FARM MECHANIZATION IN WEST PAKISTAN

by

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Typed by Gloria Merideth
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FARM MECHANIZATION IN WEST PAKISTAN

INTRODUCTION

Geography

The Islamic Republic of Pakistan, having about 80,000,000 people, is the 6th most populous nation and the largest Muslim (Moslem) state on earth. Pakistan was created by partition of British India on August 14, 1947. It was a dream of the Muslim (Moslem) people of British India realized at long last, after a continuous struggle for self-government. In it religion, culture and geography have all combined as an urge for a separate and independent sovereign state.

Pakistan was born split in two. One thousand miles of Indian territory separate her East and West wings. West and East Pakistan covers a vast area of approximately 364,737 square miles (approximately the size of the combined areas of Texas, Ohio, New York, and Massachusetts) of which 310,236 square miles belong to the former and 54,501 square miles to the latter. West Pakistan is nearly 900 miles in length and 200 miles in breadth and falls between the latitudes of 23° N and 36° N (in approximately the same latitudes as southern California) and between the longitudes of 60° E and 75° E. West Pakistan again is co-terminus with Afghanistan and Iran.
and is also connected with the Muslim (Moslem) states of Iraq and Arabia through the Persian Gulf. Geographically Pakistan becomes the eastern end of the Middle East, so famous in the history of Asia and the old world. (See Figure 1.) West Pakistan is bounded by India on the east, Afghanistan and Iran on the west and the Arabian Sea on the south. The U. S. S. R. is only a crows flight from the north end of West Pakistan.

**Government**

Pakistan is divided into two administrative units, the Province of East Pakistan and the Province of West Pakistan. Each Province has a Legislative Assembly elected by the people and a Governor appointed by the President of the Islamic Republic of Pakistan. After the inception of Pakistan, and until March 1956, the Governor-General used to be the head of the State. Pakistan did not have a constitution and a Constituent Assembly was set up for this purpose. The draft of the Constitution was delayed by 9 years because of political reasons. Finally the Constitution, based on the principles of Islamic Social Justice was introduced and passed by the Constituent Assembly and was assented to by the Governor-General. It came into full force on March 23, 1956, when Pakistan became a Federal Republic to be known as the
Figure 1
Pakistan in relation to its neighboring countries.
"Islamic Republic of Pakistan".

Sovereignty under the Constitution is vested in the people, and the Government is carried on by their elected representatives. The President, who is the Head of the State, is elected by the people's own elected representatives and can be impeached for violating the Constitution or for gross misconduct.

The majority party in the National Assembly is called upon by the President to form a council of ministers known as the Federal Cabinet. A similar cabinet is formed in each Province. The Federal and the Provincial Cabinets are responsible to the National Assembly and the Provincial Assemblies respectively. Provinces have been given, as far as possible, complete provincial autonomy. Fair and free elections to the National Assembly and the Provincial Assemblies are guaranteed through an independent election commission. Preparations are now being made to hold the first nationwide elections to the National Assembly in March 1958. The National Assembly or Parliament shall consist of equal number of representatives from both East and West Pakistan. Each wing shall have a High Court of its own, and both have above them a Supreme Court to which recourse is open for both East and West Pakistanis.
History

In assessing the true value and importance of economic development programs, it is necessary to consider certain basic factors, both historic and economic. Today, in this age of technological advancement, there still are countries in the Eastern hemisphere which remain undeveloped, although vast potential resources, both human and material are available there.

It must be remembered that while most of the underdeveloped nations in the East have attained their political independence in recent times, the peoples in these regions have always been rich in culture and tradition.

Pakistan is only 9 years old, yet the cultural heritage of the land and peoples comprising present day Pakistan stretch back to antiquity. The Indus Valley in West Pakistan was the cradle of one of the most ancient civilizations. Archeological discoveries at Mohenjo Daro reveal that five thousand years ago there dwelt in this area a people who had well developed systems of architecture, sanitation, sewage disposal and irrigation, and were proficient in the arts and crafts. Stone implements discovered in Rawalpindi in West Pakistan, are believed by experts to have been made sometime between three and five thousand years ago.
Historians agree that Central Asia was the region where mankind was first known to have flourished. It was there that man first harnessed the forces of nature for improved living conditions. It was also in the East that the knowledge of arts and sciences of mathematics and astronomy, of architecture and medicine was first developed. Again it was there—that is, in the Middle East—that all the great religions of the world were revealed for the guidance of man. It was from there that vast hordes of people moved eastward to find the Chinese culture, westward to give rise to the civilization of both the Euphrates and the Nile Valleys. This move continued in gradual stages to Greece and Rome and further on to the whole of Europe. This expansionist trend continued and later, in search of a new trade route to India, resulted in the discovery of the Americas and the New World. A similar movement southward, probably as a bifurcation of the western move, led to the growth of the Indus Valley civilization in what is now West Pakistan. This great and ancient civilization may have been contemporaneous with the Mesopotamian and Egyptian civilizations (1).

History records the rise and fall of nations, so also of civilizations. Nevertheless, ideologies, culture and traditions remain rooted to the soil. Pakistan's
ancient cultural heritage was a blending and a fusion of the cultures of the Greeks, the Buddhists, the Arabs and the Persians. The Mogul period in the history of Indo-Pakistan subcontinent was one of great development in art, literature, architecture, mathematics and the science of government administration. The third Mogul Emperor, Akbar, ruled over India when Queen Elizabeth was reigning in England. In point of time this was before the first settlement in the U. S. at Jamestown in 1607. From this time onward, the west progressed rapidly and spread its sphere of influence, which ultimately led to the East being held in fee by western powers. Since then the underdeveloped areas have remained stagnant (1).

**Economic Stagnation**

It was not the static nature of their ideological concepts and philosophies or an unwillingness to change for the better which was responsible for their economic stagnation, but it was for a reason over which they could exercise no control. Now what was that reason? It was the evil of colonialism which was responsible for the static economy of Asian and African countries. The U. S. was fortunate; its ill effects here were short-lived. The industrial revolution came at a time when mercantile
powers exercised full control of the world trade and were militarily able to frustrate any attempt of competition. America bears witness to this fact. It is mainly the military and colonizing champions of the mercantile colonial powers of the West that is accountable for the ruination and the stagnation of the economic welfare of the Asian and other colonial areas of the world.

There was a wide and unbridgeable social gulf between the local peoples and their rulers resulting in widespread inhibitions and complexes. The chains that enslaved them ate into the souls of the people. There was, therefore, an inertia and a sense of frustration which kept them stagnant for they had not the means, nor the power to free themselves from the shackles of foreign bondage.

Another important factor contributing to the economic stagnation of the people in these areas was the neglect in the provision of educational facilities, which the rulers deliberately and purposefully overlooked.

This colonial system was responsible for impoverished and unbalanced economics of these countries. The capital that could have been utilized for developments was siphoned off to foreign countries. The result was that there were no adequate funds for providing facilities for training of technicians. Education was at the minimum standard,
Economic Situation at the Time of Birth

It is fortunate that most of these countries have emerged from colonial domination and are now grappling with economic problems to the best of their ability with whatever resources they have at their disposal. Pakistan is one of these countries, but centuries of neglect cannot be remedied in a few years. The time element is vital.

Pakistan, at the time of its inception, was economically poor. Real industries did not exist. Pakistan produced 70% of the world's jute—and had not a single jute mill. Pakistan produced 30,000,000 pounds of wool—and had not a single woolen mill. She produced 15,000,000 hides and skins—and had not a single tanning factory.

A modern state is built on a steel framework of power plants, factories, railways, roads, cable and telephone lines. The young Pakistan had very little of this essential framework.

In a land 80% agricultural, modern farming was unknown. In the whole of the Far East with 23% of the world's arable land, only 0.5% of the world's tractors were in use. In West Pakistan there were only about 500 tractors for 26,000,000 acres of cultivated land. The land, lacking efficient irrigation and fertilizers, yielded scant crops
of wheat, rice, cotton and jute upon which the nation's wealth depends. Seventy percent of Pakistan's vitally needed foreign exchange earnings come from the sale of cotton and jute. West Pakistan is largely desert with too little water and East Pakistan is largely delta with too much. Population density in West Pakistan is 109 per square mile and in East Pakistan, 777 per square mile. With an average literacy rate of 18.9% and a life expectancy of 31 years, Pakistan faced the awesome, almost overwhelming task of education and medical care for 100,000 villages with few teachers and doctors.

**Pakistan's Struggle Upward**

In less than a decade, a mere breath in the life of a nation, Pakistan has laid the foundation of a semi-industrial state to provide the steel and cement for buildings; the cloth for clothing; the roads, rails, ports and air fields for transport; and the dams for electrical power.

The government has also made sure these dams brought water to the desert, creating new farm lands, irrigating the old, lending new hope to a nation which is 80% agricultural. The food from those new lands is vital, for Pakistan has faced the threat of mass famine three times in recent years.

In Pakistan's struggle, the assistance from friendly
nations has often helped make it possible for the people to gather courage and keep going. Foreign aid has meant: capital, technical assistance, wheat and rice, and other commodities.

"A slender acquaintance with the world must convince every man that actions, not words, are the true criterion of the attachment of friends."

- - - - - George Washington

Pakistan is now well on its way to progress. She has vast agricultural, mineral and other economic resources at her disposal. Now it is for the people of Pakistan to make the best use of these resources as quickly as possible. The author is reminded of the words of Quaid-i-Azam, the founder of Pakistan:

"Nature has given you everything; you have unlimited resources. The foundations of your State have been laid, and it is now for you to build, and build, as quickly and as well as you can. So go ahead and I wish you God speed."

- - - Quaid-i-Azam Mohammad Ali Jinnah

Purpose of Study

Being predominantly agricultural country, it is imperative for Pakistan to develop its agriculture without delay. While agriculture is a vast field of human endeavor which includes soil and water conservation, rural electrification, farm structures and many other sciences, the
The author is particularly interested in farm mechanization for the purpose of this study. Evidently labor saving machinery cannot be introduced before developing industry so as to absorb the labor displaced from the farms, and yet mechanization cannot be delayed too long. So it is obvious that both industrialization and mechanization, being so closely interrelated, should go forward shoulder to shoulder.

The purpose of this study is an attempt by the author to develop a progressive program of farm mechanization in West Pakistan with particular reference to the average farmer so that greater efficiency in human effort and better economy in production can be achieved. Such a program will extend over a period of 25 or more years.
NATURAL CONDITIONS IN WEST PAKISTAN

Land and Topography

West Pakistan inherited part of the extra-peninsular mountains with their complex rock structure, deep and narrow, but soil covered valleys with powerful waterfalls and snow covered peaks. The mountains are like walled ranges of rocks lying one behind the other, all convex towards the Indus plain, the convexity being less and less gradual as they lie more and more distant from the Pakistan frontier. The outward shape of these ranges as they overlook the Indus plain is peculiar. They are not arranged in one straight line of mountain ranges, but fall in the form of festoons.

The northwestern part of the country is largely hilly with high spurs separated by lateral valleys. In general, it is full of crests and troughs of rocky undulations and is Himalayan in character. However, there are moist fertile valleys and very good pastures in the lower lands. In spite of this kind of rugged hilliness, this part of the country has some excellent wooded glens, as well as good drainage.

The southwestern part is a dry plateau, covered with terrigenous deposits all over, and lies outside the influence of the monsoon. The height of the surrounding
uplands is from 5,000 to 7,000 feet, but the lower ranges are from 1,000 to 3,000 feet high.

The eastern part of the country, stretching from north to south, until recently known as the Provinces of Punjab and Sind, is a wide plain sloping mostly from the 1,500 foot contour to the 500 foot contour in the north, and from the 250 to the 100 foot contour in the south. In the northern part of the two Provinces, the slope of the land is only about two feet per mile, while in the southern part, it is hardly nine inches per mile. The whole of this area is irrigated by a network of canals which is the biggest canal irrigation system in the world. The southern land (formerly Sind) is largely desert, while the northern part, formerly known as Punjab, is considered to be one of the most fertile agricultural soils in the world.

On the whole, West Pakistan, except for the narrow belt of mountains in the west, is largely plain, flat, wide and spacious and covered with deep drifted soil which is an excellent agricultural soil. It would be difficult to find a land of this character in other parts

1/ Punjab, Sind, Northwest Frontier Province, and Baluchistan were four Provinces of West Pakistan before October 3, 1955, when they were integrated into one unit by the "Establishment of West Pakistan Act, 1955".
of the world with such a strange geological birth, such a variety of rock formations, such peculiar relief features, micro climates, drainage patterns, land forms and sceneries, as West Pakistan.

Varieties of Soil

The soil in West Pakistan is one of the best agricultural soils. Generally it is sandy loam, but in the mountains and hilly regions, the soil is residual and derived from the barren rocks, which are highly calcareous. In the river valleys it is the drift soil, transported by the great rivers from the Himalayas and deposited in the low levels. This soil is rich in certain salts which make the plains very fertile. Sandy clays and loams, less calcareous and paler in color, are found in the Punjab plain, while clayey loams, less sandy and more calcareous, are found in the lower plains of Sind. Besides, there are intricate sand and clay belts, more than a dozen feet deep, found all over the valleys, as the rivers have shifted their courses during the past ages. The sand belts are more numerous and much deeper in the upper reaches of the river valleys, as sand is dropped earlier by the waters of the inundations than the other finer materials. The depth of the alluvium is often hundreds of feet. One very important feature of the
The alluvium of these rivers is that the soil is renewed every season by floods and its fertility is thereby maintained. Silt and clay, deposited from flood waters, have made some of the best agricultural soils in Sind. Besides this, there are what are called Kalar soils, which are impregnated with salt and which require reclamation both in the Punjab and in Sind.

**Soil Erosion**

In West Pakistan both water and wind erosion occur in different parts of the country. It has been estimated that excepting the 19,000,000 acres of irrigated land in West Pakistan, 97,000,000 acres of the reported area are suffering from one form of erosion or the other. Under some foreign aid programs, extensive measures for soil conservation in the country are being taken.

**Rivers**

Most of the cultivated area in West Pakistan, where the principal food crop is wheat, is entirely dependent upon irrigation from the waters of the Indus and its tributaries, which flow through India or Indian-occupied Kashmir, before entering Pakistan. Without the Indus, one of the world's largest rivers, West Pakistan would be a desert. It's four tributaries, Sutlej, Ravi, Chenab,
and Jhelum, join it at different places. The Indus and the Jhelum, being actually snow fed, have a double peak in their discharge curves, one in April and May when the snow melts and the other in July and August when there are rains. The peak discharge of the Indus exceeds 900,000 cubic feet per second, and not even fifteen percent of it is utilized by man in the whole region. There is however, a very up-to-date and magnificent canal system. Pakistan has built three Punjab canal links to meet shortages and to control and distribute more evenly the waters she receives from these rivers. The canal links are designed to shift water from one river to the other as the need arises. They are called the Balleki-Suleimanki Link, the Marala-Ravi Link, and the Bombanwala-Ravi-Bedian Link. The first canal is 54 miles long, the second 63 miles long, and the third 87 miles long, plus a 21-mile extension. The Marala-Ravi Link will irrigate 237,600 acres of land.

Most of the rivers in West Pakistan are navigable to a certain extent. These waterways have been neglected since the construction of the railways, but with the increasing demand for transport, advancement of agriculture, and the growth of industries, even the canals can be made navigable.
Climate and Rainfall

The climate of West Pakistan is generally called tropical monsoon climate. Dryness and heat, with hot winds are predominant features of the climate of West Pakistan in summer, while chilly weather and some rains are those of winter. The heat in summer in some of the dry parts is so great that the people have named a period of some 40 unbearable days as the "Chaliho", when the climate is extremely hot. Parts of West Pakistan actually fall within the sub-tropics, so there is a succession of western depressions, which reach these parts from as far as the Atlantic Ocean and the Mediterranean Sea, with the result that there are occasional storms and showers of rain in the winter, which make the climate Mediterranean to some extent. In winter the day temperature does not rise above 75° F., while in summer it goes above 110° F., in June in the drier parts. Dust storms are common, particularly in drier parts during the summer. Some of these storms are followed by hail, which damages late Rabi crops. Frosts occur in the northern

1/ There are two main crop seasons: Kharif (or summer) and Rabi (or winter). Important Kharif crops are cotton, sugar cane, "Jowar" (great millet), "Bajra" (bulrush millet), maize, rice, "toria" (Indian rape), groundnut, bottle gourd, pumpkins, bitter gourd, cucumbers, melons, chilies, lady's finger, brinjal, etc., and Rabi crops are wheat, barley, grain, "Sarson" (Indian colza), oats, Egyptian clover, carrot, pea, tomato, potato, onion, garlic, etc.
parts of the country during December and January, which occasionally damage crops and young fruit trees. West Pakistan has two main rainy seasons: (a) Monsoon rains from July to September, and (b) winter rains from December to March. The bulk of the rains however, is received during the monsoon season. The mean annual rainfall in general ranges from less than 5 inches to 10 inches, while at some places in the North, it goes up to 30 inches.

Ports

Karachi, the capital of Pakistan, is a bustling seaport that has tripled in population since Pakistan gained her independence in 1947. Since then, a steady progress has been maintained in the development of this port. It has been expanded to make possible the handling of 12,000 tons of cargo a day.

Karachi's airport, a terminal point for the world airlines, is one of the largest and busiest in Asia. Population of Karachi is approximately 1,500,000.

Population

The rate of increase of population is an important factor which needs careful consideration in any development program. The total population of Pakistan in
January 1951 was estimated at 75,842,000. Since then no census has been taken, but a fairly accurate estimate of the present population can be made on the basis of the rate of increase during the past decades. The population of Pakistan is increasing rapidly, particularly in the areas now constituting West Pakistan. Some economists, like Colin Clark, have estimated the increase at 1½ per cent per year. This rate of increase is also supported by the increase recorded during the decennial census shown in Table 1 (14).

Table 1. Percentage Increase in the Population by Decades

<table>
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<tr>
<th>Decade</th>
<th>Percentage Increase</th>
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<tr>
<td>1901-11</td>
<td>11.9</td>
</tr>
<tr>
<td>1911-21</td>
<td>9.7</td>
</tr>
<tr>
<td>1921-31</td>
<td>8.8</td>
</tr>
<tr>
<td>1931-41</td>
<td>8.8</td>
</tr>
<tr>
<td>1941-51</td>
<td>7.9</td>
</tr>
<tr>
<td>1951-61</td>
<td>66.7</td>
</tr>
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or an average of 1.03 per cent per year.

The rate of increase in the future could very well be higher than previously because of the following reasons:

1. In the past many parts of Pakistan faced calamities, particularly famines. The loss of life in the famine of 1943 in East Pakistan alone was estimated at more than 3,300,000
deaths. With a National Government in control, it is hoped that such famines will not be expected in the future. Under the circumstances, the rate of increase should be well maintained.

2. The death rate in Pakistan is high mainly because of undernourishment of the people. The nutritional value of the diet in Pakistan is markedly low. Also the diet is deficient in milk, fish, meat and eggs which provide most of the fat contents.

In West Pakistan the average man gets less than 25 per cent of his total need of milk. This figure for meat is 21 per cent and for eggs it is only 2 per cent, which is negligible. In fact, the people of West Pakistan are undernourished and live below subsistence level.

The National Government should pay more attention to the development of health and education and as a result the death rate will decline in the future.

Consequently if the rate of increase is taken at $1\frac{1}{2}$ per cent per year, it would not be an over estimate. The population of Pakistan increasing at the rate of $1\frac{1}{2}$ per cent per year on the first of January every year should stand as shown in Table 2.
Table 2.

**Estimated Population of Pakistan Every Year on January 1 from 1951 to 1956**

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Increase over Previous year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>75,842,000</td>
<td>Census report 1951</td>
</tr>
<tr>
<td>1952</td>
<td>76,790,025</td>
<td>948,025</td>
</tr>
<tr>
<td>1953</td>
<td>77,749,900</td>
<td>959,875</td>
</tr>
<tr>
<td>1954</td>
<td>78,721,774</td>
<td>971,874</td>
</tr>
<tr>
<td>1955</td>
<td>79,705,796</td>
<td>984,022</td>
</tr>
<tr>
<td>1956</td>
<td>80,702,118</td>
<td>996,322</td>
</tr>
</tbody>
</table>

For the purpose of the recent Five-year Development Plan, the planning board has considered the rate of increase as 1.5 per cent per year.
ECONOMIC CONDITIONS IN WEST PAKISTAN

Mineral Resources

Pakistan is believed to be rich in mineral resources, although they have not as yet been adequately explored. The production of several minerals, which are basic to the development of heavy industry, is presently limited by substandard qualities, insufficient deposits, or inaccessibility. It should be emphasized, however, that additional exploration may prove the deficiency in minerals to be only temporary.

Two of the greatest acquisitions in recent years have been the discovery of natural gas and iron ore in West Pakistan. These two -- power and iron-- will amply fill the gap that was acutely felt in the way of large-scale industrialization of Pakistan.

Iron and Steel

Iron and steel and heavy engineering industry are among the most important ones, especially for Pakistan. They can hardly afford to dispense with these two basic industries.

From aeroplanes and locomotives, down to the manufacture of pins and nails, everything depends upon iron and
steel. In fact, today the strength of a country is judged from the amount of steel it produces. Pakistan was seriously lacking in this respect and it was generally believed that she had no iron ore deposits in either wing of the country. However, the government of Pakistan arranged a survey of the country. The survey produced surprising results as it revealed that the northwestern part of West Pakistan contains rich deposits of iron ore with an iron content of about 45 per cent. The deposits in Mianwali district alone are estimated to have an absolute minimum of 17,000,000 tons and a maximum of 100,000,000 tons. Pakistan's iron ore resources appear to be mainly hematite iron.

**Natural Gas**

The year 1952 witnessed an event of profound significance for the economy of Pakistan. A great obstacle in the way of her swift industrialization was removed and she was no longer to depend upon the import of coal and fuel oil for the production of power in a greater part of West Pakistan.

The event was the discovery of a vast reservoir of natural gas at a place called Sui by the British firm, Pakistan Petroleum Limited. Expert geologists have estimated that this reservoir contains over 2.25 billions
Figure 2(a)
Natural gas terminal station in West Pakistan.
cubic feet of natural gas which represents a supply of
115,000,000 cubic feet per day for a period of over 60
years and probably for 100 years. Sui gas will be
available for both industrial and domestic consumers
at prices lower than any competitive fuel. It is an
ideal fuel for steam power-plant installations and is
likewise a convenient fuel for internal combustion
ingines and gas turbines of all sizes.

The immense importance of the Sui gas project to
the economy of Pakistan can be gauged from the fact
that when full plant capacity is reached, the gas, as
fuel, will be equivalent to 1,500,000 tons of coal, thus
saving about 1/ Rs. 70,000,000 ($14,730,000) annually
in foreign exchange. Recently natural gas has been
discovered at a place near Sukkur and there are bright
chances of finding oil in the area. Indications are
that the gas will be available in commercial quantities.

Petroleum

The production of crude petroleum has increased
from 13,360,000 imperial gallons in 1947 to 72,360,000
imperial gallons in 1955. Oil exploration work

1/ One United States dollar = 4.75 Rupees.
is being carried on in the country for further development of this industry.

**Coal**

There has been a steady rise in the production of coal ever since the birth of Pakistan. Production of coal during 1955 went up to 567,000 tons as compared to 241,000 tons in 1948. There has also been an improvement in the quality of coal mined at Sharigh and some of the railway engines are utilizing this coal for fuel.

**Chromite**

Chromite deposits occur in Hindubagh, Chaghai and Kalet areas of West Pakistan. The production during 1955 was 28,000 tons.

**Salt**

Salt occurs in several parts of West Pakistan and its production has fluctuated between 3.8 and 4.0 million maunds \( \frac{1}{1} \) per year in recent years.

**Gypsum and Limestone**

These minerals occur in abundance in West Pakistan

\( \frac{1}{1} \) One maund = 82-2/7 pounds.
and their production has risen from 14,000 tons (gypsum) and 279,000 tons (limestone) in 1949, to 28,000 and 887,000 tons respectively during 1955.

**Antimony**

Deposits occur in Chitral and experiments are being carried out to determine a suitable and economical process for refining the ore at the site.

**Sulphur**

Sulphur deposits occur at Koh-i-Sultan and a sulphur refining plant has been installed at Quetta.

**Other Minerals**

Silica sand, fireclay, celestite, ochres, bauxite and soapstone are also being mined on a minor scale in West Pakistan. Comparative figures of production of these minerals in 1949 and in 1955 are given in Table 3 in tons.

**Table 3.**

**Comparative Figures of Production of Minor Minerals in West Pakistan in 1949 and in 1955**

<table>
<thead>
<tr>
<th>Year</th>
<th>Silica sand</th>
<th>Fireclay</th>
<th>Celestite</th>
<th>Ochres</th>
<th>Bauxite</th>
<th>Soapstone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1949</td>
<td>1,000</td>
<td>7,000</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1955</td>
<td>9,000</td>
<td>8,000</td>
<td>430</td>
<td>260</td>
<td>1,020</td>
<td>269</td>
</tr>
</tbody>
</table>
Animal Resources

Man's wealth is no longer counted in heads of cattle. Nevertheless, cattle remains wealth, and so does every bird and beast domesticated by man. These animals yield valuable materials for food and clothing. We all need milk and meat, eggs and butter to eat, and wool and leather to wear.

Not only that, Pakistan is an agricultural country which is still using old methods of cultivation with draft animals and a farmer without a pair of oxen hardly gets his living from the land. So, in a country like Pakistan, animal life plays a vital part.

Wool and hides and skins are among the most important export commodities. Pakistan produces about 15,000,000 hides and skins every year. The total number of tanneries in operation last year was 81; of these 24 were mechanized. Pakistan exports about 25,000,000 pounds of wool annually.

It has been estimated that present fish production in West Pakistan from fresh water sources is 14,700 tons. According to a new 5-year plan, fish production will probably increase to 22,600 tons with further development anticipated.
Agricultural Resources

Agriculture is the mainstay of Pakistan. It has been the most important industry from time immemorial.

The total area under cultivation amounts to about 54,000,000 acres, devoted largely to the production of food crops. Rice in East Pakistan and wheat in West Pakistan are the staple foods of the population. Normally Pakistan has a slight surplus of food grains, but owing mainly to two successive failures of the monsoons, it was forced to import 827,000 tons of wheat in the crop year (May-April) 1952-53, and 892,000 tons in 1953-54, most of it from the United States under a grant of 700,000 tons. However, Pithawalla says, "West Pakistan has been a granary of the world since very ancient times, wheat having been exported even in the Mohenjo Daro age."

"Pakistan's principal export commodities are agricultural, the most important of which are jute, cotton, tea, wool, and hides and skins. In the calendar year of 1953, exports of an agricultural nature accounted for over 98 per cent of Pakistan's total exports. Pakistan grows about 70 per cent of the world's jute, including most of the better varieties, and is the free world's fifth largest producer of raw cotton. The bulk of Pakistan's cotton and most of its food grains, other
than rice, come from West Pakistan. Baluchistan and the Northwest Frontier Province are important fruit-growing centers in West Pakistan.

"The government is attempting to increase Pakistan's agricultural production, particularly that of food grains, through the introduction of modern implements and methods and a greater use of fertilizers; the construction of large multi-purpose irrigation projects; and the reclamation of land, as well as stopping the loss of arable land through water logging and salinity.

**Forests and Forest Products**

West Pakistan, being a dry land, has very few forests. West Pakistan does not have the required acreage under forests needed for a balanced economy and even this is on the gradual decline. The over-all percentage of forest to total ground surface is hardly four. In early days, forests were gradually destroyed with every increase in population, for bringing more land under cultivation and for making more pasture lands.

Forests play an important part in reducing soil erosion. Some measures should be taken for making the people conscious of the importance of trees. Land which is unsuitable for either crops or pastures may be usefully utilized for growing trees. The government has,
however, brought under new plantations an area of about 23,000 acres. Some 1,563,000 acres of land in different parts of West Pakistan have been either selected or are under consideration for tree plantations.

Water and Power Development

The shortage of water, fuel and electric power has been an outstanding hurdle in the way of Pakistan's agricultural and industrial development. All the five rivers in West Pakistan, generally known as the life blood of West Pakistan, also flow through Indian territory before entering Pakistan. The discharge of most of the rivers can be varied in the Indian territory. Pakistan government is engaged in a water dispute with India in the United Nations. Most of Pakistan's coal is low grade, while petroleum production is sufficient only to meet about 20 per cent of present requirements.

Under the new 5-year plan, it is expected that by 1960, two and a half million acres of new land will be brought under irrigation, improved water supply will provide for another 2,700,000 acres, and about 560,000 acres of saline and water logged lands will be reclaimed. Ground Water Development Organization is a government organization set up in West Pakistan to carry out intensive and systematic investigation of
ground water potential under the supervision of American engineers.

Two large multi-purpose dam projects -- Warsak and Mangla -- and three major irrigation projects -- (See Figure 2(b).) the Ghulam Mohammad, Taunsa and Guddu barrages -- and a large number of small projects are included in the 5-year plan.

The power development program is designed to provide sufficient power for all essential needs by 1960.

Transport and Communication

In West Pakistan the Northwestern Railway, a 5,362 route mile system, is the main means of long haul transport for goods and passengers. Almost all of West Pakistan's internal trade, and it's export-import trade via Karachi, moves over this rail system.

West Pakistan has about 32,000 miles of road, mostly surfaced with inferior material.

West Pakistan has a first-class air terminal at Karachi through which 17 international airlines operate about 50 services weekly.

There are about 50,000 miles of open telegraph wire in West Pakistan. Karachi is linked by radio-telegraph with several other cities in Pakistan, as well as with London, Paris, New York, Tehran, Osaka, Peking, and Moscow.
Figure 2(b)
The 3,000 foot Ghulam Mohammad barrage across the Indus River.
West Pakistan has approximately 37,000 telephones. Radio Pakistan, owned by the government, has five broadcasting stations, operating nine transmitters. There are an estimated 80,000 radio receivers in Pakistan.

The new Five-year plan provides for the rehabilitation of the track of all the main railroads and the more important branch lines, purchase of about 100 locomotives, 600 passenger cars, 6,000 freight cars, and smaller items, construction of about 18,000 miles of new roads and improvement of 22,000 miles of existing road. The plan also provides for vast development of air transport, shipping, telephones, and broadcasting.

**Industries**

Pakistan was left with comparatively little industry following the partition of the sub-continent, and only three industries -- cotton textiles, cement, and sugar -- could be called large-scale. However, considerable progress has been made toward industrialization since 1947. With the year 1948 as base at 60, the index of large scale industrial production rose to 421 in 1956. Table 4 shows the per cent of increase in production of different commodities from 1948 to 1955.
Table 1

Percent of Increase in Production of Different Commodities from 1948 to 1955

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>149%</td>
</tr>
<tr>
<td>Crude oil</td>
<td>312%</td>
</tr>
<tr>
<td>Natural gas</td>
<td>Infinity</td>
</tr>
<tr>
<td>Electric energy</td>
<td>334%</td>
</tr>
<tr>
<td>Salt</td>
<td>5%</td>
</tr>
<tr>
<td>Gypsum</td>
<td>132%</td>
</tr>
<tr>
<td>Cement</td>
<td>111%</td>
</tr>
<tr>
<td>Sugar</td>
<td>1,329%</td>
</tr>
<tr>
<td>Cotton textiles</td>
<td>525%</td>
</tr>
<tr>
<td>Silk textiles</td>
<td>Infinity</td>
</tr>
<tr>
<td>Jute products</td>
<td>Infinity</td>
</tr>
<tr>
<td>Leather</td>
<td>1,098%</td>
</tr>
<tr>
<td>Paper</td>
<td>Infinity</td>
</tr>
</tbody>
</table>

The industrial policy of government in relation to the promotion of new industries is based principally on two primary considerations:

1. Whether the industry will earn foreign exchange more than it spends on the import of equipment, raw material and replacements, and
2. Whether the new industry will reduce imports and thus save foreign exchange.

Investments in industries are welcome as long as these two conditions are fulfilled. Schemes of industrial development, which satisfy either of these two conditions, receive priority in the matter of import licenses and government assistance in other forms.

West Pakistan has several light engineering industries which turn out such articles as oil engines,
agricultural implements, machine tools, electric fans, rubber products, and utensils. Surgical equipment and sports goods are mainly on the cottage-industry level, but many of their products have earned an excellent reputation for quality.

**Pakistan Industrial Development Corporation**

Pakistan Industrial Development Corporation was set up on January 12, 1952 for the all-around development of industry with capital advanced by the government. This corporation was entrusted with the development of the following 12 industries:

1. Jute
2. Paper
3. Heavy engineering
4. Ship building
5. Heavy chemicals other than fertilizers
6. Fertilizers
7. Sugar
8. Cement
9. Textiles
10. Natural gas
11. Chemicals, pharmaceuticals and dye-stuffs
12. Development of power from Sui gas
In the four and a half years since its establishment, the PIDC has already completed, either alone or in association with private capital, about 30 industrial projects involving a capital expenditure of approximately Rs. 500,000,000 ($105,000,000). Seven more projects, costing Rs. 160,000,000 ($33,700,000) were scheduled to come into operation during 1956. Preliminary work was started on 21 other projects which were estimated to cost on completion over Rs. 793,000,000 ($167,000,000).

Today PIDC factories are producing in large quantities such important consumer goods as paper, board, cement, jute products, woolen textiles, cotton yarn, chemicals, etc., which have brought about a change in the pattern of the country's economy.

Judged by Western standards, the results may appear meager. But seen in the context of Pakistan's limited resources and the virtual absence of industry at partition, the country's progress borders on the phenomenal.

**Health**

Health is one of the most important things to man. An unhealthy man cannot produce as much as he consumes.

General standard of health in Pakistan is low. The most important reason for this is the lack of quantity
Figure 3

Fertilizer factory at Daud Khel, West Pakistan.
and quality of daily minimum requirements of food for every man. Lack of technical personnel as well as equipment adds to the uncontrolled spreading of diseases and in consequence to further deterioration of public health.

Both of these difficulties are based on the economic conditions of the country. However, progress has been made during the last few years. At the time of partition, hundreds of dispensaries had to go without medical officers because most of the staff was non-Muslim (non-Moslem) who went to India. Health services were dislocated and almost all of the central public health institutions went to Indian government. The situation, however, has been improving very fast, but still there is a lot to be done. Along with other phases in the economic development programs and foreign economic aid programs, health is being given special consideration. Many research institutes, training centers, medical colleges and hundreds of dispensaries and hospitals have been opened in recent years.

Among the infectious diseases, malaria and tuberculosis are widespread throughout Pakistan and are the major public health problems of the country. The factors contributing to the spread of the diseases are malnutrition, over-crowding, unsanitary and unhygienic
environments, as well as increasing industrialization and urbanization of the country.

**Education**

According to the 1951 census, literacy in Pakistan is 18.0 per cent. Figures are not available, but it is estimated that almost entire rural population, engaged in farming, is illiterate. The government is continuing her efforts to eradicate illiteracy and to raise the standard of education in Pakistan. More and more schools and colleges are being established to provide educational opportunities to the people. The total number of educational institutions in Pakistan, according to 1955-56 figures are shown in Table 5.

**Table 5**

<table>
<thead>
<tr>
<th>Total Number of Educational Institutions in Pakistan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary schools</td>
</tr>
<tr>
<td>Secondary schools</td>
</tr>
<tr>
<td>Technical high schools</td>
</tr>
<tr>
<td>General colleges</td>
</tr>
<tr>
<td>Professional colleges</td>
</tr>
<tr>
<td>Polytechnic colleges</td>
</tr>
<tr>
<td>College of Domestic Science</td>
</tr>
<tr>
<td>Teachers Training Institutions</td>
</tr>
<tr>
<td>Commerce colleges</td>
</tr>
</tbody>
</table>

**The New Five-Year Plan**

Pakistan government drew up a Six-year Development Plan in 1948, but later it was realized that the plan
was put together in a hasty fashion and failed to fully take into consideration the available resources and the requirements of all sectors of the nation's economy. So in 1953, this plan was abandoned and a full-time planning board was set up. This board, with the assistance of the Ford Foundation, formulated a new Five-year Development Plan consistent with Pakistan's potentialities and requirements. The draft of the plan was released by the Planning Board on May 14, 1956.

The implementation of the plan is estimated to cost Rs. 11,600,000 ($2,442,000) from 1955-56 to 1959-60. Expenditure on the program in the public sector is expected to be Rs. 8,000,000 ($1,685,000) and in the private sector to about Rs. 3,600,000 ($760,000,000).

A 20 per cent increase in Pakistan's national income is envisaged by the end of the Plan period. After making allowance for the increase in population, the Board estimates that Pakistan's per capita income will go up by 12 per cent.

The principal objectives of the Five-year Plan are:

1. To raise the national income and the standard of living of the people

2. To improve the balance of payments of the country by increasing exports and by the production of substitutes for imports
3. To increase the opportunities for useful employment in the country
4. To make steady progress in providing social services, housing, education, health, and social welfare, and
5. To increase rapidly the rate of development, especially in East Pakistan and other relatively less developed areas.

Among many other phases, the Plan gives first priority to Village Agricultural Industrial Development and agriculture. About one-third of the total expenditure planned for the public sector is to be devoted primarily to various programs relating to agriculture -- irrigation, Village-AID, reclamation and drainage.

**Economic Aid**

Foreign economic assistance has been a source of great help for the development of Pakistan.

The major part of foreign aid to Pakistan has come from the United States. The actual amount of aid offered during various years (U. S. year July-June) to Pakistan is shown on Table 6.
Table 6

U. S. Economic Aid to Pakistan
From 1951 to 1956
(Million Dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount (Million Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>0.600</td>
</tr>
<tr>
<td>1952</td>
<td>10.000</td>
</tr>
<tr>
<td>1953</td>
<td>12.254</td>
</tr>
<tr>
<td>1954</td>
<td>23.007</td>
</tr>
<tr>
<td>1955</td>
<td>110.700</td>
</tr>
<tr>
<td>1956</td>
<td>156.000</td>
</tr>
</tbody>
</table>

As a participant in the Colombo Plan for co-operative economic development in South and Southeast Asia, Pakistan has been offered external financial assistance by Canada, Australia, New Zealand, Ford Foundation, the U. N., and the United States. The government of Pakistan has also had technical assistance from several United Nations agencies.

As a result of assistance from the United Nations, from the United States, and from nations participating in the Colombo Plan, large numbers of Pakistanis have received training abroad, while many experts have visited Pakistan in an advisory capacity.
Importance of Agriculture in West Pakistan

As has already been stressed, Pakistan is predominantly an agricultural country. Agriculture, with its branches of animal husbandry, forestry, fisheries and horticulture, is the largest segment in the economy of Pakistan. About 60 per cent of the total income is derived from agriculture. Nearly 75 per cent of the civilian labor force is engaged in agriculture and 90 per cent of the people living in villages are dependent directly or indirectly on agriculture (48). Nearly 95 per cent of the total foreign exchange earnings is contributed by agriculture (48). It constitutes the base of Pakistan's national economy.

Pakistan holds a strategically important position in the world. West Pakistan resembles the countries extending up to the northern part of Africa, in its soil, climate, natural scenery and the religious affiliations of its people. East Pakistan resembles most of the countries of Southeast Asia. Pakistan, thus, occupies the central position in the Asian and the Far Eastern countries. A great responsibility, therefore, devolves on Pakistan as she should take her proper place in the social and political affairs of the
Eastern countries of the world. But this is not possible when hunger stalks the land and the great majority of the people are poor beyond description. The first step in alleviating these handicaps will naturally be to increase the wealth of the country by improving its agriculture.

The problems of agricultural stability, its strength and the factors of its growth, therefore, must receive special attention in all plans of development. Agricultural productivity, in terms of the labor engaged in agriculture, is at present exceedingly low, and is reflected in the low level of income of the farmers and the agricultural laborers, and by the inadequate diet of the people in general.

Agricultural development, therefore, has been a vital link in the chain of policies formulated by government to insure national prosperity.

The development of agriculture has been based on the following considerations: First, the overall aim to improve the standard of living of the farmers by increasing their incomes; second, to produce sufficient food to feed the increasing population of the country; third, to produce raw materials, such as cotton, jute, wool, tea, tobacco, sugar cane, hides and skins, to meet the requirements of the industries which are being
established in the country; and last, to produce a sufficient surplus of exportable commodities to earn the much needed foreign exchange for financing essential imports of machinery and consumer goods which are not produced in the country. Naturally, therefore, all the steps taken by the government towards the development of agriculture were directed to one or more of these objectives (48).

**Total Arable Area and Its Distribution**

The total area of Pakistan is a little over 233,000,000 acres. About 61,000,000 acres are under cultivation, 6,000,000 are under forests, 27,000,000 are classed as culturable waste, 57,000,000 as unculturable waste land and 82,000,000 acres have not been classified. These categories are shown in Table 7 (48).

**Table 7**

<table>
<thead>
<tr>
<th>Land Utilization in Pakistan</th>
<th>Million acres</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net area sown</td>
<td>49.2</td>
<td>21</td>
</tr>
<tr>
<td>Current fallows</td>
<td>11.5</td>
<td>5</td>
</tr>
<tr>
<td>Total area under cultivation</td>
<td>60.7</td>
<td>26</td>
</tr>
<tr>
<td>Forests</td>
<td>6.1</td>
<td>3</td>
</tr>
<tr>
<td>Culturable waste</td>
<td>27.0</td>
<td>12</td>
</tr>
<tr>
<td>Not available for cultivation</td>
<td>57.4</td>
<td>24</td>
</tr>
<tr>
<td>Area not classified</td>
<td>82.3</td>
<td>35</td>
</tr>
</tbody>
</table>
Table 8 shows the area under principal crops from 1948 to 1955. It is indicated that there has been an increase in the total acreage sown to the principal crops since 1948. Although there have been yearly fluctuations in the acreages primarily as a result of weather conditions and governmental controls, there has been an overall increase in acres sown to crops. This increase was the result of irrigation and "grow more food schemes" as well as favorable weather in 1953-54. The increase in acreage under food crops is almost entirely accounted for by the increased acreage sown to rice in East Pakistan. There was an increase of 5.2 per cent in the area under food grains and 8.3 per cent in the area under cash crops.

For the seven year average ending 1954-55, the food crops occupied 85 per cent of the total area under major crops. This figure would stand at about 74 per cent when the entire cropped area is considered.

Considering West Pakistan alone, only about 27,000,000 acres out of a total of 198,000,000 acres, is actually cultivated. About 16,000,000 acres are classified as culturable waste. The entire area under wheat is in West Pakistan.
## Table 8

### Area Under Principal Crops in Pakistan 1948-55

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Million Acres)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>21.50</td>
<td>21.83</td>
<td>22.40</td>
<td>22.48</td>
<td>23.02</td>
<td>24.53</td>
<td>23.70</td>
</tr>
<tr>
<td>Wheat</td>
<td>10.69</td>
<td>10.43</td>
<td>10.89</td>
<td>10.24</td>
<td>9.53</td>
<td>10.65</td>
<td>10.66</td>
</tr>
<tr>
<td>Gram</td>
<td>3.00</td>
<td>2.60</td>
<td>2.96</td>
<td>2.31</td>
<td>2.24</td>
<td>2.77</td>
<td>3.10</td>
</tr>
<tr>
<td>Other food grains</td>
<td>5.13</td>
<td>5.32</td>
<td>5.12</td>
<td>4.61</td>
<td>5.08</td>
<td>5.77</td>
<td>4.96</td>
</tr>
<tr>
<td><strong>Total of food grains</strong></td>
<td><strong>40.32</strong></td>
<td><strong>40.18</strong></td>
<td><strong>41.37</strong></td>
<td><strong>39.64</strong></td>
<td><strong>39.67</strong></td>
<td><strong>43.72</strong></td>
<td><strong>42.42</strong></td>
</tr>
<tr>
<td>Sugar cane</td>
<td>0.71</td>
<td>0.77</td>
<td>0.70</td>
<td>0.70</td>
<td>.87</td>
<td>0.96</td>
<td>1.02</td>
</tr>
<tr>
<td>Oil seeds</td>
<td>1.76</td>
<td>1.65</td>
<td>1.90</td>
<td>2.14</td>
<td>1.83</td>
<td>1.92</td>
<td>2.09</td>
</tr>
<tr>
<td>Jute</td>
<td>1.88</td>
<td>1.56</td>
<td>1.95</td>
<td>1.78</td>
<td>1.91</td>
<td>0.97</td>
<td>1.24</td>
</tr>
<tr>
<td>Cotton</td>
<td>2.65</td>
<td>2.80</td>
<td>3.07</td>
<td>3.38</td>
<td>3.48</td>
<td>2.93</td>
<td>3.19</td>
</tr>
<tr>
<td>Tea</td>
<td>0.07</td>
<td>0.07</td>
<td>0.08</td>
<td>0.08</td>
<td>0.07</td>
<td>0.08</td>
<td>0.07</td>
</tr>
<tr>
<td>Tobacco</td>
<td>0.16</td>
<td>0.17</td>
<td>0.18</td>
<td>0.18</td>
<td>0.17</td>
<td>0.19</td>
<td>0.24</td>
</tr>
<tr>
<td><strong>Total of commercial crops</strong></td>
<td><strong>7.23</strong></td>
<td><strong>7.02</strong></td>
<td><strong>7.18</strong></td>
<td><strong>8.26</strong></td>
<td><strong>8.33</strong></td>
<td><strong>7.05</strong></td>
<td><strong>7.85</strong></td>
</tr>
<tr>
<td><strong>Grand total</strong></td>
<td><strong>47.55</strong></td>
<td><strong>47.20</strong></td>
<td><strong>48.55</strong></td>
<td><strong>47.90</strong></td>
<td><strong>48.20</strong></td>
<td><strong>50.77</strong></td>
<td><strong>50.27</strong></td>
</tr>
</tbody>
</table>
Table 9 shows the production of the principal crops since 1948-49. It appears that in spite of an increase in acres, the production did not show corresponding increases. There was, on the contrary, a slight fall. The declining food production presents a serious problem, especially when the population is increasing at a rapid rate.
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Rice</td>
<td>8.41</td>
<td>8.17</td>
<td>8.20</td>
<td>7.76</td>
<td>8.15</td>
<td>9.15</td>
<td>8.41</td>
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<tr>
<td>Wheat</td>
<td>3.99</td>
<td>3.89</td>
<td>3.95</td>
<td>2.97</td>
<td>2.39</td>
<td>3.68</td>
<td>3.17</td>
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<tr>
<td>Gram</td>
<td>0.80</td>
<td>0.65</td>
<td>0.79</td>
<td>0.48</td>
<td>0.37</td>
<td>0.65</td>
<td>0.63</td>
</tr>
<tr>
<td>Other food grains</td>
<td>1.20</td>
<td>1.21</td>
<td>1.16</td>
<td>0.96</td>
<td>0.94</td>
<td>1.33</td>
<td>1.15</td>
</tr>
<tr>
<td>Raw sugar</td>
<td>1.03</td>
<td>1.07</td>
<td>0.87</td>
<td>0.87</td>
<td>1.09</td>
<td>1.26</td>
<td>1.23</td>
</tr>
<tr>
<td>Oil seeds</td>
<td>0.31</td>
<td>0.27</td>
<td>0.33</td>
<td>0.35</td>
<td>0.27</td>
<td>0.32</td>
<td>0.37</td>
</tr>
<tr>
<td>(Million bales)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jute</td>
<td>5.48</td>
<td>3.33</td>
<td>4.45</td>
<td>6.33</td>
<td>6.82</td>
<td>3.61</td>
<td>4.66</td>
</tr>
<tr>
<td>Cotton (lint)</td>
<td>0.99</td>
<td>1.31</td>
<td>1.52</td>
<td>1.65</td>
<td>1.90</td>
<td>1.44</td>
<td>1.65</td>
</tr>
<tr>
<td>(Million pounds)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tea</td>
<td>33.60</td>
<td>38.88</td>
<td>37.86</td>
<td>53.00</td>
<td>52.00</td>
<td>52.00</td>
<td>54.00</td>
</tr>
<tr>
<td>Tobacco</td>
<td>141.92</td>
<td>148.97</td>
<td>162.40</td>
<td>178.95</td>
<td>167.10</td>
<td>201.99</td>
<td>262.04</td>
</tr>
</tbody>
</table>
Yield of Crops

Yields per acre of principal crops in Pakistan for 7 years ending in 1954-55, is shown in Table 10 (p.8). It appears that commercial crops e.g. jute, cotton, tobacco and tea, have shown improvement, but the yields of food crops have not shown any significant changes. It is not possible to explain fully the behavior of cash crop production, but it looks as though farmers have been giving more attention to these crops to obtain higher cash returns.

Agricultural authorities have ascribed two main reasons for low yields per acre of crops:

1. The cultivated area per head of population is small — 1.1 acres in West Pakistan and 0.51 acres in East Pakistan.

2. Low fertility of the soil, irregularity and inadequacy of rainfall, prevalence of salinity, water logging and soil erosion, lack of adequate irrigation drainage and flood control systems, high incidence of plant pests and diseases, primitive production methods, lack of credit, and adverse systems of tenure.
Table 10

Yield Per Acre of Principal Crops in Pakistan 1948-55

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>10.6</td>
<td>10.2</td>
<td>10.0</td>
<td>9.4</td>
<td>9.6</td>
<td>10.2</td>
<td>9.7</td>
</tr>
<tr>
<td>Wheat</td>
<td>10.0</td>
<td>10.1</td>
<td>9.9</td>
<td>7.9</td>
<td>6.8</td>
<td>9.4</td>
<td>8.1</td>
</tr>
<tr>
<td>Barley</td>
<td>7.9</td>
<td>7.6</td>
<td>7.7</td>
<td>6.1</td>
<td>5.2</td>
<td>6.9</td>
<td>6.8</td>
</tr>
<tr>
<td>Maize</td>
<td>10.8</td>
<td>11.0</td>
<td>11.0</td>
<td>10.5</td>
<td>9.7</td>
<td>11.5</td>
<td>11.2</td>
</tr>
<tr>
<td>Bajra</td>
<td>4.6</td>
<td>4.3</td>
<td>4.4</td>
<td>3.6</td>
<td>3.3</td>
<td>4.8</td>
<td>4.3</td>
</tr>
<tr>
<td>Jowar</td>
<td>5.6</td>
<td>5.4</td>
<td>5.3</td>
<td>5.1</td>
<td>4.5</td>
<td>5.1</td>
<td>5.3</td>
</tr>
<tr>
<td>Gram</td>
<td>7.3</td>
<td>6.8</td>
<td>7.3</td>
<td>5.6</td>
<td>4.5</td>
<td>6.3</td>
<td>5.5</td>
</tr>
<tr>
<td>Raw sugar</td>
<td>39.5</td>
<td>37.6</td>
<td>34.1</td>
<td>33.5</td>
<td>34.0</td>
<td>35.7</td>
<td>32.8</td>
</tr>
<tr>
<td>Rape and mustard</td>
<td>4.8</td>
<td>4.5</td>
<td>4.8</td>
<td>4.4</td>
<td>4.0</td>
<td>4.5</td>
<td>4.9</td>
</tr>
<tr>
<td>Linseed</td>
<td>4.4</td>
<td>4.4</td>
<td>4.5</td>
<td>5.1</td>
<td>4.6</td>
<td>4.4</td>
<td>5.0</td>
</tr>
<tr>
<td>Sesamum</td>
<td>4.6</td>
<td>4.4</td>
<td>4.5</td>
<td>5.1</td>
<td>4.6</td>
<td>4.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Seed cotton</td>
<td>5.3</td>
<td>6.7</td>
<td>7.1</td>
<td>7.0</td>
<td>7.8</td>
<td>7.0</td>
<td>7.4</td>
</tr>
<tr>
<td>Jute</td>
<td>14.2</td>
<td>10.1</td>
<td>17.3</td>
<td>17.3</td>
<td>17.4</td>
<td>18.2</td>
<td>18.2</td>
</tr>
<tr>
<td>Tea</td>
<td>5.6</td>
<td>6.4</td>
<td>6.1</td>
<td>7.9</td>
<td>7.9</td>
<td>8.4</td>
<td>8.9</td>
</tr>
<tr>
<td>Tobacco</td>
<td>10.5</td>
<td>10.7</td>
<td>11.0</td>
<td>11.8</td>
<td>11.6</td>
<td>12.7</td>
<td>13.4</td>
</tr>
</tbody>
</table>

* One Maund = 82-2/7 pounds
Crop Rotations

Proper crop rotations are very essential in maintaining the soil fertility and increasing the yield of crops. The advantages of scientific crop rotations are unknown to the farmers and nowhere will the proper crop rotations be found in practice. However, the government has been encouraging adoption of such rotations in which legumes and green manure crops are included. In the former Punjab area, remission of land revenue and water rate is provided for crops used as green manure.

Soil Fertility

Soils in West Pakistan are generally deficient in nitrogen and humus. Continued cropping without proper crop rotation and fertilization program, has further depleted the soil of essential plant food elements. The use of artificial fertilizers in Pakistan is very low compared to the agriculturally advanced countries of the world. West Pakistan uses 0.45 pounds of the chief fertilizer elements per acre of arable land, while in the Netherlands this figure stands at 360 pounds (32). The use of fertilizers was first introduced by the government in 1952. From then, until the winter of 1955-56, West Pakistan had imported 186,654 tons of fertilizers.
Even if fertilizer use is restricted to only 20 per cent of the area under minor crops, it will require about 234,000 tons of fertilizers annually (32). To meet the increasing demand, the government has set up a fertilizer factory at Daud Khel producing 50,000 tons of ammonium sulphate annually and another factory of 85,000 ton capacity is planned to be set up very soon.

Farming Methods

It is an amazing fact that the agricultural practices prevailing in Pakistan today are almost as old as the soil itself. Although everyone from the king to the clown has realized the importance of agriculture, yet no serious attempt has ever been made to improve the farming methods coming down from generation to generation. The plow is generally considered to be the most important tillage tool and is probably the oldest of all agricultural implements. The same old wooden plow which has been used for thousands of years still plows the fields, though modification in sizes have been made to suit local conditions.

A plow has been defined as a farm implement used to cut, turn up and break up the soil. The plow used by an average village farmer of West Pakistan does not
perform any of these functions; it does nothing more than scratching the soil only about 2 inches to 4 inches deep. The author, therefore, does not find any justification in calling this scratching tool a plow. (See Figure 4.) A plow similar to a moldboard plow, but small in size, is being used on government farms and by a very few farmers.

Tillage is the preparation of the soil for planting and the process of keeping it loose and free from weeds during the growth of crops. The primary objectives and fundamental purposes of tillage are divided into three phases: 1. To prepare a suitable seed bed; 2. To destroy competitive weeds; 3. To improve the physical condition of the soil (55). Further tillage equipment can be divided into two general classes, namely primary tillage equipment, and secondary tillage equipment.

Equipment that is used to break deeply and loosen the soil to prepare a suitable seed bed may be considered as primary tillage equipment. Included in this group are various kinds and types of moldboard, disk, and chisel plows. Secondary tillage equipment includes harrows, pulverizers, weeders, and special tools for surface tillage to conserve moisture and destroy weeds (55).
Figure 4

Farming in the valley of Peshawar, West Pakistan.
The so-called plow found in villages of West Pakistan is the only tool used as both the primary and the secondary tillage equipment. The field is plowed twice in two perpendicular directions. The last operation is done by leveling and crushing the clods with a drag made of wood pulled by a pair of oxen.

Probably no other implement on the farm is so indispensable as the plow. There can be a substitute for any other implement, but it is hard to get subsistence out of the soil without a plow. According to Smith (55), the plow is an index of advancement in civilization, he says:

"When man grasped a crooked stick and began to till the soil, he took his first step toward civilization. With each phase in the development of the plow, there has been a corresponding advance in civilization. A study of the history of mankind shows that it is possible to have culture without techniques, but there is no viable culture without the plow."

Harvesting is done by means of hand sickles. It is a very slow and laborious method. One man can cut only about one quarter of an acre per day.

Threshing, again, is a time consuming operation. It is done by the trampling of oxen on the straw as shown in Figure 5. For about four to six weeks, the
crop lays on the threshing ground and often wind storms cause a great deal of damage and loss. Broadcasting is the only means of seeding. Transportation of commodities to the market is by bullock-cart, as shown in Figure 6, and not every farmer owns his own cart.

**Tractors and Equipment**

The main purpose of farm mechanization is to increase the production per man hour, which is extremely low in Pakistan. This increase can be brought about by introducing more and better tools for the use of the farmers. The indigenous implements and tools are primitive in design and inefficient in use and operation. Some implements, like the chaff cutter, tirphali and the iron cane crushers (See Figure 7.) recommended by the Agricultural Department, have been widely adopted (32).

Bullock power is the chief source of energy for draft purposes. However, tractors are now being increasingly used in Pakistan. The number of tractors in the country has increased from 500 at the time of Partition to about 4,000 in 1956. The main difficulty is the high cost of machinery, non-availability of spare parts and servicing facilities in the country. To solve this problem, the government of Pakistan, in cooperation with the International Cooperation Administra-


Figure 5

Old method of threshing.
Figure 6
Carting cotton to the market.
Figure 7

A sugar cane crusher at work.
workshops in West Pakistan at Lyallpur, Peshawar, Tando Jam, Quetta, Khanpur and Khairpur and one in Dacca in East Pakistan. The United States Government is supplying all the equipment for these workshops besides giving advisory help. The government of Pakistan is furnishing the buildings and land.

Farm Labor

No reliable information is available on the farm labor conditions in Pakistan. A survey was, however, conducted by Darling (5) in 1953-54, but even that is not very accurate. Most of the information was gathered from the meetings with the village people who gathered around on one of his chance visits or even on a chance stop by the roadside. However, it is a fact that the standard of living of laborers varies from low to wretched. They are hardly able to make both ends meet. Wages are too low.

In fact, very little attention has been given to labor conditions, probably because owners and tenants outnumber the landless laborer. The census returns for 1951 show that, out of a total agricultural labor force of 16,900,000, only 10.6 per cent (1,800,000) were landless agricultural laborers. For West Pakistan the percentage was no more than 3.6.
Figure 8

Agricultural workshops at Tando Jam, West Pakistan.
Darling has classified the agricultural laborer into three categories -- permanent, casual and seasonal. Permanent laborer is engaged for at least six months continuously, and the casual laborer is engaged and paid by the day. Midway between the two, with some features of both, is the seasonal laborer who is employed for a particular agricultural purpose -- cotton picking, harvesting, transplanting or weeding -- and who often comes from another district.

Irrigation and Sources of Water

West Pakistan can be divided into two hydrologic areas:

1. The areas drained by the River Indus and its tributaries, and the adjoining tracts depending on the Indus River system for their water supply.

2. The areas drained by coastal tributaries and desert streams, comprising most of the Quetta and Kalat Divisions and adjoining tracts.

Indus Basin

West Pakistan has a magnificent canal irrigation system which is believed to be the biggest in the world. The source of water for these canals is the Indus system of rivers which comprises the main Indus
and its major tributaries, the Kabul and Kurram on the right bank, and the Jhelum, the Chenab, the Ravi, the Beas, and the Sutlej on the left. All rise in the Himalayas or its western extensions, and are snow-fed. The whole of the Beas and the head reaches of the Ravi and the Sutlej are in India, while those of the Chenab and the Jhelum lie mostly in the Kashmir state. The entire basin covers an area of about 348,000 square miles, of which 201,000 square miles lie in West Pakistan. In addition there are about 29,000 square miles which lie outside the Indus Basin, but are dependent on the Indus River system for their water supply.

The grass area of the Indus Basin in West Pakistan is 131,000,000 acres, of which 75,000,000 are arable, but the net area sown to crops is only 27,500,000, of which 90 per cent produces one crop per annum. The net area irrigated in an average year is 21,000,000 acres, which represents 28 per cent of the arable and 76 per cent of the cropped area.

Almost all of the basin in Pakistan received less than 15 inches of rainfall, 60 per cent less than 10 inches and 16 per cent less than 5 inches. Along the sub-montane tract, the rainfall varies from 30 to 40 inches. The rainfall is distributed evenly throughout
the year, but is concentrated in the monsoons (June to September). Local rainfall shows great variation from year to year in respect of quantity, incidence and duration.

The rivers are subject to extreme variations of flow, the summer maximum discharge being about 100 times the winter minimum. The dry season discharge in the main river channels is too low, and supplies for the winter crops and the critical periods for the summer crops are always short. On the other hand, for 2 to 2½ months, the rivers carry large surpluses over and above the agricultural requirements, and considerable quantities escape from the land without being put to beneficial use.

The utilization of river flow is further complicated by the fact that the fluctuations in the stream flow of all rivers in the region more or less follow the same hydrographic pattern. Whenever the main Indus, the Jhelum and the Chenab are in deficient supply, the Ravi, the Beas and the Sutlej are also correspondingly short. Hence, both the shortages and the floods are accentuated.

Not enough is known about the ground water resources to give a quantitative idea of their potentialities or limitations for development.
A number of irrigation and multi-purpose projects are either undertaken or preliminary investigations are proceeding to increase the flexibility of the irrigation system and utilize the waters of these rivers more usefully.

Coastal Tributaries and Desert Streams Region

The total area of the region is over 135,000 square miles. For the most part, it is barren, with rugged mountains interspersed with semi-desert valleys and plains. Zhob River in the north and some streams in Mekran and Las Bela in the south, drain into the Arabian Sea. Great aridity and wide temperature ranges are the leading features of the climate. Because of the high temperatures, low humidity and strong winds, the evaporation losses are very heavy, particularly from April to September. The rainfall is scanty, badly distributed and exceedingly irregular. The number of rainy days is extremely limited. The annual rainfall is hardly over 10 inches anywhere.

The total arable land, scattered all over the region, aggregates approximately to 10,000,000 acres, of which about 4,000,000 are cultivated. Not all of this, however, is farmed at one time. The actual acreage under crops varies from year to year, depending
on the amount, intensity and time of occurrence of the rainfall. In an average year, probably not more than 20 per cent of the cultivated acreage is sown to crops.

Apart from the major river valleys, the greater part of the area is perfectly arid and the only source of water is the uncertain and limited rainfall. There are innumerable small streams with insignificant flows and only in the larger ones does the flow continue for any considerable period of time. Generally, flows are of a flashy character, the greater part of the run-off occurring at very high rates for very short periods. Most of the streams have steep bed slopes. Practically no organized information exists for the proper assessment of the water resources of the region. As a very rough estimate, the stream flow in an average year may be placed at 4,000,000 to 5,000,000 acre feet (48). No reliable data on floods, maximum and minimum flows, evaporation and percolation losses are available.

**Village Agricultural and Industrial Development Program**

The Village Agricultural and Industrial Development program, commonly known as Village AID, represents the first determined effort of the Central and Provincial governments to help the rural masses tackle their social and economic problems. The program touches
intimately every phase of the daily life of the people of Pakistan in the villages and is intended to encourage local talents and develop rural leadership. The Village AID, wherever necessary, supplements the local efforts of people by providing them with technical assistance and material. The objectives of the program may be summed briefly as follows (32):

1. To create a spirit of self-help, initiative leadership and cooperation among the villagers and to lay the foundation for self-sustaining economic, political, civic and social progress.

2. To create conditions for a richer and higher life through social activities, including recreational facilities for men, women and children.

3. To raise the productive output and income of the villagers through modern techniques of farming, cooperatives, cottage industries, etc.

4. To multiply the community services available in rural areas such as schools, dispensaries, health centers, hospitals, sources of pure water supply, etc.
5. To coordinate the working of such nation-building departments of government and extending their activities into the villages by providing an extension service to the country.

6. To provide a welfare base for the entire administrative structure of government.

For the achievement of the foregoing objectives, nine institutes for preparing a class of specially trained workers have been set up. Also, two academies have been set up for training development officers and supervisors for the development areas. A team of American experts has been touring Pakistan to formulate their recommendation about the curriculum of training for the academies. Details of Village AID program are beyond the scope of this study.

The Five-year Village AID plan envisages the setting up of 172 development areas of 150 villages each within five years, covering about one-fourth of the entire country side of Pakistan.

**Agricultural Education and Research**

There are three agricultural colleges at present in West Pakistan, but the most important of them is the Punjab Agricultural College, Lyallpur. The Punjab
Agricultural College offers curricula leading to the degrees of B. Sc., M. Sc., and Ph. D. in agriculture. Students are attracted to the college not only from all over Pakistan, but also from Egypt, Afghanistan, Iran and Ceylon. The college has well equipped modern laboratories in the sciences allied to agriculture. In agriculture itself, 5 to 9 hours a week are devoted to practical work on the farm. (See Figures 10 and 11.)

Attached to the college for various purposes are:

1. A Student Farm of 98.6 acres where students grow crops and carry out all farming operations connected with crop husbandry.

2. Lyallpur Agricultural Farm of 280 acres where students receive training in large scale farming.

3. A Botanical Experiment Farm of 161.85 acres where students receive training in crossing, selecting, testing of plants and all other work connected with the evolution of improved plant types.

4. A Dairy Farm, where students receive training in modern dairying, breeding, feeding and management of cows, buffaloes, etc.

5. A Poultry Farm for training students in poultry production and management.
Figure 9

The Punjab Agricultural College and the research institute Lyallpur, West Pakistan.
Figure 10

Students doing Agriculture Practical at the students farm.

Figure 11

Students harvesting wheat.
6. A garden of 25 acres for training students in laying out a garden and in modern methods of fruit culture as well as in the evolution and propagation of improved fruit varieties.

7. A cannery for training students in the processing of squash, juices, cordials, jams, jellies, and in the canning of fruits and vegetables.

8. An Engineering Workshop for training students in handling tools, use of power machinery and acquainting them with improved implements, water-lifts, tube-wells, etc. (52).

The West Pakistan Department of Agriculture carries out research at the Punjab Agricultural College and Research Institute, Lyallpur. The research sections have their sub-stations in different parts of the country. One of the sections included in research is engineering, which was founded in 1914. The staff of this section consists of an agricultural engineer, a sub-divisional officer, a workshop superintendent, and other laborers for work in the Workshop at Lyallpur and for boring wells throughout the Province. (See Figures 12 and 13.)

The engineering section is mainly concerned with supplementing the water supply of the Province by
boring open percolation wells and by sinking tube-wells. It also carries out research on agricultural implements and has developed a cream separator, and a single row cotton drill.
Figure 12

Agricultural implements in the courtyard of the Engineering Workshops. The tripod in the background to the right is the tube-well boring rig.

Figure 13

Persian wheel at work.
MECHANIZATION OF AGRICULTURE IN WEST PAKISTAN

--- SOCIAL AND ECONOMIC PROBLEMS

**Meaning of Mechanization**

Mechanization is generally understood in Pakistan to mean the cultivation of land by tractors and tractor powered implements. In fact, it embraces every form of farm equipment from the simplest to the most complex. To quote an FAO report, "Power is needed to wield tools, pull implements, and drive machines, and it is these contrivances that ultimately perform the work desired, whether they are operated by muscles, wind, water, steam, hydrocarbon fuels or electricity". (48.) Replacement of an indigenous plow by a modern implement, or a wooden Persian wheel by an iron one, or improvements in other animal-drawn machines such as water lifters, sugar cane crushers and threshers, can be called improved mechanization.

**Position in Other Countries**

"Progress in the improvement of tools and machines has not been uniform. In world agriculture at present, there are many different technological levels, and often several stages of development are represented side by side in the same area." Speaking very roughly,
hand tools are characteristic of Africa, simple animal-
drawn implements of the ancient cultures in southern
and eastern Asia, and more highly developed animal-
drawn and power-operated equipment of Europe, North
America, the U. S. S. R., and Oceania. Latin America
has a wide variety of equipment". (FAO.)

Generally, progress in the use of modern agricul-
tural equipment has taken place in conjunction with the
growth of other industries. Countries, therefore, with
a high level of agricultural technology are, with a few
exceptions, also those with high levels of industrial
and general economic development.

North America is usually regarded as the outstanding
example of progress in farm mechanization. With about
17 per cent of the world's arable land, the region has
over 70 per cent of the world's tractors. In addition
to equipment for land preparation, seeding, etc., large
numbers of complex machines are used for such agricul-
tural operations as harvesting, haymaking and baling,
and the preparation and handling of livestock feedstuffs.
The U. S. A. ranks as the biggest users of tractors
among the large countries.

Europe, with 12 per cent of the world's arable
land and 15 per cent of the tractors, is second only
to North America in the quantity of modern farm machinery
in use. According to FAO reports in 1950, the following Table 11 gives the per cent of tractors in use in the world and the per cent of the world's arable land in different regions of the world.

Table 11

Number of Tractors and Arable Land in Different Regions of the World

<table>
<thead>
<tr>
<th>Region</th>
<th>No. of tractors in use</th>
<th>Total arable land</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Per cent)</td>
<td>(Per cent)</td>
</tr>
<tr>
<td>North America</td>
<td>70</td>
<td>17</td>
</tr>
<tr>
<td>Europe</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>U. S. S. R.</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>Latin America</td>
<td>1.5</td>
<td>9</td>
</tr>
<tr>
<td>Near East</td>
<td>0.3</td>
<td>more than 6</td>
</tr>
<tr>
<td>Far East</td>
<td>less than 0.5</td>
<td>more than 23</td>
</tr>
<tr>
<td>Africa</td>
<td>less than 1.0</td>
<td>more than 12</td>
</tr>
<tr>
<td>Oceania</td>
<td>1.9</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Scope of Mechanization in West Pakistan

West Pakistan has about 4 times as much waste land as its annual cropped area. Main reason for this is the lack of tractors and modern efficient equipment. There are about 4,000 tractors in West Pakistan and more than 2/3 of them are owned by the government. They are mostly used in the new irrigation areas and the other land reclamation projects. Again the number of tractors used in Pakistan is insignificant as compared to other mechanized countries. In the United Kingdom with a much smaller area, namely 31,000,000 acres, of which 17,000,000
are under grass, as compared to over 27,000,000 acres in West Pakistan and 22,000,000 acres in East Pakistan, the number of tractors in use in 1951 was close to 400,000. The U. S. A. is the biggest user of tractors. The number of tractors in use in 1951 was close to 2,000,000. Hence, the introduction of modern agricultural machinery is being awaited for by the farmers of Pakistan. Not only that, there are millions of acres deteriorating every year because of soil erosion and water logging. Large areas are infested with many kinds of weeds, and only 20 per cent of the potential crop is obtained.

Another important factor is the destruction of crops by pests. Millions of arable acres are going to waste because of insufficient rainfall, where tractors would be invaluable for rapid cultivation and sowing after the rains.

All these tremendous losses can be minimized by the introduction of modern farm machinery, and as such, there are wide possibilities for using tractors and heavy equipment for reclaiming these areas.

Although an increasing number of private cultivators are purchasing tractors and although the continued introduction of tractors is essential, the fact that large areas are farmed by primitive methods and
with obsolete equipment means that important improvements can be achieved through a wider use of improved hand tools and animal-drawn equipment. Greater efficiency of human labor and animals may be more economically achieved by such methods than, in the immediate future, by the introduction of tractors.

Land Ownership and Tenures

One of the greatest hurdles in the way of farm mechanization is the landlordship and tenures. The institution of landlordship is characterised by concentrations of holdings in the hands of a small number of landlords. Land tenures in Pakistan have evolved over a period of 150 years or more under the influence of changing political and social forces.

Land Ownership

During the later periods of British rule, some attempts were made to raise agricultural productivity and the material standards of rural population, but adequate attention was not paid to problems of land ownership and tenures. Later on, until 1950, many committees have been formed and many recommendations have been made by them. Some of the committees proposed a series of long term and short term measures.
Long-term measures aimed at (a) ceilings on ownership of individual landlords with provision for compensation and (b) distribution of land thus released among the tenants. Most of the short-term measures recommended by the various committees were written into legislative acts, but action is still to be taken on long-term measures, probably because most of the leaders, at the helm of affairs, are themselves landlords.

Recent figures showing the extent of land concentrations are not available, but sufficient data is available to establish their existence. According to the Punjab Tenancy Laws Committee, land ownership in the former Punjab was distributed as shown in Table 12 (48).

Table 12

<table>
<thead>
<tr>
<th>Size of Holding</th>
<th>Acres</th>
<th>No. of owners</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thousands</td>
<td>% of total</td>
</tr>
<tr>
<td>Less than 10 acres</td>
<td>7,092</td>
<td>31.8</td>
</tr>
<tr>
<td>10 to 99 acres</td>
<td>10,428</td>
<td>46.7</td>
</tr>
<tr>
<td>100 to 499 acres</td>
<td>2,502</td>
<td>11.2</td>
</tr>
<tr>
<td>500 acres and above</td>
<td>2,295</td>
<td>10.3</td>
</tr>
<tr>
<td>Total</td>
<td>22,317</td>
<td>100.0</td>
</tr>
</tbody>
</table>
The preceding table shows that more than one-fifth of the arable area is owned by about six-tenths of one per cent of the owners and almost 80 per cent of them own less than one-third of the area. The position is worse in the former Province of Sind. About 3 per cent of the total owners, each with holds averaging 1,000 acres, owns 48.6 per cent of the total arable area. Over 70 per cent of the total farm land is owned by only 7 per cent of the owners. According to an article written by the then Revenue Minister of Sind in 1955, the total occupied land in Sind was 8,600,000 acres, of which 1214 landlords held 1,100,000. About 3,000 landlords held 6,000,000 acres, and of these 295 persons held 5,000 acres or more each. Some of the holdings exceeded 60,000 acres each (48).

**Land Tenures**

Land tenures in Pakistan do not follow any uniform pattern. They can be grouped under three categories:

1. Large landed estates owned by individual landlords. The village population consists largely of tenants who cultivate the land.

2. Peasant proprietors who own comparatively small areas, which they cultivate themselves with the help of members of their families or hired
workers. Such owners are usually settled in the form of village communities.

3. Raiyatwari, a system under which land is granted directly by the State on a tenancy basis, but with security fully guaranteed in practice. The occupant is free to give up any land and avoid his liability for land revenue. The occupant enjoys heritable and transferable rights, which places him practically on the same footing as an owner.

Tenants are of two categories: occupancy tenants and tenants-at-will. Occupancy tenant is a tenant with a heritable and transferable right in the whole or part of his land. His rent may be in cash or a share of the crop, and in the former case, it may be no more than the land revenue and government cesses. They are now in the process of being abolished by giving them the rights of ownership on nominal payments.

In the past a tenant-at-will could be evicted after a year subject to the notice of ejectment being properly served. Now a tenant can only be evicted if he is not cultivating the land according to the specific terms of his tenancy, or does not pay the rents punctually. Now a tenant-at-will has more security than before.
In a country developed industrially there can be many ways of raising the standard of living, but in a country which is predominantly agricultural, probably the only sure basis of economic security is land. Although some acts have been passed to give more security to the tenant, yet the problem of land reforms remains one of the most serious. As has been shown in the foregoing pages, the bulk of land in West Pakistan is owned by comparatively few people. The landlords live in towns leaving the management of their lands to agents, who have little interest in the tenants or the improvement of land. In spite of protective legislation, the tenants are at the mercy of their landlords. Landlords enjoy high economic and social status and with their influence in politics and administration are able to exploit the tenants in various ways, thereby obstructing the process by which tenants can raise their economic and social status. In the opinion of the author, no development plan can be as effective unless proper agrarian reforms are made. Whereas concentration of holdings is a social evil, the fragmentation of holdings is detrimental to the agricultural productivity. Size of holdings is certainly a limitation on the introduction of farm machinery. Too small a piece
of land may not justify the cost of equipment.

A committee of experts should be set up immediately to formulate a comprehensive program of land reforms. The committee should consider all the recommendations previously made. Following are some of the suggestions which are of basic importance:

1. The landlords should be abolished and the right of ownership should be transferred to the cultivator. This can be done in two ways:
   A. The maximum size of holdings may be fixed and beyond that the land should be acquired by the government through legislation and transferred to the tenant. The tenant may have to pay the nominal price of land over a number of years.
   B. High revenue should be imposed on land. Beyond a certain limit, the revenue should go on multiplying with the size of holdings so that the landlord may be tempted to leave the excess area to revert to the government.

2. Fragmentation of holdings should be eliminated. This can be done by determining the minimum size of economic holdings, and fixing this as the unit. This unit of holdings should not be sub-divided under any conditions.
3. The existing uneconomically small holdings should be consolidated.

**High Costs**

The imported price of tractors and other agricultural equipment is so high that it is almost impossible for a farmer to buy one. The cost of spare parts is still higher and sometimes they are not available, which makes the situation still worse. Furthermore, the running of power machinery is very expensive because of high costs of fuels and lubricants. Immediate measures should be taken by the government to make the agricultural machinery, spare parts, fuels and lubricants available to the farmer at as low a cost as possible.

**Taxes**

Heavy taxes are imposed on the machinery. Farm tractors, tractor repair parts, and agricultural machines and implements should be exempted from custom duty and sales and other taxes.

**Lack of Technical Knowledge**

The village farmers are absolutely illiterate. They cannot be expected to handle the machinery without
doing damage to it. There should be some trained
operator to handle the machinery. For this purpose
the government is opening workshops designed to provide
training facilities for tractor drivers and farm
mechanics apart from servicing facilities and manu-
facture of indigenous implements.

Displacement of Labor

Unemployment, as a result of mechanization, has
always been an argument as well as fear against the
mechanization of agriculture in the under developed
countries of the world. But mechanization is not as
simple as installing an automatic machine in a factory
and firing a couple of workers out of a job. It is
commonly said in the United States that for every machine
which displaces one worker, there are three new jobs
created. The development of agriculture by its very
nature, is a slow process. It takes a good number of
years before some significant results can be achieved.
It takes an even longer time for the evolution of a
better breed of cattle. These basic factors about the
nature of agriculture have to be borne in mind in
formulating agricultural development programs and
assessing their results. Even the most highly mechanized
country, the United States, did not achieve this
mechanical outlook overnight, though surprisingly quick.

The situation in West Pakistan is different. In the initial phases, mechanization would mean employment rather than unemployment. This is because of the fact that the waste land in West Pakistan is four times as much as the annual cropped area. Use of machinery in developing this area can be a source of employment for thousands of people. Tractors and power machinery can be used in (a) reclamation of arable waste land, (b) development of land in the new irrigation project areas, and (c) dry farming and moisture conservation work. In such conditions the introduction of heavy machinery would rather create employment opportunities for the village people. With the improvement of employment conditions, need for more and better hand tools and implements for the existing farmers would be a natural consequence. Therefore, the improvement of hand tools and implements should take place side by side with the reclamation projects. After a certain stage, when the standard of living in rural areas has materially improved, tractors and power machinery can be introduced gradually. It is hard to predict when exactly that stage would be reached, but if all the foregoing obstacles have been removed, if all-around development of the country continues at the same rate as it is today, and
if the political conditions remain normal, this period could be very roughly estimated around 25 years.

There are two important features of employment in the villages, depending on the season: (a) Agricultural season e.g., harvesting and threshing, cotton picking, transplanting, etc., when even the existing labor is insufficient, and (b) off-season when there is nothing to do except the routine of feeding the cattle. During the season when the farmer is overly busy and wages are high, because of inefficient methods and limited time available, often the operation is delayed. Damage to the wheat crop due to winds is not uncommon when it lies on the threshing ground for weeks. During this period, the use of machinery through cooperative farming would be very useful.

In the off-season, however, the situation is different. During this season the farmer has very little to do and most of the laborers are out of a job. For these periods, as well as for those when the farmer might have time by the use of labor saving machines, cottage industry may be encouraged.

In West Pakistan cottage industries play only a small part in the peasant's life. There are some cottage industries existing in the villages, but they are not developed to any appreciable extent. Some of
them are mat-making and embroidery, butter-making, gold thread work on shoes, making Kullahs (a kind of cap), making baskets. The most common industry in the former Punjab Province is spinning for home use. All these are done by both men and women and may earn them only a few cents. It would be difficult to suggest the expansion of anyone of these industries or the introduction of new ones. These are the matters of broader inquiries to be undertaken in the immediate future. However, it is certain that cottage industry would help to meet the problems of unemployment and would add to the farmers' income. Beyond any doubt, cottage industries have a wide scope in the villages of West Pakistan. Some of the small scale industries which may be considered are the following: Handloom weaving, blacksmithy, carpentry, pottery, and cheese-making.
Program is divided into two parts:
1. Objectives of program.
2. Planned program.

Objectives

Before formulating any program of economic development, it is well to set forth certain objectives and then all efforts should be directed toward achieving these objectives. There should be a judicious basis for the establishment of such objectives.

One important conclusion which can be drawn from the foregoing analysis is that Pakistan is UNDER-DEVELOPED. How much Pakistan is under-developed is a difficult question to answer. There is no standard yardstick for measuring the degree of development of a country.

One criterion for measuring the degree of development of countries is the proportion of the population engaged in agriculture. Modern economists consider a nation advanced or developed, undeveloped or backward, according to the percentage of agricultural products in the national economy; the lower the percentage the higher the degree of development, and the higher the percentage the lower the degree of development. This
would be true only for those countries which are predominantly agricultural.

As a matter of fact, there are only a few countries considered developed or highly advanced. Even England, which was considered in the 19th Century to be the most advanced industrial nation, is now considered by its own economists to need more development in comparison with the United States.

An equal percentage of agricultural production in two countries would not necessarily mean equal economic development, equal productivity per man, or equal ease in each man's life.

In comparing the degree of development in two countries, a yardstick of development might conceivably be worked out by a double measurement which would involve:

1. Estimation of the average productivity per man in an international unit of account for each country.

2. An estimate of the cost of living in each country in terms of international units.

Another criterion which might be established would be the distribution of wealth and national income. The percentage of middle class, the backbone of the social entity, is high in more developed countries, and low in
backward areas.

Measured by any of these criteria, Pakistan would come in the category of under-developed or backward countries. "Backwardness" here means backwardness in economic development. This may or may not coincide with backwardness in civilization.

Pakistan's dominating economic difficulty does not arise because she is predominantly agricultural; her problem is not the lack of heavy industry nor the infancy of her light industry. Her main concern is low agricultural production, which is decreasing, while her population increases. Therefore, the primary aim of any development program would be to increase agricultural production and to ultimately provide each and every citizen of Pakistan with the following basic necessities:

Better education
Better health
Better food
Better clothing
Better habitation

These are the basic needs of every human being. Every Pakistani, as well as every other citizen of the world, should have the opportunity to get, by his toil, a share sufficient to enable him to enjoy a decent life.
The present standard of living in Pakistan is low. The problem is how to provide the people with a better one.

It could be said that Pakistan's agricultural development should come first, because it is only by increasing agricultural production that the people can be better and less expensively fed.

It could be argued that since most of Pakistan's mineral resources are unexplored, priority should be given to the development of mines and the industrialization of the country.

A third premise would be to say that sanitation is the essential requirement for good health. An unhealthy man cannot produce as much as he consumes. Hence, the primary emphasis should be placed on sanitation and health.

There are those who would state that education is the most important element, because without knowledge and skill, no one can produce economically, store goods without deterioration or know how, when, and where to trade his products.

It is obvious that all these factors are interrelated, so much so that no one of them can be developed independent of the other. We cannot neglect education and divert all effort toward agriculture or neglect agriculture and develop industry. A co-related plan
comprising them all is necessary.

The recently developed Five-year Plan is directed toward the development of all phases of national endeavor with agriculture having the highest priority. General recommendations and provisions for further studies and research have been made in certain fields. No detailed program in any field of endeavor has been made; this was beyond the scope of the plan. For example, improvement of small implements has been recommended, but no improved hand tools or implements have been suggested.

This study will be limited to the mechanization of farms to insure more agricultural production. Although all other phases of development have significant effects on agriculture, yet their consideration here, to any great extent, would be beyond the scope of this study. However, it is very strongly recommended that education and health authorities develop a detailed program of their own. Heavy and small rural industry should be developed simultaneously.

**Planned Program**

From information previously presented, it is evident that Pakistan is an economically poor nation. An average village farmer of West Pakistan is hardly
able to support himself and family, and there are times when food is not available. The quality and quantity of food is of the lowest grade. The farming methods are primitive and productivity is very low.

It is essential, therefore, to develop immediately a program to increase agricultural production by improving the methods of farming. The program must be workable and comprehensive and should fit into the social and economic structure of Pakistan. The farmers are unable to buy machines even if they are convinced of their utility. The program for increased agricultural production, is made up of two parts: (a) to improve the tools and implements available to the farmer, and (b) to help him make the best use of them. The plan therefore, aims at providing both tools and training.

**Improvement of Hand Tools and Implements**

**Plows**

The plow generally used by an average farmer is nothing more than a scratching device. The draft on this plow is not enough for a pair of oxen. The Indian Agricultural Research Institute has developed a 2-bottom plow which is a combination of two ordinary single bottom plows. It is simple in construction. The two bottoms are suitably coupled by means of an angle iron frame-work
and pulled by a single central beam, as shown in Figures 14 and 15. Although this plow does not have any mold board, the fact that it performs twice as much work as a single plow is in itself quite an improvement. The weight is 50% heavier than the single plow of the same design. The draft is not more than 260 pounds, which is not heavy for bullocks. This plow is very stable and therefore convenient and less tiresome to operate.

Another plow developed by the Allahabad Agricultural Institute in India is made of steel and is light in weight. It consists of three separate steel pieces joined together by welding, and a landside steel plate is riveted to it for reinforcement. The handle and draw beam are made of wood. This plow weighs 31 pounds and has a draft of 168 to 280 pounds. It plows 0.74 acres per working day of eight hours, when pulled with an average pair of bullocks plowing an 8 inch furrow 3 to 4 inches deep. The increased width of the furrow alone is an improvement of about 80% over the present rate of plowing, which is hardly 1/2 acre in a 10-hour day. (See Figure 16.)

Figure 17 shows another type of plow made for Indian bullocks. This plow weighs 40 pounds and requires 160 - 200 pounds of pull when plowing a furrow
Figure 14

Plowing with a two-bottom wooden plow.

Figure 15

A two-bottom wooden plow.
6 inches wide, 4 - 6 inches deep. The moldboard of this plow is connected to the beam by a piece of steel which resembles the frog of a modern moldboard steel plow. With a little skill and care, all three plows can be made by a village blacksmith using scrap material.

If tractors and implements are available and are maintained in the agricultural workshops being set up in West Pakistan, and rented out to the farmers, the cost of cultivation can be materially reduced. Comparative costs of bullock-farming and tractor cultivation as worked out by the Pakistan Agricultural Inquiry Committee in 1952 (33) are given in the Appendix.

**Spike-Tooth Harrows**

A drag made of wood is generally used for breaking clods, pulverizing and leveling the field after it has been plowed twice or thrice. A spike-tooth harrow made of wood can be easily made by a village carpenter. (See Figure 18.) The one shown in Figure 19 has a wooden beam and steel spikes. The width of these harrows can vary from 5 to 8 feet. These would be light enough for a pair of oxen to pull. They would also be inexpensive to build.

The spike-tooth harrow shown in Figure 20 may be a little more costly, but it is much more efficient than
Figure 16

Allahabad plow.

Figure 17

A moldboard plow.
the other two. It has a steel frame with adjustable steel spikes. Some farmers can buy their own harrows and others can rent them from the village cooperative society.

**Seeding Machine**

The only seeding machine known to a village farmer is the human hand used for broadcasting. Large quantities of seed are wasted by this method.

**Dibbler**

The dibbler, shown in Figure 21, can be used with some saving in seed and time. This device has a wooden frame 3 ft. x 1 1/2 ft. with a long handle in the center. There are 27 pegs fitted at the bottom of the frame in three rows 9 inches apart, the spacing between any two pegs being 4 inches. The pegs may be fixed or preferably adjustable for depth. The weight is approximately 10 pounds. One man can drill holes in the field by pressing the dibbler in the ground. Another man will drop the seed in the holes, thus made, and cover them by foot. This dibbler also can be made very easily by a village carpenter. The cost of such a dibbler would vary from $1.00 to $1.50 in West Pakistan.
Figure 18
A low cost spike tooth harrow with wooden spikes.

Figure 19
A low cost spike tooth harrow with steel spikes.
Figure 20
Improved spike tooth harrow.

Figure 21
Dibbler
Drill

The sowing season is very short and therefore, time is an important factor in this operation. If a 5-disk McCormick Seed Drill could be imported, and rented out to the farmers by the cooperative society, it would expedite the seeding operation. The saving in seed wasted by broadcasting would be enough to justify the cost of the machine. Even a small seed box mounted on a plow would be better than broadcasting.

The small grain drill shown in Figure 22 can be made in agricultural workshops. It has 5 rows with 10 inch spacing between seeding tubes. This machine would be too costly for small farmers to buy. The village cooperatives should be encouraged to buy and rent them to farmers.

A comparison of the costs of sowing with a seed drill to hand broadcasting behind a plow in the Etawah district of India is shown in Table 13, converted into U. S. currency.
Table 13

Relative Costs of Seeding by Drill and by Plow Based on One 10-Hour Day

<table>
<thead>
<tr>
<th>Seed Drill</th>
<th>Behind the Plow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>Cost</td>
</tr>
<tr>
<td>Bullocks</td>
<td>2</td>
</tr>
<tr>
<td>Men</td>
<td>2</td>
</tr>
<tr>
<td>Machine hire (for 3 acres)</td>
<td>1.58</td>
</tr>
</tbody>
</table>

Total cost

<table>
<thead>
<tr>
<th>Acres covered</th>
<th>Cost per acre</th>
<th>Seed rate per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>$1.16</td>
<td>60 lb.</td>
</tr>
<tr>
<td>1</td>
<td>$3.47</td>
<td>130 lb.</td>
</tr>
</tbody>
</table>

The saving per acre in using a seed drill, thus, comes out to be $2.31 and 70 pounds of seed. If a machine sows 40 acres in one season, the saving in seed comes out to be 2,800 pounds, whose price at 3¢ per pound in Pakistan would be $84; this is enough to cover the cost of one machine.

Harvesting

A. Sickle: The harvesting machines used in the United States cannot be introduced in Pakistan in the near future. They are too costly to buy, even for a village cooperative society. The harvesting period is
Figure 22

A simple low cost grain drill which can be manufactured in West Pakistan.

Figure 23

A pedal-operated Japanese paddy thresher.
very short and the only way to expedite this operation is to improve the little hand tool called the "sickle" used for harvesting the crop. The ordinary sickle, commonly in use, has a blade 14 inches long which is not even sharp enough to cut the stalk quickly. One man can barely cut one quarter of an acre in a day. The sickle shown in Figure 24 was evolved in India with the following special features:

1. It was serrated, which increased the speed of cutting considerably.
2. A particular angle was given to the blade which provided about 9 inches of cutting edge.
3. It was made from high carbon steel and would therefore last longer.
4. The blade was given a downward dip which enables it to cut closer to the ground.
5. The handle was designed to protect the hand from being injured. It was comfortable to work with and hold.

Such a sickle can be very cheaply made by a village blacksmith from scrap material. It was shown that the cutting speed with this sickle was improved from 1/4 to 1/3 acre per day.
B. Mower: Another possibility for speeding up the harvesting operation would be to purchase animal-drawn mowers. They require some skill to operate, but they have been proven satisfactory. These again can be purchased by the village cooperative society and rented out to the farmers.

**Threshing**

Threshing done by the primitive methods mentioned in the preceding pages is a very lengthy operation. The wheat crop lays on the ground for more than a month and often the farmer suffers huge losses from rain and winds.

A. Olpad Thresher: The old models of olpad thresher were all made of wood. They consisted of a wooden frame with 20 disks, 18 inches in diameter. The disks had teeth $1 \frac{1}{4}$ inches deep at $1 \frac{1}{2}$ inches pitch. The bearings were wooden blocks with holes to carry the iron ends of the axles. The whole machine was so weak that it went loose in no time, with the result that there was always some trouble.

Later on, many improvements were made. Wooden disks and bearings were replaced by steel, the frame was changed to angle iron, and the axle was made out of a steel bar $3/4$ inch in diameter with wooden blocks.
as spacers between the disks. In 1952 an improved model was introduced in India, as shown in Figures 25 and 26. It had no wooden parts except the seat plank. The axle was changed to a 5/8 inch square steel rod and the spacers were made of cast iron sleeves. Expanded metal guards were fixed over the frame as a safeguard against accidents. The bearings were made of cast iron with small holes for lubrication. Wooden bushings were provided inside the bearings. A rake made of iron flats was fixed behind the thresher, as shown in the Figure, and it could be operated from the seat when needed, by means of a handle.

This implement is very simple in construction and very easy to operate. It is not very costly and does not require any special care and maintenance. It can be easily made in the agricultural workshops. Village cooperatives can purchase and rent them out to the farmers. A farmer with large holdings can afford to purchase one for himself. Any minor repair or the replacement of wooden bushings can be done by a village blacksmith or the farmer himself. The farmers should be encouraged to do minor repair work on their equipment.
Figure 25
Improved Olpad thresher.

Figure 26
Improved Olpad thresher at work.
It has been shown that the cost of threshing wheat by bullocks is 2-1/3 times greater than threshing done by the olpad thresher.

B. Japanese Paddy Thresher: The type of thresher shown in Figures 23 and 27 seems to be the most suitable for small rice farms. This machine is pedal operated, simple in construction, light in weight and easy to manufacture. It is also very convenient to operate. By a little practice, any villager can work this machine easily. There are no delicate parts to damage or fine adjustments to make.

The speed of the drum is 350 - 370 r.p.m. obtained by treading the pedal about 100 times per minute. One man can operate the machine and the average output is about 26 pounds of threshed rice per hour. The machine is shown working in Figure 27. Grain falls behind the machine and the whole stalk is left in the hand. This machine has been shown to be about 70 per cent more efficient than the old method of flailing.

**Scoop**

Village fields are often uneven and require leveling. The scoop shown in Figure 28 is a very handy device for this purpose. It is made of steel plate with a suitable curve, and can be pulled by a pair of bullocks. A man
Figure 27

Japanese Paddy thresher shown working.
Figure 28
Scoop.
works the scoop by raising or lowering the handle as required. This is illustrated in Figure 28.

**Yoke**

The yoke is a device through which the bullocks transmit power to the implement pulled behind. The old yoke in use for centuries is directly tied to the implement and thus wears out very quickly. Its design is such that in many cases, the neck of the animal is injured and bleeds most of the time. This reduces the efficiency of the animals.

The yoke shown in Figure 29 is better designed at no extra cost. The curved surface touching the animal's neck makes it comfortable for them. It has an iron ring in the center and the implement is tied to it by means of a rope. Now the rope wears out instead of the yoke.

**Implementation of Program**

The success of a development program very much depends on the way it is implemented. The method of implementation is an important factor in making a program a progressive and dynamic one. No matter how useful a machine is, it does not have any practical value unless it is adopted and used. As has been
Figure 29

Improved yoke.
mentioned before, the present study aims at providing both tools and training to the farmers. So far we have suggested the means and ways of improving the farming methods and implements in the light of existing social and economic conditions of the country. The problem of making the farmer adopt and make the best use of them is still unsolved. In other words, the next most important step is to make a plan for the propagation of improved implements. Such a plan would involve a vast study of the local conditions, administrative structure of the government and many other considerations, and as such, the detailed research on these factors is beyond the scope of present study. Also, because the local conditions are so divergent from place to place within the country and the government policies are so uncertain, it is not possible to suggest a comprehensive program of implementation without consulting the local government authorities. However, some general suggestions can be made.

It has been generally experienced that the uneducated farmers are prone to continue the old traditions and methods of farming. They would reject the improved quality of seed and would refuse to adopt better methods of farming without giving any reasons. Probably the reason in their minds is that,
"what was good for their parents is good for them". This is mainly because of illiteracy of the rural people. Therefore, apart from many other social and economic problems involved in introducing new agricultural practices, there is always some human inertia to be overcome. This is more aggravated in West Pakistan because of the high rate of illiteracy of the people.

The importance of some kind of extension service and cooperative farming societies needs no emphasis. Cooperative farming societies are already started in West Pakistan, but they are mostly limited to newly developed areas, and to the rehabilitation of refugees. The program of Village Agricultural and Industrial Development has also been launched very extensively. The fundamental aims of these organizations is to create a spirit of self-help, quality of leadership and cooperation among the villagers and to create conditions for over-all development and better standards of live. The workers are generally selected from among the villagers. No doubt the results of first experiments are very encouraging and more attention is being directed toward this field of endeavor, but there is need for better staff and skilled workers, so far as the introduction of new agricultural
implements is concerned. The program of providing improved implements and training to the farmers may be included as a part of the Village-AID program, or else it may preferably be entrusted to the engineering section of the Department of Agriculture. In each case, a separate staff, comprising qualified agricultural engineers, mechanics and laborers, should be constituted exclusively for the purpose of mechanizing the farms. The duties of this staff shall be to design new machines, improve the old ones and demonstrate on the farms the working and maintenance of these machines. Agricultural workshops recently set up in West Pakistan will be available for this purpose. To start with, this project should be implemented as an experiment in a selected area. If proved successful, of which the author is very confident, it can be spread over to other areas on a larger scale. When the farmers are well trained and are able to continue using the implements without external help, the government should hand over the management of machinery to the cooperative farming societies. The principal objectives of the existing cooperative farming societies are:

1. To supply good seeds, fertilizers and improved agricultural and industrial implements.
2. To acquire implements, machinery or cattle for hire to its members.

3. To disseminate knowledge of the best methods of farming, by demonstration or otherwise, in consultation with the agriculture department.

4. To encourage the development of cottage industries and other subsidiary occupations and to provide facilities in respect of funds, raw materials, tools, technique and the marketing of the finished produce.

5. To create funds for loans to members.

6. To arrange for and maintain facilities like playgrounds, roads, schools, hospitals, water supply, drainage, electricity, reading rooms, and other objects of common advantage for the members.

7. To undertake any other measures designed to encourage in the members the spirit and practice of thrift, mutual help and self-help and to raise their standard of living.

The foregoing objectives are quite comprehensive and much improvement can be achieved through the implementation of these objectives with proper assistance from the government. These societies will be unable to carry out demonstration of farm machinery
without the guidance of agricultural engineers in the initial stages. Hence, it is imperative that engineering staff, as proposed above, must be entrusted with the responsibility of implementing the program of mechanization. Later on, the cooperative societies can continue the management with occasional advice from the department.

The government will start the implementation program in the project area and the staff will be headed by an Executive Engineer with his headquarters in the nearest agricultural workshop. The implements shall be taken to the villages and demonstrations will be made right on the farms. Preferably two pieces of land adjacent to each other shall be farmed, one with the old implements and the other with the improved ones. The resulting comparative increase in production through the use of improved implements shall prove the utility of the new machines. The farmers then, can be given these machines on nominal rent for their own use. Due consideration shall be given to the constructive suggestions and difficulties of the farmers, and thus further improvements in the machines shall be possible. The following factors must be kept in view while giving demonstrations:
1. It must be made sure that the implement is really useful to the area where it is introduced.

2. The worker who goes to demonstrate the implement in the field, must be convinced of its utility. A half-hearted worker always creates a bad impression in the field. A failure of one demonstration, especially the very first one, would be a serious setback. It may take many times more effort and patience to make up and re-establish the confidence of the farmers, who are apt to forget a hundred successes, but will never forget one failure.

3. An implement is demonstrated in the farmer's own field under normal conditions. It would be better to let him follow his usual practice in half the field, while in the other half new methods are practised.

4. Average bullocks, preferably those belonging to the farmer, should be used. In case of a hand-operated machine, it should be shown to the farmer that he can learn to operate it after a short period of instruction.
5. The instructions should be made as brief as possible in the form of steps or points.

The foregoing principles should be closely followed in regard to the demonstrations. After the usefulness of the implement has been established through demonstrations and the farmers are convinced of its utility, the machine should be put on hire by fixing a suitable rent for the next season. Experience shows that if anything is given free to the people, it dampens their initiative and the spirit of self-help. When this practice is established, the village cooperative society will take over the management, and then the farmers will pay the rent to their own organization and as such they will help themselves. It is estimated that the first experimental project will take about one and a half or two years. Then the program shall be expanded over a larger area and the same process shall be repeated on a larger scale. If this program is carried out successfully, it is estimated that almost the whole of West Pakistan can be covered in about 20 years time, and by the end of 25 years, almost every farmer will be using efficient animal-drawn implements and a few of them will be in the process of switching over to the use of tractors. If the practice of cooperative farming and the over-all development of
the country continue at a reasonable rate, it is hoped that by the end of the plan period, there will be a general trend of changing over to the modern methods of farming.

Agricultural Engineering Education

There is a great dearth of agricultural engineers and technicians in the country. There are three agricultural colleges in West Pakistan at present, but none of them has curriculum in agricultural engineering. It is strongly recommended that agricultural engineering courses should be taught in all the agricultural colleges in conjunction with the engineering colleges as soon as possible. At present, the number of agricultural engineers in the country can be counted on the fingers, while the country is said to be predominantly agricultural. Highest priority should be given to agricultural engineering education. For the present needs of the country, more and more students should be sent to the U. S. A. for agricultural engineering education. A separate department of agricultural engineering should be set up in the Department of Agriculture and the research in agricultural implements should be carried out in the agricultural workshops.
CONCLUSIONS

Pakistan is an independent sovereign state in Asia with a population of 80,000,000 people who are mostly illiterate. Sometimes called a geographical absurdity, Pakistan is divided into two parts, each part being 1,100 miles away from the other. West Pakistan is mainly a broad plain of good agricultural soil. The mighty Indus River and its tributaries are the main source of water. Although the rainfall is insufficient for agricultural purposes, West Pakistan has a magnificent canal irrigation system. West Pakistan has very little heavy industry and limited resources. However, during the last 9 years, Pakistan has made tremendous progress which is evidenced by the fact that industrial production during the year 1956 was about 7 times as much as during 1948. Iron ore and natural gas have been discovered in West Pakistan in large quantities, and there are possibilities of further discoveries of these and other minerals. A number of irrigation and multi-purpose projects have been undertaken. Foreign aid, especially U. S. economic aid, has been a great source of encouragement and assistance for the people of Pakistan. Development of Pakistan's resources during the last few years has been very rapid and under the
circumstances, it is estimated that Pakistan will have a sound economic condition and the people of Pakistan will be enjoying a reasonably good standard of living within the next two decades. An increase of 25 per cent in the national income is envisaged by the end of 1960 in the recent 5-year development plan.

Agriculture is the backbone of Pakistan's economy. The principal export commodities are agricultural, more than 90 per cent of foreign exchange earnings is contributed by agricultural products and 85 per cent of Pakistan's population lives in villages. Pakistan's greatest concern is her low agricultural productivity per man per acre. The principal reason for this is the use of obsolete farm implements and primitive farming methods. Having 4 times as much waste land, much of which can be reclaimed, as its annual cropped area, West Pakistan has wide possibilities for mechanization of farms. Although tractors and modern farm equipment can be used in development areas and reclamation projects which will provide employment for millions of jobless laborers, greater efficiency of human efforts and animal power can be achieved, in the immediate future, through the improvement of existing hand tools and inefficient farm implements. Immediate introduction of tractors and heavy farm
machinery in place of animal power and obsolete implements, is neither feasible nor possible under the present social and economic condition of West Pakistan. It is for this reason that this study was undertaken. A detailed plan for the improvement of implements available to the farmer and a proposal for the implementation of the plan has been suggested. It is proposed that the government organize a separate staff capable of improving the design of farm implements and demonstrating them to the farmers. An area comprising about 100 villages may be selected for the first experiment. After two years the program may be expanded to about 10 such project areas, and within the following 5 years, 50 such development areas comprising 5,000 villages can be covered. If the progress is satisfactory, it is estimated that in about 15 years of time, 25,000 villages can be brought under this project. Figures are not available, but making a very rough estimate of 50,000 villages in West Pakistan, it is estimated that the whole of West Pakistan can be mechanized by the end of 25 years. By that time it can be hoped that every farmer of West Pakistan will be using improved animal-drawn farm implements, and a few big farmers will be using tractor powered implements. Before the end of this plan period, the country will
have made significant progress, most of the waste land will have been developed, hundreds of thousands of acres will have been reclaimed, many irrigation and multi-purpose projects will have been completed, dozens of factories and mills will be in production, many new factories and dams will be under construction, and the overall economic condition of the country will be sound. At that time it is imagined that there will be a state of real industrial revolution throughout Pakistan. It is at this stage that a new program of farm mechanization will be needed which will aim at the introduction of tractors and modern farm machinery in West Pakistan. This might well take another 25 years when the country will be completely mechanized.

The greatest difficulty encountered in developing this program of mechanization was the lack of current data on the agriculture of West Pakistan and the limited time available. The author had to be content with whatever information was available from sources within the United States. Therefore, very rough estimates have been made. The basic approach, however, is sound. A careful study of local conditions should be made before attempting to implement the overall broad program. There are many limitations to the implementation and success of the program, such as the
government policies, economic situation of the country, speed of industrial development, reclamation of waste land, and the development of village industries. The author, in consideration of the needs of West Pakistan, has presented this program of farm mechanization in the light of the social and economic structure of the country and is very hopeful of satisfactory results if the program is implemented as outlined.
Figure 30

A Pakistani farmer.
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APPENDIX

COMPARATIVE COSTS OF BULLOCK-FARMING AND TRACTOR CULTIVATION
Cost of Bullock-Farming

The cost of bullock-plowing has been calculated in two different ways. The following method is more accurate because it includes depreciation on cattle and implements while the other method does not.

Cost of Bullock-Flowing Per Acre

Flowing 1 acre in 2 days @ Rs. 2½ a day = \(5\) Rupees

Labor @ Rs. 1½ per day for 2 days = \(2\frac{1}{2}\)

Depreciation of cattle and implements = \(\frac{1}{8}\)

Total Rs. = \(8\)

($1.68)

This analysis has been made on the assumption that one pair of bullocks costs Rs. 2½ per day for their maintenance and plows \(\frac{1}{2}\) acre per day which is very nearly true. Wage rate of a laborer is assumed to be Rs. 1½ per day. Thus, the cost of plowing per acre works out to be Rs. 8. But the committee (33) says that

* One Rupee (Re. 1) = 21¢ in U. S.
several witnesses considered the cost of bullock cultivation higher than Rs. 8 per acre in the former Punjab Province.

**Tractor Cultivation**

Three types of tractors have been considered using kerosene and diesel as fuel. Use of gasoline has been ruled out because it is too expensive in Pakistan. Statistics for three types of tractors are given in Table 14, after several thousand hours test.

Table 14

Statistics for Three Types of Tractors

<table>
<thead>
<tr>
<th>Type of Tractor</th>
<th>No. of Cylinders</th>
<th>Engine Speed r.p.m.</th>
<th>Horse Power</th>
<th>Fuel Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>900</td>
<td>34</td>
<td>Powerine or Kerosene</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>1,350</td>
<td>33</td>
<td>High Speed Diesel</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>540</td>
<td>35</td>
<td>Crude Oil (Light Diesel)</td>
</tr>
</tbody>
</table>
Working Cost Per Hour

This is based on 8,000 hours to 10,000 hours as life of a tractor and the monthly work as 80 hours. This is shown in Table 15.

Table 15
Comparison of Working Cost Per Hour of Three Types of Tractors

<table>
<thead>
<tr>
<th>Type of Tractor</th>
<th>Fuel, Lubricants, Spares &amp; Depreciation</th>
<th>Labor for 80 hours per mensum and overhead</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>* Rs.</td>
<td>As.</td>
<td>Ps.</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

Depreciation of Implements

Three types of implements were considered:
1. Harrow (2" to 3") . . . . . Re. 0-6-0 per hour
2. Cultivator (5" to 6") . . . Re. 0-6-0 per hour
3. Disk Tiller (5" to 6"). . . Re. 1-0-0 per hour

* Rupees. One Rupee (Re) = 16 Annas (As)
One Anna = 12 Pies (Ps)
The output of these three tractors in different operations is as follows:

With Harrow . . . . . . . . 2.0 acres per hour
With Cultivator . . . . . . . 1.2 acres per hour
With Disk Tiller . . . . . . . 1.2 acres per hour

The approximate cost of operation per acre with the three tractors works out as shown in Table 16.

Table 16

Comparison of Cost of Operation Per Acre
With Three Types of Tractors

<table>
<thead>
<tr>
<th>Type of Implement</th>
<th>Type of Tractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Harrow</td>
<td>Rs. 3, As. 12</td>
</tr>
<tr>
<td>Cultivator</td>
<td>Rs. 6, As. 5, Ps. 3</td>
</tr>
<tr>
<td>Disk Tiller</td>
<td>Rs. 7, As. 8, Ps. 3</td>
</tr>
</tbody>
</table>

From these figures we can see that with the harrow, which compares with bullock-plowing, the cost per acre per operation is less than half the cost of bullock-plowing. Even with the cultivator which does much better work than bullock-plowing, the cost is about 3/4 that of bullock-plowing.