14	60	49	.09

Source: Pakistan, Ministry of Agriculture, 1972 Pakistan Census of Agriculture (Provisional Data).

biological-chemical (divisible and adaptable) technology and tractors as mechanical-engineering (less divisible and adaptable) technology. Tubewells fall in between these classifications as pumps and engines (or electric motors) are more divisible and adaptable than tractors usually are. A priori, then, one would expect that the use of fertilizers would be more uniformly distributed over the size of farms than that of tubewells and the latter than the tractor usage. In other words, fertilizer use would be scale-neutral, whereas tractors would be subject to indivisibilities, or to economies of large-scale operation.

Indeed, this is what is revealed by Table 3 in the top panel for Pakistan as a whole. Focusing on the provincial data in the lower panels, however, one is struck by a sharp contrast in the patterns of input usage across farm sizes between the Punjab and Sind. The former, which dominates overwhelmingly the nation's agriculture, exhibits the pattern essentially identical with that of the nation as a whole. The percentage of cropped area fertilized is remarkably uniform across farm sizes. The smallest (up to 3 ha) size group has as many private tubewells per 100 ha of farm area as the 10-20 ha size group. Clearly the stock of tractors per unit area makes a distinct break between those size groups below 20 ha and those above in the Punjab. In contrast, Sind data show that the use of all inputs are subject to certain indivisibilities. Aside from tractors for which indivisibility is clearly established, the use of fertilizers and private tubewells per unit farm area show distinct scale effects as one moves from small to larger farm sizes. A question of some significance

concerns, then, identifying factors accounting for this contrast in the scale effects of input utilization in the two provinces.

Perhaps the most important, certainly the most striking, contrast in the structural environment of agriculture lies in the sharply divergent tenurial patterns across farm sizes that exist in these two provinces. According to the 1972 agricultural census (Table 4), fully 63 percent of the farms in Sind were pure tenant farms with 24 percent of the total accounted for by owners and the remaining 13 percent by "owner cum tenant" farms. In Sind tenant farms are proportionally more prevalent among smaller size groups than larger ones. Whereas tenant farms occupy 60 to 70 percent of the size groups with less than 10 ha, the proportion is reduced to a half of that margnitude among 10-20 ha size farms and to 15 percent or so among those over 20 ha. In the Punjab, on the other hand, tenant farms account for 28 percent of the total with 42 percent accounted for by owner-farmers and the balance of 29 percent by "owner cum tenant" farms. In addition, the Punjab data show that the proportional share of the three tenurial characteristics remains more or less similar across size groups, with the outstanding exception that the smallest size group has a substantially larger proportion (56 percent) of owner farms than other (larger) size groups. In contrast, the Sind data exhibit a clearly discernable pattern of increasing importance of owner farms (and decreasing importance of tenant farms) as the farm size increases.

If access to economic and public service inputs (such as

Table 4

Size Distribution of Number of Farms by Tenure

The Punjab and Sind, 1972

Farm size in ha	Total no. of farms in size group	Owner farms	Owner cum tenant farms	Tenant farms
		(Percent of total in group)		
The Punjab				
Up to 3	980,600	56	19	25
3 - 5	564,500	32	34	34
5 - 10	549,200	31	37	32
10 - 20	209,300	36	37	27
20 - 60	64,600	46	39	15
Above 60	7,100	40	30	30
Total	2,375,300	42	29	28
Sind				
Up to 3	270,800	28	9	63
3 - 5	256,900	15	11	74
5 - 10	165,100	24	18	58
10 - 20	38,500	42	26	31
20 - 60	13,400	60	22	18
Above 60	2,900	69	15	15
Total	747,600	24	13	63

Source: Pakistan, Ministry of Agriculture, 1972 Pakistan Census of Agriculture (Provisional Data).

water, power, credit and extension services) is easier for larger size farms than small and for owner farmers than for tenant farmers (the latter of whom are often subject to insecure tenure arrangements), one should find that smaller farms in Sind (comprising more tenant farms than in the Punjab) would use less inputs per unit area and curtail the use of even the most divisible of the inputs in question. The availability of tubewells in Sind is clearly dependent on the increasing size of farm area contrasting dramatically to the situation in the Punjab. Furthermore, the pattern of use of divisible inputs in Sind reveals a distinctly lower proportion of fertilizer usage and that of fertilized area by the province's smallest farms with holdings up to 3 hectars. Indeed, the findings of the 1972 agricultural census are remarkably consistent with the particular interpretation of impacts of agrarian structure on input utilization hypothesized above.

The neutrality of a technological innovation would depend on the extent to which information and risk-taking capacity are distributed among different farm sizes (and tenurial characteristics) as well as on relative access to irrigation, working capital and other inputs. If access to information (in the sense of acquiring and decoding new information) and pivotal inputs is equal, then large and small farms should share to the same extent in proportionate grains in output. There should be no difference among different size farms with respect to static efficiency. Large and small farms would be able to equally share the beneficial impacts of technological changes. Whether or not their

relative access is equal is the question of paramount importance in appraising impacts of innovations in a given agrarian structure.

Agrarian Structure and Technological Innovations

Agrarian structure characterized by a specific size distribution of holdings and tenurial relations, in turn, would be affected by types of innovations introduced. Promotion of lumpy, indivisible inputs would enhance the relative strength of the large and impede the growth and development of the smaller and weaker of the farming sector. On the other hand, promotion of divisible, scale-neutral inputs and services could, if supported by requisite institutional and organizational factors, narrow productivity differentials among different size farms. Experiences of some East Asian countries (Japan, Taiwan, etc.) appear to indicate successful interactions between agricultural innovations and agrarian structure faced with a deteriorating land/man ratio. Pakistan's experience between the two agricultural census years in this regard has yet to be fully appraised. Some results, however, are already evident.

The government of Pakistan has consistently encouraged the use of tractors, principally by providing credit on subsidized terms and by permitting imports on preferential terms. It is observable in Table 3 that there is a distinct break between the size groups below 20 ha and those above the hectareage in terms of tractor ownership. Not only are the tractors in Pakistan owned by larger sized farmers but evidence has accumulated that tractor

mechanization has led to further growth in the size of tractor farms. A survey of farmers who received loans to purchase tractors in the country, conducted by the World Bank and the Agricultural Development Bank of Pakistan, shows that the average size of these farms increased from 45 to 109 acreas (about 18 to 44 ha., i.e., approximated by 140 percent) after the introduction of tractors. It is to be noted that of the newly acquired land of the tractor farms more than 40 percent was "previously rented-out land" (i.e., former tenants and sharecroppers were evicted) and that "previously uncultivated land" amounted only to 22 percent, the balance being divided between "newly rented-in land" (24 percent) and "newly purchased land" (12 percent).[7] It is clear that only the acquisition of land previously uncultivated, by reclaiming and developing such land with the use of tractor power, is unambiguously socially desirable. It is equally clear that other types of acquisition that enlarged the land-holdings of tractor owners represent displacement of their own or other farms' tenants and sharecroppers.

A survey conducted by K. M. Azam in a Punjabi village (Harmoia village in Lyallpur district) reveals that access to credit is not uniform across farm sizes. Small farmers mentioned lack of credit most often as the reason for not using as much fertilizer as desired. They did so too most frequently as the constraint on their farm production. The percentage of those so responding, moreover, was found to decline as farm sizes increased.[8] It is evident that the smaller farmers face relatively more severe constraints of credit and irrigation water,

the two outstanding enabling factors of the new technology. Although the record of small farmers in adopting (albeit the lag of a reasonably short duration after their larger counterparts) more divisible inputs in the new technology has been impressive, the structurally imposed adversity they face is nonetheless real. The severity of the constraints has been overcome by substituting on-farm resources (e.g., farmyard manures) for purchased inputs (e.g., purchased fertilizers), to some extent. The extent of this maneuverability is limited over time, according to the perspective gained from our comparison of the two agricultural census years, and the disparity between the large and small appears to have widened.

The contrast between the progressive Punjab and more backward Sind (in terms of organizational/institutional environment of agriculture), furthermore, suggests that the difference in technological impacts between the large and small is greater in a region where tenancy is more prevalent (and especially where tenancy is less secure). It appears to follow, therefore, that while the income disparity between the large and small farms is likely to widen as a consequence of the innovations introduced into Pakistan's agriculture, it would likely to be more pronounced in a less progressive region such as Sind.[9]

Conclusions

Wolf Ladejinsky wrote feelingly several years ago that one must look beyond the new technology to find the cause of accentuated imbalances developing in the Indian countryside.[10]

The experience of Pakistan in the recent decade, as well as those in India and elsewhere, confirms his apt observation. Scale neutrality (in technical sense) was only the first step in a long and difficult road of intorducing and diffusing technology to small holdings and of raising the incomes and welfare of small farmers.

There is no question that technological innovations and agrarian structure interact between each other. In the longer-term perspective, however, both these are affected by institutional innovations that aim at improving small farmers' access to inputs. Especially important in this regard are research, extension, and land (water) infrastructure that are characterized by indivisibility, externality, and jointness in supply and utilization. Farmers' organizations, various legislations and administrative measures can (and should) enable the requisite organizational changes establishing and preserving favorable access to these "public service inputs" for small farms. The will of the state and the effectiveness of its public administration in the countryside must then be a part and parcel of the essential rural institutions affecting rural development.

FOOTNOTES

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1. Before December 1971 Pakistan consisted of the present states of Pakistan and Bangladesh, then known as West and East Pakistan. Geographically and climatically West Pakistan was a continuation of the Middle East rather than a beginning of Asia, forming in this (and other) respects a complete contrast with East Pakistan. In this paper the term Pakistan refers only the the present state of Pakistan.

2. I have discussed the details of these developments in my earlier paper. Hiromitsu Kaneda, "Economic Implications of the Green Revolution and the Strategy of Agricultural Development in West Pakistan," Pakistan Development Review (Summer, 1969), pp. 111-143.

3. Government of Pakistan, Pakistan Economic Survey 75-76 (Islamabad 1976), also 73-74 and 74-75 editions, Embassy of Pakistan, Pakistan Affairs (Washington, D.C., September 1, 1976) reports that the 1973 floods damaged 10,000 villages, inundating an area over 10.36 million acres. Eight million people were affected, according to the report, and half a million houses were destroyed.

4. Cliften R. Wharton, Jr., "The Green Revolution: Cornucopia or Pandra's Box?" Foreign Affairs (April 1969), pp. 464-476. Also, Wolf Ladejinsky, "Ironies of India's Green Revolution," Foreign Affairs (July 1970), pp. 758-768.

5. A highly literate account of the interplay of forces between agrarian structure and propagation of technology: Wolf Ladejinsky, "Green Revolution in Bihar, the Kosi Area: A Field Trip," Economic and Political Weekly (September 27, 1969), pp. 147-162.
6. Pakistan, Census of Pakistan, 1951, 1961 and 1972 reports.
7. IBRD, The Consequences of Farm Tractors in Pakistan, (February 1975).
8. K. M. Azam, "The Future of the Green Revolution in West Pakistan," International Journal of Agrarian Affairs, (March 1973).
9. Similar conclusions on the district level was reached by M. H. Khan, The Economics of the Green Revolution in Pakistan (Prager, 1975), especially p. 120.
10. Wolf Ladejinsky, "The Green Revolution in Bihar...". op. cit.