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LAND DISTRIBUTION, TECHNOLOGICAL CHANGES AND PRODUCTIVITY IN PAKISTAN'S AGRICULTURE: SOME EXPLANATIONS AND POLICY OPTIONS

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ABSTRACT

This paper investigates the structural change, technological innovations and performance of agriculture in Pakistan from historical perspectives. We used data spanning from1948-2008. The data shows that land reforms introduced in Pakistan have not made any significant increase in the cultivated area. Only slight change has occurred in the early seventies. However, they seem to have induced conversion of large into small farms. As such, the proportion of area under small farms has increased and the ratio of tenancy to ownership has decreased to some extent. Modern input had the increasing trend in early seventies. The use of modern varieties of rice and wheat has increased more in Punjab and Sindh than in other provinces. Similarly, the use of fertilizer and pesticides has also increased overtime. The credit extension in input subsidies has also increased in the same period. The data also show that the application of new verities of seeds (Irri rice and HYV wheat) and improvement in agricultural technology are key source of land productivity growth in Pakistan.

Keywords: *Land distribution, Technological change, Farm productivity, Modern inputs, Agriculture credit.*

1. INTRODUCTION

The main challenge for development efforts in Pakistan lies in its rural sector, which is suffering from widespread poverty, rising unemployment, growing income inequalities and disproportionally low health and education opportunities. Most of these problems arise mainly, if not solely, from the skewed distribution of land ownership, leading to correspondingly highly unequal distribution of income and social power (Khan, 1997; Hameed, 2008). Infect, it has rendered the rural society both rigid and iniquitous. A number of technological problems also arise from extremely uneven distribution of land in Pakistan. For example, population pressure on unequally distributed land has forced perpetuation of traditional methods of cultivation, and dominance of small size of cultivation units and tenancy farming, which work ultimately to block incentives for technological progress. Similarly, many economic problems stem primarily from the inability of the agricultural sector with inequitable land distribution to provide full employment opportunities and its resulting failure to yield incomes needed for providing a satisfactory living standard to the rural population of the country (Chaudhry, 1994; Khan, 2006). Further, rural households with low income do not have enough saving capacity due to their low incomes to enable adequate capital formation

for raising the productivity of both land and labor and thereby optimizing their potentials (Malik, 2005).

After independence, Stagnation in agricultural production, experienced during immediate post–independence years and emergence of food deficits in the fifties are attributable not only to the highly unequal distribution of land and the attendant problems of incentives and constraints of adoption of new technologies but also to the absence of any integrated policy framework to tackle them. Except for the construction of some irrigation projects, the agricultural sector failed to stir itself out of a state of inertia. However, accentuation of shortages of food, foreign exchange and raw material for industrial development towards the end of the fifties forced the planners to contemplate a policy of agricultural development (Batsin, 2008; Hamid, 2008). This policy aimed at achieving self-sufficiency in food, increasing production for both domestic use and export, and reducing unemployment in the country.

The increased emphasis on agricultural and rural development in government policy, during the early sixties coincided with the advent of the so-called 'green revolution'. This revolution started with the scientific and technological breakthrough in farm of inputs, like high yielding varieties of seeds (HYV), fertilizers and pesticides, and in rapid expansion of agricultural mechanization leading to assured supply of irrigation water and farm power from tube-wells and tractors (Kamper, 2003; Kuriakose, 2005; Acumen, 2008).

In Pakistan, the green revolution period can be divided into two sub-periods with regard to the use of these inputs. During 1960-64, increased water availability due to greater supply of surface water and, more importantly, rapid expansion in tube-well installations, mostly, in the private sector, was the cutting edge of development. But in the second phase, i.e., 1964-69, high yielding varieties of seeds, fertilizers, pesticides, farm mechanization, and continued increases of supplementary water supply contributed to the breakthrough in the agriculture of the country (Ahmad & Chaudhry, 1987). The liberal subsidization of inputs and higher output price incentives provided the needed motivation, in the form of higher profitability, to the farmers for adopting new technologies. The result of these economic incentives and technological improvements was that while the agricultural sector grew at an annual growth rate of only 1.8 per cent during the first plan period, its growth rate jumped to 3.8 per cent per annum during the second plan, and to 6 per cent during the third plan period. The peak growth of 11 per cent was registered during 1967-68.

This tempo of high growth rate could not be maintained for long. The rate of agricultural output growth plummeted from 7.5 per cent per year during 1966-70 to 1.9 per cent during 1970-78. The green revolution came riding on a wave of significant increases in public expenditure on subsidies, which propelled the initial state of the breakthrough. But since the concomitant development of support services, like agricultural extension service, and education and training did not take place, the agricultural sector began, despite the greater availability of most key inputs like fertilizers, high yielding varieties of seeds and water, to experience diminishing returns due to inadequate attention paid to their efficient of their use (Greer, 2006). Further, even land reforms interdicted in the early seventies could not keep the 'green revolution' from fading due to the institutional failure. However, agricultural production once again showed a rising trend in the late seventies, mainly because of favorable weather conditions, better input distribution, and more appropriate farm price incentives.

It has variously been argued that since the overall growth and development of the economy depends largely on the prosperity of agriculture, effort must be directed to enable it to generate a reasonable marketable surplus each year so that the needs of abundant supply of cheap food and fiber, large volume of exports and rising incomes of people connected with agriculture for them to be able to absorb a reasonable proportion of industrial output are fulfilled satisfactory (Hamid, 2008). Unfortunately, the role of agriculture was not viewed in this perspective in the 1950s and 1960s. Industrialization was considered the key to economic development. The result was that agriculture stagnated and the industrial sector lost its major source of support. Economic development of the country thus came to a standstill. Although the potential role of the agricultural sector began to be emphasized in the 1970s, natural disasters combined with inefficient government policies acted to restrict the growth of agriculture to a low level. Nevertheless, the performance of the sector during the 1980s was fairly impressive. The government seemed to have realized then the

potential of this sector and some progress has since been made in formulating an effective long-term strategy for the encouragement and support of all forms of agricultural activity.
This paper reviews the performance of the agricultural sector over the past sixty years and then discusses some of the important issues facing this sector.

2. AGRARIAN SYSTEM

The agricultural sector of Pakistan is characterized by highly differentiated and asymmetrical structures and relationships between production and ownership of means of production, specially land and capital. These differences among various categories of land ownership have led to and are a reflection of the capitalist development of agriculture. Broadly, the present agrarian groups in the country may be classified into five categories.

Firstly, there are landlords who own large areas of land. They generally rent out their lands to landless sharecroppers. They neither work for themselves nor provide their labor resources to others. Yet, they determine the division of the produce raised by tenants on their own considerations. Tenants, in general, are compelled by circumstances of lack of alternative work opportunities and resources to accept the terms dictated by landlords. In Sindh and to be relatively less extent in other provinces, for example, sharecroppers play no role in production decisions. Land as a primordial traditional factor without any economic considerations plays a central role in determining the landlords-tenants relationships.

Secondly, there are owner-operator farmers, who reveal considerable heterogeneity opposite to the general impression of absolute homogeneity of their interests. Normally, these farmers may own most or some of the land; they cultivate and also rent in or get some land on lease from other owners.

Thirdly, it is the class of family farmers called middle peasants, who may own, rent in or lease a part of the cultivated land. These landowners, however, depend almost entirely on their family labor for production. Generally, they neither work for others nor seek others to work for them.

Fourthly, it is the class of sharecroppers, who are called "haris" in Sindh. They also include poor peasants or marginal landowners. They rent, cultivate and share the output with landlords. They depend almost entirely on their household labor. At times, they work for landowners on wages to supplement their meagre income. They account even at present for an important component of the feudal system.

The *final* class is of wageworkers. This class includes landless households who work on wages for others, particularly for rich, capitalist farmers. They may be remunerated in cash or in kind. They may work as permanently hired or as seasonal labor. They make both ends meet by working in and out of the agricultural sector. These workers constitute the burgeoning proletariat for agriculture and industry.

How the structure of land ownership changed in Pakistan overtime has may be interesting to know. Table 1 shows that although the share of landowners with over 100 acres has declined overtime both in number and area, they still own disproportionately large share of the cultivated area of Pakistan. Conversely, the area cultivated by the other categories of farmers has increased. The share, for instance, of farmers owning less than 5 acres of land, which they operated in 1960, has increased from 5 percent in 1972 to 9 percent in 1980 and 11 percent in 2000. Similarly, Table 2 shows the distribution of land by tenure. The area cultivated by the smallest owner operators in farms size of less than 5 acres has increased from 43 percent in 1960 to 56 percent in 1972 and then to 65 percent in 1980 and 67 percent in 2000.

What is general has happened in the distribution of land during 1960 to 2000 is that size classes operating less than 12.5 acres have gained area. There is a qualitative difference in this change that occurred between the 60s and the 70s, and the 70s and 80s and 2000s. Between 1960 and 1972, the two large size classes above 50 acres and not the two middle size classes between 12.5 and 50 acres have lost area to the small size classes under 12.5 acres during the inequality of operated area but not significantly where as the reverse of it happened between 1970, 1980 and 2000. It may thus be seen that the large farm sizes remained constant but the small farm sizes below 12.5 acres gained net area between 1972 and 1990 increasing inequality of operated area during this period.

It is also important to know what changes in area operated have occurred between 1980 and 1990. The middle size classes between 12.5 and under 25 acres also gained area. It is this gain by the largest size class over the 80s compared to its loss over the 60s, and stability over the 70s, which has lead to increase in concentration of land in the country.

This increase in concentration over the 90s is noticeable clearly from Table 3 & 4. These tables show that the mean area of both losing size classes, i.e. those of 12.5 acres and 50 acres and land gaining size classes i.e. below 12.5 acres, has decreased over time due to increase in their number. However, the mean area of the largest size class of above 150 acres has increased over time by 8 acres between 1972 and 1980, and by 27 acres between 1980 and 2000. So, it is these gains in area percentage share in land mean farm size by the largest size class above 150 acres which account for increase in concentration of operated area over the last two decades, especially during the 80s.

Tenurial status of farmers has also experienced changes over time. The major tenurial change between 1960 and 1980 is that a reduction in the percentage of tenant cultivated area in each farm size has been accompanied by a concomitant increase in that of owners. Between 1960 and 1972, tenants in each size class lost area, while owners cum tenants gained. Between 1972 and 1990, all tenants and owners cum tenants lost area. If this change is aggregated, the percentage of tenant area decreased from 39 percent in 1960 to 30 in 1972 and then to 22 in 1980 and 18 percent in 2000. The total number of tenants decreased from 44 percent of the operators in 1960 to 35 in 1972 and to 26 in 1990. In other words, the proportional number and area of tenants decreased by approximately 10 percent in each decade, reducing their number to half of them by 1990. The concentration of operated area between 1960, 1972 and 1990 is explained by tenants falling out of the distribution and their area being resumed by the owners.

Distribution of farm size is skewed[1] in Pakistan. According to the Census of Agriculture 2000, there are about 6.3 million farms in the country and their average size is 3.23 hectors and about 86.2 percent are under 5 ha., accounting for 38.5 percent of farm area; 7.8 percent are medium size and account for 16.2 percent of the area; and about 6 percent are large and take up more than 45.3 percent of the area Table 3. About 6.6 millions are operational units. About 85.7 percent are small operators and area under their operation is about 43.4 percent of the farm area, while 8.8 percent medium size farm operators share about 19.1 percent. About 5.6 percent consider the large farm and they cultivate 37.5 percent of the area Table 4. Regarding self plowed, about 77.6 percent of the farms are operating 73.3 percent of the total area. Similarly, 14.5 percent of the area is cultivated by 8.4 percent owner-cum-tenants and the remaining 14 percent of farms are running by small tenants Table 5.

In a country like Pakistan, where most cultivators are either landless or most of the land is owned in large parcels by small numbers of households, a transfer of substantial land to the former groups can extend the peasant system or even transform it into a co-operative (co-operatized) farm system. On the other hand, a land reform programmed can also promote, rather than retard, the development of capitalist agriculture by creating necessary pressures on landlords by policy measures without redistributing land to landless share-croppers and poor peasants. There is substantial evidence that the land reforms of 1972 may have contributed to this tendency without strengthening the peasant system (Mahmood 1993 and Khan 2006). The progress of implementation of land reforms may be seen from Table 6. It seems that land reforms introduced in the country have not exercised any significant impact in terms of increase in the total cultivated area Figure 1. However, they seem to have affected the distribution land by different size categories of farms.

3. AGRICULTURE TECHNOLOGY AND INPUTS

Agricultural technologies have popularly been classified as mechanical technologies and biological technologies. Mechanical technologies relate generally to those technologies which are embodied in machines and appliances such as tractors, tube-wells, threshers, diggers, combine, etc. used in performing different farm operations. Typically, mechanical technologies enable farmers to expedite farm operations and thus enable the same labor to cultivate more land and increase cropping intensity. Similarly, diffusion of these technologies results not only in higher cropping intensity but also in quick planting and harvesting

[1] Over time the situation may have improved, nonetheless, the distribution is still perceived to be skewed.

of crops, and handling of output. Although these technologies have a positive effect of cultivated area and cropping intensity but they do not necessarily increase yield of crops.

Biochemical technologies, on the other hand, relate to new, more input responsive seed varieties, use of chemical fertilizer and controlled application of irrigation water. Application of these technologies, in general, induces substitution of labor and industrial inputs for land. Besides, these technologies increase crop yields.

Biological technologies have also been regarded as the cause and effect of the Green Revolution that occurred during 1960s and 1970s in different countries of the world. In Pakistan, the Green Revolution started during the early 1960s, although some of the modern inputs were introduced in the late 1960s. The main ingredients (inputs) of the Green Revolution witnessed here were identified as HYVs, fertilizers, pesticides, tractors and irrigation.

3.1 Water

The most significant change that has occurred in the agrarian structure of Pakistan has been due to increased supply of irrigation water, particularly from private tube-wells especially in Punjab. Private tube-wells have not only provided additional water but have also provided it at demand. The cultivation of new irrigation-intensive crops is increasing and increased use of fertilizer is resulting in synergistic effects on output and thereby on profit of farmers (Acumen, 2008). In fact, it has been the increase availability of increased irrigation water that has facilitated rapid adoption of fertilizers and new seeds particularly of wheat and rice since around the mid-sixties in the country (Kemper, 2003; Khan, 2006).

The total area irrigated by all sources of water has increased over the years from 9.3 million hectares in 1965-66 to 17.9 in 1996-97 and 26.8 percent in 2006-07. Most of this increases in attributable to tube-wells. More specifically, area irrigated by canals has increased from 7.5 million hectares to 7.8 whereas that by tube-wells from none to 9.5 million hectares in the same period of time.

During the 1990s more than 100 million acre feet were diverted annually into the heads; by 2001/02 only about 79.6 million acre feet were being diverted, then in 2006/07 availability was restored to about 102 million acre feet. The number of private tubewells has increased from 506.8 thousand to 964.3 thousand in the last ten years Table 7 nevertheless the level of groundwater abstraction could not increase corresponding with the number of tubewells during same period. About 37.4 million acre feet were irrigated by private tubewells in 1996/97; in 2007/08 this increase to about 40.4 million acre feet[2]. Such "over-mining" and attendant saline infringement into fresh groundwater areas could damage aquifers permanently. Year-wise number of tube-wells in operation are shown by Figure 2 and area irrigated by different sources in Figure 3, respectively.

3.2 Fertilizer

No chemical fertilizer was used in Pakistan in the 1950s. However, the application of inorganic fertilizers increased at rate of over 40% per annum between 1959-60 and 1969-70. This continuing upward trend in fertilizer use, as shown in Figure 4, brought total fertilizer consumption to more than 300 thousand nutrient tones by 1969-70. By 1970, demand for fertilizers had gone through the initial spurt of the Green Revolution, and the use of the product continued to increase regularly at 12.4 percent in the 1980s and at 8.2 percent in 1995-96 (GO P, 1997-98).

The annual consumption of nitrogenous fertilizer was about 2.6 million nutrient tons in 2007/08 Table 8. This off-take is about 9.5 percent lower than the previous year. About 979 thousand nutrient tons of phosphate fertilizer was used in the same year which is 15.1 percent higher than the previous year. The off-take of potash was only 43,000 nutrient tons, but was an increase of almost 60 percent over the previous year. The government is providing subsidy of Rs 250 per bag on diammonium phosphate to encourage the farmer's balanced use of fertilizer. The suggested Nitrogen to Phosphate ratio is 2:1, as compared to historic use of over 3 N to 1 P. The ratio improved to 2.7:1 In 2006/07. This is despite manifold increase in

[2] Agriculture Statistics of Pakistan 2007/08

the price of phosphatic fertilizer. The gap between local production and consumption is filled through imports by the public and private sectors. Table 9 shows that Pakistan has been importing on average about 700,000 nutrients MT in a year.

3.3 Tractors

The impact of mechanical technologies on agricultural growth and agrarian structures has been a controversial issue in Pakistan. This applies particularly to the use of tractors. Despite the continued controversy over their impact, the number of tractors has increased rapidly since the mid sixties Figure 2. The argument in favor of encouraging farm tractors is that they affect positively cropping intensity, yields level, land preparation and post-harvest operations. However, opinions differ widely on their positive effects, particularly on yield level and cropping intensity. Some economist also content that large-scale tractorization in Pakistan has resulted in labour displacement, tenant eviction and expansion of already large landholdings (Malik, 1994; Khan, 2006). This argument implies that rich peasants and big landlords are increasingly finding it profitable to encroach on the land of poor peasants and sharecroppers hence occasioning undue concentration of land.

The process of tractorization, dominated by large tractors, was initiated by pressure from large landowners. It has, in turn, resulted in the concentration of tractor ownership on the one hand and in increased pressure for expansion in area operated by large landlords and rich peasants, on the other. The government has so for closely regulated the tractor market. Public policy has so far consistently favored the import and use of large tractors. The government has also provided handsome incentives for the purchase of tractors by reducing import duties and taxes. These incentives are in addition to the low interest loans advanced by the Agricultural Development Bank of Pakistan.

Tractors in operation increased at an average rate of over 14 percent during the 1970s, and 13 in the first half of the 1990s. The growth of tractors had dropped during the late 1990s. Probably because most of large farmers had by this time already equipped them with the necessary farm equipments. The mechanization of smaller farm holdings is not easy, because almost all farm machines accessible in Pakistan are basically designed to operate on large farm holdings. However, smaller tractors are now becoming popular and possibilities of their manufacturing in Pakistan are being explored. Despite the growth of tractors and tube-wells the availability of farm power in Pakistan is estimated still as much below the optimal level and many tasks on the majority of landholdings are still being performed manually Malik (1994).

The reported tractors in the country are about 400,500 in which 83 percent are in the Punjab province[3]. The majority of farmers use tractor-drawn blades, ridgers to prepare seed beds and cultivators. The other most common use is tractor-operated threshers, and haulage of inputs and produce from and to market. Tractor-drawn implements such as mould board plow; seed planters, fertilizer dusters, pesticide spraying, and harvesting are in limited use. To encourage mechanization, the import duty on agricultural machinery is kept at the minimum.

3.4 Pesticides

Pest attacks are a major factor in low level of agriculture production in Pakistan. The beneficial effects of all other inputs may wipe out with in a couple of days if pests break out. The use of pesticides in Pakistan is, however; not as widespread as it should be. The need for increased use of pesticides has become greater as the use of fertilizers and improved seeds have increased. Pest attacks are generally more likely to occur in plants nurtured by fertilizer and cultivated from HYV seeds.

Imports of pesticides grew fast during 1952-53 to 1959-60. However, this growth rate was deceptive, because imports began to increase from a very low level. In fact imports of pesticides in quantity began in 1972-73 Figure 5. Yet quantities imported fluctuated widely from year to year, as there were no organized system of plant protection in Pakistan. Further, farmers have often not been able to afford the expenditure required for the needed application of pesticides. Consequently, pesticide take off has varied widely overtime in country.

[3] Agricultural Statistics of Pakistan 2006/07: Table 116

During 2006/07, 15,500 MT of pesticides were imported, while 75,000 MT were locally formulated Table 10. Most of the farmers generally use pesticides without giving consideration to the infestation level and often spray the crop unnecessarily. The indiscriminate use of a wide range of pesticides is creating health and environmental hazards. The extension departments in the provinces need to circulate required information regarding the safe and correct methods of pesticide application.

3.5 Agricultural Credit

Farm credit is a major source of acquiring new technology for an efficient and profitable agriculture, and the key determinant of the level of production (Khan, 1997; Zuberi, 1989). Income from harvests in Pakistan generally comes only twice a year and is subject to fluctuations. Farm households, thus, rely on borrowing to tide over periods between harvests and poor crops. First farmers fulfill consumption requirements from production and then sell the surplus to buy inputs from the market. However, the growing popularity of "HYV agriculture" has enhanced the importance of rural credit significantly. Farmers now need credit in ever-increasing amounts to finance timely purchases of modern inputs and farm implements. Credit helps not only in removing financial constraints but also provides incentives to growers for adopting new technology and practices with new aspirations and horizons, provided it is properly delivered (Rao & Khan, 1991; Malik, 1991). However, the clientele of the rural credit markets are an often-small farmer who often fined it difficult to fulfill the collateral requirements of the lending institutions. In order to facilitate the adoption of "HYV" technology amongst small farmers, the government has disbursed large amounts of credit often at highly subsidized rates. The trend of credit disbursement is depicted by Figure 6. Peak expansion rate of credit was observed during the 1970s. The rural credit expansion rate was estimated at 42 percent per year during 1969-70 to 1976-77. Such a surge in rural credit during this period was due to the nationalization of the commercial banks (Qureshi, e*t al.,* 1992; Bastin 2008). Nationalization of banks aside, overall agricultural credit has tended to increase at an annual average rate of 25 percent over the period from 1965-66 to 2006-07 which has been higher than the average growth rates of all the other agricultural inputs.

4. AGRICULTURAL OUTPUT AND GROWTH

Agricultural output has increased irregularly in Pakistan. It has grown at fast rates in some years and at slow rates in others. Table11 shows that the growth rates of output barely in excess of 1.0 percent per annum during the early 1950s and just over 2 per cent during 1954-55 to 1959-60. However output growth rates increased continuously during the sixties. Specifically, agricultural output increased at an annual growth rate of 3.8 per cent during the first half and at 6.3 percent during the second half of the sixties. These accelerated growth rates resulted mainly from rising growth rates of crop production, although other sectors of livestock and forestry have also contributed to the increased growth of output of agriculture.

During the early seventies, the annual growth rate of agricultural output declined to the historically lowest level of 0.8 percent. While crop production had a growth rate of 0.5 per cent, output of rice, cotton and sugarcane fell persistently. Except for poultry, the livestock sector also demonstrated equally disappointing performance. However, the agricultural growth revived after the mid-1970s and both the crop and livestock sector registered respectable growth rates of over 4.0 per cent and 3.0 per cent, respectively.

The livestock and non-cereal crops have since around 1980s emerged as the prime mover of agricultural growth. The livestock sector registered annual growth rate of about percent compared to the overall agricultural output growth rate of 3.3 per cent. Cotton has been another factor in improved output performance of the agriculture. It showed 6.7 per cent growth rate. By contrast, growth rates of entire crop sector and cereal crops were estimated at less than 3 and 2.0 per cent, respectively. During the period of 1984-85 and 1989-90, cotton and livestock production witnessed further accelerated growth and thereby the overall growth of agricultural output. When the growth rate of cotton was rising, growth rate of wheat showed some recovery but those of sugarcane and rice remained very low. In the 1990s, the agricultural growth rates fell further to less than 4.0 in 1989-90 and to 3.0 percent in 1994-95 and 4.1 percent in 2000-08. This was primarily due to slower growth rates of cotton, rice and wheat. Although sugarcane and livestock showed improved output performance but it was not adequate enough to offset the decline in performance of cotton, wheat and rice. Consequently, agricultural output growth subsided during the 1990s. Over the past sixteen years, Agriculture has grown at an average rate of 3.7 percent per annum. However,

volatility in the sector is high, with the range of growth varying between 6.5 percent and 1.0 percent. The fluctuation in overall agriculture has been largely dependent on the contribution of major crops.

5. AREA, PRODUCTION AND YIELD OF WHEAT AND RICE

Wheat accounts for a staple crop in Pakistan. Continues increase in its output is pursued as a policy goal in the country (Bastin, 2008); Dorosh, 2006; Siddiqui, 2007) and its historical production is examined below. Wheat production fluctuated widely during the 1950s due to the ravages of floods, pest attacks, and, on occasion, prolonged droughts. Like production, area planted to wheat also fluctuated but to a lesser extent. As such, downswing in production of wheat during the 1950s was not so much due to any reduction in its area but to a sharp drop in its yield. Wheat area has generally accounted for 30 to 35 percent of total crop area in Pakistan. Between 1954-55 and 1959-60, wheat production grew at an annual average rate of just over 4 percent but at rate of over 3 percent during early 1960s. This out put growth was due to continuous increase in its area Figure 7. However, during the later half of the 1960s the production grew at an annual average rate of more than 12 percent as a result of combined increase in both areas and yield (GOP, 1968). Secular increase in yield per hectare is shown in Figure 8. Such a high growth rate was followed by low rate of 1.3 percent per annum for the period 1979-80 to 1984-85. Severe drought in 1986-87 and again in 1991-92 has been among the factors responsible for frequently fluctuating wheat yield in the country.

Unlike wheat, rice has generally shown a rather consistent output performance with amplitudes of its production much smaller those of wheat and cotton over the year (Siddiqui, 2007). Rice generally occupied about 10 percent of the national cropped area. Rice production increased at an average rate of 2.7 percent per annum from 1947-48 to 1954-55 and at 5.3 percent from 1959-60 to 1964-65. The latter rate of increase has been caused partly by the introduction of new rice seeds (IRRI) whose yield increased by 9 percent in 1967-68 and by more than 24 percent in 1968-69 when the Green Revolution was in full swing. As could have been expected, such an increase in yield of rice could not be maintained for long. Rice production growth diminished the 1970s along with the fading of the Green Revolution. Its growth rate fell to 2.3 percent during 1969-70 to 1976-77 and could not increase subsequently. Consequently rice production targets could not be achieved during 1987-88 to 1989-90 (GOP, 1989-90). The estimated trend rates of yield levels show some interesting change. As a whole the yield levels have increased only modestly in the last fifty years. By comparison, wheat yield rose by 2.8 percent and that of rice by 2.1. In the first 8 years after 1947, the crop yields tended either to be static or to fall. However, yields increased significantly during the 15 years following 1959-60 Figure 9. Since 1980, the wheat yield has maintained an annual growth rate of 1.8 percent and rice 0.8.

Introduction of modern varieties of wheat and rice brought about significant changes in Pakistan's agriculture. The adoption of the Irri rice varieties in different province of Pakistan is shown in Figure 10. Punjab and Sindh adopted these newly introduced seeds more rapidly than Baluchistan and NWFP and also exceeded them in cultivated area Figure 11. It is worth mentioning that a considerable proportion of increase in rice production in the post land reforms period resulted from both increased area and yield of new varieties Figure 12.

The adoption of new seeds of wheat in different provinces of Pakistan has been shown in Figure 13. The rate of its adoption in Punjab and Sindh has been in considerable excess of that in Baluchistan and NWFP. As in rice, the production of wheat as showed in Figure 7 also increased considerably in the post land reforms period.

From the past 16 years, wheat production has increasing trend. About 8.6 million hectors cultivated area in which 85 percent is irrigated and 97 percent is under high yielding varieties of seeds. Research yields for irrigated bread wheat production are around 6,130 kg per hector.—low compared to international best practice (e.g., Australian growers using irrigation in a similar production environment regularly obtain yields of 8,000 kg per hector). The national average for the past five years has been 2,770 kg per hector. Barani yields reach 1,530 kg per hector (about half the irrigated yields). Total production is about 23.3 million tonnes, of which 98 percent is based high yielding varieties of seeds. About 85 percent of production occurs in Punjab (75percent and Sindh (11percent).
Pakistan's rice production generally shows a 16-year increase, 30 totaling 5.5 million tonnes from 3.2 million tonnes. Basmati varieties provide a high quality export that positions Pakistan favorably over

volume exporters like Vietnam. A key competitor is Thailand, whose "hom malis" – a fragrant rice variety--has high export acceptance. This is due partly to land reforms and partly to technological advancement.

6. AGRICULTURAL PRICE POLICY AND ADOPTION OF NEW TECHNOLOGIES

A price policy may serve as an incentive for farmers to increase their production. There is convincing evidence in Pakistan that a shift from an unfavorable to a favorable price policy for agriculture was the main motivating force behind the Green Revolution in Pakistan (Aresvik, 1967; Dorosh, 2006). Some important dimensions of the domestic agricultural price policy are discussed below.

6.1 Input Subsidies

Pakistan has subsidized agricultural inputs since the mid-1950s. Initially, chemical fertilizer was subsidized in order to popularize its use (Naqvi, 1989; Khan, 2006; Hamid, 2008). The list of subsidized inputs and the rate structure of the subsidies were expanded in later years so that towards the end of the sixties, almost all the agricultural inputs including fertilizers, insecticides, seeds, irrigation water, tube-well installations, and the operation and purchase of tractors and tractor-related equipment were subsidized in one or the other form (Aresvik, 1967; Kuhnen & Fritjof, 1989). In the 1970s, subsidies were curtailed to some extent in response to input price increases that occurred in the wake of world worldwide recession, oil embargo, credit crunch, war with India, and steep devaluation of Pakistani Rupee (Chaudhry, 1982). Although subsidies were applicable to most inputs during the seventies, government decided to under pressures from the IMF and the World Bank resolutely remove them from the beginning of the 1980s (GOP, 1980). As a consequence, there was a total withdrawal of subsidy from seeds, insecticides, tubewells, and tractors. Phased withdrawal of fertilizer subsidy was also under taken, culminating in the case of nitrogenous fertilizers in 1984-85 and in the case of phosphoric and potash fertilizers in 1989-90 (World Bank, 1996).

A perusal of relevant data on subsidies presented in Table12 can enable many arguments. First, the input subsidies trended continuously up over the period under consideration. Second, in the case of implicit subsidies, irrigation water accounted for as large a share as almost 60 percent of the total subsidy, followed by institutional credit and electricity. Third, many land arguments about the size of the agricultural input subsidies have been made in most of the government meetings and public forum, they hardly exceeded Rs. 2 to 3 billion for most of the period, and never exceeded Rs. 8 billion a year. Finally, as a percentage of budgetary expenditure, total subsidies on agricultural inputs fell from nearly 10 percent in 1979-80 to 1.5 percent in 2000.

7. TECHNOLOGY AND GROWTH

It is variously argued that the technology makes a positive contribution to higher growth rate of agriculture. For instance, there is documented evidence of private tube-wells installations increasing cropping intercity by 50 percent (Muhammad, 1965). The shorter duration of the high-yielding varieties (HYVs) of wheat and rice and the availability of chemical fertilizers have produced similar results (Gill, 1973). The quickness of operations permitted by tractor cultivation augmented the cropping-intensity effects of tube-wells and HYVs (Lawrence, 1970). The yield-increasing effects of the above technologies were equally important. Each of the tube-wells and HYVs of wheat and rice raised crop yields by 50 percent (Muhammad, 1965; Gill, 1973). The new varieties of cotton, introduced in the 1980s, have a yield potential of 3 to 4 times that of the traditional varieties (Chaudhry 1994 and Chaudhry 1995).

8. LARGE VS SMALL FARM PRODUCTIVITY

There is impressive empirical evidence on the inverse relationship between the farm size and its productivity in agriculture (Ruttan, 1969; Dorner, 1972; Cornia, 1985; Johnston & Tomich, 1985). Empirical evidence in Pakistan also lends support to the inverse relationship between farm size and agricultural productivity (Chaurdry, 1982; Naqvi, Khan & Chaudhry, 1989; Sharif et al., 1986; Hai 1997). Some of the factual information in this regard has been depicted in Table13. It is apparent from this table that the gross productivity of the small farms has been consistently higher than that of the large ones between 1965-66 and 2004-05. In the light of the above, there is no room for the assertion that the large farms overtook the small farms in farm productivity under the Green Revolution. Indeed, the differences in the adoption rates of various modern technologies between the two groups have narrowed with the passage of time.

It is argued that the major difference in farm investments of larger and small farmers lies in their ownership of tube wells and tractors. According to the 1980's Census of Agriculture, large farmers owned nearly 59

percent of the tractors and about 39 percent of the tube-wells. By contrast, the small farmers owned only 16 percent of the tractors and 35 percent of the tube-wells (GOP, 1985). However, the situation of small farmers with respect to farm water and power on their increased access to custom sales of tube well water and tractor services. Accounting for this fact, nearly 35 and 32 percent of the small farmers were users of tractors and tube-wells. By contrast, the respective percentages were 44 and 33 for the large farmers.

As far as the adoption of bio-chemical technologies is concerned, both the large and small farms used HYVs with almost the same proportion by the early seventies (Chaudhry, 1996). It may be interesting to note that the HYVs of wheat accounted for 68 percent of wheat acreage in 1980, on both the small and large farms. By contrast, the small farms devoted nearly 54 percent of their rice area to HYVs of rice compared to 44 percent on large farms (GOP, 1983). Whatever differences in the rates of application of fertilizer on large and small farms existed in the Sixties, they were greatly reduced by the early 1980s (Naqvi, Khan & Chaudhry, 1994).

One of the most probable reasons for a somewhat lesser use of the modern inputs on the small farms relative to the large ones is that they are compelled by their resource endowments to prefer to make a more intensive use of some of the traditional inputs. For example, although tractors may enable the large farms to undertake tillage operations with precision, small farms can do the same in better ways with greater inputs of human labour and animal power in addition to their access to hiring of tractors. According to available evidence, the labour input per unit of land for the small farms is, at least, twice as much as that for the large farms (Chaudhry, 1989); Herring & Chaudhry, 1974; Chaudhry, 1982). Similarly, the bullock-power input of the small farmers was 4 times that of the large farmers. Although the small farmers have a somewhat limited access to tube-well water, their proportionate irrigated area has historically exceeded that of the large farmers, probably because they tend to use water more efficiently. This would be particularly true if the small farmers had only a limited access to surface and ground water supplies. According to the 1990's Census of Agriculture, the proportionate irrigated area of the small farmers was close to 81 percent as against 73 percent of that of the large farmers. A somewhat lesser use of chemical fertilizer on the small farms is perhaps more than offset by their higher application of manure which they use twice as per acre as is done by large farmers (Chaudhry, 1982). As farmyard manure is rich in plant nutrients, its greater use would be instrumental in enabling the small farmers to secure a higher and better soil-nutrient balance than is obtained by large farmers, who solely depend on chemical fertilizers.

9. CONCLUSION

This study attempts to assess the structural change, technological innovations, and nature of technological change in the agricultural sector of Pakistan. Firstly, we saw the impact of land reforms on the distribution pattern of the cultivated land in the country surprisingly; the land reforms introduced in Pakistan so far have exercised no direct significant impact on its agrarian structure. They have not made any significant increase in the cultivated area of the country barring a slight increase in early seventies. However, they seem to have induced conversion of large into small farms. As such, the proportion of area under small farms has increased and the ratio of tenancy to ownership has decreased to some extent.

The use of modern varieties of rice and wheat has increased on all farms in whole of Pakistan. Relatively, the use of the new varieties of wheat and rice is more widespread in Punjab and Sindh than in other provinces. Similarly, the use of fertilizer, pesticides, etc has also increased overtime indicating the occurrence of technological change in the agricultural sector of the country.

Chronological data show that agricultural productivity has been growing due to use of new verities of seeds and application of modern technologies. Application of modern techniques of production shows that, first, an important part of productivity growth of land is attributed to use of new seeds in Pakistan. Second, land reallocation toward high value crops is the key source of agricultural growth during the post-Green Revolution period. Predictable patterns of the engine of productivity growth of land are generally consistent with prospect that use of new verities of seeds and improvement in agricultural technology are important factors to the realization of farmers' economic rationality.

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Table 1: ***Distribution of Operated Area in Pakistan, 1960, 1972, 1980 and 1990***

Operated area (Acres)	No. of Farms				Farm Area (Acres)				Mean Farm Area (Acres)			
	1960 (%)	1972	1980	1990	1960 (%)	1972	1980	1990	1960	1972	1980	1990
< 5	19.0	28.2	34.1	47.5	3.0	5.2	7.1	11.3	2.2	2.4	2.4	2.2
5 - <12.5	44.3	39.9	39.4	33.4	23.6	25.2	27.3	27.5	7.9	8.2	8.0	7.7
12.5 - < 25	23.8	21.1	17.3	12.2	27.0	26.6	24.7	21.5	16.9	16.5	16.5	16.4
25 - < 50	9.0	7.7	6.5	4.7	19.0	18.8	17.8	15.8	31.3	31.9	31.8	31.5
50 - <150	3.3	2.7	2.4	1.8	16.0	15.1	14.7	13.9	72.3	72.1	71.9	70.5
> 150	0.5	0.4	0.3	0.3	11.5	9.5	8.5	10.1	331.3	277.3	285.4	310.4
Total	100	100	100	100	100	100	100	100	14.9	13.0	11.6	9.4

Source: Mahmood, (1993), quoted from Agricultural Census of Pakistan: 1960, 1972, 1980, 1990

Table 2: ***Distribution of Land by Tenure, 1960, 1972 and 1990***

Operated Area (Acres)	1960 Number %			1960 Area %		
	Owners	Owner+ Tenant	Tenant	Owners	Owner+ Tenant	Tenant
< 5	47.7	13.1	39.2	42.5	16.6	40.0
5 - <12.5	32.2	21.9	45.9	31.5	22.3	46.3
12.5 - < 25	30.1	23.2	46.7	29.9	23.3	46.8
25 - < 50	32.8	24.7	42.5	32.9	25.2	42.0
50 - <150	44.4	26.2	29.4	46.0	25.9	28.1
> 150	63.3	19.4	17.3	68.9	18.1	13.1
Total	35.3	20.9	43.8	38.3	23.0	38.7
Operated Area (Acres)	1972 Number %			1972 Area %		
	Owners	Owner+ Tenant	Tenant	Owners	Owner+ Tenant	Tenant
< 5	61.4	11.8	26.8	55.9	15.6	28.5
5 - <12.5	33.3	25.4	41.4	31.7	26.0	42.3
12.5 - < 25	31.2	31.6	37.2	31.3	32.7	36.0
25 - < 50	38.4	34.4	27.3	38.2	35.8	26.0
50 - <150	49.0	55.2	15.8	49.3	36.0	14.7
> 150	62.8	28.4	8.8	62.4	29.6	8.0
Total	14.7	23.8	34.5	39.5	30.9	29.6
Operated Area (Acres)	2000 Number %			2000 Area %		
	Owners	Owner+ Tenant	Tenant	Owners	Owner+ Tenant	Tenant
< 5	70.7	9.0	20.4	65.4	11.8	22.8
5 - <12.5	45.1	22.0	32.9	43.9	22.6	33.5
12.5 - < 25	45.8	28.0	26.2	46.0	28.9	25.1
25 - < 50	49.8	31.9	18.3	49.7	33.0	17.3
50 - <150	61.3	29.2	9.5	61.7	29.7	8.6
> 150	75.6	23.2	4.2	73.4	22.9	3.7
Total	54.7	19.4	25.9	52.1	26.3	21.6

Source: Mahmood (1993), quoted from Agricultural Census of Pakistan: 1960, 1972, 2000.

Table 3: Area of Farms (Ownership) By Size of Farms, 2000

Size (Hectares)	Farms		Farms Area		Avg. size (Hectares)
	Number	%	Hectares	%	
All Farms	6,311,356	100.0	20,366,993	100.0	3.23
Under 0.5	1,455,802	23.1	401,662	2.0	0.28
0.5 to under 1.0	1,107,723	17.6	821,341	4.0	0.74
1.0 to under 2.0	1,297,226	20.6	1,782,716	8.8	1.37
2.0 to under 3.0	838,310	13.3	1,949,053	9.6	2.32
3.0 to under 5.0	744,114	11.8	2,883,253	14.2	3.87
Small Farms	5,443,175	86.2	7,838,025	38.5	1.44
5.0 to under 10.0	491,420	7.8	3,297,276	19.0	6.71
Medium Farms	491,420	7.8	3,297,276	16.2	6.71
10.0 to under 20.0	249,859	4.0	3,181,750	15.6	12.73
20.0 to under 40.0	86,506	1. 4	2,199,333	10.8	25.42
40.0 to under 60.0	19,941	0.3	894,496	4.4	44.86
60.0 and above	20,455	0.3	2,956,113	14.5	144.52
Large Farms	376,761	6.0	9,231,692	45.3	144.52

Source: Census of Agriculture 2000.

Table 4: Number of Operational Units and Area of Farms by Size of Farms, 2000

Size (Hectares)	Farms		Farms Area		Avg. size (Hectares)
	Number	%	Hectares	%	
All Farms	6,620,054	100.0	20,406,782	100.0	3.08
Under 0.5	1,290,098	19.5	362,544	1.8	0.28
0.5 to under 1.0	1,099,330	16.6	821,245	4.0	0.75
1.0 to under 2.0	1,425,370	21.5	1,981,277	9.7	1.39
2.0 to under 3.0	966,411	14.6	2,256,772	11.1	2.34
3.0 to under 5.0	890,755	13.5	3,442,507	16.9	3.86
Small Farms	5,671,964	85.7	8,864,345	43.4	1.56
5.0 to under 10.0	580,200	8.8	3,891,228	19.0	6.71
Medium Farms	580,200	8.8	3,891,228	19.1	6.71
10.0 to under 20.0	260,791	3.9	3,324,310	16.3	12.75
20.0 to under 40.0	77,773	1.2	1,955,330	9.6	25.14
40.0 to under 60.0	15,277	0.2	689,070	3.4	45.11
60.0 and above	14,054	0.2	1,682,491	8.2	119.72
Large Farms	367,895	5.6	7,651,201	37.5	119.72

Source: Census of Agriculture 2000.

Table 5: Number of Private Farms By Tenure, 2000

Tenure	Farms		Farms Area	
	Number	%	Hectares	%
Owner cultivator	5,134,504	77.6	14,961,275	73.3
Owner-cum-tenant	558,991	8.4	2,963,441	14.5
Tenant	926,562	14.0	2,482,061	12.2
Total	6,620,057	100.0	20,406,777	100.0

Source: Census of Agriculture 2000.

Table 6: Progress of Implementation of Land Reforms upto 2000.

Province	Area Resumed	Area Disposed off	Balance	Persons Benefited
1959 MLR 64				
Punjab	511244	505082	6162	109889
Sind	346307	300091	46216	43131
N-W. F.P	112108	27287	14821	24314
Boluchistan	53268	53196	72	6221
Total	1022927	955656	67271	186555
Province	Area Resumed	Area Disposed off	Balance	Persons Benefited
1972 MLR 115				
Punjab	121593	94583	27010	36017
Sind	112920	72478	40442	17167
N-W. F.P	57415	55122	2293	12811
Boluchistan	185015	76298	101017	5398
Total	376943	298481	178462	71393
Province	Area Resumed	Area Disposed off	Balance	Persons Benefitted
Act- 11 of 1977				
Punjab	40381	22253	18131	9437
Sind	12901	8611	4290	2118
N-W. F.P	9440	6695	2745	2694
Boluchistan	11497	1022	10475	286
Total	74222	38581	35641	14535

Source: Agricultural Statistics of Pakistan: 2000-01

Table 7: Water Availability at Farm Gate (Million Acre-Feet)

Years/Season	Ground Water			Total
	Public T. wells	Private T. wells	Scrap T. wells	
1996-97	1.93	37.40	-	39.33
1997-98	1.93	38.27	-	40.2
1998-99	1.93	38.63	10.51	51.07
1999-00	1.93	38.27	9.71	49.91
2000-01	1.93	39.35	9.27	50.55
2001-02	1.93	39.71	8.65	50.29
2002-03	1.93	40.08	8.01	50.02
2003-04	1.93	40.08	8.01	50.02
2004-05	1.93	40.08	8.01	50.02
2005-06	1.93	40.38	8.01	50.32
2006-07	1.93	40.38	8.01	50.32

Source: *Planning & Development Division (Water Resources Section) and IRSA*

Table 8: Fertilizer Consumption, 1990–2007(000 N/Tonnes, Percent Change over Previous Year)

Year	Nitrogen	%Change	Phosphate	% Change	Potash	% Change	Total	% change	N.P. ratio
1990/91	1471.6	(+) 0.3	388.5	(+) 1.6	32.8	(-)18.2	1892.9	(+) 0.1	3.8:1
1991/92	1462.6	(-) 0.6	398.0	(+) 2.4	23.3	(-)29.0	1883.9	(-) 0.5	3.7:1
1992/93	1635.3	(+)11.8	488.2	(+)22.7	24.1	(+) 3.4	2147.6	(+)14.0	3.4:1
1993/94	1659.4	(+) 1.5	464.2	(-) 4.9	23.2	(-) 3.7	2146.8	(-) 0.1	3.6:1
1994/95	1738.1	(+) 4.7	428.4	(-) 7.7	16.6	(-)28.4	2183.1	(+) 1.7	4.1:1
1995/96	1990.9	(+)14.5	494.4	(+)15.4	29.7	(+)78.9	515.0	(+)15.2	4.0:1
1996/97	1985.1	(-) 0.3	419.5	(-)15.1	8.4	(-)71.7	2413.0	(-) 4.1	4.7:1
1997/98	2075.0	(+) 4.5	551.0	(+)31.5	20.0	(+)150.0	2646.0	(+) 9.7	3.8:1
1998/99	2099.0	(+) 1.2	465.0	(-)15.6	21.0	(+) 5.0	2585.0	(-) 2.3	4.5:1
1999/00	2217.0	(+) 5.6	596.0	(+)28.2	18.5	(-)13.1	2832.0	(+) 9.5	3.7:1
2000/01	2264.5	(+) 2.1	676.7	(+)13.5	22.8	(+)23.2	2964.0	(+) 4.6	3.4:1
2001/02	2285.3	(+) 0.9	624.5	(-)27.6	18.8	(-)18.0	2928.6	(-) 1.2	3.7:1
2002/03	2349.1	(+) 2.8	650.2	(+) 4.1	20.5	(+) 9.2	3019.8	(+) 3.1	3.6:1
2003/04	2526.7	(+) 7.6	673.5	(+) 3.6	21.8	(+) 6.3	3222.0	(+) 6.7	3.8:1
2004/05	2796.4	(+) 0.7	865.1	(+) 28.5	32.5	(+)49.2	3694.0	(+)14.7	3.2:1
2005/06	2926.6	(+) 4.7	850.5	(-) 1.7	27.0	(-) 16.9	3804.1	(+) 3.0	3.4:1
2006/07	2649.7	(-) 9.5	978.7	(+) 15.1	43.1	(+) 59.6	3671.5	(-) 3.5	2.7:1

Source: *National Fertilizer Development Centre (NFDC), Islamabad.*

Table 9: Import of Fertilizers (thousand nutrient tons)

Year	N	P	K	Total
1990/91	365.0	264.0	56.0	685.0
1991/92	360.0	257.0	15.0	632.0
1992/93	393.0	357.2	8.9	759.1
1993/94	313.0	547.0	43.0	903.0
1994/95	73.0	186.0	2.0	261.0
1995/96	248.8	280.6	51.6	581.0
1996/97	472.8	381.0	24.3	878.1
1997/98	286.9	415.7	11.1	713.7
1998/99	421.8	425.0	37.2	884.8
1999/00	233.0	416.0	13.8	662.8
2000/01	194.0	369.1	16.5	579.6
2001/02	178.5	429.5	17.7	625.7
2002/03	215.7	542.4	7.9	766.0
2003/04	204.2	553.5	6.4	764.1
2004/05	309.7	458.2	16.9	784.8
2005/06	603.4	639.8	25.1	1268.3
2006/07	307.6	476.2	12.1	795.9

Source: *National Fertilizer Development Centre, Islamabad.*

Table 10: Consumption of Pesticides

Year	Quantity M.T.			Value (million Rs)
	Imports	Production	Total	
1990	7502	9941	14743	4581
1991	6157	14056	20213	5536
1992	6691	16748	23439	6554
1993	6128	14151	20279	5384
1994	10693	14175	24868	5808
1995	20136	23239	43375	7274
1996	24151	19068	43219	9987
1997	24168	13836	38004	9904
1998	22765	18811	41576	6960
1999	27210	18470	45680	7324
2000	19764	41535	61299	4971
2001	20678	26914	47592	7741
2002	27103	42794	69897	6790
2003	24028	54105	78133	8138
2004	40482	89116	129598	12592
2005	28371	76792	105164	10379
2006	12721	30855	43576	5906
2007	15553	75123	90676	12290

Source: *Agriculture Statistics of Pakistan 2006/07 Department of Plant Protection, Karachi.*

Table 11 Agricultural Growth Rate, 1950-55 to 2007-08

Years	1950-55	1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-97	1997-01	2002-08	1950-08
Growth rate	1.01	2.10	3.78	6.26	0.78	3.91	3.28	4.57	3.93	2.97	2.30	4.1	3.7

Source: G O P, Economic Survey (various issues)

Table 12 Agricultural Subsidies by Inputs, 1979-80 to 2000-01
(Rs. In Million)

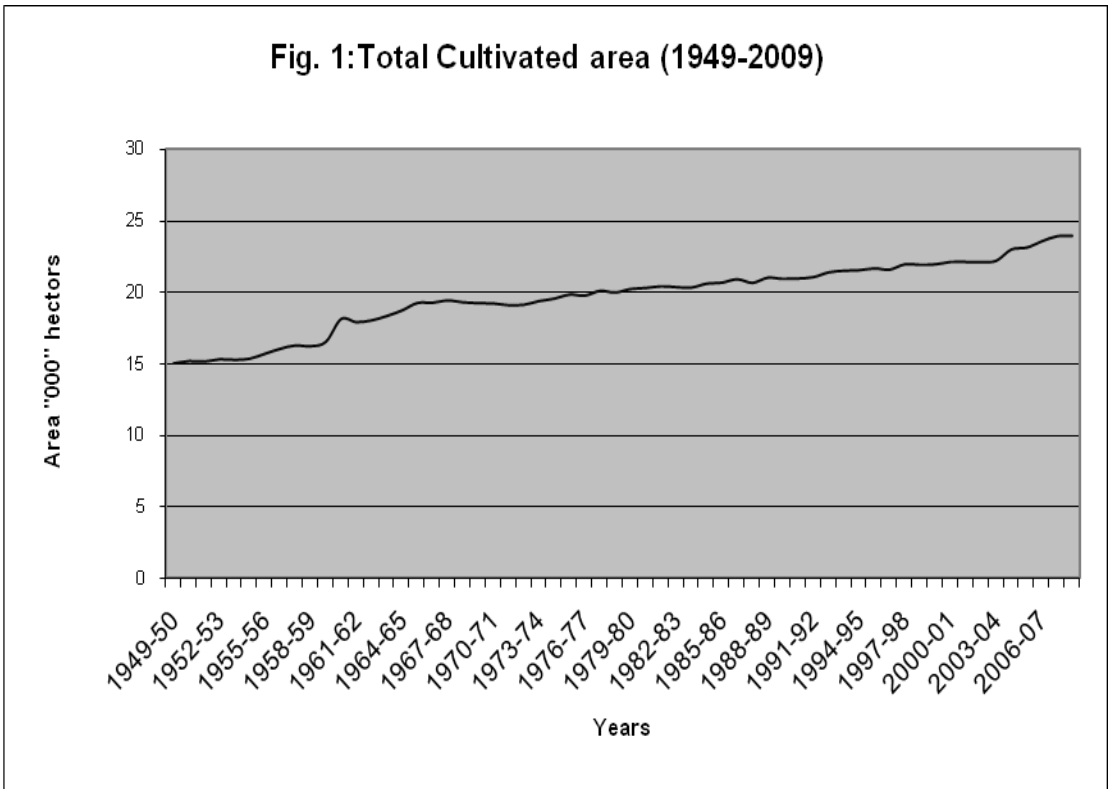
Years	Fertilizer	Irrigation	Govt. Credit	Electricity	Total
1979-80	2455	297	116	-16	3121
1980-81	2448	338	180	-18	2898
1981-82	1750	416	265	-11	2444
1982-83	1949	437	347	-100	2658
1983-84	1460	661	524	-153	2498
1984-85	1500	228	543	101	2974
1985-86	2409	1005	448	16	3894
1986-87	1284	2134	551	375	3444
1987-88	9195	1352	785	1112	5259
1988-89	2415	1154	1009	1148	5720
1989-90	1248	1028	2107	1380	4872
1990-91	1191	1545	1526	1925	6220
1991-92	810	2701	1744	1796	7512
1992-93	805	3111	1993	1724	7639
1993-94	79	2565	1980	330	5680
1994-95	77	2938	1986	330	533
1995-96	78	2761	1817	345	523
1996-97	72	2913	1911	324	512
2000-01	56	2311	2657	245	NA

Source: Ghaffar and Sahibzada (1995), and Govt. Of Pakistan, Economic Survey, various issues.

Table 13: Productivity Per Acre of Small and Large Farms, 1965-66 to 2004-05

Years	Value of Output (Rs.) Per Acre		Small as %age of Large farm Productivity
	Small farms	Large farms	
1965-66	363	205	177.1
1966-67	515	250	206.0
1967-68	561	230	243.9
1968-69	552	250	220.8
1969-70	657	349	188.2
1970-71	700	332	210.8
1973-74	526	303	173.6
1981-82	1719	1031	166.7
1995-96	7301	7419	209.3
2004-05	9312	9281	288.1

Source: Government of Pakistan (2008)



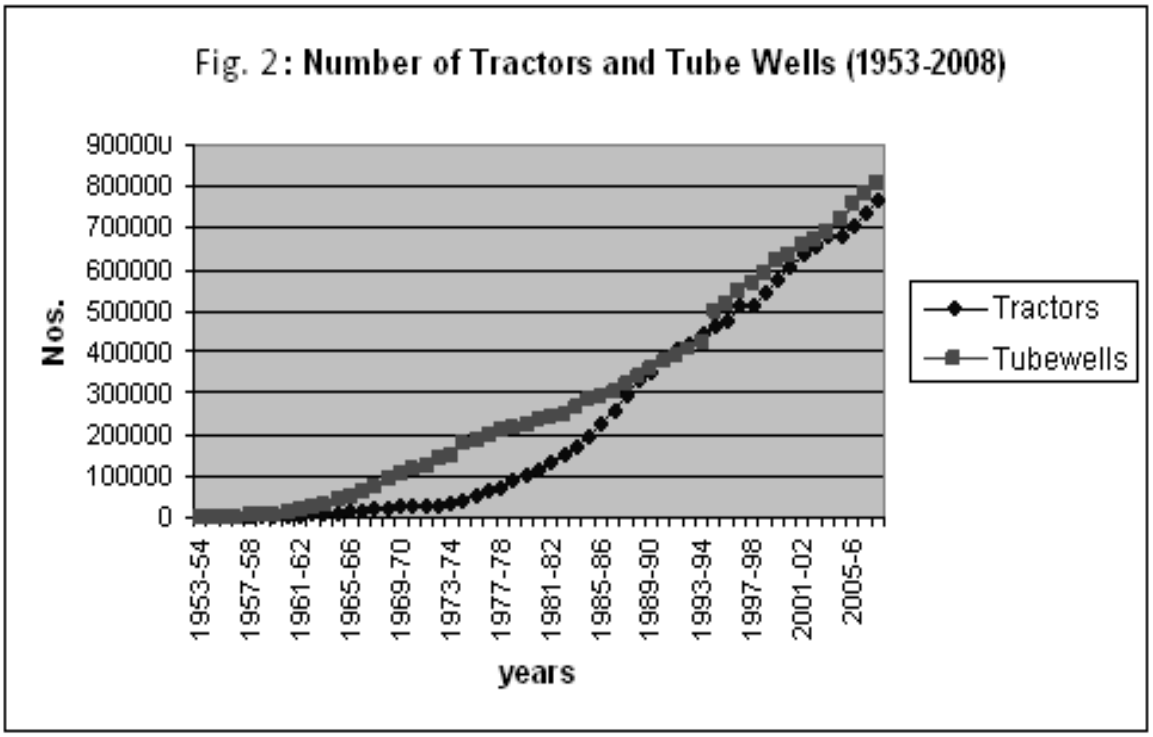


Fig: 3: **Area Irrigated by Different Sources**

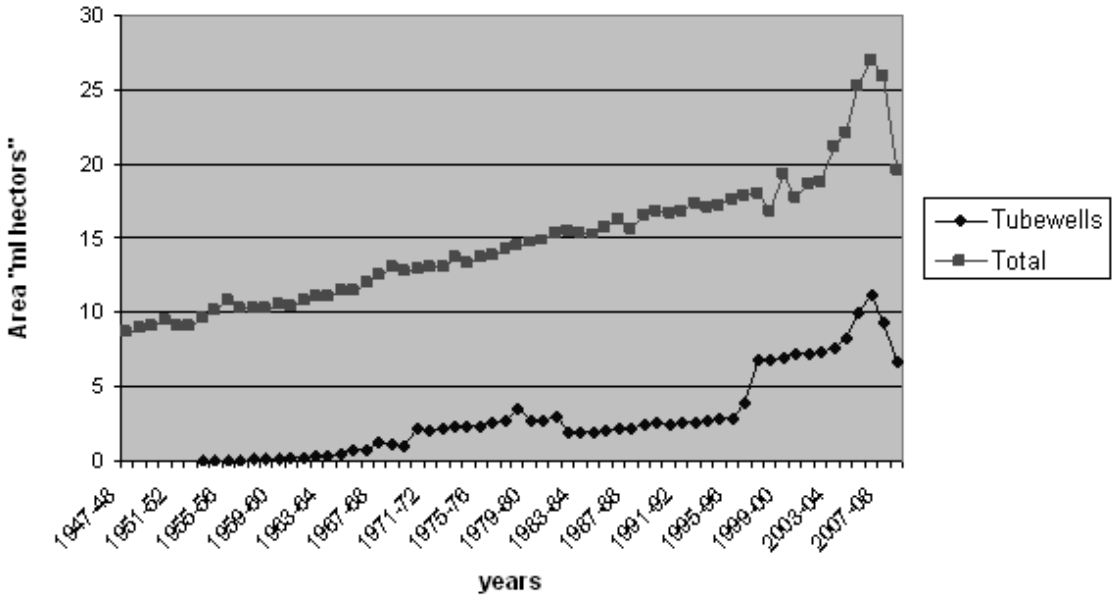


Fig. 4: **Fertilizer off-take, 1954-2008**