

RESEARCH STUDY

**AGRICULTURE MODEL OF CHINA & ITS POSSIBLE REPLICATION IN
PAKISTAN**

**PLANNING & RESEARCH DEPARTMENT
ZARAI TARAQIATI BANK LIMITED**

Table of Contents

1. Agriculture in China	3
2. Salient features of Chinese Agriculture	3
3. Major Crops in China & Pakistan	3
4. Difference between Pakistani Agriculture & Chinese Agri-yields	4
5. Difference between Chinese and Pakistani Farm holding	5
6. Difference between Agriculture Labour Force	5
7. The Chinese Agri-Model	5
8. The Construction Models of the Pilot Counties	6
9. The Models of Eco-Agricultural Engineering in China	7
10. Chinese Eco-Farming	9
11. Chinese fisheries model	12
12. Agriculture in Pakistan	13
13. Cropping pattern of Pakistan	13
14. Agro-Ecological Zones and Crop Production Regions	14
15. Government's Role in Agriculture Development	17
16. Contribution of Agriculture Development Bank of China (ADBC) in Agriculture	17
17. Replication of Chinese Model in Pakistan	17
18. References	18

Agri-Model of China and its possible Replication in Pakistani Environment

The agriculture is vital to China as it employs over 300 million farmers. The world is looking up to the Chinese agriculture model with appreciation because of huge agriculture production. In 2014 the Chinese farmers' lives were improved. The per capita disposable income of rural residents grew by 9.2%, outpacing that of those living in urban areas. In rural areas, the number of people living in poverty was reduced by 12.32 million, and over 66 million more people gained access to safe drinking water.

Agriculture in China

China is the world's most populous country and one of the largest producers and consumers of agricultural products. Although China's population is more than four times that of the United States, its cropland area is only 75% of the U.S.A. total. China uses intensive farming practices to produce large amounts of food and fiber from limited supplies of land, water, and other natural resources. Indeed, the value of China's agricultural output is about twice that of U.S.A.

China is one of the world's leading importers of agricultural products, as well as major exporter of agricultural commodities. China's trade pattern in agricultural commodities follows its comparative advantage. It tends to import land-intensive commodities (such as soybeans, cotton, wheat, and barley), and it exports labor-intensive commodities (such as fish, fruits, and vegetables). China has also been a major exporter of corn in most years.

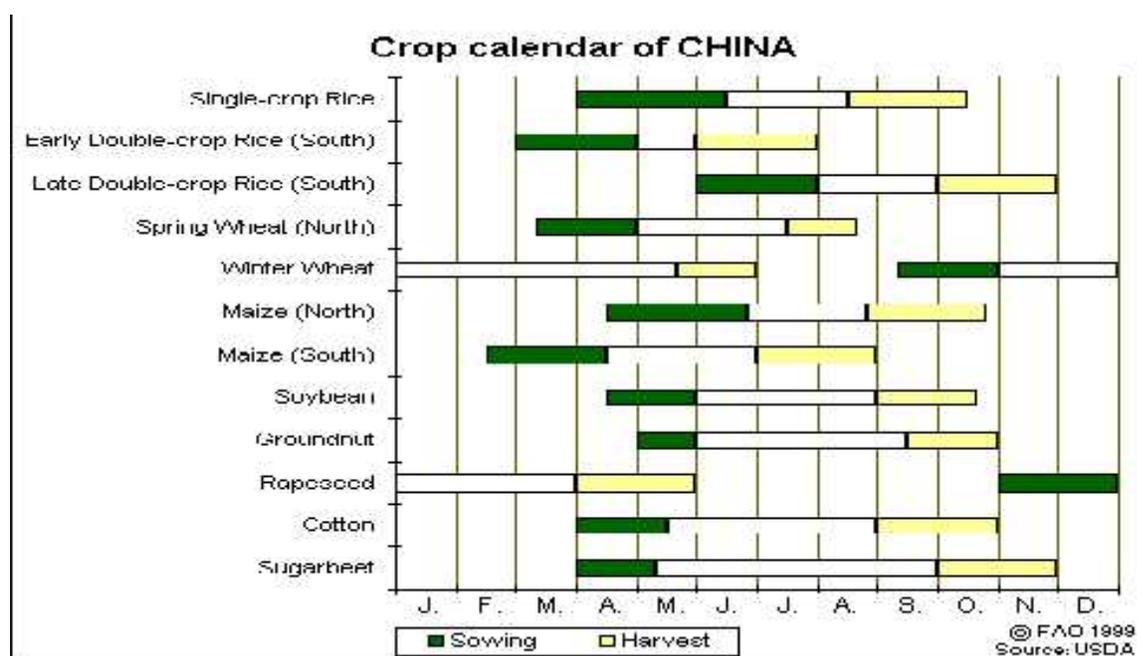
China accounts for 10% of arable land, produces food for 20% of the world's population and ranks first in worldwide farm output. They made it possible by devising different techniques to increase yield of crops by making use of nature, and farming termed as Eco-Farming.

Salient features of Chinese Agriculture

Chinese Agriculture contributes slightly less than 20% to GNP. Vast majority of Chinese farmers own only 0.5 ha per family. Therefore they optimize per unit area with very high cropping intensity. All land in China belongs to State .farmers are given land only on transferable lease for 30 years. Inputs of fertilizer and others are high. Government provides certified seeds for all crops. Government has developed an excellent infrastructure with roads, electricity and phones in each village. State provides irrigation facility where possible. Subsidy is provided for installing biogas plants in sub-tropical areas. Hybrid seed for maize and rice are used and for cotton whole area under cultivation is under BT cotton (hybrid).TV and Radio are used for information dissemination.

Major Crops in China & Pakistan

Major crops in china and Pakistan are almost similar .Wheat, Cotton, Rice, Corn, Sugar-cane except that soybean is minor crop in Pakistan while it is a major crop in China however, per acre yield of different crops largely varies. Cropping pattern is similar except double cropping in China due to cultivation of a hybrid variety of Rice.



Difference between Pakistani Agriculture & Chinese Agri-yields

Pakistan's per hectare rice yield is 3.1 tons, whereas China is the largest producer of rice with per hectare yield of 6.5 tons. Similarly, Pakistan produces pulses per year with per hectare yield of 0.6 tons and China produces 1.2 tons per hectare. Pakistan's sugarcane production is 52.4 tons per hectare whereas China obtains a yield of 65.7. (Source: Pak-China Joint Chamber of Commerce and Industry; PCJCCI).

Table1: Comparative Crop Yield of Pakistan & China

Sr.No.	Crops	Yields in Pakistan Kgs/Hectare 2011-12	Yields in Pakistan Kgs/Hectare 2013-14	Yields in China Kgs/Hectare 2011 year
1	Cotton	815	773	1,308
2	Wheat	2,714	2,797	4,837
3	Sugarcane	55,196	56,666	66,485
4	Rice	2,396	2,437	6,687
5	Maize	3,991	4,053	5,748

Source: Economic survey of Pakistan 2013-14 General Survey of Crop production 2011 ,Ministry of Agriculture ,China

Difference between Chinese and Pakistani Farm holding

Chinese agriculture differs from that of Pakistan in holding size and ownership. Chinese farmers have extremely small holding size and no private ownership. Chinese farmers own only 0.5 ha per family while in Pakistan average size of farm in the country is 2.59 ha acres whereas cultivated area per farm is 2.10 ha. Owners possess 75% of farm area, while 14% area is possessed by owner cum tenants and rest 11% belongs to tenants.

Difference between Agriculture Labour Force

According to general survey of crop production 2011 of Ministry of agriculture of china the agriculture labour force is 53% of the total Chinese Labour Force while in Pakistan agriculture contributes to 43.7% of total Pakistani labour force according to the Economic Survey of Pakistan 2013-14.

The Chinese Agri-Model

Chinese model involves use of hybrid seeds, better water management, increased role of government for ensuring effective safety and support mechanism and public-private partnerships.

The Definition of the Chinese Eco-Agriculture

Chinese eco-agriculture is a new integrated agriculture system which integrates agricultural production, rural economic development, environmental improvement and protection, resources fostering and using together effectively.

The Characteristics of Chinese Eco-Agriculture (CEA)

- 1). **Development objectives.** It aimed at harmonizing the human being and nature; facilitating the sustainable development of agriculture, rural economic development and social development; and, achieving the integrated decision-making of multiple objectives.
- 2). **Eco-technologies.** It requires to achieve the optimization of the whole agriculture technical system and to exert the advantages of the integrated technologies through a series of typical eco-engineering models.
- 3). **Production structure.** It specially emphasis the structure optimization of agriculture, forest, animal husbandry, fishing and side occupation, and strengthening of their linking, so it develops the integrated agriculture system of eco-economic optimized and facilitated each other.

The Phases of Eco-Agriculture in China

Phase 1

From the end of 1970s to the mid of 1980s. Its start mainly focused on studying and small scale experimental unit.

Phase 2

From the mid of 1980s to early 1990s. It focused on establishing agricultural village and farm unit and study on eco-engineering models and special technologies. The research on pilot eco-agriculture county was initiated.

Phase 3

Since the early 1990s. The construction of the pilot eco-agriculture county was initiated.

Phase 4

Since 2000. Eco-industrialization is underway.

The Main Achievements of Eco-Agriculture in China.

- 1) To advance sustainable healthy development of agricultural and rural economy
- 2) To raise the agricultural resources use efficiency and improve the eco-environment.
- 3) The pilot eco-agriculture counties play a considerable pilot role.
- 4) To strengthen the consciousness of eco-environmental protection and bring good social effects.
- 5) To form many good eco-agriculture models and eco-technical systems.

The Construction Models of the Pilot Counties

1. Models in Fragile Ecological Zone
2. Models in Plentiful Eco-resources Zone
3. Models in Main Grain Production Zone
4. Models in Developed Coastal and Suburban Zone

1. Fragile Ecological Zone

Mainly includes the upstream regions of Yangzi River and Yellow river, the windy and sandy north area and other regions which have more mountains and plateaus area. The pilot counties in the Zone have poor natural and economic conditions.

The basic model is the **three approaches** of treatment and structure optimizing:

Firstly, it should improve the exasperated eco-environment, especially recover vegetation;

Secondly, it should emphasizes the agricultural infrastructure construction, especially the basic farmland construction;

Thirdly, it should optimized the agriculture produce structure, especially raising the yields of cereal crops and reducing the area of cereal crops, expending the area of forest, fruits and animal husbandry.

2. Plentiful Eco-resources Zone

The pilot counties in Plentiful Eco-resources Zone have poor traffic and economy, but have rich natural and ecological resources.

The basic model is the **three approaches** of Eco-agriculture protection and industry development:

Firstly, protecting the eco-environment and natural resources, and keeping the superiority of eco-agriculture;

Secondly, strengthening the agricultural infrastructure construction;

Thirdly, developing the characteristic agricultural products and develop the eco-industry.

3. Main Grain Production Zone

Main Farm Production Zone mainly lies in plain where main products, such as grain, cotton and oil crops are scoping. The pilot counties in the Zone have the developed planting and animal breeding, and have a developed mechanizing, intensive and scoping agriculture industry.

The model is to form a **benign circulation of the industrialized farming** management by combining farming with breeding and processing, and to establish an agricultural industry system with efficient use of resources.

4. Developed Coastal and Suburban Zone

The pilot counties lie in the coastal and suburban areas, which having higher agricultural industry level, higher technology level and developed economy, which stand for the higher development level of Chinese agricultural modernization.

The main problems are the high inputs, high cost of the labor force and the agricultural environment pollution. Meanwhile, due to its good locations and big markets, it suits for developing the high quality agricultural products. The model could be named **Technology Leading Model**.

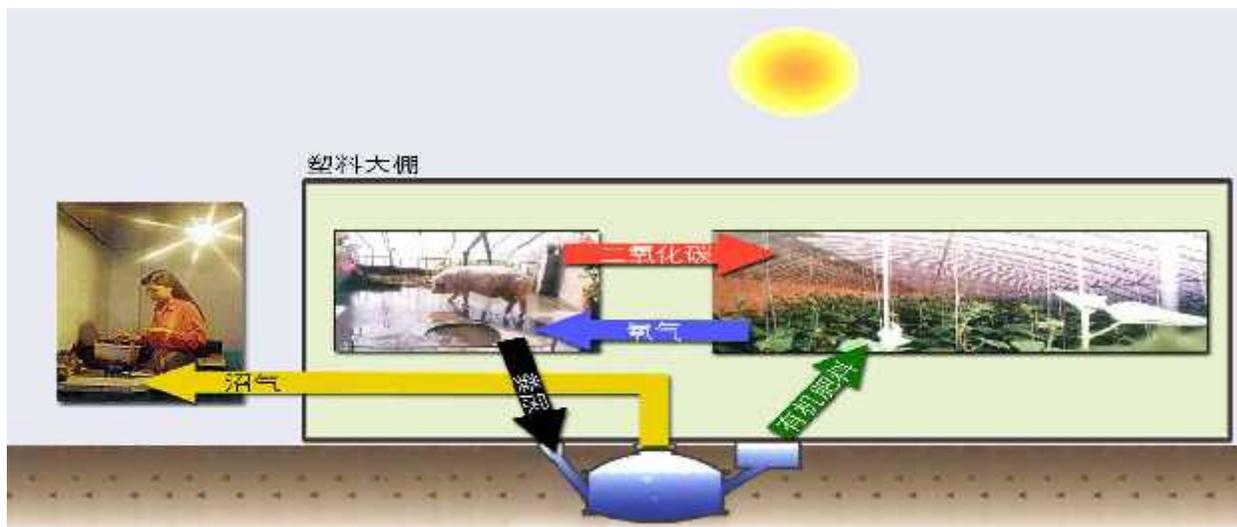
The Models of Eco-Agricultural Engineering in China

1. Four in One Model in North China
2. Five in One Model in North West China
3. Pig-Biogas-Fruit Tree (Or Rice, Vegetable, Fish) 'Model in South China

1. Four in One: Biogas generating pool, pig house and vegetable are assembled in solar greenhouse. The solar greenhouse provides feasible temperature and moisture for biogas

generation, pigs & vegetable, and the pigs can raise the temperature in solar greenhouse. The respiration of pigs and burn of biogas produce carbon dioxide to vegetable, which could increase the yield of fruit vegetable by 20%, or of leaf vegetable by 30%.

In common, one household can raise 10 pigs, plant 150 square meter vegetable, and produce 300 cubic meter biogas per year. The average income raise is 3500 RMB per year.



2. Five in One:

A schematic diagram of model is as under:



3. 'Pig-Biogas-fruit tree (or rice, vegetable, fish) 'model in South China

Leading by animal husbandry, biogas production combined with foodstuff, sugarcane, tobacco, vegetable, fruit, fish and other production. The core of this model is the biogas production pool. The excrement of human and pigs can be converted to biogas. Residue of biogas production can be used to plant fruit tree, fish, pig and vegetable.

More similar models can be found in 'pig-biogas-fruit tree' in Ganzhou, Jiangxi province; 'pig-biogas-rice' and 'pig-biogas-vegetable' in South China. Every household can produce 300 cubic meter biogas per year, which cuts down the cost 150 by RMB and the saving of fertilizer and pesticide can be cut down by 350RMB. The income can increase to 1500RMB from the improving of quantity and quality of products. The net income of a household can be increased to 2000RMB per year.

China Moving Towards Eco-agricultural Industrialization Development

Now China is moving towards eco-agricultural industrialization. This phase is characterized by the following:

- 1) Non-pollution (product, environment, input)
- 2) Market Orientation (local, regional, global)
- 3) Institutionalization (standardization—EU, America, Japan, UN, IFOAM)
- 4) Industrialization (variety, input, growing, fostering, processing, service-authentication, consultation and symbol, etc)
- 5) Internationalization (standard, market)

Chinese Eco-Farming

Rice Duck Farming In China

The eco-friendly techniques include "rice duck farming", where ducks are raised on rice paddies and feed on pests and weed. This means that farmers do not have to use earth and water-ravaging chemical pesticides or herbicides.

Duck droppings are an excellent natural fertilizer to rice plants. Growing two or more crops in proximity helps reduce disease outbreaks. Such a technique reduces loss from rice blast disease, caused by a destructive fungus that damages panicles and leaves, before rice grains are formed.



Rice-Fish Farming in Southeast China

Qingtian rice-fish culture system is a typical mode of eco-farming, in which rice provides shade and organic matter for fish, in turn, fish removes the weed, loosens the soil, improves fertility, provides oxygen and devours pests. This eco-cycle system greatly reduces the dependence on external chemicals and increases system biodiversity. In the typical farmland ecosystem, rice and weeds are producers; fish, insects and all kinds of aquatic animals such as loach and eel are the consumers; while bacteria and fungi are the decomposers. Fish eats insects, while weeds and fish manure nurtures the paddy field.



Dry land Farming System

In Dry lands millets are grow in sand with superior natural environment; and farmyard manure are applied, coupled with biotechnological pest control. The Aohan region in Inner Mongolia

wins the reputation of best miscellaneous grain producer in China and plays an important role in safeguarding food security and food safety.

Raised Beds over Water

Xinghua Duotian Agrosystem is a typical example of wetland agro-system, known for its indigenous management of low-lying land in water bodies and the splendid landscape created by miles of “duotian” (elevated pieces of field) above water which is rarely seen in the world. Duotian are islets of different size created by ancestors of local people over 1000 years ago to meet their subsistence needs. They were built in swamps by people digging and piling muddy soil together, turning not farmable wetlands into quality fields. Crops grow on these raised plots above water and fish or waterfowl swim in water around them. It is a unique way to use available land and soil resources and it offers local people not only freedom from floods but also sustained livelihood. All farmers own boats.



Chinese Organic Farming

The rapid embrace of organic farming serves multiple purposes including food safety, health benefits, export opportunities and by providing price premium for the produce of rural communities.

Massive Research in Agriculture Technologies

China is massively investing in agriculture research and biotechnologies, in particular GMOs with a \$3.8 billion program in year 2010.

Food Sovereignty/National Grain Self-Sufficiency

China for long has focused on self-sufficiency in agriculture and is producing massive crops of grains.

Off-Shore Food Securitization

Off-shore food securitization normally involves holding agriculture assets abroad and using local labor. China invested \$30 billion in Soyabean farming in Argentina since 2005 to 2010 contributing to economic expansion and food securitization. China has 30 agriculture co-

operation agreements involving 2.2 million hectares (5.4 million acres) at regional level, in the Philippines 1.2 million acres and also in Laos, Kazakhstan and Russia.

Chinese Fisheries Model

Chinese Fisheries Model consists of the following parts:

1. Healthy Development of Marine Fishing

The 18,000 km-long winding continental coastline and more than 20,000 species of marine life have given birth to the vigorous development of Chinese marine.

2. Emerging Sea Farming

China has successively overcome the technical difficulties of artificial breeding and culture of prawn, sea fish, sea cucumber, ormer, etc., treatment of water for sea farming, development of feed and prevention of various breeding diseases, and has sped up the breed improvement and rejuvenation in the sea farming industry, cultured a great number of elite breeds and developed new breeding methods such as shallow sea raft breeding, three-dimensional breeding, deep sea cage breeding, etc. through transgenic technology, cell engineering technology, genetic breeding technology and sex control technology. In particular, the application of bioengineering technology, acoustic and optical technology in the industry has greatly improved the scientific and technological competence and industrial performance of the whole sea farming industry.



3. Development of Aquatic Product Processing and Export

With reform and opening-up furthering in China, the influence of international market on domestic market has been increasing. Driven by the growing international demand for aquatic products, the Chinese aquatic product processing industry has developed

rapidly with continuously and rapidly increasing scale, output and value. A great many leading aquaculture enterprises, integrating production, processing, transportation and marketing facilities, have developed continuously with enhanced competitiveness, and become pillars to Chinese marine fishery; the deep and intensive processing capacity of the companies has been obviously improved, and many high-quality products with fine packaging and rich nutrition and convenient for consumption have been on the market in large quantities, enjoying increasing market share

4. Distant Water Fishery

In the thirties years of reform and opening-up, China's fishery industry has made one more significant achievement: distant water fishery has begun to develop and ranked among the first in the world. In March 1985, the first distant water fishery fleet of China succeeded in entering the fishing grounds of West Africa in the Atlantic Ocean, a ground-breaking breakthrough in Chinese distant water fishery industry. Now after over twenty years of development, thanks to low-cost labor force, continuous technical and management innovation and public policy support, the Chinese distant water fishery has developed rapidly and continuously and become one of the most important distant water fishery countries in the world.

5. Development of Fisheries Breeding & Aquaculture Breeding

China has done remarkable progress in fisheries breeding and aquaculture breeding through following methods:

- a. High standard pond breeding
- b. Deep water cage breeding
- c. Kelp-breeding farms

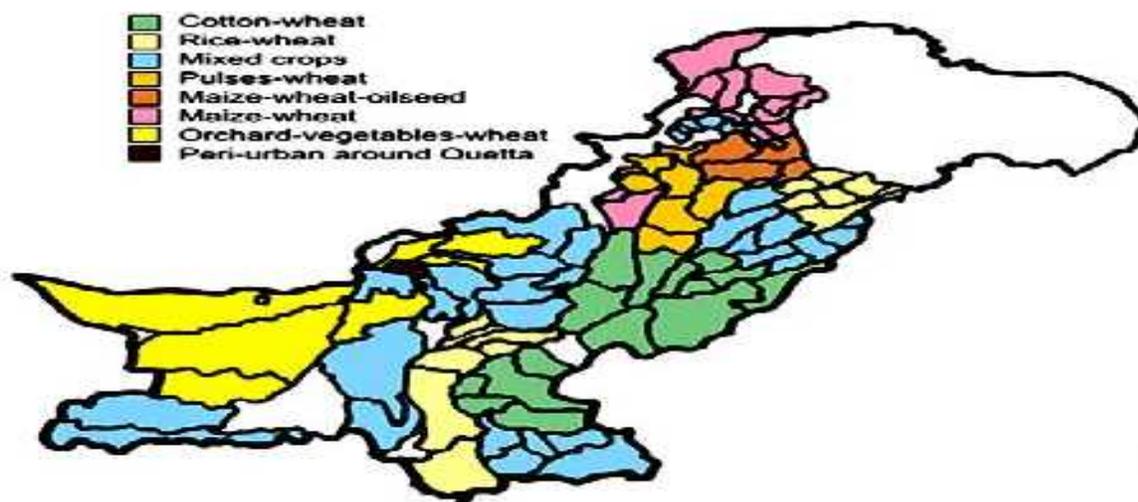
Agriculture in Pakistan

Wheat, Cotton, Rice, Corn, Sugar-cane are major crop in Pakistan. Pakistan's per hectare rice yield is 3.1 ton., Pakistan produces pulses per year with per hectare yield of 0.6 tons. Pakistan's sugarcane production is 52.4 tons per hectare.

in Pakistan average size of farm in the country is 6.4 acres whereas cultivated area per farm is 5.2 acres.75% of farm area is possessed by owners, while 14% owner cum tenants and rest belongs to tenants. Cropping intensity is 159% in Pakistan.

Cropping Pattern of Pakistan

The Cropping pattern of Pakistan is shown below;



The Agriculture Landscape of Pakistan

Agro-Ecological Zones and Crop Production Regions

Pakistan is situated between the latitudes of 24° and 37° north and longitudes of 61° to 75° east, stretching over 1 600 kilo metres from north to south and 885 kilo metres from east to west, with a total area of 796 095 square kilo metres. It has a subtropical and semi-arid climate. The annual rainfall ranges from 125 mm in the extreme southern plains to 500 to 900 mm in the sub-mountainous and northern plains. About 70 percent of the total rainfall occurs as heavy downpours in summer from July to September, originating from the summer monsoons, and 30 percent in winter. Summers, except in the mountainous areas, are very hot with a maximum temperature of more than 40 °C, while the minimum temperature in winter is a few degrees above the freezing point.

Agro-Ecological Zones in Pakistan

Basically, the country has been divided into ten agro-ecological zones based on physiography, climate, and land use and water availability.

Zone I

Indus Delta. The climate is arid tropical marine. The mean monthly summer rainfall is 75 mm and winter rainfall less than 5 mm. The mean daily temperature is between 34 °C and 40 °C in summer and between 19 °C and 20 °C in winter. The soils are clayey and silty. Rice, sugar cane, banana and pulses are the major crops.

Zone II

Southern Irrigated Plain, the Lower Indus Plain. The climate is arid and subtropical. The mean monthly summer rainfall is 18 mm in the north and 45 to 55 mm in the south. The soils are silty

and sandy loam but the upper areas of the flood plain are calcareous loamy and clayey. Cotton, wheat and sugar cane are grown on the left bank of the Indus and rice, wheat and gram on the right bank.

Zone III a

Sandy Desert (a). The maximum rainfall is 300 mm. The soils are sandy and loamy fine sand. The land is used for grazing.

Zone III b

Sandy Desert (b) - sand ridges and dunes. The rainfall is between 300 and 350 mm. The soils are sandy and loamy fine sand. The land is used for grazing.

Zone IV a

Northern Irrigated Plain (a) - Flood Plains and Bar Uplands. The climate is semi-arid to arid. The mean annual rainfall is 300 to 500 mm in the east and 200 to 300 mm in the southwest. The soils are sandy, loam-clay and loam. The canal irrigated crops are wheat, rice, sugar cane, oilseed and millets in the north and wheat, cotton, sugar cane, maize, citrus and mangoes in the centre and south.

Zone IV b

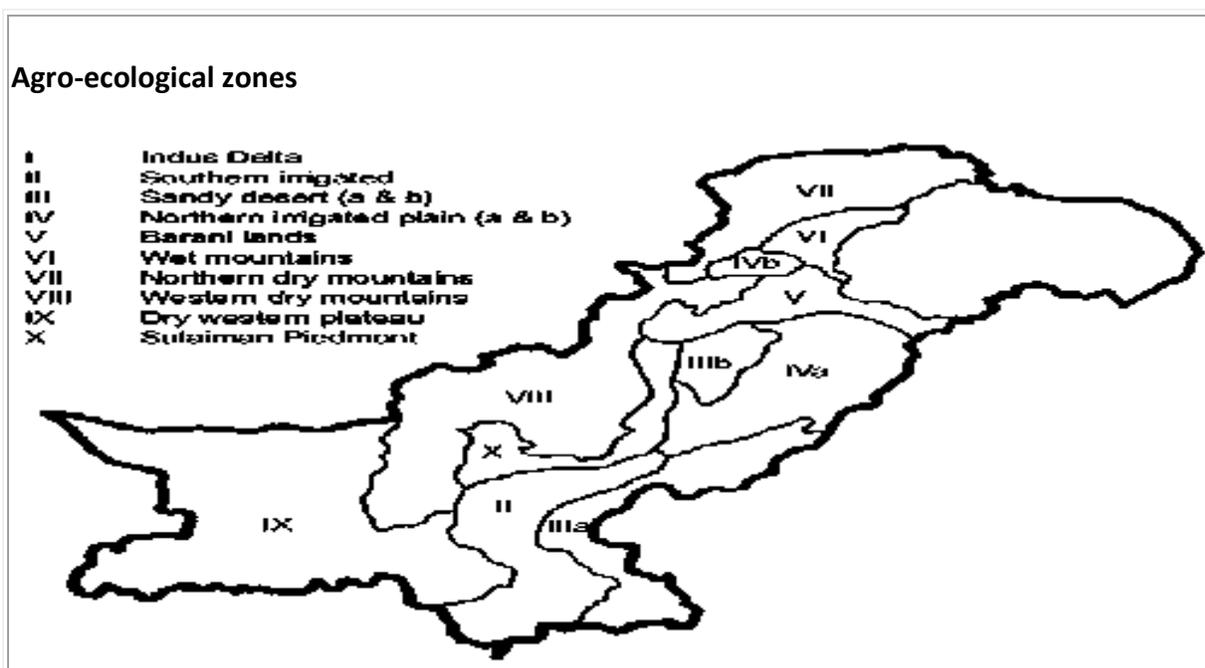
Northern Irrigated Plain (b) - Alluvial valleys of Peshawar and Mardan. The climate is semi-arid. The mean monthly rainfall is 20 to 30 mm. The soils are silty clays and clay loams. The main crops are sugar cane, maize, tobacco, wheat, berseem, sugar beet and orchards.

Zone V

Barani (Rain fed) Lands. This covers the Salt Range and the Potwar Plateau. In the North the mean monthly rainfall is 200 mm in summer and 35 to 50 mm in winter. The climate in the Southern part is semi-arid and hot. The mean monthly rainfall is 85 mm in summer and 30 to 45 mm in winter. The main crops are wheat, millet, oilseed and pulses.

Zone VI

Wet Mountains - High Mountains. The mean monthly rainfall is 235 mm in summer and 116 mm in winter. The soils consist of silt loams to silty clays. A small area is under rain fed agriculture but most of it is under forest.



Source PARC, 1980

Zone VII

Northern Dry Mountains. The mean monthly rainfall is 25 to 75 mm in winter and 10 to 20 mm in summer. The valley soils are deep and clayey. Most of the area is used for grazing.

Zone VIII

Western Dry Mountains. They are composed of barren hills with steep slopes. The mean monthly rainfall is 95 mm in summer and 63 to 95 mm in winter. The soils in the valleys are deep and loamy. Most of the land is used for grazing. On part of the loamy soils wheat and fruit crops are grown.

Zone IX

Dry Western Plateau - Mountainous Areas. The mean monthly rainfall is 37 mm in summer. The coastal belt receives a sea breeze. The land is used mainly for grazing. Melons, fruit crops, vegetables and wheat are grown where water is available.

Zone X

Sulaiman Piedmont - Plains of the Sulaiman Range. The climate is arid and hot. The mean monthly rainfall is less than 15 mm. Irrigation relies on floods of the hill torrents. Wheat, millet and gram are the main crops.

Government's Role in Agriculture Development

1. The *Ministry of Agriculture (MOA)* is an executive state agency within the government of the People's Republic of China. Areas of responsibility includes agriculture and environmental issues relating to agriculture, fishery, consumer affairs, animal husbandry, horticulture, animal welfare, foodstuffs, hunting and game management as well as higher education and research in the field of agricultural sciences.

2. The *Agricultural Development Bank of China* is a Chinese Policy Bank under the People's Central Bank of China (PBOC). As such, is responsible for funding projects related to China's economic growth. If the ADBC requires funding for its own operations, its bonds are considered as safe as the Central Bank's bonds, however PBOC or PRC government don't guarantee any kind of borrowings including bonds.

Contribution of Agriculture Development Bank of China (ADBC) in Agriculture

Agriculture Development Bank of China lends to Joint Liability Groups. ADBC issues financial bonds as well. ZTBL may consider the option of issuing an agriculture bond. ADBC offers intermediary services like insurance brokerage which can be easily replicated at ZTBL as it can generate income for the bank. It is notable that ADBC 's think tank is following a "Concept of Scientific Outlook on Development " which is leading agriculture development in a scientific way and is successful too. Secondly the "Two-Wheel Strategy" (lending for crops and lending for rural development side by side) followed by ADBC is also appreciate able. ZTBL has a lot to learn from ADBC when it comes to lending for water conservation as it lends for" rural waterway network projects". Similarly ADBC supports Rural Infrastructure construction like road networks and small grid projects also. County development is also financed by ADBC like converting of barren land into cultivatable farms. Cognizant of the fact that ZTBL cannot adopt all of the products, services and strategies followed by ADBC, owing to its own market conditions and regional and institutional constraints, it is suggested that it may choose at least one or two things which can be easily replicated at ZTBL with no strings attached.

Replication of Chinese Model in Pakistan

Prof. Linxiu Zhang, Deputy Director Centre for Chinese Agriculture Policy, Chinese Academy of Science Beijing visited Pakistan in 2012 and according to him Chinese model is only replicable in Pakistan with some major modifications. None-the-less a tailored Agri-model can be developed for Pakistan's agriculture to replicate the same in a phased manner.

The Pakistani model is as under:

1. Dry land Farming in Zone-III (a&b)
2. Zone-I Indus delta can be used for Rice & Fish cultivation model.
3. Marine Fisheries and cage breeding can be adopted in coastal areas of Zone II, III-a and Zone IX. Zone IX can be used as acqua /marine processing zone.

4. Pond breeding can be done in Zone VI. Also can be used for tea cultivation.
5. Pakistan can go for Off –Shore Food Securitized which can create employment of local labour as well.
6. Distant water fishery is still unexplored by Pakistan.
7. Raised bed over water technique can be used in coastal areas of Sindh on small islands.

References

1. <http://www.parc.gov.pk/>
2. <http://english.agri.gov.cn/>
3. <http://www.adbc.com.cn/en/index.aspx>
4. http://www.scj.go.jp/en/sca/activities/conferences/conf_5_programs/

Research & Editorial Team:

Mr. Farhat Karim Hashmi EVP (P, R & T D), Mr. Muhammad
Rashid SVP (P&RD), Abida Razzaq VP (P&RD)