Islamic Republic of Pakistan

Data Collection Survey on Agricultural Sector in Sindh Province in the Islamic Republic of Pakistan

Final Report

February 2022

Japan International Cooperation Agency (JICA)

ALMEC Corporation
Kaihatsu Management Consulting, Inc.
Nippon Koei Co., Ltd.

4R
JR
22-027

Islamic Republic of Pakistan

Data Collection Survey on Agricultural Sector in Sindh Province in the Islamic Republic of Pakistan

Final Report

February 2022

Japan International Cooperation Agency (JICA)

ALMEC Corporation
Kaihatsu Management Consulting, Inc.
Nippon Koei Co., Ltd.

Table of Contents

Appendices

Table and Figures

Abbreviation

ac·ft	acre-foot
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AI	Artificial Intelligence
AIS	Agriculture Information Service
AMA	Asaan Mobile Account
AMIS	Agriculture Marketing Information Service
APR	Annual Percentage Rate
ATM	Automatic Teller Machine
AWB	Area Water Board
BB	branchless banking
BCM	billion cubic meters
BOI	Board of Investment
BPO	business process outsourcing
BSO	Business Support Organization
CA	commission agent
CABI	Centre for Agriculture and Bioscience International
CBU	capacity building unit
CCA	culturable command area
CDNS	Central Directorate of National Savings
CEO	Chief Executive Officer
CI	community institution
CIDA	Canadian International Development Agency
CLIS	crop loan insurance scheme
CNIC	Computerized National Identity Card
C/P	counterpart
COVID-19	Corona Virus Disease 2019
CO	community organization
CRA	climate resilience agriculture
CRP	Community Resource Person
CSR	corporate social responsibility
DAM	Department of Agriculture Marketing
DFID	Department for International Development
DF/R	draft final report
DG	District Governor
DO	Direct Outlet
DOA	Department of Agriculture
EAD	Economic Affairs Division
EDB	Engineering Development Board
EMI	Electric Money Institution

ETBAMRP	Enhancing Technology-Based Agriculture and Marketing in Rural Punjab
EU	European Union
FA	Field Advisor
FAO	Food and Agriculture Organization of the United Nations
FCDO	Foreign, Commonwealth & Development Office
FGD	Focus Group Discussion
FHBWs	Female Home-Based Workers
FMFB	First Microfinance Bank
FO	Farmers' Organization
F/R	Final Report
FSP	Financial Service Provider
FVC	Food Value Chain
GAP	Good Agricultural Practices
GB	Gilgit-Baltistan
GCA	Gross Command Area
GDP	Gross Domestic Product
GIS	Geographic Information System
GLP	Gross Loan Portfolio
GOS	Government of Sindh
GRASP	Growth for Rural Advancement and Sustainable Progress
GWh	Gigawatt-hours
ha	Hectare
HAI	Hydro-Agro Informatics
HEIS	High Efficiency Irrigation Systems
IC/R	Inception Report
ICT	Information Communication Technology
ICT	Islamabad Capital Territory
IDA	International Development Association
IDMT	Irrigation and Drainage Management Transfer
IFL	Interest Free Loan
IPD	Irrigation and Power Department
ISO	International Standardization Organization
IT	Information Technology
ITC	International Trade Centre
IVR	Interactive Voice Response
JCC	Joint Coordination Committee
JFPR	Japan Fund for Poverty Reduction
JICA	Japan International Cooperation Agency
JV	Joint Venture
KBL	Khushhali Bank
KP	Khyber Pakhtunkhwa
KPI	Key Performance Indicators

LAN	Local Area Network
LSO	Local Support Organization
M/P	Master Plan
MAF	million acre-feet
MC	Market Committee
MCC	Ministry of Climate Change
MF	Micro Finance
MFB	Microfinance Bank
MFI	Microfinance Institution
MFP	Microfinance Provider
MMFB	Mobilink Microfinance Bank
MNFSR	Ministry of National Food Security & Research
MNO	Mobile Network Operator
MOC	Ministry of Commerce
MOF	Ministry of Finance
MOIP	Ministry of Industry and Production
MOITT	Ministry of Information Technology and Telecommunication
MOST	Ministry of Science and Technology
MOU	Memorandum of Understanding
mS	Millisiemens
MSME	micro small or medium enterprise
NARC	National Agricultural Research Centre
NBMFC	Non-Bank Microfinance Company
NCIS	National Crop Insurance Scheme
NFIS	National Financial Inclusion Strategy
NGO	Non-Governmental Organization
NHA	National Highway Authority
NIC	National Incubation Center
NPGP	National Poverty Graduation Programme
NPSC	National Project Steering Committee
NRSP	National Rural Support Programme
ODA	Official Development Assistance
OFWM	On-farm Water Management
O&M	operation and maintenance
PDM	Project Design Matrix
PAD	Punjab Agriculture Department
PDD	Planning and Development Department
PDMA	Provincial Disaster Management Authority (Government of Sindh)
pH	potential of hydrogen
PIDA	Punjab Irrigation and Drainage Authority
PITB	Punjab Information Technology Board

PKR	Pakistan Rupee
PMC	planning and monitoring cell
PMN	Pakistan Microfinance Network
PO	plan of operation
PP	Pakistan Post
PPAF	Pakistan Poverty Alleviation Fund
ppm	parts per million
PPRP	Peoples' Poverty Reduction Program
PRA	Participatory Rural Appraisal
PSC	Provincial Steering Committee
ROSCA	Rotating Saving and Credit Association
RSP	National Rural Support Program
PTA	Pakistan Telecommunication Authority
PTCL	Pakistan Telecommunication Company Limited
SAFWCO	Sindh Agricultural & Forestry Worker's Coordinating Organization
SAGP	Sindh Agriculture Growth Project
SAP	Sindh Agriculture Policy
SAPIC	Sindh Agriculture Policy Implementation Commission
SBIP	Sindh Barrages Improvement Project
SBP	State Bank of Pakistan
SC	supply chain
SDGs	Sustainable Development Goals
SECP	Securities and Exchanges Commission of Pakistan
SHEP	Smallholder Horticulture Empowerment & Promotion
SIAPEP	Sindh Irrigated Agriculture Productivity Enhancement Project
SID	Sindh Irrigation Department
SIDA	Sindh Irrigation and Drainage Authority
SME	small and medium enterprise
SMEDA	Small and Medium Enterprise Development Authority
SMS	Short Message Service
SRSO	Sindh Rural Support Organization
SVVCP	Strengthening Vegetable Value Chain in Pakistan
SWAT	Sindh Water and Agriculture Transformation Project (SWAT)
SWMO	Sindh Water Management Ordinance
SWP	Strategic Water Plan
TMFB	Thardeep Microfinance Bank
TOT	training of trainers
TNA	training needs assessment
UAE	United Arab Emirates
UNCTAD	United Nations Conference on Trade and Development
USAID	United States Agency for International Development
USSD	Unstructured Supplementary Service Data

VC	value chain
VO	village organization
WAC	Water Allocation Committee
WADO	Women Agriculture Development Organization
WAPDA	Pakistan Water & Power Development Authority
WC	watercourse
WCA	Watercourse Association
WDFP	Women Development Foundation Pakistan
WG	working group
Wifi	Wireless Fidelity
WISP	Sindh Water Sector Improvement Project
WTO	World Trade Organization
WUG	Water Users Group

Summary

1 Overview of Sindh Province: Nature, Economy and Society

Pakistan borders India, China, Afghanistan, and Iran, with the Arabian Sea in the south. Although it has a subtropical climate and dominantly has hot and dry areas, the temperature and precipitation vary greatly depending on the area. It has an extremely diverse climate. Sindh is one of the four provinces of Pakistan on the eastern side of the Arabian Sea and the lower side of the Indus River. It is bounded by Balochistan, another province of Pakistan, and Punjab, Rajasthan, and Gujarat in India.

The province is often classified into four regions from a topographical viewpoint: (i) the dry and barren Kirthar Mountains in the west, (ii) the central alluvial plain divided by the Indus River, (iii) the desert area in the east, and (iv) the Indus Delta in the south. Sindh has a desert climate and very little rainfall. April to September is called the Kharif, and October to March is the Rabi. The average annual rainfall is about 150 mm, and it rains more from July to September, mainly during the monsoon season. The Indus River has a small annual difference in water volume due to glacial meltwater during periods of low precipitation. During high precipitation, however, the amount of water varies significantly from year to year. Floods often occur and cause great damage.

When it comes to the economic infrastructure, in Pakistan, 73.9% have access to electricity and only 58.7% in its rural areas, according to the World Bank data in 2019, and improving access to electricity in rural areas is a key issue. Production of electricity is about 134,981 GW, of which Sindh accounts for 17%. Although the road transport network is the crucial infrastructure that provides inter-regional access, most rural roads have issues, such as unpaved roads, lacking drainage systems, inadequate maintenance works, etc.

The political, economic, and social structure of Pakistan has been represented by the dominance of large landowners. In the past, several land reform and redistribution efforts have been implemented, and the relationships among large landowners, tenant farmers, and sharecroppers in rural society have had certain changes. However, the dominant power structure of the large landowners persists until today. According to the 2000 statistical data of Sindh, the farmers with less than 2.5 ha (6.2 acres) of agricultural land was 29.8% of the total farmer population, while the area of agricultural land was at 4.8%. On the other hand, 2.3% of the total number of farmers have more than 50 ha of farmland or 25.7% of the total farmland area. It is said that a small number of large-scale farmers hold a high percentage of farmland, and this had not significantly changed in 2010. In the rural areas of Sindh, large landowners and landlords called Zamindars form the ruling hierarchy, and powerful Zamindars sometimes play clergy roles, strengthened by religious authority. Moreover, the structure of rural society in Sindh is characterized by *Baradari*, a clan hierarchy that divides society. In Sindh, it refers to people belonging to a clan that shares the same bloodline. All people belong to some *Biradari*.

Pakistan ratified the Convention on the Elimination of All Forms of Discrimination against Women and has gradually developed the legal framework toward gender equality. However, according to the Gender Gap Report 2021, Pakistan ranks 153rd out of 156 countries in the world in terms of the gender gap index, and the discrimination has worsened significantly over the past few decades. Islamic and customary laws in each community are prioritized for decision-making, etc., and have remained unchanged for years. Violence against women is allowed, and women's rights remain unguaranteed. The poverty rate in Pakistan has steadily improved over the past two decades, but various problems of poverty persist due to issues such as repeated disasters. The poverty rate in

rural areas is about four times higher than in urban areas. In particular, poverty has been more serious in the Lower Sindh districts.

2 Agriculture Sector in Sindh

Agriculture in Sindh is irrigated agriculture using the Indus River as a water source, mainly for cereal crops (wheat and rice), industrial crops (sugarcane and cotton), and a small percentage of horticultural crops. Most farmers are small-scale (having less than 12.5 acres of cultivated land) and are landed farmers. There are two cropping seasons, the monsoon and the dry seasons. Monsoon season is the main cropping season when more water is available for agriculture. The production volume by the crop is mostly industrial and cereal crops, while horticultural crop production accounts for only 5%. The production volume of sugarcane (industrial crop) is extremely high at nearly 70% of the total crop production volume. The major crops in Sindh are grown during the Kharif season. The major crops include rice, sugarcane, cotton, maize, beans, vegetables (okra, cucurbitaceous vegetables, chili), and fruits (mango, banana, and papaya). Generally, sowing is from April to June, and harvesting is from October to December. During Rabi, the temperature is usually low and with little rainfall. It is also the season when the Indus River source area freezes, reducing the volume of water, and thus the amount of available surface water decreases. Wheat, tobacco, barley, mustard, vegetables (tomato, onion, chili), and fruits (lemon and jujube) are the main crops grown.

The soil in Sindh is poor in nutrients and organic constituents, and saline areas are widespread. For agricultural production improvement, it is essential to supply the deficient nutrients through chemical fertilizers and improve the organic components through applying organic fertilizers. In addition, irrigation drainage and other measures to reduce soil salinity are necessary. There are areas with high salinity in six districts in the Upper Sindh (e.g., Kashmore and Sukkur) and five in the Lower Sindh (e.g., Tando Allayar and Badin). Salinity in Sindh is caused by waterlogging of irrigation water due to inadequate drainage facilities and clayey soils, which leads to the dissolution of salt in the soil.

The major policies of the agricultural sector are the “Sindh Agriculture Policy (SAP: 2018–2030)” and the “Sindh Agricultural Produce Markets (Development and Regulation) Act 2010.” In water resource management and irrigation, the major policies are “Sindh Water Policy” and “Sindh Water Management Ordinance (SWMO) 2002.” As for the former, two factors (i.e., the overall management of water resources and water management of canal and drainage systems) are directly related to agriculture. Regarding SWMO 2002, it provides for the establishment of public systems to distribute and deliver irrigation water, remove drainage water, and manage floodwaters. When it comes to organizational structure, the Department of Agriculture (DOA) has five main sub-departments, namely the Directorate General (DG) Agriculture Extension, DG Agriculture Research, DG Agriculture Engineering, DG On-Farm Water Management, and Planning and Monitoring Cell. The main function of the Sindh Irrigation Department (SID) include barrages, construction work, irrigation (e.g., rivers and riverian surveys, drainage, and embankments), etc. Related agencies include the Sindh Irrigation and Drainage Authority (SIDA) and Area Water Boards (AWBs).

3 Small-Scale Horticultural Agriculture in Sindh

In Lower Sindh, where the poverty rate is higher than in Upper and Central Sindh, horticultural crops are widely grown. The high-quality horticultural products are shipped to Karachi and Hyderabad Districts. More than half of the farmers use recycled seeds because properly certified

seeds are difficult to obtain, and inferior quality seeds are widely sold. As for fertilizers, about 60% of the farmers use combined chemical and organic fertilizers, while 34% use only chemical fertilizers. Three-quarters of farmers use insecticides, fungicides, and herbicides. Over 20% of the farmers cited agricultural inputs as a challenge to their cultivation, over 60% mentioned limited availability of inputs, and 35% pointed out the price-related challenges (high prices and fluctuating prices).

Most farmers use tractors and power tillers for tillage and sprayers for spraying pesticides. Nearly 80% of the farmers use agricultural laborers for cultivation and weeding. Most farm work is done exclusively by men. The farming activities in which both men and women are mainly engaged are sowing, weeding, and picking. Regarding where to sell crops, about 30% of the farmers consult with their spouses, and 50–70% consult about other matters (e.g., crops and areas for cultivation). Regarding agricultural water sources, irrigation channels and groundwater are equal at 37%. When it comes to the time of shipping, okra is mostly sold in April and May, cucumber in June and July, and onion and tomato in November and December. Although shipping times for every crop are different, sales are low typically during February and September. As for fruits, none are sold in January and August.

Slow progress has been made in forming farmer organizations (FOs) in the province. However, more than 80% of farmers believe that it is possible to form FOs and exchange information among the members of FOs. The main source of household income of horticultural farmers is horticultural crops. They also earn from other crops and agricultural products, such as livestock. As for the sources of agricultural working capital, own money (savings) is the most common source of working capital. About 50% of the farmers operate their farms using only their funds, 73% have savings for agricultural inputs purchases, 45% use financial services, and 30% have savings accounts (68% of the financial service users). The most common challenges faced by the farmers when growing horticultural crops are crop failure by diseases or natural disasters, water shortage, and availability and price of inputs.

4 Food Value Chain in Sindh

In Sindh, most horticultural crops are distributed in and out of the province through fruit and vegetable wholesale markets. Middlemen have established strong interdependent relationships with farmers and various chain (VC) actors, and various forms of middlemen play a central and important role in this distribution system. Some deal with input materials and others collect crops from farmers and mediate the sale and purchase of crops at wholesale markets, among others. Other middlemen play multiple roles, including exporters and processors as well. Karachi and Hyderabad districts have large-scale fruit and vegetable markets, providing for consumers in both districts.

Pakistan is one of the largest producers of crops in the world. More horticultural crops have been produced in Sindh than in other provinces with its appropriate climate conditions. The south-central districts of Sindh are where most major horticultural crops are produced. According to the interviews in this study, there is very little post-harvest processing, storage, and processing carried out at the farm level. Very few farmers have facilities for post-harvest crop processing and sorting, collection points, and warehouses for safe storage of crops. The processing sub-sector is also underdeveloped, and the associated infrastructure (e.g., cold chain) is in poor condition.

Wholesale markets in Sindh are operated by privately managed Market Committees (MCs). Across the province, there are 71 MCs. Middlemen (Aarthi) bring the produce to the market. The auction

decides the price of the produce, and other middlemen (Mashakhor) provide the produce for the consumer market. Prices of each crop are published daily, and the government regulates the retail prices. Fluctuating prices is regarded by farmers as one of the challenges and essentially due to seasonal variations as well as natural disasters and inconsistent import volume restrictions imposed by the government. The difficulty of transporting agricultural produce is also viewed as one of the VC challenges due to the inadequate development of roads (e.g., unpaved roads). Limited traveling speed is one cause for longer transportation time, resulting in cargo damage, quality deterioration, etc. A large amount of crop wastage, attributable to cargo damage and quality deterioration, occurs daily in the wholesale market. Since it is difficult for various actors of Sindh to meet international requirements by improving pesticide residues, etc., exportation has been sluggish.

Crops traded in the wholesale market are shipped and sold by middlemen to retailers, etc. In the districts of Karachi and Hyderabad, the types of retailers include local markets with multiple stores, fruit and vegetable stores on street corners, street vendors with hand carts, supermarkets, and so forth. According to the consumer survey conducted for this study, 17–23% purchase vegetables from supermarkets, and this consumption trend is expected to increase. However, since most consumers regard freshness as more critical, they purchase vegetables in local markets and retail stores. Many supermarkets procure perishable goods through their channels, while others outsource their sales floor to vendors. Although many customers buy products for freshness, food safety is not their top priority, and thus, organic vegetables are not in high demand.

5 Current Condition of Water Resources in Sindh Province

Sindh Province is mainly dry and relatively arider than the upcountry areas. Irrigation is therefore critical for agriculture in the province, as the contribution of rain towards crop water requirements is negligible. The Indus drains an area of about 950,000 km^2 and generates a mean annual discharge of 6,682 m^3/s. Another important and increasingly used water source in the dryland and canal area is groundwater. Groundwater resources complement available water resources in Sindh. However, groundwater use is comparatively less for two primary reasons. Firstly, most of the area lies on saline or brackish water, and secondly, canal command areas are being provided with surface irrigation supplies. In Sindh, about 30% of the farmlands are irrigated. Owing to climate change, Pakistan's water availability is projected to become more unreliable. Under the prevailing situation, DOA and World Bank implemented the Sindh Irrigated Agriculture Productivity Enhancement Project (SIAPEP) to reduce water loss at the field level by terminal waterway rehabilitation. The High Efficient Irrigation System (HEIS) was also introduced. Since the Indus River is higher in some places than the surrounding lands, it cannot drain areas throughout much of Sindh. The groundwater table is even shallower in one-fourth of the province, and the land is waterlogged, which is affected strongly by drainage and sea waterlogging.

The barrages of Sukur, Kotri, and Guddu command a total area of about 6.000 million ha, and there are 14 main canals in the province. Target areas of improvement for the main and branch canals in the Water Sector Improvement Project (WSIP), funded by the World Bank, were Ghotki Feeder, Nara, and Fuleli. In WSIP, distributaries and minor canals were rehabilitated and improved. The FOs would be involved in all stages of work on the distributary/minor canals. There are over 46,000 watercourses in the province, among which about 5,500 are supposed to be rehabilitated in SIAPEP. As of November 2021, 4,900 have been rehabilitated. The rehabilitation and extension of watercourses account for about 30% of the entire watercourses. Sindh has taken some bold steps in the move towards irrigation and drainage reforms. The long-term goal of the proposed reforms is to ensure farmers' participation in the system at successively higher levels. After the irrigation

and drainage strategy of 1994, the Sindh Assembly passed the SIDA Act in 1997. The Sindh Water Management Ordinance (SWMO) came into enforcement in 2002. However, even with the passing of the ordinance, a dual institutional arrangement continues to exist in the irrigation sector. Out of 14 main canals, four have been transferred to SIDA. Under the administration of SIDA, irrigation facilities' water distribution and monitoring are implemented by the AWB, FOs, and the Watercourse Association (WCA). The operation and maintenance (O&M) of AWB and FOs are based on fees collected from farmers. O&M fees are collected by AWB and FOs. FOs implement maintenance works, deploying voluntary farmers as well as hired machines.

Flood irrigation in field application is a traditional method adopted by most farmers in Pakistan. A significant amount (20–25%) of irrigation water is lost during its use due to the unevenness of fields and poor field designs, leading to excessive water use in low-lying areas and under-irrigation in the more elevated areas of fields. Over-irrigation leaches soluble nutrients from the crop root zone, makes the soil less productive, and degrades groundwater quality. Considering those situations, in SIAPEP, the HEIS such as drip and sprinkler irrigation systems has been introduced. It is pointed out, however, that the cost borne by the farmers and O&M fees are too high.

6 Agricultural Finance

In Pakistan, access to financial services is limited, and account ownership is low by international standards, although access has been increasing. According to Global Findex in 2017, account ownership is 21%. Account ownership of females is only 7%, showing a large gender gap. Financial literacy also has been improving, but the figure is still low. According to the Financial Inclusion Insight Survey (FII Survey), the share of those with financial knowledge in 2020 is 19%. Payment by consumers is now digital, but in governmental institutions, the processes of salaries and pensions are still slower than in other countries. Meanwhile, in Pakistan, digital finance, such as mobile accounts and branchless banking (BB), has been developed. Female users were only at 5.3% in 2017, while male users were about 30%.

In the country, the National Financial Inclusion Strategy (NFIS) was developed in 2015 to improve the current situation. The microfinance (MF) sector is considered one of the most crucial sectors to support the poor, including small-scale farmers. NFIS set the goals by 2020, but many were accomplished before 2020, and a revised action plan (Action Plan within its first 100 days) was formulated in 2018. The action plan set six targets and KPI to attain by 2023. When it comes to the MF sector, various laws and policies have been developed, such as the 2001 Microfinance Institution Ordinance. As for the outreach of MF by comparison to other provinces, the rate of borrowers to the population in Punjab is 4.4%, while Sindh is 2.5%. When it comes to financial services, Punjab province is more advanced than others, even Sindh. In Punjab, to enhance governance and improve digital literacy, the Punjab Information Technology Board (PITB) was established in 1999, which created IT systems for various sectors. PITB formulated some IT systems for the agricultural sector and established the Agriculture E-Credit Scheme to address the financial issues of farmers. Obstacles to the prevalence of MF include budgetary shortage for training, customers' lack of literacy, insufficient credit information, negative impacts of COVID-19, and others.

Crop loan, which is the loan for purchasing inputs, is the mainstream agricultural finance in Sindh. It can be categorized into two types: working capital from commercial banks for economically affordable farmers and what MFP provides for small-scale farmers. MFP typically offers farmers a crop loan with a tenure aligned with the period from the input purchase until the harvest season of a particular crop with relatively small loan ticket sizes. As for agricultural insurance, although the

Crop Loan Insurance Scheme (CLIS) was introduced in 2008, it is pointed out that only a small risk is covered by the scheme. NFIS plans to introduce the National Crop Insurance Scheme (NCIS), a yield index insurance, as a new agricultural insurance scheme to replace CLIS.

Small-scale farmers are heavily influenced by intermediaries, not only in farming but also in finance, and have virtually no access to formal finance. In particular, it was revealed that females do not have an account at a financial institution and have almost no contact with financial institutions for purposes other than receiving cash benefits from the government. They are even strongly dissatisfied response of the bank when receiving cash benefits. Both men and women are significantly anxious about crop failures due to climate change and natural disasters.

7 Application of ICT for Agriculture in Sindh

In 2018, the government formulated the “Digital Pakistan Policy” and launched various support measures for ICT companies. As for the agriculture sector development. There are a small number of agrotech companies targeting small-scale farmers, and many of them are start-ups: weather forecasts/ yield forecasts, agricultural extension advice, crop monitoring, and others.

Founded in Hyderabad in 2018, the ICT Agricultural Extension Services Center (hereafter referred to as the “ICT Center”) was a response to the scarcity of field extension officers. The head office is in Hyderabad, and sub-centers were eventually established in Larkana District, Mirpur Khas District, and Sukkur District. The ICT Center broadcasts a live video program. However, the number of viewers per day was about 3,000 to 4,000. Although the ICT Center has had budgetary constraints, it is expected to play a vital role in providing small-scale farmers with various services using ICT.

Regarding the smartphone ownership rate, the access rate in Hyderabad is significantly lower than that in Karachi. Apparently, the main use of smartphones is rarely for farming-related purposes. There is a need to impose the use of ICT among small-scale farmers in Sindh for farm management purposes. In the meantime, PITB is planning to build a virtual market for direct trading between retailers and farmers to solve relationship issues with middlemen, as well as to introduce an app named “AgriSmart” for agricultural extension workers and a database of farmers, providing them with various digital services. Meanwhile, to improve small-scale farmers’ access to information, a wide variety of efforts have been made in India, Bangladesh, and Nepal, namely developing apps, building portal sites, and conducting educational activities using ICT. Similarly, in Sindh, there is a need to accelerate these kinds of efforts.

8 Current and Past Projects of JICA, Other Donors, and NGOs on Agriculture and Rural Development

The activities of the World Bank, other donors, and NGOs can be summarized as follows by area of cooperation, district, and beneficiary.

Table 1 Outline of Activates of Other Donors and NGOs

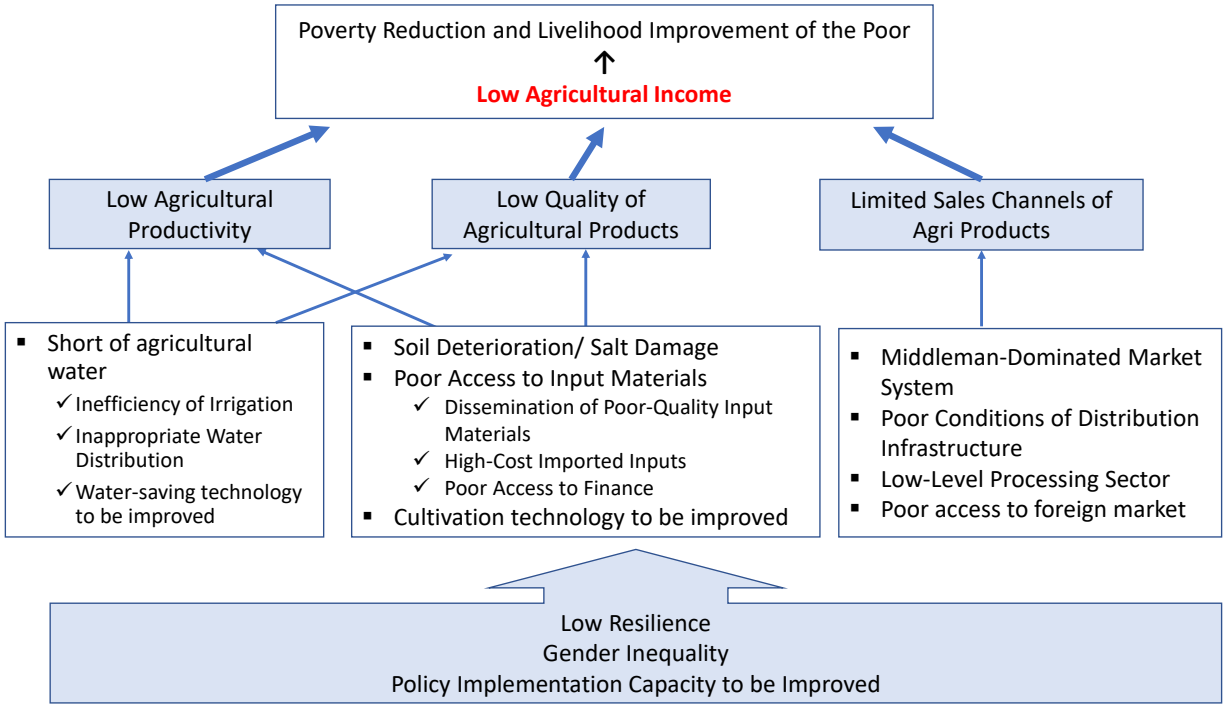
Items	Contents
Area of Cooperation	● More projects have been implemented in the areas of “water resources/ irrigation,” “FVC,” and “livelihood improvement of poor farmers/ food security.”
District	● International donors and NGOs have so far implemented projects in all the districts of Sindh. ● A smaller number of projects have been implemented in the districts of Nausheroferonze, Jamshoro, Tharparkar, Sujawal, etc., which do not seem to be appropriate for general agriculture.

Beneficiary	● Candidate beneficiaries can be small-scale farmers, agribusinesses, the poorest populations, female farmers, etc. ● NGOs' target beneficiaries are mostly small-scale farmers. ● Some of the World Bank's target beneficiaries are small-scale farmers, while most of them, in practice, have a land of about 25 acres.

Source: JICA Study Team

9 Potentials for JICA's Future Cooperation

One of the central challenges of the livelihood of small-scale horticultural farmers is "low agricultural income," as the figure below indicates.



Source: JICA Study Team

Figure 1 Problem Analysis of Sindh's Agriculture Sector in Sindh

In order to increase the agricultural profit of small-scale farmers, the key challenges and approaches to tackle are shown in the table.

The World Bank, other donors, and NGOs have tackled the agricultural sector of Sindh for more than a decade. Likewise, JICA has worked on livestock development to improve the livelihood of small-scale farmers by livestock development in Sindh and the capacity development of agricultural extension workers in Balochistan. When considering the details of the contents of cooperation, the achievements and lessons learned of other donors and NGOs, as well as past experiences of JICA, must also be accounted for.

Once the potential projects are implemented, their implementation and achievements must be monitored and reflected in the planning for the following year.

When it comes to using the approaches to the key challenges, there is also a need to consider the said cross-cutting challenges, such as gender inequality and DOA's capacity development.

Table 2 Key Challenges and Approaches

Key Challenges	Approach
1) Low efficiency of irrigation	● Improve the efficiency of irrigation
2) Dissemination of low-quality input materials	● Improve small-scale farmers' cultivation technology through capacity development of DOA's extension workers
3) Low cultivation technology	● Enrich the knowledge of small-scale farmers about input materials through capacity development of DOA's extension workers
4) Inadequate and inefficient dissemination of information on prices, etc.	● Develop a price information system ● Improve access of small-scale farmers to related information
5) Imbalanced water distribution among water courses	● Develop capacity of irrigation management of parties interested
6) Poor access to finance and inadequate public financial services	● Improve the access of small-scale farmers to finance
7) Inadequate use of organic fertilizers	● Facilitate the use of organic fertilizers by small-scale farmers through capacity development of DOA's extension workers
8) Inadequate cooperation among farmers	● Help form farmers' organizations so that they may enjoy various advantages of the formation

Source: JICA Study Team

Introduction: Overview of Study

1 Background and Objectives

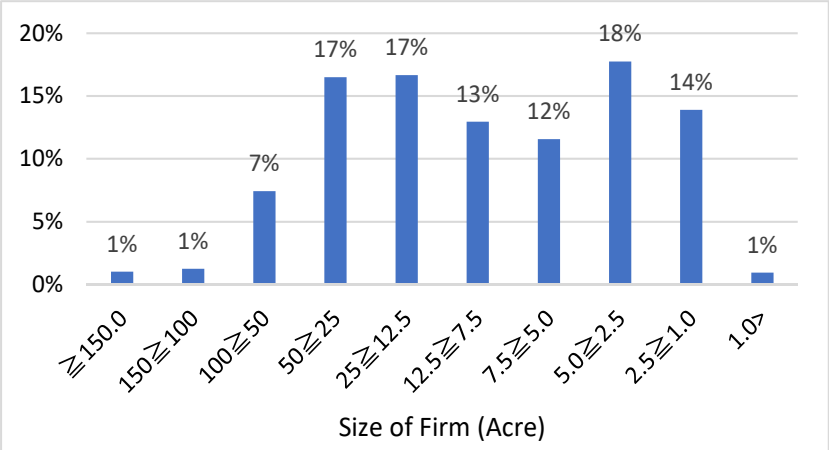
The Islamic Republic of Pakistan (hereinafter "Pakistan") has a population of 220.9 million. In terms of employment, its agriculture sector accounts for about 42% (Pakistan Bureau of Statistics, 2018) and is expected to absorb an increasing number of young and female laborers. However, agricultural productivity is low, and its share in the GDP is only 19% (ibid.). In the Sindh province, 65% of its labor force is engaged in the sector, while more than 30% of its population are regarded as extremely poor. Agriculture is expected to play a major role in reducing poverty. About 60% of the farmers in the province are smallholders (World Bank, 2014), mostly have worked on cotton production, while the food value chain (FVC) of horticulture products, which have high value, needs to be further developed to promote sales. On top of these, the climate in most parts of the province is arid or semi-arid. Water has been chronically short in supply. Management of resources should be improved (Agriculture, Supply & Prices Department, Sindh Provincial Government, 2018). Based on the estimate of the Planning & Development Board of the province, an annual water supply of 90 billion m^3 is needed by 2025 for securing food and sustaining population growth, while the currently available water resources can only supply 54 billion m^3. Water resource management should be more efficient. In the Pakistan Vision 2025, "Energy, Water and Food Security" is one of the seven pillars for change. Related critical issues include the enhancement of agricultural productivity and modernization of the sector through efficient management and use of water resources, etc. When it comes to provincial policy measures, the Sindh Agriculture Policy (2018–2030) aims to improve the management of water resources, innovate agricultural technology, and modernize FVC.

Given the status of and issues in the agricultural sector of Sindh (except its livestock subsector), this study aims to collect relevant information about smallholder farmers' farm and water resource management, as well as to consider effective approaches to increase their income and enhance agricultural productivity. The other aim of this study is to explore the possibility of cooperating with the provincial government on the sector and design cooperation programs. Meanwhile, in this report, the term "smallholder farmer(s)" refers to farmers whose farms are less than five (5) acres.

2 Target of Study

The main target of this study and the beneficiaries of the medium- to long-term cooperation programs to be developed in this study are small-scale farmers growing horticultural crops.

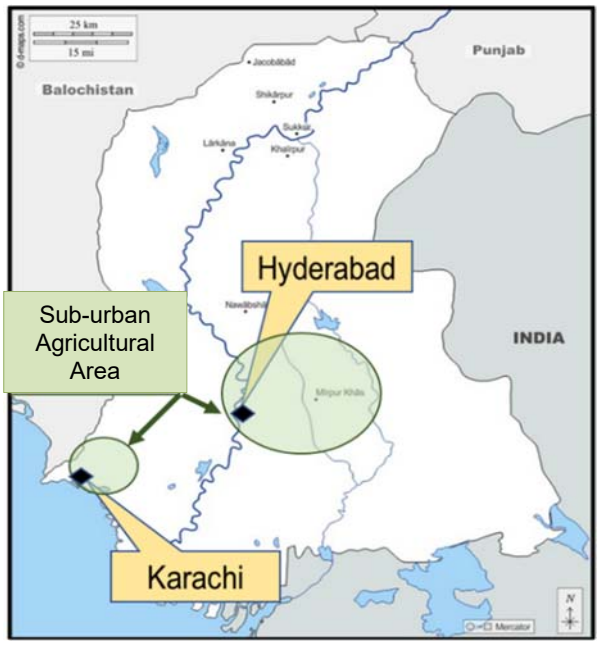
According to the Sindh Agriculture Policy (2018–2030), onion, chili, mango, banana, and dates are widely grown in the province. Tomatoes, eggplant, cucumber, leafy vegetables, watermelon, and sweet melon are also commonly sold in the market. Large-scale cultivation of wheat, rice, cotton, and sugarcane accounts for a major part of agriculture in Sindh. Vegetables, on the other hand, are cultivated by both small- and large-scale farmers (Figure 2.1.3). In the case of horticultural crops, especially for fresh consumption, careful manual cultivation is essential, as mistakes and insect damage reduce the value of crops. As a result, there is little room for agricultural mechanization in horticultural crop production, and small-scale farmers can be competitive. In other words, the **promotion of horticultural crops** is appropriate to improve the productivity and livelihood of small-scale farmers in Sindh.



Source: Compiled by JICA Study Team based on the Agricultural Census 2010 - Pakistan Report

Figure 1 Percentage of Farmers Growing Vegetables on Irrigated Land

Farmers in the surrounding cities supply fresh vegetables to large consumption areas, such as Karachi and Hyderabad. From the viewpoint of FVC of horticultural crops, the JICA Study Team assumed that the effects of development are most significant for peri-urban farmers, and it is considered that this can be used as a model to expand to the surrounding area. For this reason, the study focuses on horticultural crop agriculture in the suburbs of the city, the main target of this survey. As a result of discussions with the Department of Agriculture (DOA) of the Government of Sindh, the JICA Study Team and DOA agreed that this study focuses on peri-urban farmers growing seven types of crops: tomato, cucumber, okra, chili, onion, mango, and papaya.



Source: JICA Study Team

Figure 2 Sub-urban Agriculture in Sindh

3 Methodology

The survey period is about 4 months beginning at the end of September 2021 until February 2022. The first members of the study team entered Pakistan on 9 October 2021, and other members entered one by one. The member who entered last stayed until 27 December 2021.

The study was carried out during the COVID-19 pandemic. The spread of the infection, a concern at the beginning of the project, so the study team was able to do the fieldwork. In addition, since 1 October 2021, the Government of Pakistan had abolished the requirement for voluntary quarantine after arrival for those who enter the country, so it was possible to conduct on-site works without going through the voluntary quarantine period after entry; thus, the study was carried out efficiently.

The study was conducted by the JICA Study Team mainly through interviews with related parties and site visits, and simultaneously, two subcontractors conducted farmer and FVC survey and irrigation survey, respectively. The study team originally planned to accompany the subcontractor in the farmer survey but later canceled this plan because it would be probable that the villagers unfamiliar with foreigners would gather around the survey team and hinder the survey. Instead, with the cooperation of NGOs, the study team invited small farmer groups to a designated place and conducted both individual and group interviews directly to prove the results of the survey of the subcontractor.

1 Overview of Sindh Province: Nature, Economy and Society

Chapter 1 gives an overview of the natural conditions, economic infrastructure, infrastructure, and social structure. These are examined in each section.

1.1 Natural Conditions

This section takes a close look at Sindh's topography and climate.

1.1.1 Topography

Sindh has a population of approximately 47.9 million (2017 estimate)[1] and an area of 140,914 km^2. It is on the eastern side of the Arabian Sea coast and lower side of the Indus River and borders Balochistan, Punjab, and Rajasthan and Gujarat in India.

Topographically, Sindh is normally divided into four different regions. Firstly, the dry and barren Kirthar Mountains in the west (the reddish-brown area in the figure on the right) that is composed of the Kirthar Mountains, the Pab Mountains, the Lakki Mountains, and the hills. Due to low rainfall, there is no vegetation in this region. The second is the central alluvial plain divided by the Indus River. The plain in the central part of the province (the dark green part in the right figure) is the fertile alluvial plain that constitutes the valley of the Indus River. The length of the Central Plain is about 580 km, which is banana-shaped and long from north to south. The east region is a desert area (yellow and ocher parts in the right figure) with low dunes and flatlands in the north, Achhrro Thar (white sand desert) in the south, and Thar desert in the southeast. The desert stretches in most of the Tharpakar district. Lastly, the Indus Delta is in the southern part of the province and the lower reaches of the Indus River (the blue-green part at the bottom of the right figure). Waterways have been constructed in some parts of this area, and many of them are covered with raised terraces.

Source：
https://esdac.jrc.ec.europa.eu/images/Eudasm/Asia/images/maps/download/PK2008_2SO.jpg

Figure 1.1.1 Topography of Sindh Province[1]

1.1.2 Climate

(1) Climate and Precipitation

Sindh has a desert climate and very little rainfall. The period from April to September is called the *Kharif,* and October to March is called the *Rabi*.[2] The average annual rainfall is about 150 mm, and it rains more from July to September, mainly during the monsoon season. Winter (October to

[1] For details, please refer to "Development Statistics of Sindh 2019."

[2] For details about cultivation in the Kharif and Rabi periods, please refer to 2.1.3 of Chapter 2.

January) is relatively warm, and summer (May to August) is very hot. Daytime temperatures often exceed 40 degrees Celsius. The monsoon wind from the southwest begins in mid-February and continues until the end of September.

Although Karachi district belongs to the desert climate zone, the rainfall is about 250 mm, which is a large amount in the desert climate. The humidity is relatively high because the district is close to the sea. Precipitation is concentrated in the July-September period, which is affected by the monsoon. Hyderabad district, like Karachi district, belongs to the desert climate zone but has a mild climate throughout the year. The hottest period of the year is from mid-April until late June before the monsoon begins. Likewise, roads are flooded every monsoon season because drainage facilities are not well maintained in both districts. On top of that, flooded water is not treated with sewage except for major roads, and thus, there is concern that microorganisms will propagate and there is a risk of spreading infectious diseases.

(2) Flood

The Indus River has a small annual difference in water volume due to the meltwater from glaciers during the periods of low precipitation. However, the amount of water varies significantly from year to year, and floods often occur during high precipitation. The floods in 2010 were particularly large. In July 2010, due to the unusually high monsoon rainfall, the water of the Indus River overcame the embankment and caused flooding. Abnormal rainfall continued for another two months, causing devastating damage to the vast areas of Pakistan. In August, a levee broke near the Sukkur district, floods spread from Sindh to western Punjab, affecting at least 570,000 hectares of cultivated land in both provinces. By the end of September 2010, more than 2,000 people had died, and more than one million homes had been destroyed. Eventually, the flood-damaged area had reached 20% of Pakistan's land area, and the number of victims reached more than 20 million. In 2012, floods occurred in Khyber Pakhtunkhwa and Punjab provinces in the north, affecting 4.7 million people and killing more than 400 people.

Table 1.1.1 Temperature and Precipitation of Singh's Target Districts

Unit: Centigrades and Millimetres

2018		月												Year-Round
		1	2	3	4	5	6	7	8	9	10	11	12	
District／Province		Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	
Karachi	Highest Temperature	28.4	30.4	34.4	36.2	38.7	35.4	34.0	31.9	32.6	36.8	33.8	28.2	33.4
	Average Temperature	20.0	23.0	27.0	30.0	33.0	31.0	30.0	29.0	29.0	29.0	26.0	20.0	27.3
	Lowest Temperature	13.0	15.8	20.9	25.3	27.7	28.8	28.2	26.3	25.5	23.0	19.3	13.1	22.2
	Rainfall (*1)	41.5	TR	0.0	0.0	0.0	58.8	33.3	65.6	26.4	0.0	0.0	6.6	232.2
Hyderabad	Highest Temperature	26.6	29.6	36.2	40.6	43.0	39.8	37.3	35.6	36.4	37.5	32.2	26.1	35.1
	Average Temperature	20.0	23.0	29.0	33.0	34.0	33.0	32.0	30.0	30.0	30.0	25.0	20.0	28.3
	Lowest Temperature	11.7	15.0	19.7	23.1	26.0	26.7	26.4	25.2	23.2	21.3	17.9	11.9	20.7
	Rainfall (*2)	2.4	0.4	TR	0.0	0.0	14.0	27.0	78.0	0.0	0.0	0.0	0.0	121.8
Sindh (Total)	Average Temperature	20.0	23.0	29.0	33.0	34.0	33.0	32.0	30.0	30.0	30.0	25.0	20.0	28.3
	Rainfall (*3)	81.5	5.4	2.0	0.0	13.0	203.2	334.8	262.3	58.4	0.0	8.0	36.1	1,004.7

Note: (*1 and *2) The figures of the rainfall of Karachi and Hyderabad are those of 2017. "TR" refers to less than 0.1 millimetres.
(*3) The 2017 total precipitation of selected stations in the province (i.e., Karachi, Hyderabad, Badin, Chhor, Padidan, S.B. Abad, Sukkur/Rohri and Jacobabad)

Source: Development Statistics of Sindh 2019

1.2 Economic Infrastructure

1.2.1 Electricity

In Pakistan, 73.9% have access to electricity and 58.7% in rural areas according to World Bank[3] from a data in 2019, and improving access to electricity in rural areas is a key issue.

In Sindh, K-Electric Limited (KE Karachi) and Water and Power Development Authority (WAPDA) provides electricity. Production, consumption, and consumers data from 2018 are summarized in Table 1.2.1. Production of electricity is about 134,981 GW,[4] of which Sindh accounts for 17%.

Table 1.2.1 Generation and Consumption of Electricity in Sindh (2018)

Generation	22,456(GWh)
Consumption	20,850(GWh) By company WAPDA：6,990 K-ELECTRIC：13,860
No. of Consumers	4,409,456 By company WAPDA：1,826,021 K-ELECTRIC：2,583,435

Source: Development Statistics of Sindh 2019

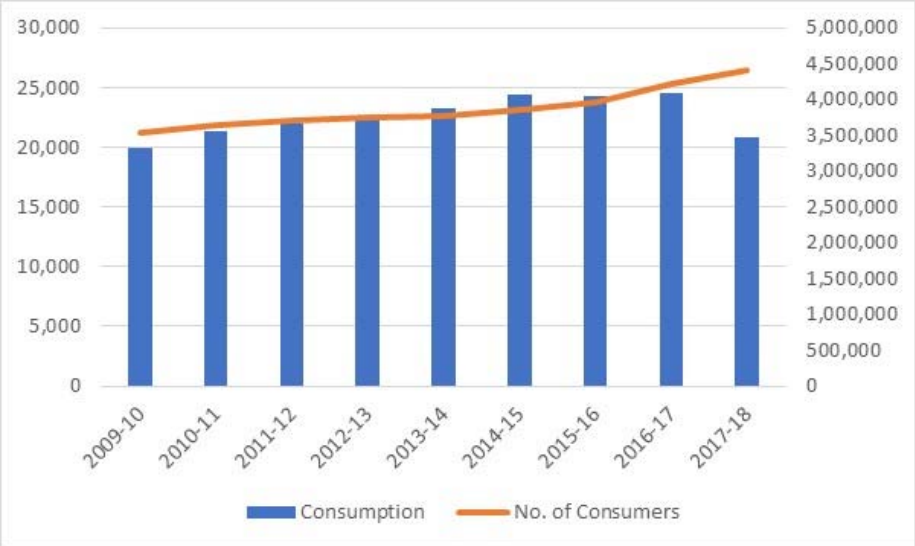
Consumption and consumers of electricity by group are shown in the table below.

Table 1.2.2 Consumption and Consumers of Electricity by Group, 2017–2018

Group	Consumption (GWh)	No. of Consumers
Domestic	11,272	3,563,582
Commercial	2,292	742,689
Industrial	5,349	48,246
Agriculture	769	25,349
Others	1,168	29,590
Total	20,850	4,409,456

Source: Development Statistics of Sindh 2019

[3] World Bank, “Access to electricity (% of population),” https://data.worldbank.org/indicator/eg.elc.accs.zs.
[4] Monthly Bulletin of Statistics, April 2021.



Source: Development Statistics of Sindh 2019

Figure 1.2.1 Consumption and Consumers of Electricity in Sindh

1.2.2 Gas

Gas consumption by facility in Sindh from 2010 to 2018 are shown in the table below. The number of consumers in industrial facility has been increasing, while consumption peaked in 2010 and has been decreasing until 2018 (except in 2016). To the number of domestic consumers has been increasing, while consumption has also increased. Consumption of the commercial facility is stable at around 9.5 billion cubic feet; however, its consumers are decreasing. Overall, the total consumption has been decreasing being affected by the reduction of the industrial facility.

Table 1.2.3 Consumption and Consumers of Gas by Group

Unit of Consumption: Mill. Cubic Feet

	Industrial		Commercial		Domestic		Total	
	Consumption	No. of Consumers	Consumption	No. of Consumers	Consumption	No. of Consumers	Consumption	No. of Consumers
2010	292,410	3,809	9,545	22,138	65,466	2,018,175	367,421	2,044,122
2011	254,822	3,987	9,486	22,870	70,896	2,119,760	335,204	2,146,617
2012	252,538	4,073	9,769	22,969	83,029	2,231,536	345,336	2,258,578
2013	257,104	4,064	9,636	21,858	85,101	2,299,185	351,841	2,325,107
2014	254,437	4,100	9,531	21,380	71,748	2,360,021	335,716	2,385,501
2015	257,333	4,096	9,465	20,893	73,982	2,430,005	340,780	2,454,994
2016	280,358	4,117	9,364	20,457	74,702	2,493,089	364,424	2,517,663
2017	243,330	4,137	9,394	20,104	86,536	2,553,124	339,260	2,577,365
2018	241,770	4,149	9,419	19,981	85,472	2,620,666	336,661	2,644,796

Source: Development Statistics of Sindh 2019

1.2.3 Road Transport

Trends of the total road extension distance of Pakistan and Sindh are shown in Table 1.2.4. Both were growing yearly but higher in Sindh, with its share increasing yearly as well.

Table 1.2.4 Total Road Extension Distance

Year	Pakistan	Sindh	Share of Sindh
2014	263,755	18,793	7.1%
2015	263,922	19,673	7.5%
2016	265,905	21,135	7.9%
2017	267,002	21,614	8.1%
2018	268,935	22,286	8.3%

Source: Development Statistics of Sindh, 2019

The Government of Pakistan issued the National Transport Policy 2018 that identified the road transport network as the crucial provider of inter-regional access. The traffic volume through national highways accounts for most cargo and commercial transport, especially the national highway route 5. Route 5 is the axle that connects Karachi port with Punjab, the nation's economic center.

Source: National Highway Authority (NHA)

Figure 1.2.2 Road Networks in Sindh Province

The National Highway Authority oversees the national highways in Sindh, while the Works & Service Department of Sindh is responsible for the provincial roads. At the district level, each district government manages the roads running in rural areas. However, most rural roads face issues, such as unpaved roads, lacking drainage systems, inadequate regulations and maintenance works, overloads, and finance shortages. In September 2018, ADB reported that the condition of around 50% of the road networks in Sindh are unsatisfactory and 30% in very poor condition.[5]

On the other hand, the number of vehicles has been increasing every year, reaching more than 1.5 million in 2018, although it dropped in 2016. According to the data by district, Karachi accounts for 83%, followed by Hyderabad at 6.3% and Sukkur at 5.7%. But both districts have mostly

[5] Sindh Provincial Road Improvement Project. (2015, October 12). Asian Development Bank. https://www.adb.org/projects/46377-002/main#tabs-0-2

motorcycles, and most four-wheel vehicles are in Karachi.

Table 1.2.5 Number of Vehicles in Sindh (2017–2018)

	2015	2016	2017	2018
No. of Vehicles	1,008,255	699,038	1,466,910	1,515,574

Source: Development Statistics of Sindh 2019

Table 1.2.6 Vehicles on Road by Type and District (2017–2018)

Province/ District	Motor Cars, Jeeps & Station Wagon	Motor Cycles	Taxies	Rickshaws	Buses/ M. Buses	Trucks	Tractors	Pickups/ D.Vans & Others	Total
Sindh	638,971	553,595	5,685	66,399	13,890	21,045	7,110	208,879	1,515,574
Khairpur	2	832	0	0	2	0	2	0	838
Ghotki	0	304	0	0	0	0	0	0	304
Jacobabad	8	10	0	0	6	4	4	2	34
Kashmore Kandhkot	0	22	0	0	0	0	0	0	22
Sukkur	1,016	75,811	0	5,298	1,631	1,038	787	815	86,396
Shikarpur	1	68	0	0	2	0	2	6	79
S.B.Abad	40	12,623	0	18	7	17	881	11	13,597
Naushero Feroze	0	7,823	0	0	0	1	0	0	7824
Larkana	109	23,229	0	387	257	302	412	283	24,979
Kamber Shahdadkot	0	273	0	0	0	0	0	0	273
Sanghar	0	1,064	0	0	0	0	37	0	1,101
Mirpurkhas	140	5,276	0	91	209	456	2,256	191	8,619
Umerkot	17	101	2	0	24	53	84	55	336
Tharparkar, Mithi	9	31	0	0	16	53	50	19	178
Dadu	0	10560	0	0	0	0	0	0	10,560
Jamshoro	0	16	0	0	0	0	5	0	21
Hyderabad	2,213	70,097	267	15,766	1,135	2,645	1,500	1,919	95,542
Matiari	0	0	0	0	0	0	0	0	0
Tando Allahyar	0	8	0	0	0	0	0	0	8
Tando Muhammad Khan	0	0	0	0	0	0	0	0	0
Badin	8	1358	0	0	4	61	85	33	1,549
Thatta	0	0	0	0	0	0	0	0	0
Karachi	635,408	344,089	5,416	44,839	10,597	16,415	1,005	205,545	1,263,314

Source: Development Statistics of Sindh, 2019

1.3 Social Infrastructure

The following sections describes the status of educational institutions, medical institutions, and

medical workers in Sindh.

1.3.1 Educational Institutions

Educational institutions in Sindh are equivalent to Japanese elementary to senior high schools.[6]

In Pakistan,[7] a school that provides education in 5th grade is generally called “primary school,” while education in 3rd grade is “middle school.” Schools with 9th and 10th grades are called secondary schools, and schools with 11th and 12th grades are higher secondary schools.

Table 1.3.1 shows the number of public primary schools in the target districts and province in 2018. Primary school includes grades I to V (about 5 to 9 years old).

Table 1.3.1 Number of Public Primary Schools (2018)

District/ Province	Number of Schools				Number of Pupils			
	Boys'	Girls'	(%)	Total	Boys	Girls	(%)	Total
Karachi	1,688	270	13.8	1,958	88,495	80,799	47.7	169,294
Hyderabad	609	103	14.5	712	40,351	26,286	39.4	66,637
Sindh	33,854	4,301	11.3	38,155	1,742,756	850,240	32.8	2,592,996

Source: Development Statistics of Sindh (2019)

Table 1.3.2 shows the number of public middle schools in the target districts and province in 2018. Middle school includes grades VI to VIII (about 10 to 12 years old).

Table 1.3.2 Number of Public Middle Schools (2018)

District/ Province	Number of Schools				Number of Students			
	Boys'	Girls'	(%)	Total	Boys	Girls	(%)	Total
Karachi	247	128	34.1	375	16,766	22,804	57.6	39,570
Hyderabad	50	27	35.1	77	12,203	10,908	47.2	23,111
Sindh	1,726	555	24.3	2,281	160,470	108,879	40.4	269,349

Source: Development Statistics of Sindh (2019)

Table 1.3.3 shows the number of secondary and higher secondary schools in the target districts and province in 2018. Secondary school includes grades IX to X (13 to 14 years old), and higher secondary school is grades XI to XII (15 to 16 years old).

Table 1.3.3 Number of Secondary and Higher Secondary Schools (2018)

District/ Province	Number of Schools				Number of Students			
	Boys'	Girls'	(%)	Total	Boys	Girls	(%)	Total
Karachi	323	203	38.6	526	93,870	125,868	57.3	219,738
Hyderabad	53	30	36.1	83	37,016	36,169	49.4	73,185
Sindh	1,483	542	26.8	2,025	785,255	476,433	37.8	1,261,688

Source: Development Statistics of Sindh (2019)

1.3.2 Medical Institutions and Medical Staff

Tables 1.3.4 to 1.3.9 show the number of medical institutions and their delivery systems. According to the “Development Statistics of Sindh 2019,” the population of Karachi in 2017 was about 16.0 million, Hyderabad was about 2.2 million, and Sindh was about 48.0 million. The number of hospitals in Sindh was 100 in 2018; therefore, there was one hospital for about 500,000 inhabitants

[6] According to Development Statistics of Sindh 2019, the proportion of women in the total population of Sindh province was 47.9% in 2017. Likewise, the ratio is 47.4% in Karachi district and 47.9% in Hyderabad.

[7] For details, please refer to Kurosaki (2013) “The Characteristics and Issues of Pakistan’s Education System” (in) Oshikawa ‘Educational Development in South Asia and Social Transformation.’

and 12,788 beds and only 0.3 beds per 1,000 inhabitants. The number of beds in Japan is 13 per 1,000 people,[8] which is more severe than in other developed countries.

Table 1.3.4 shows the number of hospitals and dispensaries, rural health centers (RHC), and the number of beds in the target districts and province in 2018.

Table 1.3.4 Number of Hospitals, Dispensaries, and RHC (2018)

Districts/ Province	Hospitals		Dispensaries		RHC	
	No.	Beds	No.	Beds	No.	Beds
Karachi	14	2,210	34	20	6	28
Hyderabad	11	1,357	15	30	3	40
Sindh (total)	100	9,019	2,031	317	129	1,365

Source: Development Statistics of Sindh (2019)

Table 1.3.5 shows the number of tuberculosis centers (TBC), basic health unit (BHU), mother-child health center (MCHC), and the number of beds in the target districts and province in 2018.

Table 1.3.5 Number of Other Medical Institutions and Beds (2018)

Districts/ Province	TBC		BHU		MCHC	
	No.	Beds	No.	Beds	No.	Beds
Karachi	72	114	35	52	21	80
Hyderabad	19	0	15	30	7	21
Sindh (total)	360	318	775	1,469	110	300

Sources: Development Statistics of Sindh (2019)

Table 1.3.6 shows the number of medical staff, such as doctors and nurses, and the number of beds in the target districts and province in 2018. Among the doctors in Sindh, 21.9% are concentrated in Karachi and 18.3% in Hyderabad. Similarly, 25.5% of nurses in Sindh are in Karachi and 19.8% in Hyderabad.

Table 1.3.6 Number of Doctors, Nurses, and Other Medical Staff (2018)

Districts/ Province	Doctors	Nurses	Dispensers	X-ray Technicians	Mid-wives	Others
Karachi	1,811	512	343	76	96	403
Hyderabad	1,512	397	187	55	50	415
Sindh (total)	8,269	2,005	2,251	358	1,031	2,216

Sources: Development Statistics of Sindh (2019)

1.4 Social Structure

1.4.1 Structure of Rural Society

The political, economic, and social structure of Pakistan has been represented by the dominance of large landowners.[9] In the past, several land reform and redistribution efforts have been implemented, and the relationships among large landowners, tenant farmers, and sharecroppers in rural society have had certain changes. However, the dominant power structure of the large landowners persists until today. According to the 2000 statistical data of Sindh, the farmers with

[8] The figure is as of 1 October 2008. It is based on the results of a survey on the status of medical facilities, which was conducted by the Japanese Ministry of Health, Labor and Welfare.

[9] Land ownership categories (large farmers, small farmers, etc.) in Sindh have no clear definition. As explained in the introduction, for this study, "small farmers" will be treated as those owning less than five acres of farmland, while large landowners and large-scale farmers have 50 acres or more, in accordance with the general perception of the Sindh government officials.

less than 2.5 ha (6.2 acres) of agricultural land was 29.8% of the total number, while the area of agricultural land was at 4.8%. On the other hand, 2.3% of the total number of farmers have more than 50 ha of farmland or 25.7% of the total farmland area. Statistics show that a small number of large-scale farmers hold a high percentage of farmland, and this has not significantly changed in 2010.

Table 1.4.1 Number of Farmers and Farmland Area by Farm Size

(Unit：000、Area: ha)

	2000年						2010年					
	Farm	%	Area	%	Cultivated	%	Farm	%	Area	%	Cultivated	%
Under1ha	42	3.6%	6	0.1%	5	0.2%	42	3.8%	6	0.2%	5	0.2%
1-2.5	306	26.2%	202	4.7%	189	5.9%	306	27.4%	202	5.1%	189	6.1%
2.5-5	282	24.1%	400	9.3%	368	11.4%	282	25.3%	400	10.0%	368	11.9%
5-7.5	159	13.6%	369	8.6%	328	10.2%	159	14.3%	369	9.2%	328	10.6%
7.5-12.5	193	16.5%	739	17.2%	608	18.9%	138	12.4%	531	13.3%	450	14.5%
12.5-25	102	8.7%	711	16.5%	514	16.0%	98	8.8%	722	18.1%	559	18.1%
25-50	58	5.0%	765	17.8%	542	16.8%	64	5.7%	845	21.2%	614	19.9%
50-100	20	1.7%	509	11.8%	318	9.9%	21	1.9%	527	13.2%	371	12.0%
100-150	4	0.3%	176	4.1%	108	3.4%	3	0.3%	142	3.6%	92	3.0%
150 above	4	0.3%	420	9.8%	241	7.5%	2	0.2%	249	6.2%	117	3.8%
Total	1,170		4,297		3,221		1,115		3,993		3,093	

Source：Development Statistics of Sindh (2019)

In rural areas, large landowners and landlords called *Zamindars* form the ruling hierarchy, and powerful Zamindars sometimes play clergy roles, which are strengthened by religious authority. The combination of economic power based on land ownership and social and religious authority often results in great political power in the community. In interviews with farmers in this study, many even depend on the Zamindar for various family and private consultations besides financial matters.

In addition to the dominance of landlords and rich farmers, the structure of rural society in Sindh is characterized by *Baradari*, a clan hierarchy that divides society. In the Urdu language, it is called *Biradri*, meaning “brotherhood,” and generally refers to a social hierarchy like the caste system of South Asian Muslims. But in Sindh, it refers to people belonging to a clan that shares the same blood roots. All people belong to some Baradari. There is also a Hindu Baradari.

Villagers or residents of villages of a certain size in Sindh are divided into residential areas called “para.” The para functions as the smallest unit of the community. When disputes or problems occur among villagers, the leaders of the para make the decisions, solve problems, and help each other. In some villages, Muslims and Hindus form the same para, but in most cases, the para is made up of villagers of the same religion and Baradari. Farming and other activities are often done on a Baradari basis, and there are cases where there is no interaction between different Baradari, even if from the same village. In some cases, high-status Baradari villagers do not enter the premises of low-status Baradari or do not eat or drink what is served there.[10] Thus, due to differences in land ownership, wealth, and Baradari, there may be barriers to information, human movement and interaction, cooperation in work, etc. However, since the situation differs from place to place, any intervention in rural areas needs to be implemented with a thorough understanding of these social structures.

[10] Based on the results of the PRA Survey conducted in JICA’s “The Project on Sustainable Livestock Development for Rural Sindh.”

Box: Land ownership and farming type in Sindh Province

As mentioned above, rural society in Sindh is characterized by a structure dominated by large landowners, but there are a great variety of farming patterns, as shown below.

Landownership	Farming pattern
Own land	Grow on own land. The scale varies from small to large. In many cases, large landowners rent their land to vendors or other farmers and are not involved in farming activities themselves.
Rented land	Tenants pay land rent and use the farmland freely. Many are commercial farmers. Landowners do not provide agricultural inputs, and loans to tenants are not common.
Sharecropping	Instead of land rent, a certain percentage of the harvest (usually 50%) is submitted to landowners. In the case of fruit trees, the landowner and smallholders share the trees instead of the land. The landowner decides the crop, and inputs are provided. Some landowners provide loans.

The following is a summary of the typical status (persona) of the farmers interviewed in this study. (Details on access to finance are provided in Section 6.3.3.)

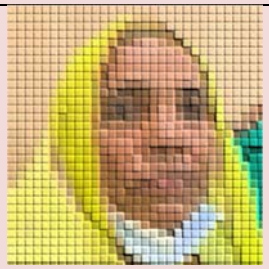
Large landowner farmer

Ali: 33 years old
- Owns 100 acres of land inherited through ancestors for banana cultivation.
- A family of nine. The female family members do not work. Her brothers are also in the same business.
- He is a graduate from a university in Karachi, has IT knowledge, and collects farming information online.
- Farming is done by hiring several laborers according to season and purpose.
- Sales are made to familiar middlemen and exporters in the wholesale market. The demand is high, and there is no problem in selling.
- Uses bank loans to invest in expanding their farmland, which he plans to in the future.
- The problem is pests and diseases. He inquiries about the causes and measures to be taken from research institutes.

Small-scale land rented farmers

Rehman: 25 years old
- Single, family of seven. Family members grow sugarcane, onions, wheat, chili, etc.
- Finished only primary education and the only literate in the family. No one in the family has higher education.
- He used to be a sharecropper, but with the financial support of an NGO, he is now able to cultivate 3 acres of leased land, which has increased his income since he no longer has to submit the harvest to the landowner. He works at construction sites and factories depending on the season. He earns about half of his income from farming.
- Recently purchased a smartphone, using it mainly for entertainment.
- He wishes to improve cultivation techniques and increase income.

Share croppers



Rubina: 45 years old
- Family of 11. She lives with her husband's parents, siblings, and children. No education. Only her children are literate.
- She grows sugarcane, tomatoes, onions, etc., on 7 acres of land owned by the landowner, and 75% of the harvest goes to the landowner. Seeds, fertilizers, and other inputs are supplied by the landowner. Irrigation and groundwater are used for farms, and the cost of the pump is shared with the landowner. Men and women work together on the farm.
- They are in debt to the middleman and the landowner but are unsure how much their debt is. Her husband and children also work in a factory and receive a salary of PKR10,000 per month. Without savings, their debts have increased due to the loss of income from the factory as a result of the COVID19 pandemic.
- They depend on landlords and middlemen for necessary information and funds.

1.4.2 Gender

Pakistan signed and ratified the Convention on the Elimination of All Forms of Discrimination against Women in 1996, and the Constitution guarantees gender equality. The government has been making efforts to develop various institutions for gender equality and women's empowerment. However, Islamic and customary laws in each community are prioritized for decision-making, and sometimes violence against girls and women, including child marriage and honor killings, is tolerated. The traditional patriarchal system has become a social norm, and the rights of women, including the right to inheritance and land ownership, are not sufficiently guaranteed.

According to the Gender Gap Report 2021 published by the World Economic Forum, Pakistan ranks 153rd out of 156 countries in the world in terms of gender gap index (it was 112th in 2006), a situation that has worsened significantly over the past few decades. Compared to neighboring countries, the degree of gender inequality is high in all aspects, including participation in economic activities, education, health, and politics. In Sindh, as seen in Table 1.3.1, the number of boys enrolled in primary education is about 1,742,000 and 850,000 girls, which is less than half of boys.

Table 1.4.2 Pakistan Gender Gap Index 2021

	Rank	Female	Male
Labour force participation	149	22.6	84.8
Estimated earned income (000$)	151	1.4	8.4
Literacy rate	144	46.5	71.1
Enrolment in primary education	145	61.6	73.2
Women in parliament	102	20.2	79.8

	Pakistan	Bangladesh	India	Nepal	SriLanka
Total score	153	65	140	106	116
Economic participation	152	147	151	107	132
Education atteinment	144	121	114	134	88
Health and survival	153	134	155	113	30
Political empowerment	98	7	51	61	90

Source: World Economic Forum, Global Gender Gap Report (2021)

Sindh is one of the first provinces in Pakistan to develop a legal framework for women's empowerment; in 2003, it became the first province in the country to establish a Women Development Department independent of the Social Welfare Department. The State Commission on the Status of Women (PCSW) was established in 2017 after a bill was passed in 2015.[11] The Policy for Women's Empowerment was enacted in 2014, ahead of other provinces and other related bills, such as the Domestic Violence Prevention and Protection Act (2013), the Child Marriage Regulation Act (2013), and the Sexual Harassment Prevention Act (2018), have also been enacted.

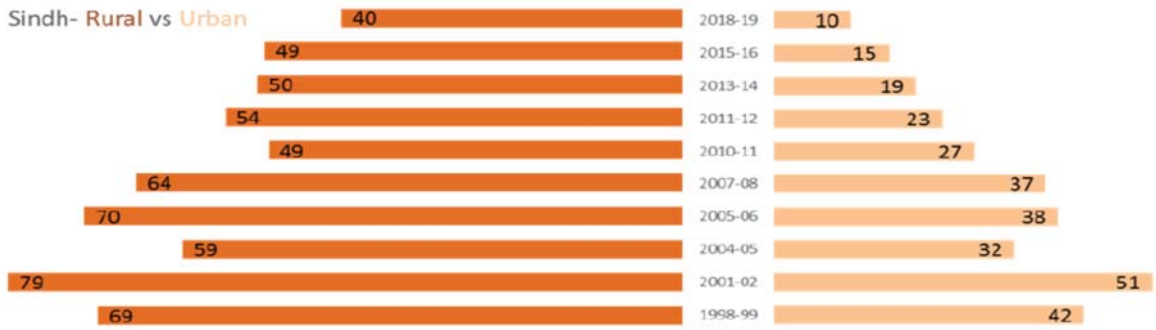
Although many women in rural areas are involved in agricultural activities, as described in section 3.5, there are few cases in which women in Sindh take a leading role in the activities. A high percentage of agricultural work is done by men, and the percentage of agricultural work done only by women is extremely small. Farming activities in which both men and women engage include sowing, weeding, and harvesting. Post-harvest processing, such as cleaning, sorting, and packaging of harvested products, is also done by a relatively high percentage of men and women working together. All these tasks can be considered relatively light work. According to a rural survey conducted in the “Sustainable Livestock Development Project in Sindh” by JICA, the main role of women is in livestock-related activities, such as cleaning livestock sheds, milking, watering, feeding,

[11] As of January 2020, no provincial government officials have been assigned to the PCSW, and no budget has been allocated (JICA's "Pakistan: Information Collection and Verification Survey on Gender-Based Violence Issues" Final Report), and according to interviews with local officials, the PCSW is hardly functioning.

and producing processed milk products. Muslim women are less likely to perform agricultural work than Hindu women. The situation of women's freedom varies greatly from village to village and Baradari to Baradari, and in many communities, women are not allowed to go out of their houses or the village, attend trainings with men and women in the same room, or attend trainings with male instructors.[12]

1.4.3 Poverty Situation

The poverty rate in Pakistan has steadily improved over the past two decades, from 61.6% in 1998–1999 to 21.5% in 2018–2019, in accordance with economic growth. However, various problems of poverty persist due to some issues, such as repeated disasters, diminishing security caused by terrorism, and social exclusiveness. Especially in rural areas, the pace of poverty alleviation is slower than in urban areas due to limited job opportunities, except in agriculture. The urban areas of Karachi and Hyderabad districts in Sindh have seen a growth of middle and upper classes and the poverty rate significantly decreased, but the poverty rate in the rural areas is about four times higher than in the urban areas.



Source: Pakistan Institute of Development Economics, “The State of Poverty in Pakistan” (2021)

Figure 1.4.1 Change in Poverty Rate in Rural and Urban Areas

Source: Geography of Poverty in Pakistan 2014–2015, PPAF

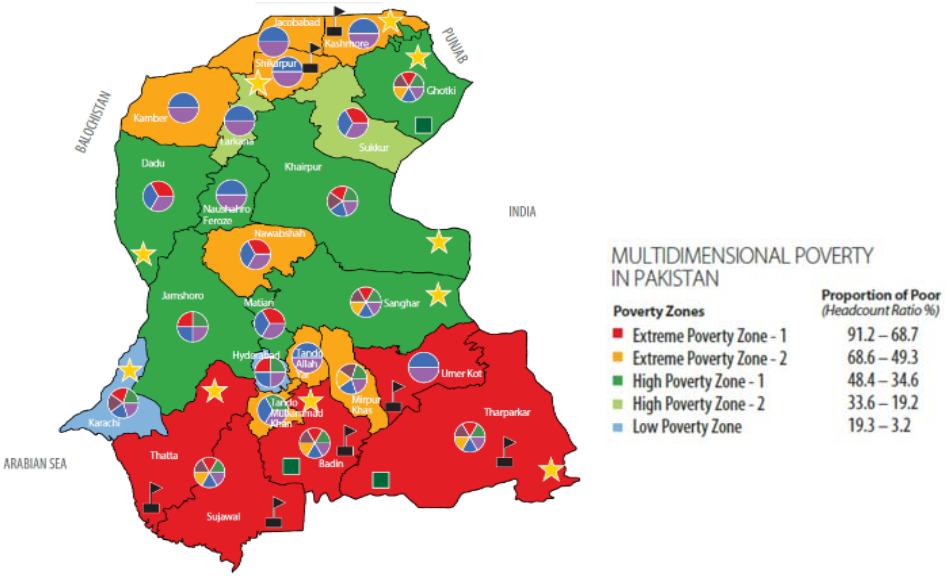
Figure 1.4.2 Poverty Rate by District

As shown in Figure 1.4.2 and Figure 1.4.3, poverty in Sindh is concentrated in the southern districts of Sindh, known as Lower Sindh.13 It is worsening in Tharparkar, Umerkot, and Thatta districts.

[12] According to an interview with the expert involved in “The Project for Improvement of Livelihood and Well-being of Female Home-Based Workers in the Informal Economic Sector in Sindh Province” implemented by JICA.

[13] There is no clear definition of which districts belong to "Upper Sindh," "Central Sindh," and "Lower Sindh." In this study, "Upper Sindh" includes the ten districts of Larkana, Dadu, Jacobabad, Kashmore, Ghotki, Shikarpur, Shahdadkot, Sukkur, Ghotki, and Khairpur. "Central Sindh" includes Sanghur, Hyderabad, Jamshoro, Hyderabad,

On the other hand, the situation of some northern districts like Kashmore, Ghotki, and Shikarpur is improving.



Source: Sindh Fact File (2021), PPAF

Figure 1.4.3 Poverty Map in Sindh

Jamshoro, and Khairpur, and “Lower Sindh" includes Mirpurkhas, Tharparkur, Umerkot, Baddin, Thatta, Sajawal, Karachi, and Tando Muhammad Khan.

2 Agriculture Sector in Sindh

2.1 Overview of the Agricultural Sector

2.1.1 Overview

Agriculture in Sindh is irrigated agriculture using the Indus River as a source of water, mainly cereal crops (wheat and rice), industrial crops (sugarcane and cotton), and a small percentage of horticultural crops. Most farmers are small-scale (having less than 12.5 acres of cultivated land) and are landed farmers. There are two cropping seasons, monsoon and dry. Monsoon season is the main cropping season when more water is available for agriculture. But the soil is poor in nutrients except for potash, and saline areas are widespread.

2.1.2 Major Crops and Production Volume

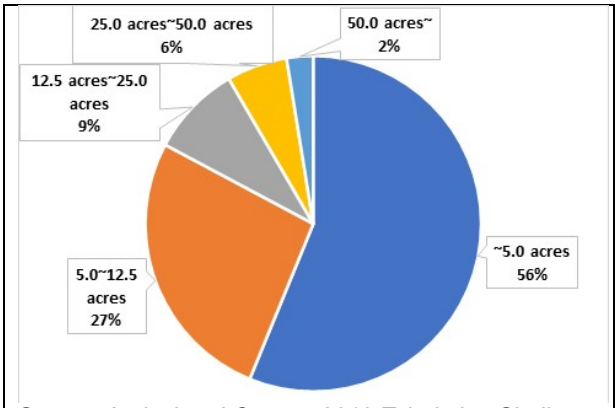
(1) Status of Agricultural Land by Size

In 2010, the number of farmers in Sindh was 1,121,363.[1] Figure 2.1.1 shows the classification of farmers in Sindh according to their area of cultivation in the same year. The percentage of smallholder farmers cultivating less than five acres was more than 50% and less than 12.5 acres was 83% of the total smallholder farmers. Medium and large farmers cultivating more than 12.5 acres of land are in Gotki, Sukkur, Khairpur, Sanghar, Jamshoro, and Karachi Districts. More than 30% of the farmers fall into the category of those districts.

In addition, the number of agricultural lands in 2010 was 1,115,293. Figure 2.1.2 shows the classification of agricultural land in the province by ownership type in the same year. Farmland owners account for 70%, and smallholders account for 26% of the total land. The portion of farmland owners is low (less than 30%) in Umerkot, Mirpurkhas, and Karachi Districts.

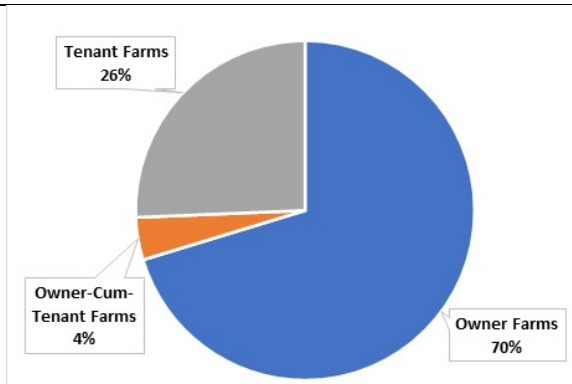
Table 2.1 1 shows the percentage of crops cultivated depending on the farmland size. Farmers with farmland below 5 acres cultivate more wheat and cotton than those with more than 5 acres. Farmers with farmland between 5 and 50 acres cultivate more rice, sorghum (JAWAR), and fodders, and with above 50 acres cultivate more sugarcane and vegetables than farmlands of other sizes.

[1] Agricultural Census 2010-Tabulation Sindh-Province. Landowners in 2021 were 1,356,614 (Board of Revenue Government of Sindh, 2021).



Source: Agricultural Census 2010-Tabulation Sindh-Province

Figure 2.1.1 Percentage of Households by the Area under Cultivation in Sindh



Source: Agricultural Census 2010-Tabulation Sindh-Province

Figure 2.1.2 Percentage of Farmland Owners in Sindh

Table 2.1.1 Percentage of Crops Cultivated (% of cultivated area, by farm size)

SIZE OF FARM (ACRES)	CROP AREA AS PERCENT OF TOTAL CROPPED AREA													
	WHEAT	RICE	MAIZE FOR GRAIN	JAWAR/ BAJRA FOR GRAIN	BARLEY	COTTON	SUGAR-CANE	TOBA-CCO	OIL-SEEDS	PULSES	FODDERS	VEGE-TABLES	**ORCH-ARDS	OTHER CROPS
UNDER 1.0	44	12	*	2	*	24	1	*	*	*	9	1	3	3
1.0 TO UNDER 2.5	45	17	*	1	*	27	3	*	1	*	3	2	1	*
2.5 TO UNDER 5.0	43	21	*	1	*	24	3	*	1	*	4	2	*	1
5.0 TO UNDER 7.5	40	23	*	3	1	19	4	*	2	1	4	2	1	1
7.5 TO UNDER 12.5	40	21	*	3	*	21	4	-	2	1	5	2	1	1
12.5 TO UNDER 25.0	37	20	*	3	1	20	5	*	4	1	5	3	1	1
25.0 TO UNDER 50.0	34	19	*	3	1	19	7	*	5	1	5	3	2	1
50.0 TO UNDER 100.0	34	19	*	2	1	17	6	*	5	1	5	4	4	2
100.0 TO UNDER 150.0	36	20	1	2	1	18	7	-	4	*	4	4	2	1
150.0 AND ABOVE	33	16	*	1	1	20	13	-	4	*	2	4	2	1

* Value less than 0.5

** also includes orchard nursery and flower fields / flower nursery area

Source: Agricultural Census 2010 - Pakistan Report, Pakistan Bureau of Statistics

(2) Agricultural Sector as a Whole

1) Overview

According to the statistical data[2] collected from 2017 to 2018 and from 2020 to 2021, the agricultural area was about 3.1 million ha per year. Figure 2.1.3 shows the ratio of the cultivated area by crop. Cereal and industrial crops dominate the total cultivated area, while horticultural crops account for only 7%. Also, as shown in Figure 2.1.4, the production volume by crop is mostly dominated by industrial and cereal crops, while horticultural crop production accounts for only 5%. The production volume of sugarcane (industrial crop) is extremely high at nearly 70% of the total crop production volume.

[2] Development Statistics Sindh 2019 and Minor Crops 2020/Minor Crops 2020-2021, both published by Sindh Agriculture Department

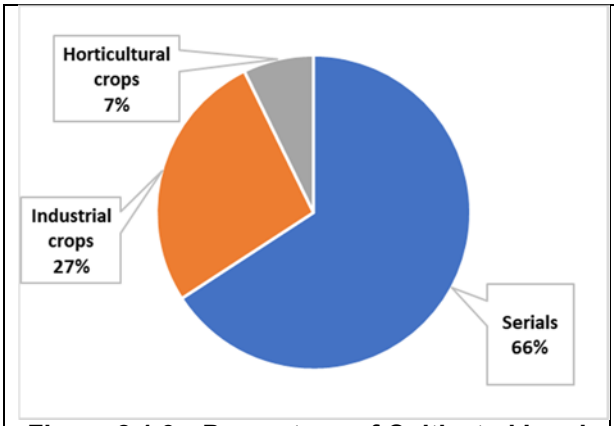


Figure 2.1.3 Percentage of Cultivated Land by Crop in Sindh

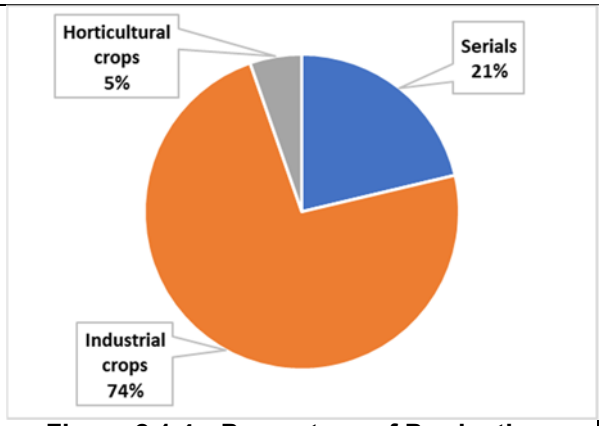


Figure 2.1.4 Percentage of Production Volume by Crop in Sindh

Cereal crops: wheat, rice, sorghum, pearl millet, maize, barley, chickpea
Industrial crops: cotton, sugarcane, sesame
Horticultural crops: chili, cucumber, okra, onion, tomato, eggplant, banana, mango, papaya

Source: Development Statistics Sindh (2019) (the 2017–2018 data is sorghum, pearl millet, maize, barley, chickpea, sugarcane, sesame); Minor Crops 2020/Minor Crops 2020–2021 (the 2020–2021 data is wheat, rice, cotton, and horticultural crops)

2) Cereal Crops

As for the cereal crops cultivated in Sindh, wheat and rice account for the majority, as shown by the percentage of area under cereals in Figure 2.1.5. Looking at the area under wheat and rice in each province of Sindh shown in Figure 2.1.6, wheat is cultivated in the entire province of Sindh, although the amount varies. Rice, on the other hand, is cultivated in some of the northern and southern Districts.

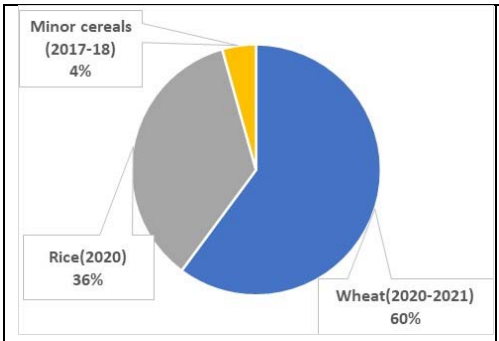


Figure 2.1.5 Percentage of the Area under Cereals by Crop in Sindh

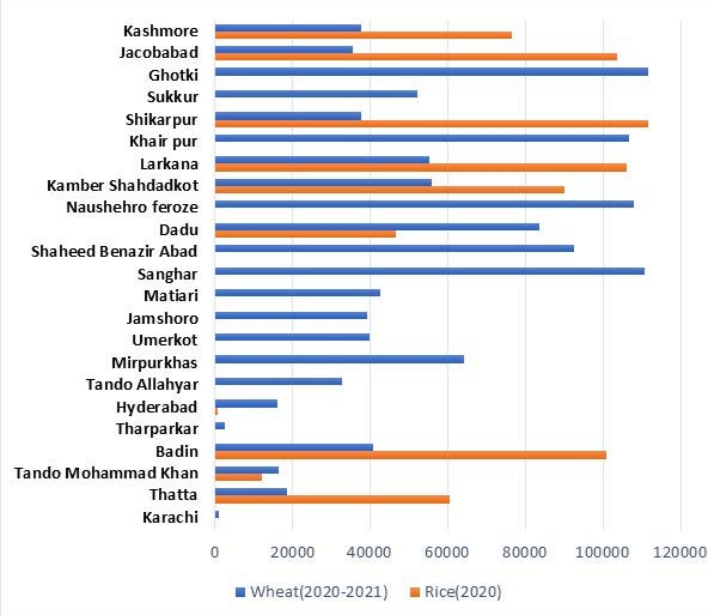


Figure 2.1.6 Area of Wheat and Rice Cultivation in Each District in Sindh (ha)

Sources: Development Statistics Sindh (2019), Minor Crops (2020), Minor Crops (2020–2021)

3) Industrial Crops

As for the industrial crops, cotton and sugarcane account for most of the cultivation area in Sindh, as shown in Figure 2.1.7. Figure 2.1.8 shows that the cultivation area for cotton and sugarcane in

each district is more limited than the area for cereal crops in terms where industrial crops are grown, while sugarcane is grown relatively throughout the province. Cotton, on the other hand, is mainly grown in the northern part of the province.

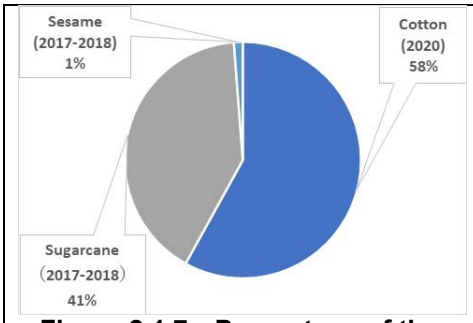


Figure 2.1.7 Percentage of the Area under Industrial Crops by Crop in Sindh

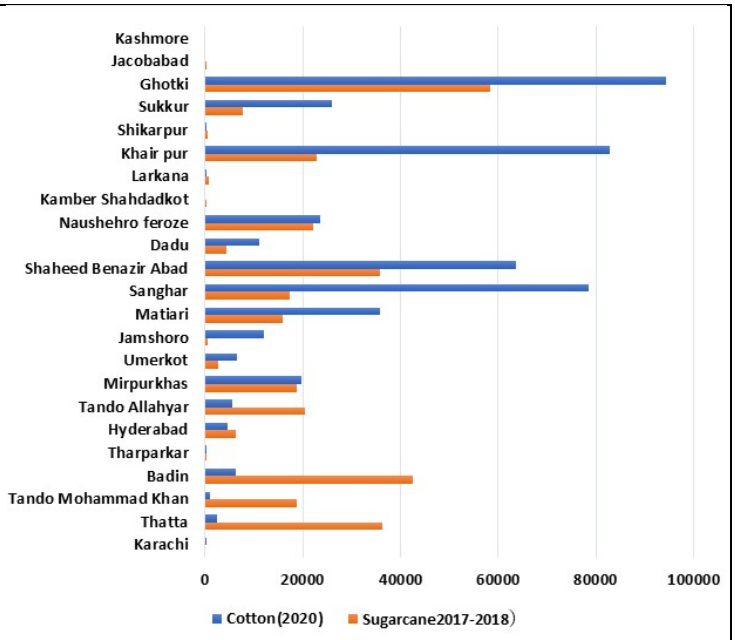
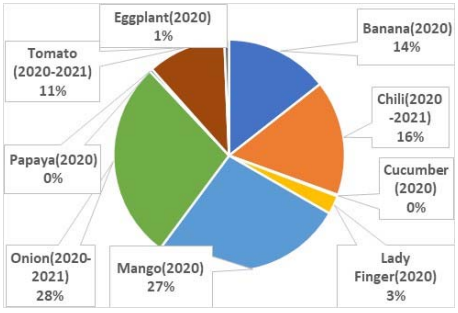


Figure 2.1.8 Area under Cotton and Sugarcane Cultivation in each Province of Sindh (ha)

Source: Development Statistics Sindh (2019), Minor Crops (2020), Minor Crops (2020–2021), Sindh Agriculture Department.

4) Horticultural Crops

For the horticultural crops, Figure 2.1.9 shows the percentage of cultivation area by crop. According to the figure, the major horticultural crops are banana, chili, mango, onion, and tomato. Figure 2.1.11 shows the cultivation area of the five major horticultural crops by province. The total cultivation area for major horticultural crops is estimated at around 1.5 million ha. The top three districts with the highest total area for the five major horticultural crops are Mirpurkhas, Thatta, and Matiari Districts, followed by Sanghar, Jamshoro, and Badin Districts. Banana and chili are grown throughout the southern part of the province. On the other hand, onions, mangoes, and tomatoes form the major production areas. Mangoes are grown mostly in the central part of Southern Sindh, mainly in Mirpurkhas District, and tomatoes are mainly grown in the bottom part of Southern Sindh, mainly in Thatta District.

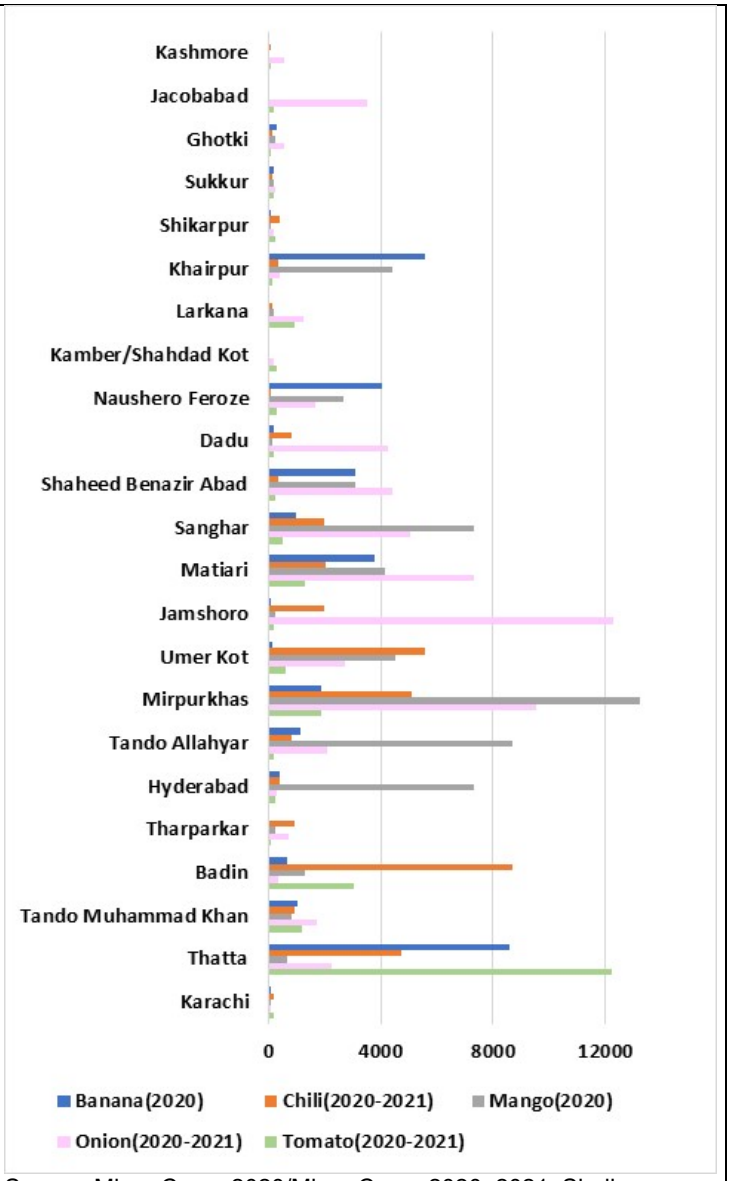


Sources of Figure 2.1.9 and 2.1.11: same as those of Figure 2.1.3 and 2.1.4

Figure 2.1.9 Percentage of Cultivation Area by Horticultural Crop in Sindh

Source: Compiled by the research team based on Figure 2.1.11

Figure 2.1.10 Major Cultivation Areas for Onion, Mango, And Tomato in Sindh



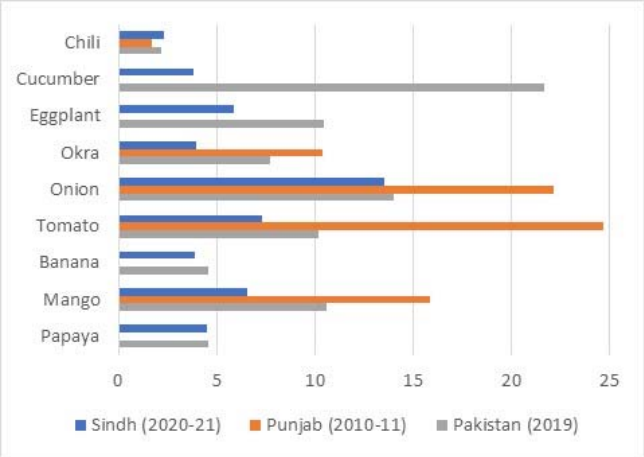
Source: Minor Crops 2020/Minor Crops 2020–2021, Sindh Agriculture Department.

Figure 2.1.11 Cultivation Areas of Banana, Chili, Mango, Onion, and Tomato in different Sindh Districts (ha)

Source: Sindh Agricultural Statistics2020–2021(Sindh Agriculture Department), Punjab Agricultural Statistics (Punjab Bureau of Statistics), FAOSTAT 2019

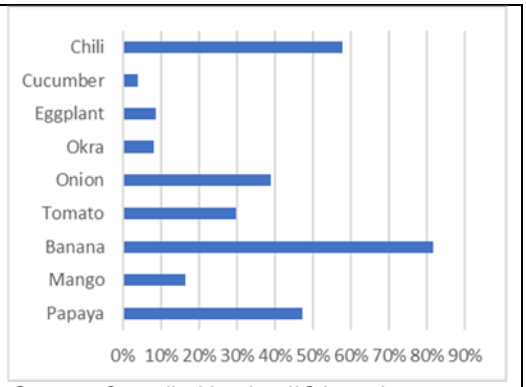
In Figure 2.1.12, the yields of major horticultural crops in Sindh are compared with those in Punjab and Pakistan. Except for chili, the yields for chili, okra, onion, tomato, and mango in Sindh are lower than in Punjab. Since the data of cucumbers, eggplants, bananas, and papayas in Punjab were not available, the results were compared with Pakistan instead. Cucumber and eggplant yields in Sindh were significantly lower than the national average, while banana and papaya yields were almost the same as the national average. This is because the production of bananas in Sindh is as much as more than 80% of the total production volume of the whole country, as shown in Figure 2.1.13. Additionally, for chili and papaya with yields not significantly different from the national average, the production volume share of Sindh is as high as around 50%. Figure 2.1.12 shows there is no significant difference between the yields of Sindh and Pakistan as a whole. In Sindh, horticultural crops are cultivated under irrigation and not for subsistence but for commodity crops, which may

be because agriculture is carried out using the necessary inputs in the arable land with the necessary agricultural water and appropriate soil to obtain a certain yield for profit.



Source: Sindh Agricultural Statistics 2020–2021 (Sindh Agriculture Department), Punjab Agricultural Statistics (Punjab Bureau of Statistics), FAOSTAT 2019

Figure 2.1.12 Comparison of yields of major horticultural crops among Sindh, Punjab, and national averages



Source: Compiled by the JICA study team from Sindh Agricultural Statistics 2020–2021 (Sindh Agricultural Department) and FAOSTAT 2019

Figure 2.1.13 Share of Production of Major Horticultural Crops in Sindh over the National Production

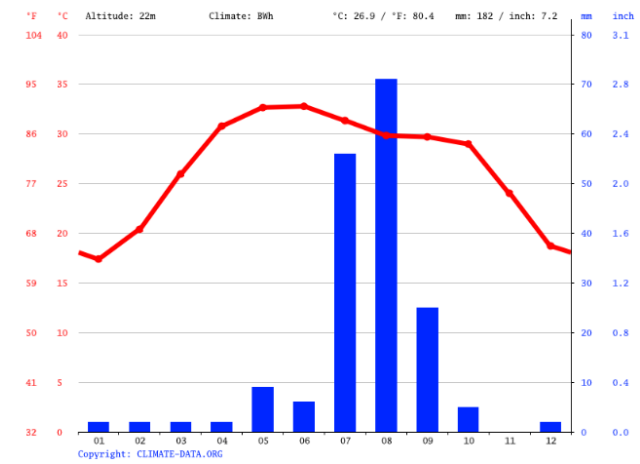
2.1.3 Cropping Seasons

Sindh has two cropping seasons: Kharif season and Rabi season.[3] During Kharif, the temperature is usually high, and the weather has some rainfall (As an example, Figure2.1.14 shows the temperature and precipitation in Hyderabad district, which is the geographical center of Sindh province and where horticultural agriculture flourishes.). In addition, the Indus River, which is supplied by meltwater from Karakoram and Hindu Kush ranges, is also in full flow, increasing the availability of water resources (Table 2.1.1). Therefore, the major crops in Sindh are grown during the Kharif season. The major crops include rice, sugarcane, cotton, maize, beans, vegetables (okra, cucurbitaceous vegetables, chili), and fruits (mango, banana, and papaya). Generally, sowing is from April to June, and harvesting is from October to December.

During Rabi, the temperature is usually low and with little rainfall (Figure 2.1.14). It is also the season when the Indus River source area freezes, reducing the volume of water, and thus the amount of available surface water decreases. Wheat, tobacco, barley, mustard, vegetables (tomato, onion, chili), and fruits (lemon and jujube) are the main crops grown. Onions are popularly grown during Rabi as it is sensitive to high temperatures, and cruciferous leafy vegetables, such as broccoli, are also grown this season because infestation of pests and diseases is lesser than during Kharif. Sowing is generally from October to December, and harvesting is from April to May.

Some crops grow during both Kharif and Rabi seasons, but the yields are higher in the latter because of the availability of agricultural water. Table 2.1.3 shows that Chile has a larger cultivation area during Rabi than the Kharif season, but the yield is only about half.

[3] For more information, see Section 1.2 3.



Source: https://en.climate-data.org/asia/pakistan/sindh/hyderabad-5809/

Figure 2.1.14 Temperature and Precipitation in Hyderabad District

Table 2.1.2 Available surface water in Pakistan (million acre-feet)

Period	Kharif	Rabi	Total
2015-16	65.5	32.9	98.4
2016-17	71.4	29.7	101.1
2017-18	70	24.2	94.2

Source: Indus River System Authority

Table 2.1.3 Area under cultivation and production of chili in Sindh.

	AREA (ha)	PROD (metric tons)	YIELD (metric tons/ha)
Rabi	18,683	29,452	1.58
Kharif	16,726	52,484	3.14

Source: Crop Reporting Service Centre, Extension Section, Department of Agriculture, Sindh.

2.1.4 Soil and Land Use

(1) Soil

1) Soil Fertility

Soil fertility is generally determined by the amount of nutrients (macronutrients, such as nitrogen, phosphate, and potassium, as well as micronutrients), soil organic matter, soil pH, soil structure, microbial richness, and topsoil depth.

As shown in Figure 2.1.15, the amount of available potassium in the soil[4] is above 150 ppm, which is at an adequate level, in all the districts except Jamshoro District. On the other hand, as shown in Figure 2.1.16, the amount of available phosphoric acid is “weak (5.1–10 ppm)” in Tando Allahyar and “very weak (<5 ppm)” in the rest of the districts, indicating that phosphoric acid content is deficient throughout the province. Soil organic matter improves the physical, chemical, and biological properties of soil and soil fertility, and the soil organic component in ordinary fields is 1–6% (ratio by weight). Figure 2.1.17 shows that the soil organic content is as low as 0.5–1.0% in almost the entire province.

Soil conductivity correlates with soil salinity and nitrate-nitrogen, where higher values indicate higher salinity and nitrate-nitrogen concentrations. For to be suitable for cultivation, soil conductivity must be around 0.5–1.0mS/cm. As Figure 2.1.18 shows, the soil conductivity is higher than 1.01mS/cm in Sindh, except in Larkana and Tarparkar Districts. Areas of high soil conductivity are also generally consistent with areas of high soil salinity, which is shown in Figure 2.1.19.

The four indicators of soil in Sindh, as described above, indicate a deficiency in nutrients and organic components and high salinity, while the potash component is at a normal level. For agricultural production improvement, it is essential to supply the deficient nutrients through chemical fertilizers and improve the organic components through applying organic fertilizers. In addition, irrigation drainage and other measures to reduce soil salinity are necessary.

[4] Amount absorbable by the plant.

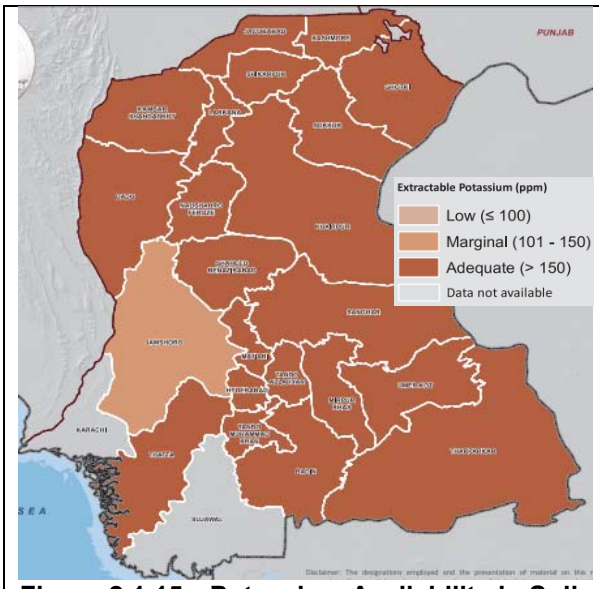


Figure 2.1.15 Potassium Availability in Soils in Sindh

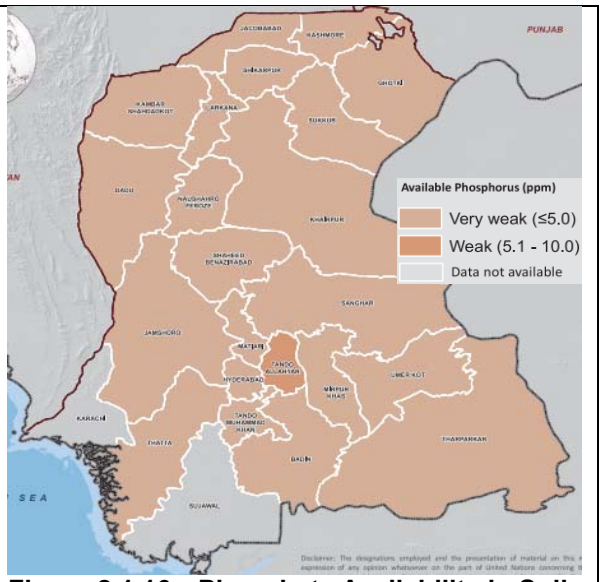


Figure 2.1.16 Phosphate Availability in Soils in Sindh

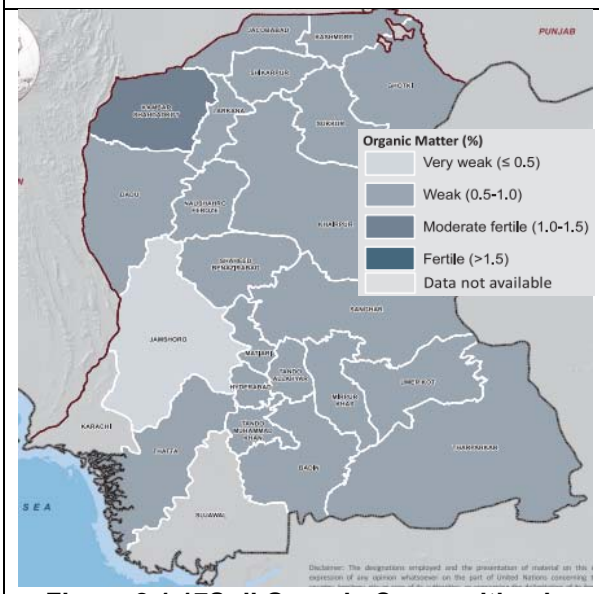


Figure 2.1.17Soil Organic Composition in Sindh

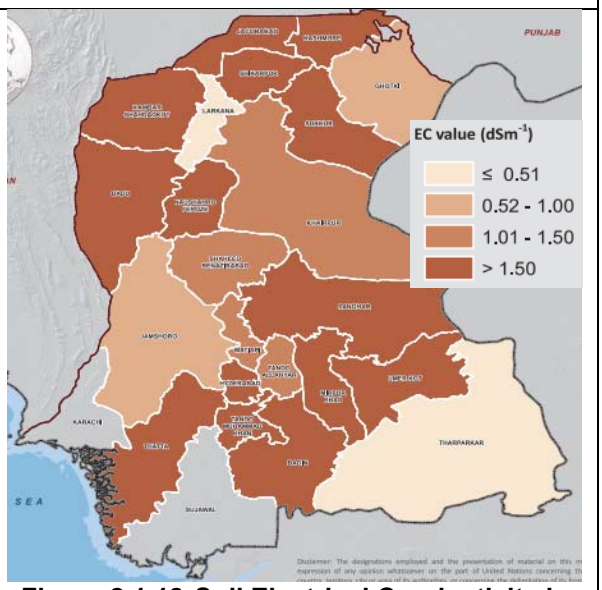


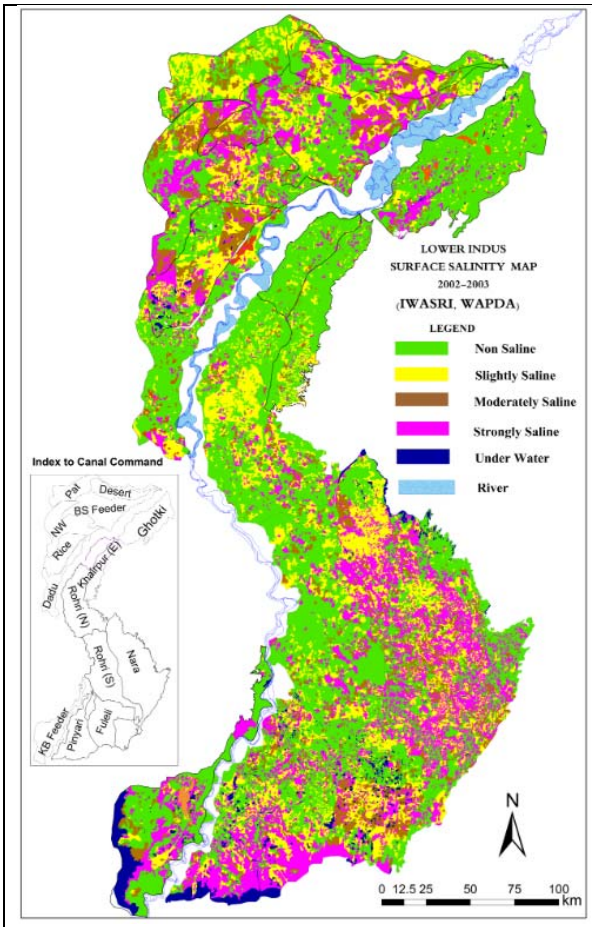
Figure 2.1.18 Soil Electrical Conductivity in Sindh

Source: Figures 2.1.15 to 2.1.18 Soil Fertility Atlas of Pakistan Sindh, FAO

2) Saline Soil

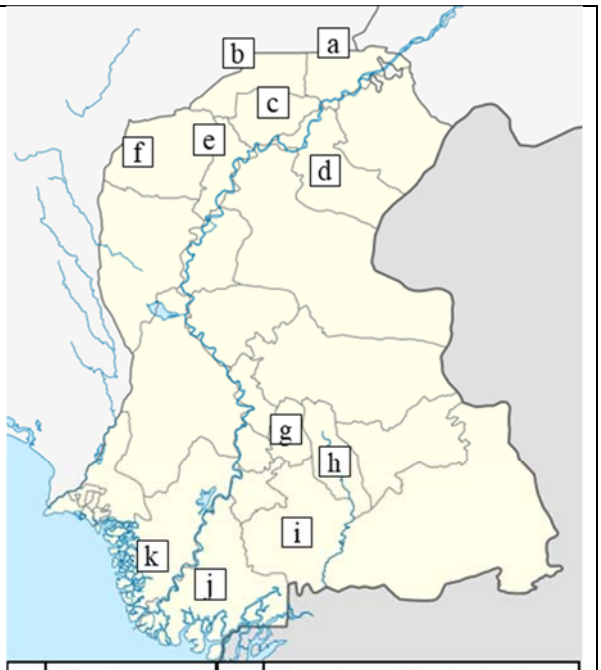
The situation of salt damage in irrigated areas in Sindh is shown in Figure 2.1.19. Figure 2.1.20 identifies the Sindh districts with high salinity. There are six in the north (Kashmore, Jacobabad, Shikarpur, Sukkur, Larkana, Qambar, and Shahdadkot) and five in the south (Tando Allahyar, Mirpur Khas, Badin, Sujawar, and Thatta). Salinity in Sindh is caused by waterlogging of irrigation water due to inadequate drainage facilities and clayey soils, which leads to the dissolution of salt in the soil. Salt in the soil rises to the surface due to capillary action caused by further irrigation. Evaporation of water from the soil brings about saline. High salinity of groundwater is also a contributing factor.[5]

[5] Sindh Agricultural Policy 2018–2030



Source: Groundwater Management Options for Indus Basin Irrigation System; Pakistan Water & Power Development Authority (WAPDA).

Figure 2.1.19 Soil Salinity in Irrigated Areas in Sindh



a	Kashmore	f	Qambar Shahdadkot
b	Jacobabad	g	Tando Allahyar
c	Shikarpur	h	Mirpur Khas
d	Sukkur	i	Badin
e	Larkana	j	Sujawar
		k	Thatta

Source: Prepared by the JICA study team based on Figure 2.1.19

Figure 2.1.20 Districts in Sindh with High Soil Salinity (pinky areas in Figure 2.1.19)

(2) Land Area

1) Arable Land Area

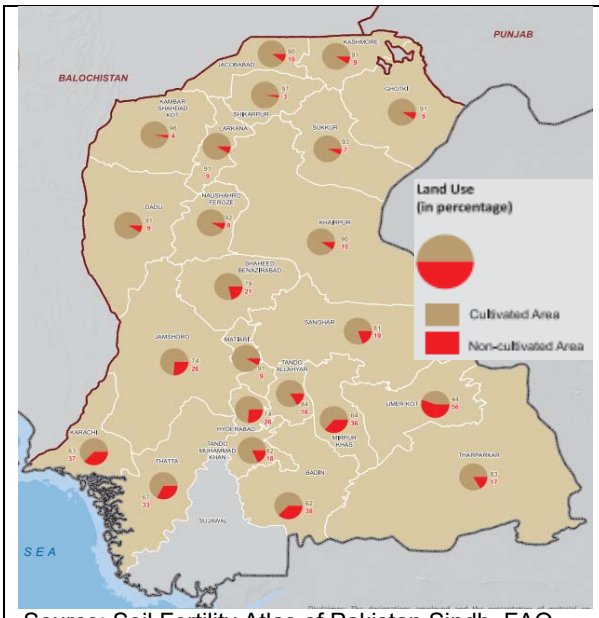
The area of arable land (cropland) in Sindh and its percentage in the province's area are shown in Table 2.1.3. Irrigated agriculture is practiced in 28.5% of the province thanks to the broad irrigation network. The total area of non-irrigated cropland consisting of river floodplain and rain-fed areas is 5.3%. Of the total area, 10.6% is not cultivated due to salt damage, suggesting that the impact of salt damage on agriculture should not be ignored.

The ratio of cultivated to non-cultivated land in Sindh is shown in Figure 2.1.21 (red color in the pie chart indicates the ratio of non-cultivated land in each district). The northern part of the province has a high ratio of cultivated land, while the southern part has a low ratio. Cultivated land, however, includes pastureland and fallow land, which are non-irrigated areas. Cropland, where agriculture is practically carried out, is shown in a subdued green area in Figure 2.1.22. Basically, cropland overlaps with irrigated areas.

Table 2.1.4 Area of cropland in Sindh

Unit / Title	Orchards	Crop on Irrigated	Crop on Marginal Irrigated Saline	Crop in River Flood Plain	Crop on Rain-fed	Forests
Million Hectare	0.13	4.02	1.50	0.40	0.35	0.12
% of Total Area of Sindh	0.9%	28.5%	10.6%	2.8%	2.5%	0.8%

Source: Sindh Agricultural Policy (2018–2030), Government of Sindh



Source: Soil Fertility Atlas of Pakistan Sindh, FAO

Figure 2.1.21 Cultivated Area in Sindh

Source: Soil Fertility Atlas of Pakistan Sindh, FAO

Figure 2.1.22 Land Use in Sindh

2) Irrigated Area

The irrigated area in Sindh is around 10,170,000 ha. Details are given in Section 5.1.4.

2.2 Agricultural Sector's Critical Policies and Issues

In the following sections, the critical policies of the agriculture and water resources and irrigation sectors are reviewed.

2.2.1 Agricultural Sector's Policies

(1) Sindh Agriculture Policy 2018–2030[6]

1) Outline

Sindh Agriculture Policy (SAP 2018–2030) is a provincial-level sector-specific policy document and was approved by the provincial cabinet in April 2018.[7] The vision of SAP is to bring income and employment to those involved in the production, processing, transportation, etc., and to develop an efficient and resilient agricultural sector.[8] The main objectives of SAP are:

(a) raising overall growth rate in the sector to 4-5% annually;

(b) reducing rural poverty to half as well as food insecurity and malnutrition;

(c) preserving agro-ecological base and efficient and sustainable use of natural resources; and

(d) enhancing resilience and climate change adaptability.

The outline of SAP is shown in the table below.[9] The first half of Chapter 1 touches on the current state, potential, and issues of the agricultural sector, while its second half discusses poverty and gender, nutrition, environmental issues, climate change, and public spending. In the first half of Chapter 2, the vision, strategy, and purpose are described. The second half of Chapter 2.4 describes the growth of the agricultural sector (promotion of private investment, implementation of research and marketing using ICT, etc.). Chapter 2.5 describes the response to food shortages and malnutrition (improvement of financial access, etc.). Likewise, Chapter 2.6 discusses the efficient use of natural resources (improvement of water courses, etc.), and Chapter 2.7 discusses climate responding to fluctuations and strengthening resilience (improvement of infrastructure through promotion of public, etc.).

Chapter 3 states the importance of promoting public and private investment for the growth of the agricultural sector and discusses the ongoing projects of the relevant departments (DOA, Department of Livestock and Fisheries, and Department of Forestry). It is pointed out that there is a need to improve the efficiency of operations by confirming and reviewing the relationship with SAP. Chapter 4 describes the establishment of the Sindh Agriculture Policy Implementation Commission (SAPIC) to monitor the progress of SAP implementation, technical support to management personnel of related departments, and public relations strategies related to SAP.

Table 2.2.1 Outline of Sindh Agriculture Policy (2018–2030)

Chapter		Section
1	Background	1.1 Current State of Agriculture
		1.2 Potential
		1.3 Challenge
		1.4 Poverty & Gender Issues
		1.5 Nutrition
		1.6 Environmental Issues
		1.7 Climate Change
		1.8 Public Expenditure for Agriculture Development
2	A New Agricultural	2.1 A Vision for Agricultural Development in Sindh

[6] SAP is one of the outputs of World Bank's "Sindh Agriculture growth Project" (SAGP). Refer to 8.2 of Chapter 8 for further details.

[7] For details, please visit the following URL (access: 10th January 2022): https://nation.com.pk/17-Apr-2018/sindh-cabinet-approves-agriculture-youth-polices

[8] FAO (2018) "Abstract of Sindh Agriculture Policy 2018–2030"

[9] Although SAP includes the issue of water resource management, it is discussed in 2.2.3 (3).

	Policy for Sindh	2.2 A Strategy for Change
		2.3 Major Objectives of the Policy
		2.4 Agricultural Growth
		2.5 Poverty, Food and Nutrition Security
		2.6 Natural Resources Use
		2.7 Resilience and Climate Smart Agriculture
3	Investments Needs	–
4	Implementation Arrangements	4.1 Management and Oversight
		4.2 Technical Support to Senior Line Managers
		4.3 Resilience and Climate Smart Agriculture

Source: Sindh Agriculture Policy (2018–2030)

2) Issues

The following three issues are important in relation to the implementation of SAP.

The first issue is that the definition of the size of farmers (small-, medium-, and large-scale) is not clearly stated, and some of the basic data (e.g., agricultural census) and information have not sufficiently been developed for decision-making on policy formulation and implementation. If SAP does not clearly define the scale, for example, the same measure will be implemented for farmers with 16 acres or less in Karachi and farmers with 12.5 acres or less in Hyderabad. This is because it will be difficult to compare the effects and impacts of the measures after they are implemented in both districts. While, of course, the circumstances are different in each district, such as the composition of the scale of farmers is different, it is not easy to implement measures under the same conditions in all districts. However, SAP has set a definition, and in principle, the definition should be followed. It is desirable to implement policies and measures. Meanwhile, the "Sindh Agricultural Census" has not been issued since 2010.[10]

The second issue is when the mechanisms (SAPIC, etc.) are not fully functioning concerning monitoring and management support related to implementation, as specified in Chapter 4 of SAP above. Public-private dialogues among the DOA, Department of Livestock and Fisheries, Department of Forestry, and Sindh. In addition, it seems that the formulation of the "Sindh Agricultural Development Strategy," which is the implementation strategy of SAP, has not progressed.

Thirdly, in connection to the second issue, there is no public-private cooperation platform (including development partners) that is implementing projects related to the promotion of the agricultural sector. International donors and NGOs have a track record of implementing various projects, and each has lessons learned, including good practices and failure cases. It is beneficial to share this experience with other donors, NGOs, and public and private sectors of Sindh.

(2) Sindh Agricultural Market Act 1939 and Sindh Wholesale Agricultural Produce Markets (Development and Regulation) Act 2010

1) Outline[11]

The "Agricultural Produce Act 1939" was passed in 1939 during British rule. Its main content was regulations on the public market. Section 8 Rule 8 of Act 1939 stipulates the establishment of a market committee (MC) led by the private sector. Later on, in Sindh Wholesale Agricultural Produce Markets Act 2010, the regulations stipulated the opening of private markets and provision of related facilities to agricultural producers. MC plays a very crucial role in the distribution system in Sindh.

[10] However, the "Agricultural Development-Statistics-of-Sindh-2018" was issued in 2018.

[11] For the details of the system of the wholesale market, please refer to 4.3.2 of Chapter 4.

According to the Directorate General (DG) Agriculture Extension, DOA, Sindh, there are 71 MCs in Sindh, each of which operates its market[12]. All these MC are classified into four classes, Class A to D,[13] and Hyderabad and Karachi MCs are in the highest Class A. Class A has a total of 18 MC members, of which 9 are producers, 6 are middlemen, 2 are consumers, and 1 is a government official. In general, the MC chairperson is selected among the producers and vice chairperson among the middlemen. Both positions are honorary and unpaid.

2) Issues

The first issue of Act 2010 is that the regulation methods and dealing with new forms of distribution transactions are not clearly defined, such as online transactions, which are becoming widespread due to the development of the internet. However, according to an interview by the JICA Study Team,[14] the draft of Act 2022 is currently being prepared, and its approval by the provincial Assembly or Cabinet is expected in the middle of this year. Its main content is regulations related to online transactions. It is important to scrutinize the contents.

The second issue is the heavy reliance on middlemen along the value chain (VC). At present, Act 2010 mainly functions as an MC led by members of the private sector, and it is commendable that the mechanism for determining the price of agricultural products through auction is maintained.[15] However, middlemen often appear in each VC process and play a major role each time. Consequently, it was pointed out that due to the asymmetry of information on prices, agricultural products cultivated by small and medium-sized farmers are traded at prices lower than they should be, and their income is reduced. In the future, instead of excluding middlemen, their coexistence and collaboration will be reviewed, and their role on VC will be transferred to other actors to reduce dependence on them. It is necessary to take such a direction in terms of policy.

2.2.2 Major Policies under Water Resources Development/Management and Irrigation[16]

(1) Sindh Water Policy

The (draft) Sindh Water Policy[17] observes that the primary use of water in Sindh is for agriculture, varying between 26.6MAF and 41.7MAF. It identifies waterlogging and salinity, low water productivity, water pollution, substandard wastewater disposal, water quality and quantity, poor reliability of water services, gender inequality in water access and decision-making, and many others as key concerns of water resource planning and management of Sindh.

The (draft) Sindh Water Policy provides a framework for integrated water management in Sindh Province.

Out of the six “burning issues” identified in the policy, two—the overall management of water resources and water management of canal and drainage systems—are directly related to

[12] Based on an interview by the JICA Study Team on 28 October 2021 with MC in Hyderabad.

[13] According to the materials obtained from DOA’s DG Agriculture Extension on 27 October 2021, MC is classified into four classes according to MC’s annual income. The number of MC by class is as follows; A:18, B:13, C:10 and D:30.

[14] Based on an interview by the JICA Study Team on 27 October 2021 with DG Agriculture Extension.

[15] For the details of wholesale market and price determination mechanisms, please refer to 4.3.2 of Chapter 4.

[16] According to an interview with the Irrigation Department, the priority areas to improve irrigation facilities are the left bank of the Indus River and the main canal on the right bank, both of which are target irrigation areas of WISP by WB. The improvement plan is in discussions in the Sindh Water and Agriculture Transformation (SWAT) project also by the WB.

[17] For details, refer to https://www.dawn.com/news/1624015 (Access: 20 February 2022)

agriculture. The other four relate to serving the dry land zones, wetlands, urban water supply, and rural WASH. The policy provides directions to address each of these issues.

For the overall water management, the policy acknowledges that existing practices focus on water service delivery rather than water management, which has resulted in a legacy of unresolved problems, fragmented water resource management, and a lack of a coherent framework in management. Therefore, it emphasizes that increased pressure on the water system makes integrated management of water resources inevitable. Furthermore, it is envisaged that the establishment of a new legal framework for integrated water resources management as well as a new organization to deal with the water resources management.

Regarding the management of canal systems, the first policy direction is to respect and optimize the multiple functions: irrigation, drinking water supply, the environment, public health, and recreation. The second policy direction is to manage water resources within the canal system—to create more equity; to attenuate the effect of high rainfall and floods or create system storage for dry periods; to reduce waterlogging, and importantly, to conjunctively balance the use of surface water and groundwater in the canal system; and to establish of a monitoring system for water resources management.[18]

(2) Sindh Water Management Ordinance, 2002

The Sindh Water Management Ordinance 2002 provides for the establishment of public systems to distribute and delivery irrigation water, remove drainage water, and manage flood waters.

It provides for the establishment of the Sindh Irrigation and Drainage Authority (SIDA) and defines its composition. SIDA will act as a reform agent, take over the main irrigation (barrages), drainage, and flood protection infrastructure, and implement participatory water management. The tasks it must perform are outlined in detail in the text. The Authority shall further establish a Water Allocation Committee at each barrage and a Community Advisory Committee for the smooth interaction with the local communities in which the Authority operates.

The government may constitute area water boards (AWBs) and Farmers Organizations (FOs) to take over the management of the main and branch canals, distributaries, and watercourses. The ordinance specfies the composition, functions, and tasks.

The ordinance further provides for the setting up of watercourse associations and drainage beneficiaries' groups made up of non-elected farmers to energize the farming community and improve service delivery; for the establishment of a Regulatory Authority of Irrigation, Drainage, and Flood Protection to promote effective interaction and collaboration between the Authority, Boards, organizations, associations and beneficiary groups; for reference of offenses and penalties; etc.

(3) SAP

In terms of water management, SAP mostly focuses on on-farm issues; however, it also points towards the need to introduce technical and institutional reforms in the water sector from above the farm level up to the main barrages. Such reforms are necessary to halt and reverse the poor maintenance of water infrastructure and address inequitable and inefficient use. This includes

[18] SWAT, which WB is preparing to start, has plans of land use analysis and monitoring by remote sensing, strengthening of groundwater (water level, water quality) monitoring, installing automatic water level measurement devices at important points of watercourses, as well as constructing an information management system that integrates and manages this information as Component 1 based on the Sindh Water Policy (refer to 8.1.2 of Chapter 8).

greater coordination between irrigation and agriculture departments/institutions to manage supply and demand.

2.2.3 Other Policies Related to Agriculture Sector

(1) Other Related Policies of Agriculture and Water Resources

The related policies other than those discussed so far in 2.2.1 and 2.2.2 are as shown in Table 2.2.2.

Table 2.2.2 Other Policies related to Water Resources Development and Management

Area	Name of Related Policy	Remarks
Input	On-Farm Water Management and Water Users' Association Ordinance 1981	Provincial level
	Seeds and Fruit Plants Ordinance 1965	
	Agricultural Pest Ordinance 1959	
	Cooperative Societies Ordinance 1966	
	Fertilizer (Control) Order, 1973	Federal/ Provincial level
	Seed Corporation Act 1976	Provincial level
	Soil Reclamation Act 1952	
Marketing and Processing	Price Control and Prevention of Profiteering and Hoarding Act, 1977	Federal/ Provincial level
	Agriculture Food and Drug Authority Act, 2016	Provincial level
	Food Authority Act, 2011	
	Agricultural Produce Markets Act, 1939/1978/2010	
Research, Education and Training	University of Agriculture Multan, Faisalabad, Rawalpindi, Peshawar, Balochistan, Tandojam	Provincial level
Irrigation and Drainage	Canal and Drainage Act, 1873	Federal/ Provincial level
	Sindh Irrigation Act, 1879	Provincial level
	On-farm Water management and Water Users Association Ordinance and Sindh Ordinance, 1982	Provincial level
Water Resources Development	Water and Power Development Authority Act, 1958	Federal level
	Indus River System Authority Act, 1992	Federal level
	National Water Policy, 2018	Federal level
Water Supply and Sewerage	Karachi Water and Sewerage Board, 1996	Provincial level
	Nation Drinking Water Policy, 2009	Federal/ Provincial level
Environment	Environmental Protection Act, 1997	Federal/ Provincial level
	National Wetland Policy, 2009S	Federal/ Provincial level

Source: JICA Study Team

(2) Other Related Policies

1) SME Development (including Agribusiness)

As is discussed in Section 8.3 of Chapter 8, the Growth for Rural Advancement and Sustainable Progress (GRASP) project has been implemented by the European Union (EU) and the

International Trade Center (ITC).[19] Although it mainly targets agribusiness, there is no definition of "agribusiness" in this country. Only small- and medium-scale enterprises (SMEs) is applied to agribusiness (see Table 2.2.3).

Table 2.2.3 Definition of SMEs by SMEDA

Category	Employment Size	Paid-up Capital	Annual Sales
Small- and Medium-scale Enterprise	Up to 250	Up to Rp. 25 million	Up to Rp. 250 million

Source: SMEDA's official website (www.smeda.org.pk/main.php?id=2-34k)

In the meantime, since SAP does not specify any measures to promote agribusiness, SMEDA's SME Policy 2007 is likewise applied to agribusiness development.

2.3 Provincial Departments

2.3.1 Directorate Generals of Department of Agriculture

This sub-section gives an overview of the five sub-departments of DOA (i.e., Directorate Generals [DGs] Agriculture Extension, Agriculture Research, Agriculture Engineering and On-Farm Water Management and the Planning and Monitoring Cell [PMC]) in view of the information on the official website of DOA, etc.

(1) Directorate General Agriculture Extension

1) Overview

Directorate General (DG) Agriculture Extension provides agricultural education and knowledge to rural agricultural communities. It plays a vital role in assisting farmers to improve their capacity by adopting and disseminating innovative agricultural technologies through its extension services. Specifically, the agricultural extension service provides face-to-face guidance, field demonstrations and guidance, and transfers agricultural knowledge through electronic media and information and communication technology (ICT) through mass media. The DG plays an important role in developing the agriculture of Sindh through this approach. As of January 2022, the number of extension workers belonging to this DG is 1,675.[20]

2) Main Functions

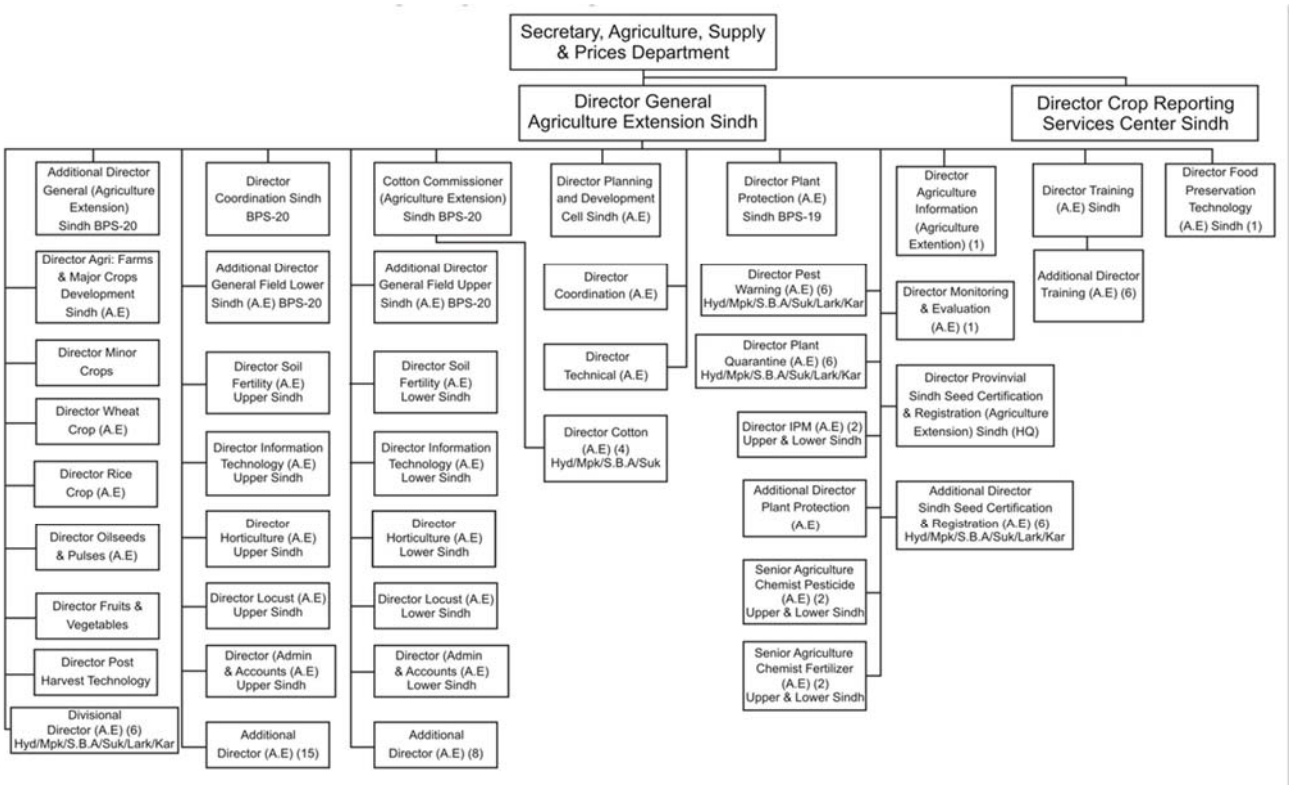
The main functions of DG Agriculture Extension are as follows.

- Disseminate information related to crop growth, management, and marketing through various means of mass media, etc.;
- educate and train farmers through the dissemination of advanced technologies, such as sowing, irrigation, fertilizer application, pests, diseases, weed control, crop harvesting, and threshing;
- prevent malnutrition by spreading good agriculture practices in rural areas; and
- provide agricultural extension services through ICT and prompt advisory services to the agricultural community.

3) Organogram

The organogram of this DG is shown in Figure 2.3.1.

[19] For project details, refer to 8.3.3 of Chapter 8.
[20] According to the secretary of DOA, the breakdown is 270 agriculture officers and 1,405 field assistants.



Source: Official Website of Sindh's Department of Agriculture

Figure 2.3.1 Organogram of Director General of Sindh

(2) Directorate General Agriculture Research (DG-AR)

1) Overview

The main campus of DG-AR[21] is easily accessible, situated in Hyderabad and in Mirpurkhas. Tandojam, a town in Hyderabad, is the hub of agriculture-related activities in Sindh. Sindh Agriculture University, Agriculture Research Institute, Nuclear Institute of Agriculture, Transfer Technology Institute, Drainage and Reclamation Center, and Local Government Training Institute are at the same campus.

2) Main Functions

The main functions of DG-AR are as follows

- Catalyze the evolution of high-yielding, climate-resistant varieties of field crops, fruits, and vegetable crops, especially in relation to resistance to drought, heat, salt, insects, and diseases; and
- Improve crops based on research experiments to obtain maximum yield (including dose, time, and input method).

3) Evolution of Improved Crop Varieties and Production Techniques

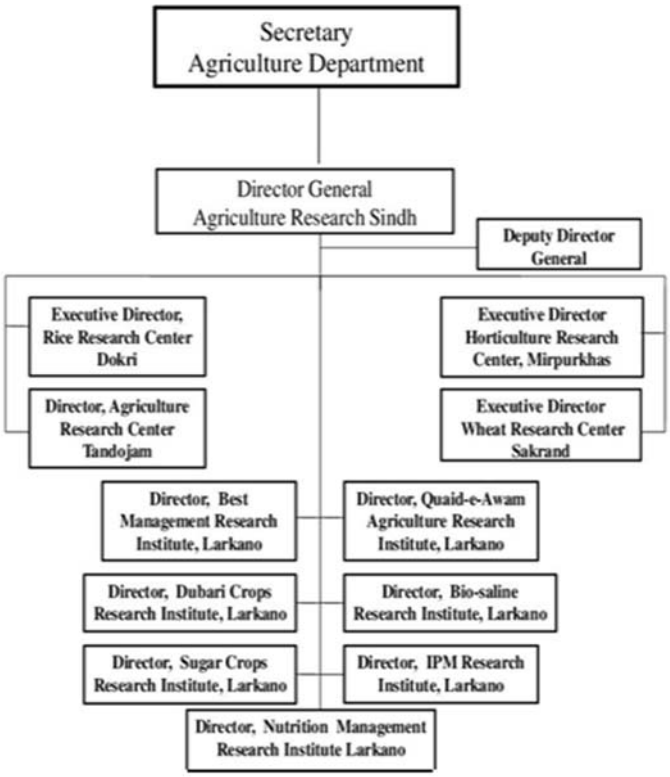
- Development of pest control technologies including integrated pest management (IPM) for control of insect pests, diseases and weed management.

[21] According to an interview conducted by the JICA Study Team on 27 October 2021 with DG-AR, it currently has no joint research project with federal-level research institutes, such as National Agriculture Research Center (NARC) and Pakistan Agriculture Research Council (PARC).

- Mass rearing of parasites (Trichogramma) and Predators (Chrysopa)
- Supply of parasites and predator cards to the growers
- Recommendations of new pesticides based on research trials
- Efficient and economical use of fertilizers based on soil and crop type

4) Organogram

The organogram of DG-AR is presented as follows.



Source: Official Website of Sindh's Department of Agriculture

Figure 2.3.2 Organogram of Agriculture Research Sindh

(3) Directorate General Agriculture Engineering

1) Overview

The DG Agriculture Engineering was established in the mid-1950s to (i) promote agricultural activities by developing waste and arable land, (ii) make food self-sufficient, and (iii) improve the socio-economic livelihood of producer communities. By improving the agricultural sector, which is a pillar of the economy of Pakistan, this DG contributes to the establishment of agriculture-related industries and the creation of employment opportunities.

2) Main Functions

The main functions of DG Agriculture Engineering are as follows:

- develop culturable wasteland with bulldozers;
- supplement groundwater for irrigation purpose through rig machines and hand boring plants;
- train manpower for tractor and implement O&M; and

- provide agricultural implements with a 50% subsidy to farmers for the promotion of agricultural mechanization.

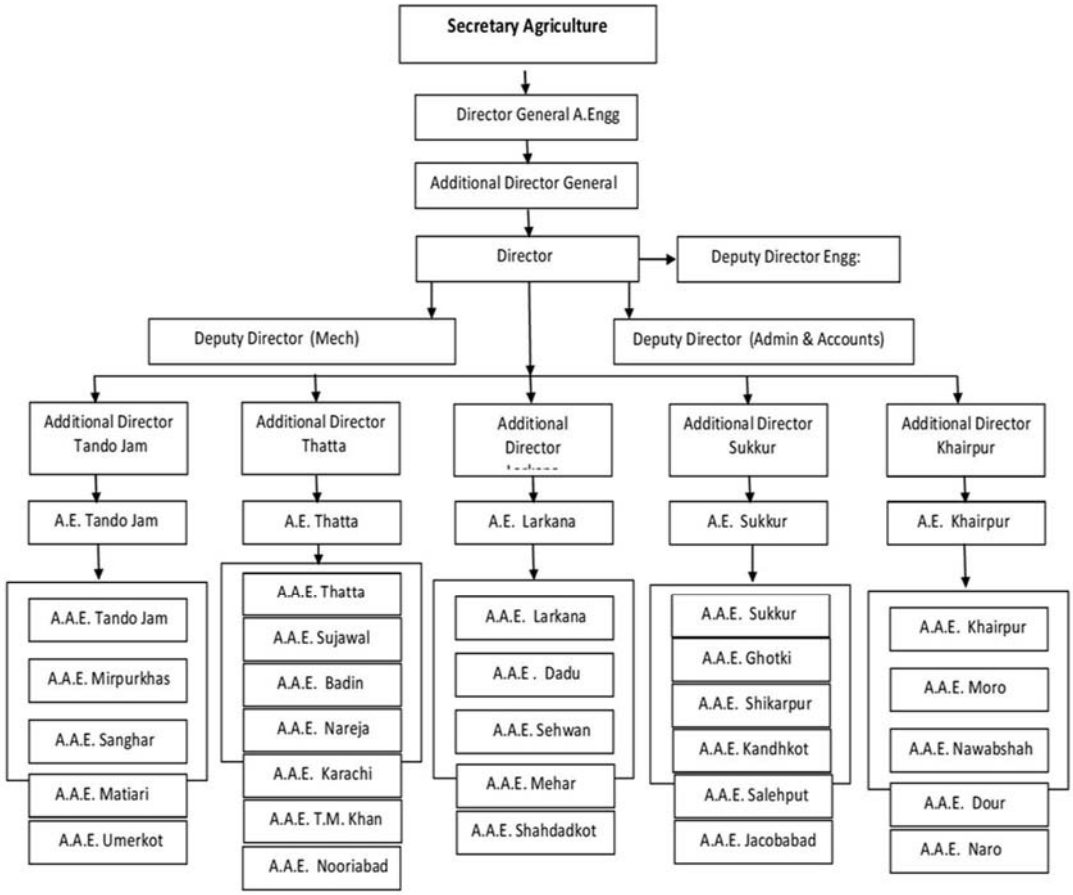
3) Related Facilities

The related facilities of DG Agriculture Engineering are as follows:

- Main Agriculture Engineering Workshop (5 units) in TandoJam (Hyderabad), Khairpur, Thatta, and Sukkur
- Sub Agriculture Engineering Workshop (10–12 units)
- Tractor Operators Training School (2) at Tandojam (Hyderabad) and Sukkur
- Agriculture Mechanization Research Cell (1) at Tandojam (Hyderabad)
- On-Farm Training Institute

4) Organogram

The organogram of DG Agriculture Engineering is shown below.



Source: Official Website of DOA, Sindh

Figure 2.3.1 Organogram of DG Agriculture Engineering

(4) Directorate General On-Farm Water Management (DG-OFWM)

1) Overview

The DG-OFWM has taken various steps to provide facilities to agriculturists for increased productivity and optimum use of irrigation water through the lining of watercourses, construction of water storage tanks, and adoption of latest technologies, such as High Efficiency Irrigation System

(Drip Irrigation System). These interventions will enhance agriculture production and significantly develop the conservation of the scarce water resource in Sindh. Saved water will be used in bringing more area under cultivation to get more production and quality agriculture outputs.

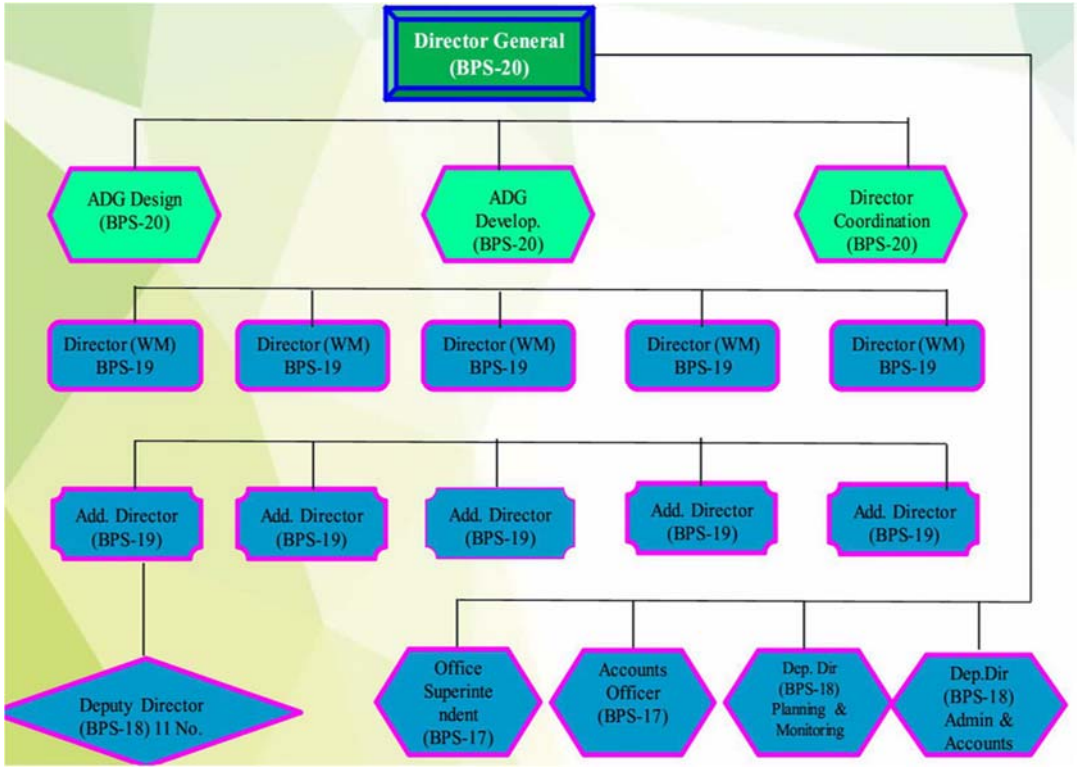
2) Main Functions

The main functions of DG-OFWM are as follows:

- improve watercourses to minimize transport loss, as well as enhance efficiency, reliability, and equity of irrigation water;[22]
- manage water resources in Barani areas through micro-irrigation and other improved water management practices;
- improve watercourses to minimize conveyance losses and the efficiency, reliability, and equity of irrigation water;
- strengthen farmer's participation to improve their capabilities for better management at the farm level;
- support the agricultural productivity enhancement measures to complement and enhance the benefits of improved water management; and
- precise land leveling for better water application and increase in crop yields

3) Organogram

The organogram of DG-OFWM is shown below.



Source: Official Website of DOA, Sindh

Figure 2.3.2 Organogram of DG-OFWM

[22] The Irrigation Department, SIDA, and AWB improve watercourses of main and branch canals and distributaries.

(5) Planning and Monitoring Cell (PMC)

1) Overview

The PMC was established in April 1979. One of its main functions is to enhance the planning, monitoring, and evaluation capacities in the projects of DOA. It began operations in 1989, with the support of FAO, to improve the effectiveness of the operations of DOA.

2) Main Functions

The main functions of PMC are as follows:

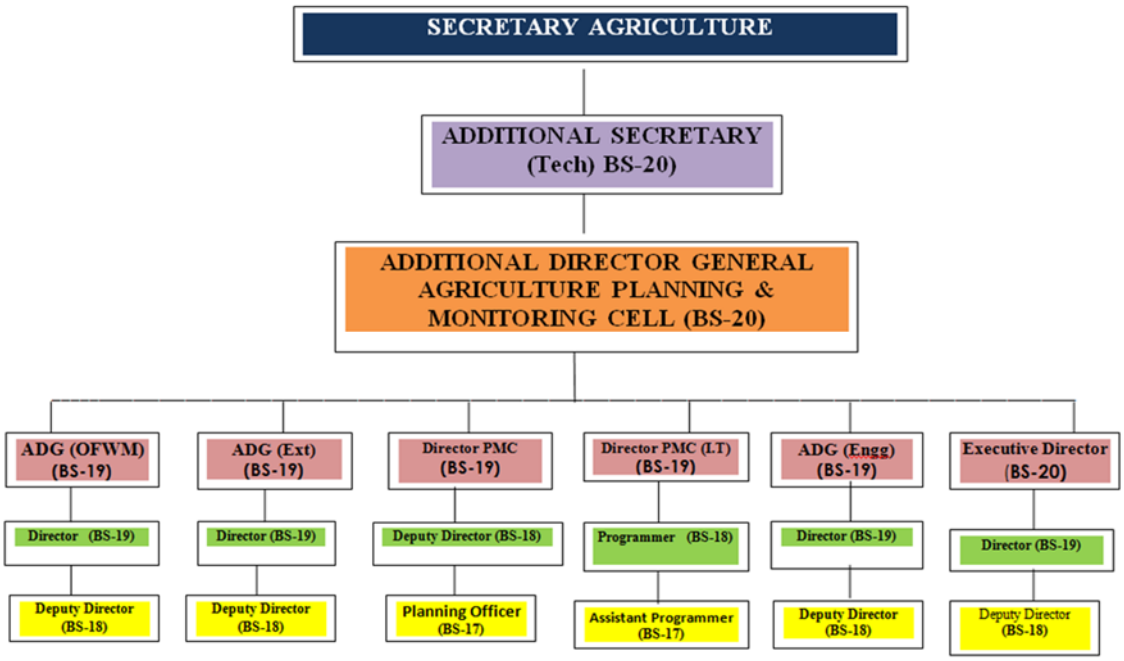
- discover, formulate, and plan development projects for DOA;
- coordinate the implementation of development projects, carefully monitoring them, and help in achieving the goals within the project period; and
- make corrections on project plans in consultation with the managers of other related departments.

3) Issues

PMC has the two following challenges to be tackled; Firstly, there are a relatively limited number of staff members who have sufficient capacities. The second challenge is to develop the capacities of existing staff members. In particular, those of project formulation, monitoring, evaluation, etc. are critical.

4) Organogram

The organogram of PMC is shown below.



Source: Presentation material from PMC

Figure 2.3.3 Organogram of PMC

2.3.2 Sindh Irrigation Department (SID)

(1) Overview

The main task of the Sindh Irrigation Department includes O&M of irrigation networks, water abstraction from barrages, O&M of flood protection facilities, and construction of small-scale

dams to reduce droughts.

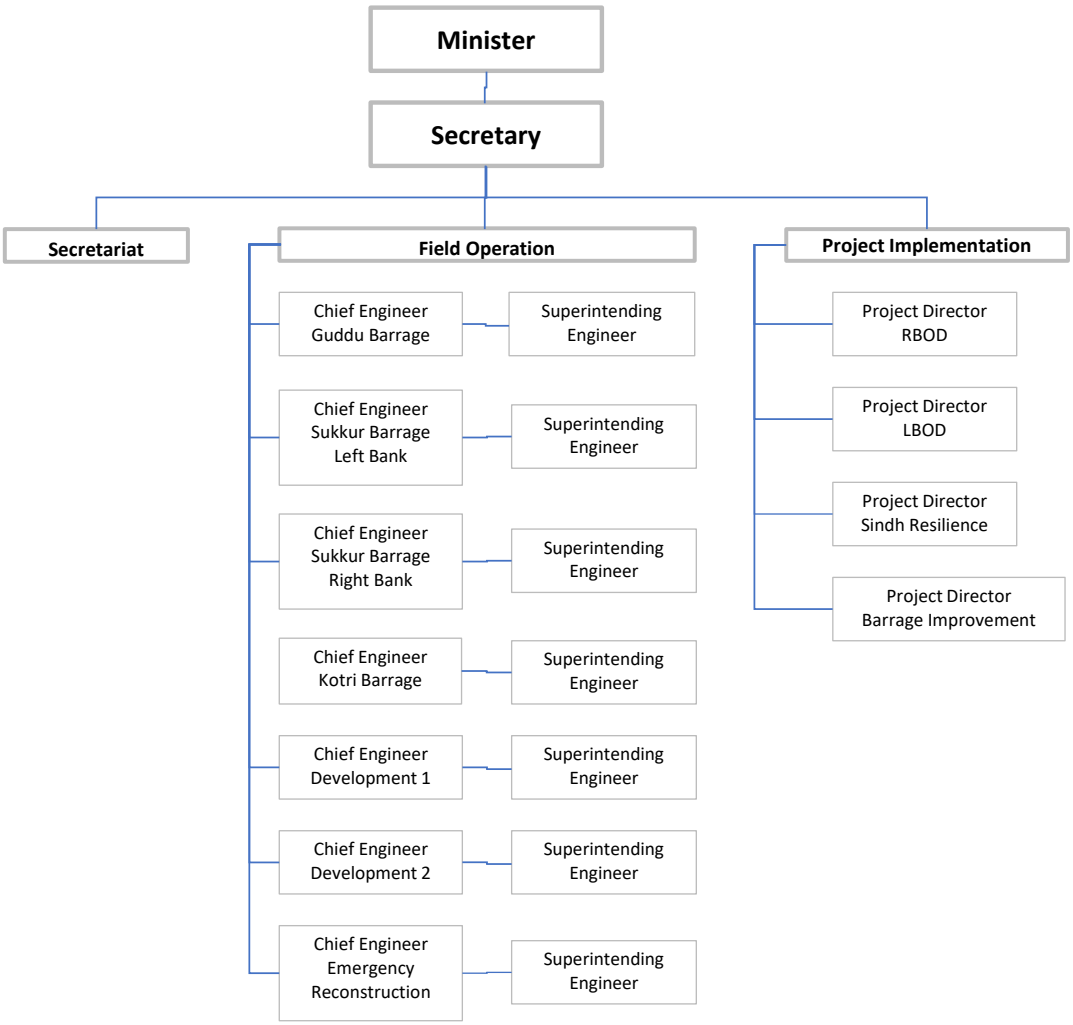
(2) Main Functions

Per the Sindh Government Rules revised in November 2017, the functions of the Irrigation Department consist of the following.

1. Barrages, construction work, and all matters connected therewith
2. Electricity [now entrusted to the Energy Department]
3. Flood Control Scheme
4. Irrigation
   I. Rivers and riverian surveys;
   II. Construction and maintenance of canals;
   III. Tube-wells and other water utilization Scheme;
   IV. Embankments;
   V. Drainage;
   VI. Storage of water and construction of reservoirs; and
   VII. Matters pertaining to distribution of river supplies.
5. Operation management of Kinjhar Lake
6. Land Reclamation schemes and administration of the Soil Reclamation Act, 1952
7. Water logging and salinity schemes
8. Services matters, except those entrusted to the General Administration
9. Coordination department

(3) Organogram

As shown in Figure 2.3.4, the Sindh Irrigation Department consists of the Secretariat at the Karachi Head Office, the field operation officers per each barrage, and the donor-funded project implementation offices. The head of each operation office is the Chief Engineer, under which the superintending engineers, executive engineers, and assistant executive engineers are assigned to manage each irrigation and drainage system. Under the Project Directors, the Project Implementation Office is in charge of project management and coordination, planning, design, procurement, and construction supervision. The total number of employees in the department is about 36,000.



Source: SID compiled by JICA Study Team

Figure 2.3.4 Organization of Sindh Irrigation Department

3 Small-Scale Horticultural Agriculture in Sindh

3.1 Selecting Horticultural Agriculture

Based on the findings in Chapters 1 and 2, the Study team selected horticultural agriculture as an agricultural sub-sector that contributes to improving the livelihood of small-scale farmers in Sindh. According to Figures 1.4.1 and 1.4.2, the poverty rate in Southern Sindh is higher than in Central and Northern Sindh, indicating a greater need for support exists in Southern Sindh. Looking at the agriculture in Southern Sindh, horticultural crops are widely grown, as shown in Figure 2.1.10 and Figure 2.1.11 in Chapter 2. Generally, horticultural crops have less room for mechanization than cereals and industrial crops, and intensive farming can improve yield and quality, making it possible for small farmers to be relatively competitive. Moreover, high-quality horticultural products are shipped to Karachi and Hyderabad districts, where they are sold at relatively high prices. As for the production of fresh vegetables, which have poor transportability and short shelf life, the area with the advantage is Sindh being close to consumption areas and where the cold chain is not widespread. Based on the above, small-scale horticultural agriculture near large cities seems to be an appropriate agricultural sub-sector to improve the livelihood of small-scale farmers, constituting the majority of farmers in Sindh.

3.2 Survey on Small-Scale Horticultural Farmers and Relevant VC Actors

The contents in Chapters 3 and 4 are based on the results of the survey on small-scale horticultural farmers and relevant VC actors conducted in this study unless otherwise noted. A summary of the farmers who responded to the survey is provided in Table 3.2.1. The sampling policy of respondents is described below.

- Districts surveyed: In order to focus on peri-urban horticultural agriculture, a major portion of samples was collected in Karachi and Hyderabad districts. The rest were from Matiari and Tando Allahyar districts.
- Area of cultivated land per farmer: As the extension section of the Department of Agriculture, Sindh mentioned that small farmers cultivating less than 16 acres of land have higher priority than others. These small farmers were chosen as samples.
- Ownership of cultivated land: In order to analyze farmers with some degree of capacity which enables the farmer to farm flexibly, more landed farmers were sampled than tenant farmers.
- Target Crops: Specific horticultural crops for the detailed survey were selected through interviews with the Secretary of Agriculture Department, as shown in Table 3.2.1. All the horticultural crops are popularly grown in Sindh.
- Sex of samples: Samples were only male farmers for quantitative survey. Most business entities in the agricultural sector in Sindh are managed by males. The target of this study is male farmers for the study team to understand the ordinary small-scale horticulture farmers in Sindh. As for women, separate focus group discussions (FGDs) and individual interviews were conducted, and the situation of women farmers was also reflected in this report.

Table 3.2.1 Overview of the Target of the Small-Scale Horticultural Farmer Survey

Number of samples	148	Ownership/non-ownership of arable land	
Surveyed District		Own land	74%
Karachi District	32	Leased land	10%

Hyderabad District	58	Share cropping	16%
Matiari District	9	Crops for the survey	
Tando Allahyar District	6	Chile	17%
Arable land area		Cucumber	10%.
Less than 3 acres	8%.	Okra	10%.
More than 3 and less than 5 acres	18%.	Onion	20%.
More than 5 and less than 7 acres	39%.	Tomato	14%.
More than 7 and less than 9 acres	11%.	Banana	8%.
More than 9 and less than 12 acres	16%.	Mango	12%.
12–16 acres or less	8%.	Papaya	9%.

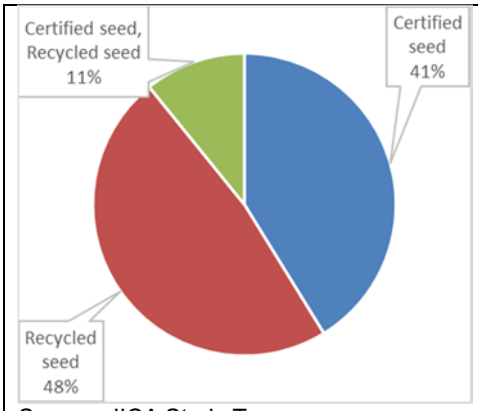
Source: JICA Study Team

3.3 Agricultural Inputs

3.3.1 Certified Seeds and Recycled Seeds

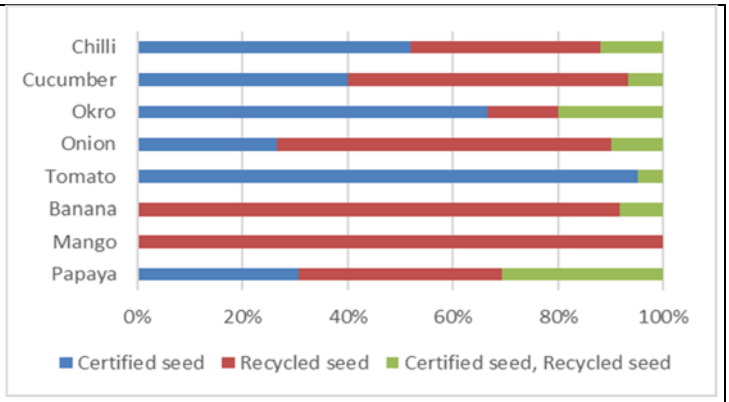
Figure 3.3.1 shows the percentage of using certified and recycled seeds for growing horticultural crops. There are 41% of the interviewed farmers use certified seeds, and 48% use recycled seeds. In the individual interviews with farmers, it was observed that they find it difficult to obtain properly certified seeds. Some of the reasons mentioned were that seeds are not available in markets, inferior quality seeds are being sold under the guise of being certified, and the high cost of certified seeds.

The ratio of certified to recycled seeds by the crop is shown in Figure 3.3.2. Propagation of banana is by suckers and mango by cutting or grafting. Farmers collect suckers, cuttings, and scions from their orchards, other farmers, or at the open market. Therefore, more than 90% of banana and mango farmers manage planting materials for themselves. Papaya is different from these two fruits as it is raised from seed only; thus, around 30% of papaya farmers use certified seeds. Among the vegetables, more than 90% of tomato growers use certified seeds.



Source: JICA Study Team

Figure 3.3.1 Use of Certified Seeds and Recycled Seeds for Horticultural Crops



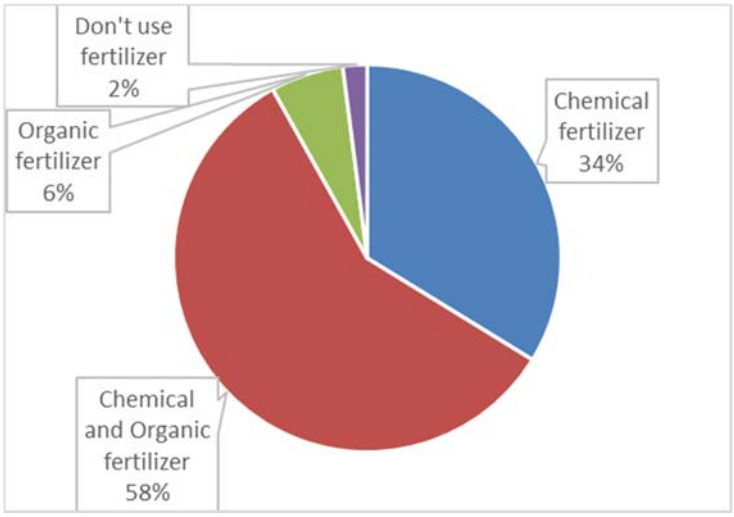
Source: JICA Study Team

Figure 3.3.2 Use of Certified Seeds and Recycled Seeds by Crop

3.3.2 Chemical and Organic Fertilizers

As for the fertilizers used by the farmers for growing horticultural crops, the percentages of chemical, organic, and other fertilizers are shown in Figure 3.3.3. Almost 60% of the farmers use both chemical and organic fertilizers, while 34% use only chemical fertilizers. Cow dung, poultry manure, and crop residues are commonly used as materials for organic fertilizers. Cow (buffalo) dung is most popularly used, as many farmers in Sindh keep buffaloes to obtain milk for their consumption

and sell the surplus. An appropriate amount of fertilizer is necessary for crops to achieve a certain level of yield and quality. However, expenses for chemical fertilizers are a large burden for average small-scale horticultural farmers. For this reason, many use organic fertilizers in combination with chemical fertilizers. Only 6% of farmers use purely organic fertilizers because the nutrient content alone is insufficient, and the amount of cow dung is limited to make compost. Moreover, the market for organic foods is still in the infant stage. Only a few stores sell organic fruits and vegetables in Karachi and other areas.[1]



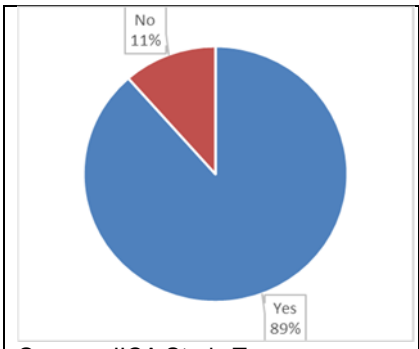
Source: JICA Study Team

Figure 3.3.1 Ratio of Chemical to Organic Fertilizer Use

3.3.3 Use of Pesticides

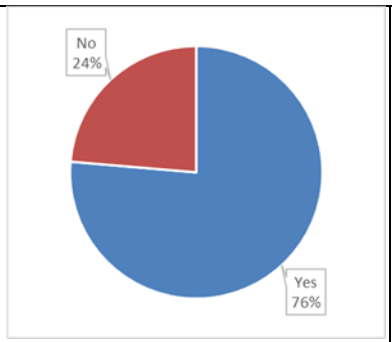
The use of insecticides, fungicides, and herbicides in the cultivation of horticultural crops by the surveyed farmers are shown in Figure 3.3.4, Figure 3.3.5, and Figure 3.3.6, respectively. In the cultivation of horticultural crops, about 90% of the farmers use insecticides and three quarters farmers use fungicides and herbicides. Insecticides and fungicides are essential to produce a certain amount of horticultural crops with commercial value. However, fruit trees (banana, mango, papaya) are less severely affected by pests and diseases than vegetables. Reflecting this, although the sample of fruit tree farmers was 29% of the total, over half of the farmers did not use pesticides, and over 60% did not use fungicides were fruit growers. It can be said that the cultivation of banana, mango, and papaya requires fewer pesticide inputs than vegetables. Herbicides are mainly used to reduce the labor required for weeding and are commonly used except for okra cultivation.

[1] Karachi Farmers Market, etc.



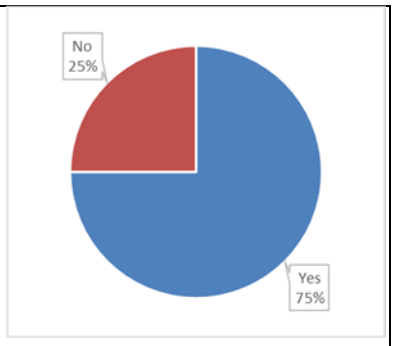
Source: JICA Study Team

Figure 3.3.3 Insecticide Utilization for Horticultural Crops



Source: JICA Study Team

Figure 3.3.4 Fungicide Utilization for Horticultural Crops

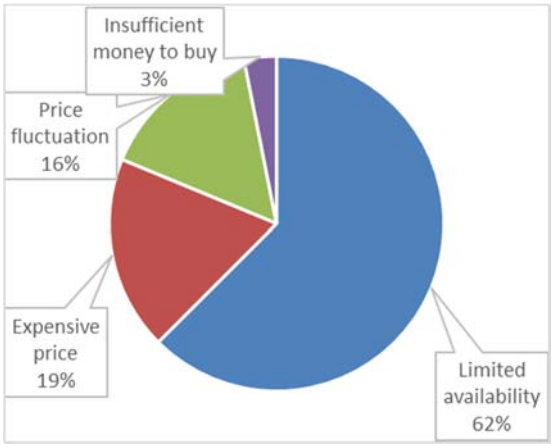


Source: JICA Study Team

Figure 3.3.5 Herbicide Utilization for Horticultural Crops

3.3.4 Issues Related to Agricultural Inputs

Over 20% (multiple responses) of the farmers cited agricultural inputs as a challenge to their cultivation. The breakdown of the challenge is shown in Figure 3.3.7. Over 60% of the farmers mentioned limited availability of inputs, and 35% pointed out the price-related challenges (high prices and fluctuating prices).



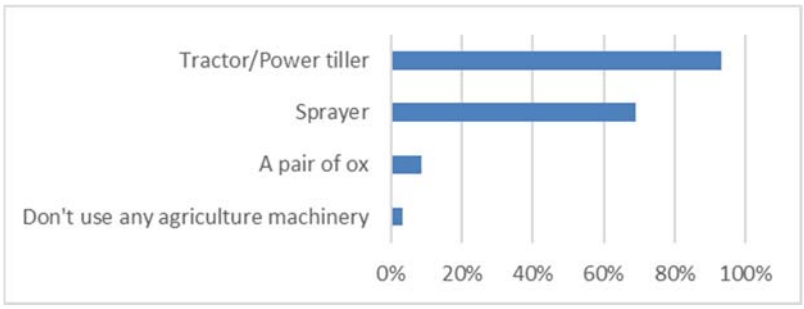
Source: JICA Study Team

Figure 3.3.2 Issues Related to Agricultural Inputs

3.4 Agricultural Mechanization and Agricultural Workers

The main agricultural machines used by the surveyed farmers are shown in Figure 3.4.1. Tractors and power tillers for tillage and sprayers for spraying pesticides are used by most farmers. Small-scale farmers rarely own tractors or tillers but use tillage services that are common in Sindh. Individuals who can afford to buy tractors are considered to have more than 50 acres of cultivated land.[2] No farmers solely relied on oxen ploughing, and only 9% of farmers use oxen in combination with tractors and tillers. Horticultural crops are cultivated on a smaller scale than cereals or industrial crops, but tillage with tractors and tillers is commonly practiced.

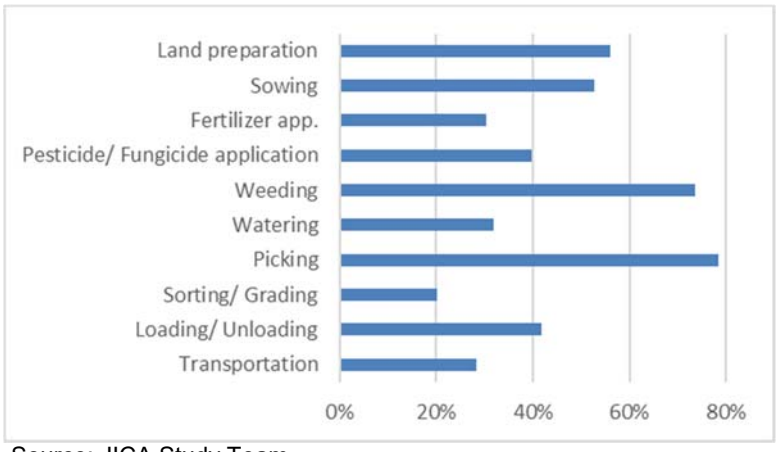
[2] Interview with a staff of the Extension Section, Department of Agriculture, Karachi Office.



Source: JICA Study Team

Figure 3.4.1 Main Agricultural Machinery Used by Farmers

The agricultural work for when surveyed farmers use agricultural laborers is shown in Figure 3.4.2. Picking is the most common agricultural work that nearly 80% of the farmers use agricultural laborers, followed by weeding at 74%. However, 75% of farmers use herbicides, as shown in Figure 3.3.6, which suggests agricultural laborers are weeding areas that cannot be controlled by herbicide. Next, more than 50% of the farmers utilize agricultural laborers for both field preparation and sowing. Figure 3.4.1 shows that tillage is commonly done by tractor or tiller, but ridging, raising seedlings, and transplanting are probably done manually.



Source: JICA Study Team

Figure 3.4.2 Agricultural Work Using Agricultural Labors

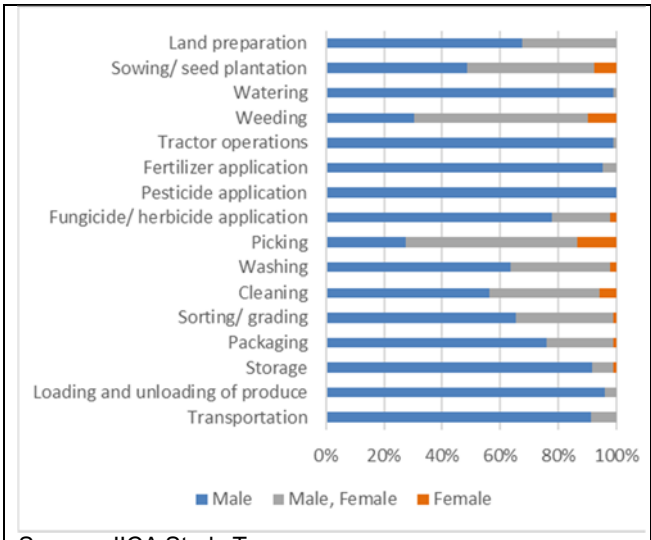
3.5 Roles of Men and Women

Most farm work is done exclusively by men. The percentage of farm work done only by women is very small. The farming activities in which men and women are mainly engaged are in horticultural crop cultivation, as shown in Figure 3.5.1. These farm activities are sowing, weeding, and picking. All of these tasks can be considered relatively light work. The results were consistent with the results from FGDs with women farmers, but more specific practices were revealed, such as women farmers do not perform tasks that require using farm equipment (such as spades), and men farmers exclusively do the irrigation and pesticide spraying.

The percentage of farmers who consult their spouses in making decisions on farming is shown in Figure 3.5.2. While only about 30% of the farmers consult with their spouses about where to sell their crops, nearly 50 to 70% consulted about other matters (crops to cultivate, areas to cultivate, selling price, and profits usage).

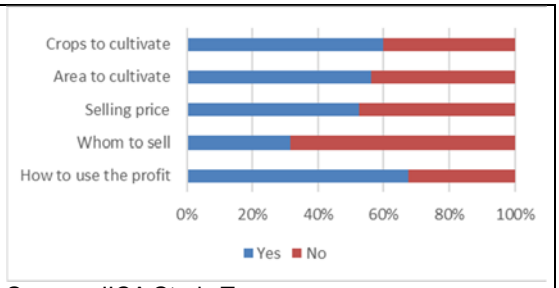
Finally, the decision-makers in purchasing consumer goods among the surveyed households are shown in Figure 3.5.3. The husband is the decision-maker in about 50% of the households.

Integrating the percentage of households where the wife alone decides and households where the wife decides together with the husband, one can say that the wife in 20% of the households is involved in the decision-making process when purchasing consumer goods. Parents or elder brothers are decision-makers in 25% of households, indicating the strong influence of elders in the households. For decision-making on investments (building and expansion of house, purchase of durable goods, etc.), the results were almost the same as those for consumer goods; however, it is only in one household that the wife does the decision-making.



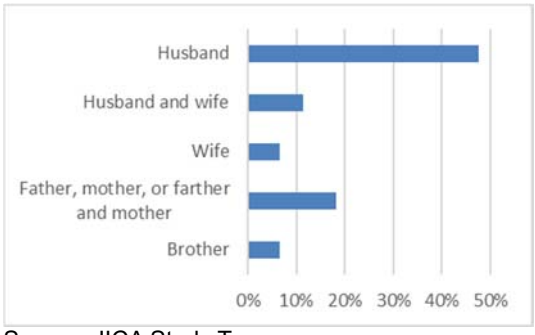
Source: JICA Study Team

Figure 3.5.1 Roles of Men and Women in Agricultural Work



Source: JICA Study Team

Figure 3.5.2 Percentage of Couples Who Consult with Each Other When Making Decisions about Farming

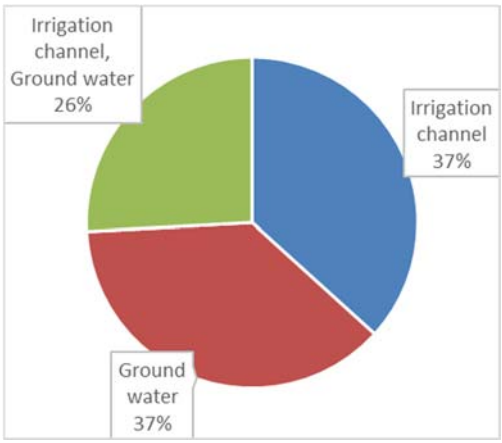


Source: JICA Study Team

Figure 3.5.3 Decision-Makers in the Purchase of Consumer Goods

3.6 Agricultural Water

Regarding agricultural water sources of the surveyed farmers, Figure 3.6.1 shows that irrigation channels and groundwater are equal at 37%. Farmers in Hyderabad, Matiari, and Tando Allahyar districts were divided into two groups: those relying solely on irrigation channels for their water source and those using both irrigation channels and groundwater. In the case of using groundwater, farmers have to bear the cost of drilling wells and installing pumps. Only one farmer uses drainage as his water source, and no farmers conduct rain-fed cultivation of horticultural crops.



Source: JICA Study Team

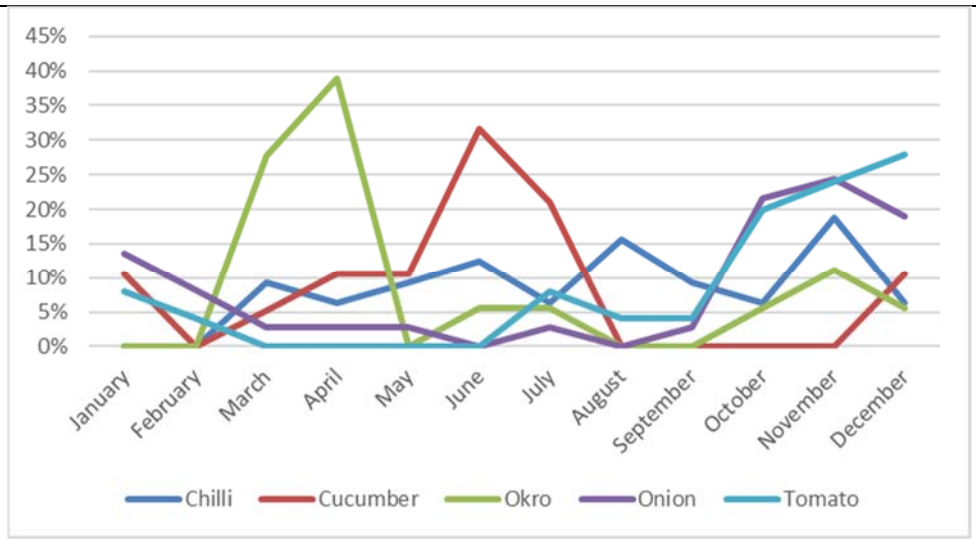
Figure 3.6.1 Water Sources for Agricultural Use

3.7 Shipping Time

Figure 3.7.1 and Figure 3.7.2 show the percentage of the sale of vegetables and fruits, respectively, by month.

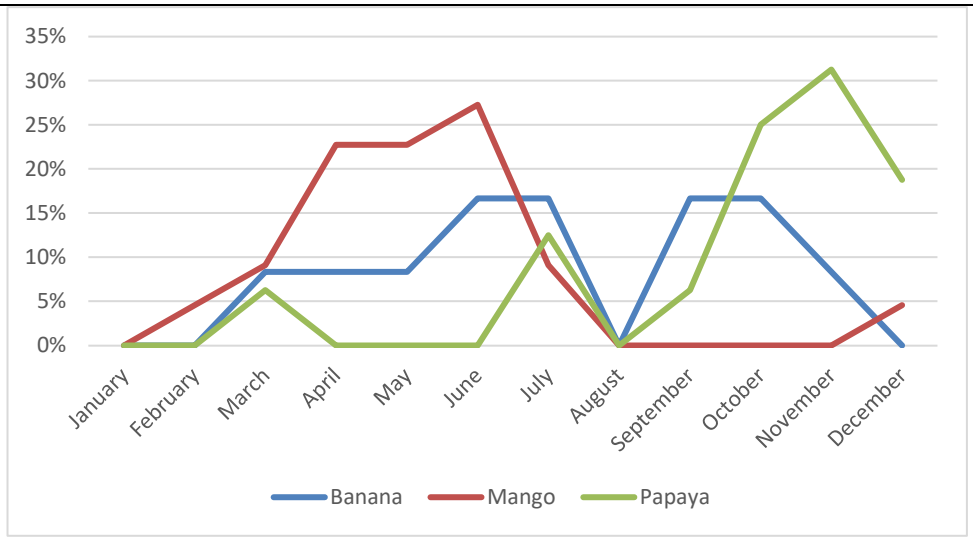
Okra is mostly sold in April and May, cucumber in June and July, and onion and tomato in November and December. Chili is sold throughout the year, probably because it grows in both the Rabi and Kharif seasons. At least one of the five vegetables sell throughout the year, but sales are low typically during February and September.

As for fruits, mangoes and papayas are typically sold from April to June and October to December, respectively. Bananas are generally sold throughout the year. Among the three fruits, no farmers sell any in January and August.



Source: JICA Study Team

Figure 3.7.1 Sales of Vegetables by Month



Source: JICA Study Team

Figure 3.7.2 Sales of Fruits by Month

3.8 Farmer's Organizations

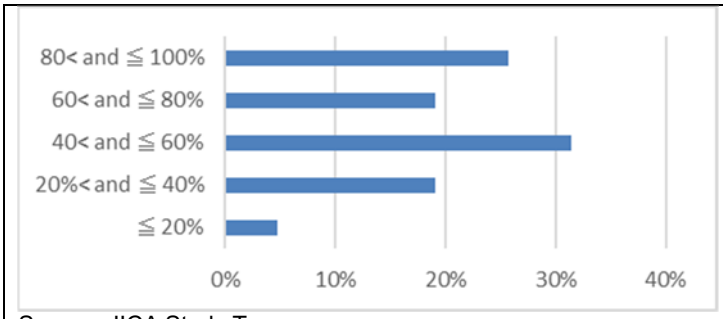
Among the farmers surveyed, only two farmers belong to farmer organizations, [3] seeking opportunities for information exchange with other farmers and participation in training. Regarding the possibility of forming farmers' organizations, 83% of the farmers confirmed it can be formed within the same Biradari, and 82% still confirmed famers' organizations can be formed in another. The possible activities of farmers' organizations answered by the farmers are shown in Figure 3.2.8. Exchanging information with other farmers was the most common answer. Nearly 50% of farmers said it was possible, followed by collective input procurement and collective selling of products. Figure 3.8.1 reflects not only the possibility of farmers' organizations' activities but also the expectations of the farmers toward farmers' organizations.

[3] Sindh Abadgar (Grower) Board and Scientific Agricultural Group

3.9 Small-Scale Horticultural Farming

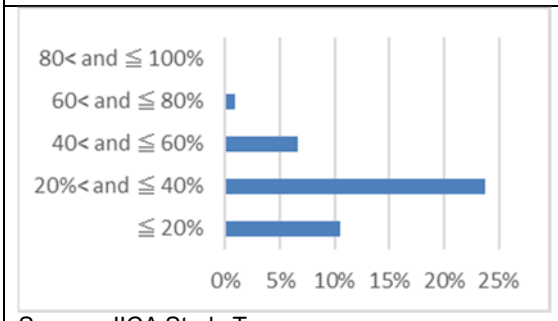
3.9.1 Income

The share of horticultural crops in the household income of the surveyed farmers is shown in Figure 3.9.1. The percentage of farmers with more than 60% of household income coming from horticultural crops is 45%; so, the share of income from horticultural crops of 55% of farmers is less than 60%. The share of other crops (mostly wheat, cotton, and sugarcane) in the household income and the share of livestock (milk and biomass sales) are shown in Figure 3.9.2 and Figure 3.9.3, respectively. A certain portion of income (less than 40%) of more than 30% of the farmers comes from other crops as well as livestock. The percentage of farmers earning as agricultural laborers (67% are sharecroppers) is 14%, and those earning off-farm (from grocery stores, drivers, etc.) account for 15%. Results indicate that the main source of household income of horticultural farmers is horticultural crops, and they also earn from other crops and agricultural products, such as livestock. A small portion of horticultural farmers earns from agricultural laborers or off-farm activities. Income from on-field farming, horticultural, and other crops farming accounts for a large share of the total income of horticultural farmers, and it can be considered vulnerable to the risk of unfavorable weather conditions.



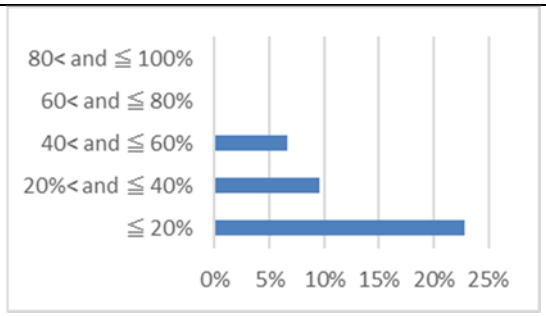
Source: JICA Study Team

Figure 3.9.1 Share of Income from Horticultural Crops in Household Income



Source: JICA Study Team

Figure 3.9.2 Share of Income from Other Crops in Household Income



Source: JICA Study Team

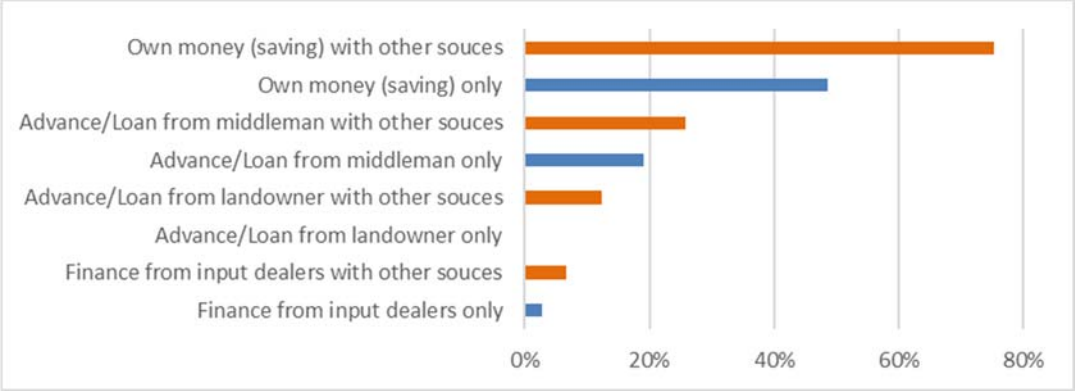
Figure 3.9.3 Share of Income from Livestock in Household Income

3.9.2 Expenditure

(1) Source of Agricultural Expenditure

The sources of agricultural working capital of the surveyed farmers are shown in Figure 3.9.4. Own money (saving) is the most common source of working capital. About 50% of the farmers operate their farms using only their funds, and nearly 80% of them use their funds for farming when combined with other sources. The second most common source of working capital is advance/loans from middlemen, and nearly 20% of the farmers rely solely on middlemen for working capital. Other

types of loans include advances/loans from landowners and loans from input dealers. Contract farming is widely practiced in Sindh, where middlemen provide inputs to farmers in advance, sell their products in the market, collect the debt (advance for inputs), and obtain profit from the sale. There are several types of contracts between landowners and sharecroppers. The most common one is that the landowner provides inputs to the sharecroppers and receives a certain percentage of the profit from them after deducting the cost of inputs from the sales of the produce. Both middlemen and landowners provide advances as agricultural inputs without any guarantee, because it is highly probable that advance can be collected from the sale of the produce. Since the advance doesn't require a written contract and guarantee, it is easy for farmers to use. Among the farmers surveyed, only one farmer used loans from financial institutions for working capital.

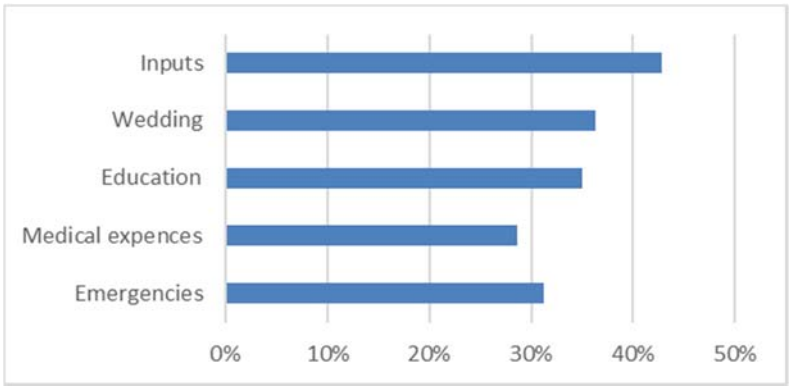


Source: JICA Study Team

Figure 3.9.4 Source of Agricultural Working Capital

(2) Savings

Among the surveyed farmers, 73% have savings, 83% keep money at home, and only 13% deposit money in financial institutions. Figure 3.9.5 shows the percentages of the different purposes of saving money. The most common purpose of saving, responded by 43% of the farmers, is to purchase agricultural inputs. However, other purposes, such as weddings, education, medical expenses, and emergencies, were also cited by around 30% of the farmers.



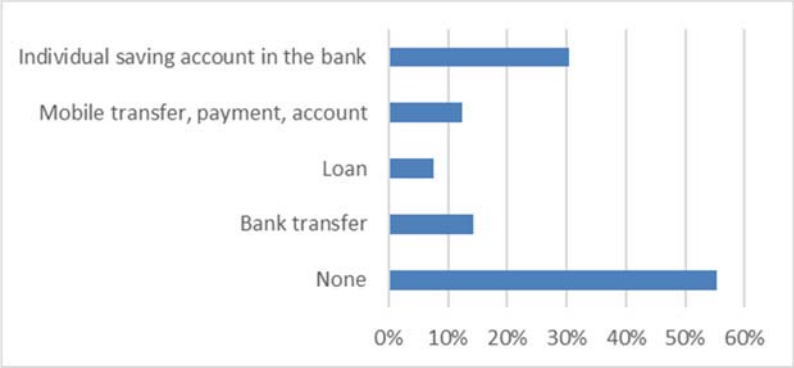
Source: JICA Study Team

Figure 3.9.5 Purpose of Saving

(3) Financial Services

As shown in Figure 3.9.6, 55% of the farmers do not use any financial services at all, and the remaining 45% do. Thirty percent have savings accounts (68% of the financial service users), and it is the most common financial service used by horticulture farmers. The use of other financial

services (through mobile phones, loans, bank transfers) is not high at only 10%. Although 36% of the farmers surveyed had experienced unforeseen emergency cases during the past three years, many had borrowed money from relatives or used their savings to cope with the situations, and only 2% had used the available financial services.

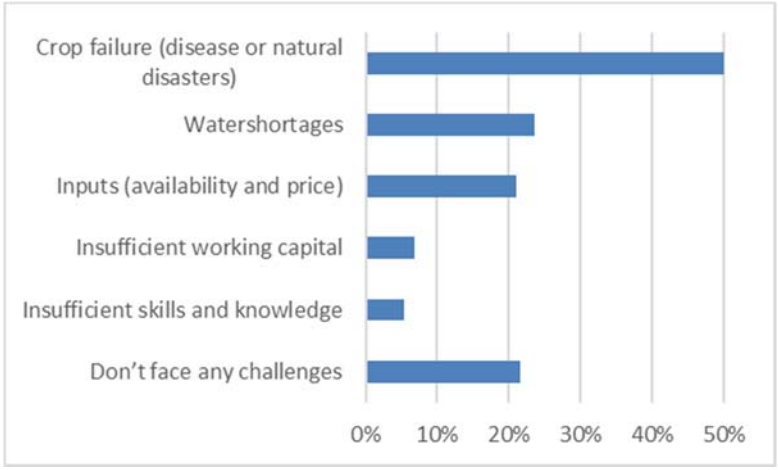


Source: JICA Study Team

Figure 3.9.6 Use of Financial Services

3.9.3 Challenges in Production for Small-Scale Horticultural Farmers

The challenges faced by the surveyed farmers in growing horticultural crops are shown in Figure 3.9.7. Among the respondents, 50% cited that the most common problem in crop failure is diseases or natural disasters, followed by water shortage at 20% and availability and price of inputs at another 20%. Only 7% of the farmers cited insufficient working capital, as there are many means to finance working capital, as shown in Figure 3.7.4. The major source of working capital is own money, and borrowing inputs in advance from middlemen or landowners is commonly practiced. Merely 5 % cited insufficient skills and knowledge. This may be since farmers have a general knowledge of the crops they cultivate and are unaware of their insufficiency of cultivation skills and knowledge since external information on agriculture is extremely limited.[4] In fact, the major challenge in crop failure is damage by pests and diseases and knowing pest control is necessary to take care of it. In FGDs and individual interviews with the farmers, some expressed the need for the Department of Agriculture for guidance in cultivation techniques.



Source: JICA Study Team

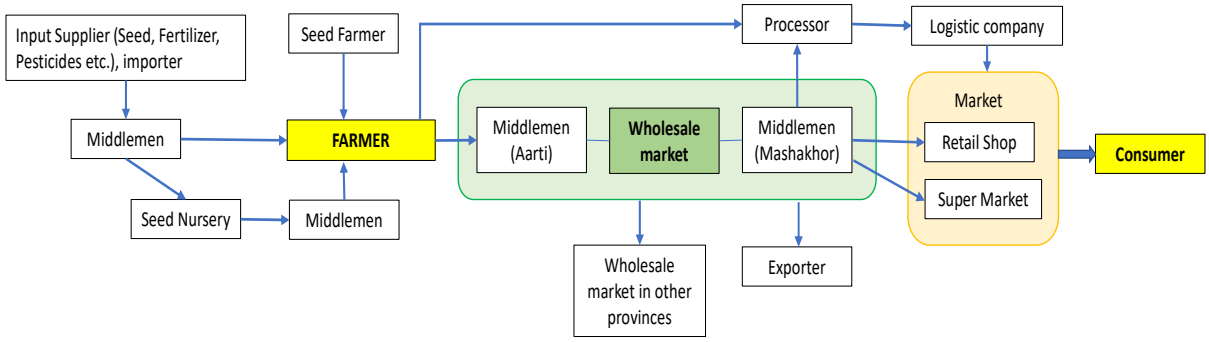
Figure 3.9.7 Challenges in Production for Small-Scale Horticultural Farmers

[4] According to an official of the extension section of the Department of Agriculture, the yield of horticultural crops in Sindh is lower than in Punjab, and there is much room for technical improvement.

4 Food Value Chain in Sindh

4.1 Overview of Value Chain of Horticulture Crops

The following figure shows the overview of the typical value chain for horticulture crops in Sindh.



Source: JICA Study Team

Figure 4.1.1 Overview of Value Chain for Horticulture Crop in Sindh

In Sindh, most of the horticultural crops are distributed in and out of the province through fruit and vegetable wholesale markets. Various forms of middlemen play a central and important role in this distribution system. They have established strong interdependent relationships with farmers and various value chain (VC) actors. For example, of the 39 middlemen interviewed in this study, 27 said they provide inputs to farmers, and 20 said they provide financial support for cultivation. At each stage of the process, there are various kinds of middlemen who play a variety of roles, including the following. Some middlemen play multiple roles, including exporters and processors as well.

- Middlemen dealing with inputs. Many farmers purchase seeds, fertilizers, etc. through middlemen.
- Middlemen (commonly referred to as "*Aarthi*") who collect crops from farmers and mediate their sale and purchase at wholesale markets.
- Commission agents (CAs) who assist in the buying and selling of crops at wholesale markets.
- Middlemen (commonly called "*Mashakhor*") who are responsible for buying crops at wholesale markets and distributing them to retail markets.

Horticultural produce is either sold at local wholesale markets in each region or large fruit and vegetable markets in the major cities of Karachi and Hyderabad districts by middlemen. The Karachi fruit and vegetable market, located along the highway that connects Karachi and Hyderabad, is said to be one of the largest fruit and vegetable markets in Asia. More than 5,000 middlemen trade daily in its 100 acres of land.

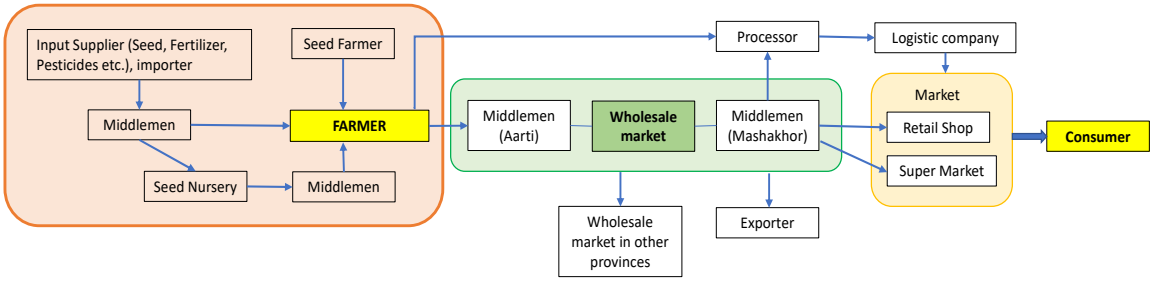
In Karachi, the commercial hub of Pakistan with a population of 16.05 million,[1] the demand for fresh and processed food has been increasing with its modernization and growth of the middle- and upper-class population. The number of supermarkets and other chain retail stores has been increasing in recent years. However, there has been little development in the agro-processing industry in Sindh. Despite the good amount of production of many internationally popular products such as mangoes, thanks to the climatic and other suitable characteristics of the province, the

[1] Pakistan Census 2017

export volume is still limited compared to the potential. It is due to the inability of crops to comply with the standards, quality criteria, and quarantine measures of destination countries, and the presence of processors and exporters in the VC is relatively small in the province. The following section provides an overview of the status of horticultural crop VCs in Sindh at various stages and analyzes their challenges and potentials.

4.2 Production of the Major Horticulture Crops

This section provides an overview of the upstream of horticultural crop VC, from production to post-harvest processing by farmers.



Source: JICA Study Team

Figure 4.2.1 Production and Post-Harvest of Horticulture Crop VC

4.2.1 Production of the Major Crops

Pakistan is one of the largest producers of crops in the world. It is the seventh largest producer of onion and chili and the fifth largest producer of okra in the world.[2] Sindh and Punjab are the major producers of mangoes in Pakistan, and their combined production makes the country the fourth largest producer in the world.[3]

The major horticultural crops surveyed in this study were selected based on the criteria of high production volume in Sindh over other provinces. The comparison with other provinces is summarized below.

Table 4.2.1 Province wise Comparison of Tomato Production

	Sindh	Punjub	Balochistan	KPK
Area of Production (000 ha)	26.4	8.1	12.6	13.4
Total production (000 ton)	**195.8**	105.6	140	127.6
Yields (ton/ha)	7.4	13	11.1	9.5
Characteristics of Sindh	The production of the province is low, but if the main production area of Babin and Thatta is considered, the yield is 20 tons/ha, which is higher than other provinces. The coastal climate is suitable for tomato cultivation. Tomato season is September–October. Since Karachi has many processing plants, there is potential for processing. Hybrid varieties (EarlyKing, Kalash, T-1359, etc.) are mainly produced.			

Source: Developed by JICA Study Team based on Ministry of Food Security and Research, Agriculture Statistics of Pakistan 2016–2017, Planning Commission of Pakistan, Cluster Feasibility and Transformation Study https://www.pc.gov.pk/web/agriculture

[2] FAOSTAT

[3] Trade Development Authority of Pakistan, *Report on Mango* (2020).

Table 4.2.2 Province wise Comparison of Onion Production

	Sindh	Punjub	Balochistan	KPK
Area of Production (000 ha)	51.7	44.7	20.1	9.0
Total production (000 ton)	**692.3**	328.2	514.6	201.4
Yields (ton/ha)	13.4	7.3	18.8	16.4
Characteristics of Sindh	Major production area for onions is around the Mirpurkhas district. The production of the district accounts for 70% of the province's consumption. The district has more cold storage for onion than in other provinces. Onion has two harvest seasons, from March to May and October to February, and the main varieties are Phulkara and Nasarpuri.			

Source: Same as Table 4.2.1

Table 4.2.3 Province wise Comparison of Chili Production

	Sindh	Punjub	Balochistan	KPK
Area of Production (000ha)	**131.5**	15.1	10.4	1.0
Total production (000ton)	**126.2**	7.11	4.36	0.4
Yields (ton/ha)	2.4	1.6	1.5	1.2
Characteristics of Sindh	Chili wholesale market in Kunri is the distribution hub of international and domestic chili marketing in Pakistan. The climate and sandy-clay soils of the Umerkot district are suitable for chili cultivation. Indigenous variety of Dundicut are maily grown and popular.			

Source: Same as Table 4.2.1

Table 4.2.4 Province wise Comparison of Cucumber Production

	Sindh	Punjub	Balochistan	KPK
Area of Production (000 ha)	684	1772	925	-
Total production (000 ton)	2592	44919	6777	-
Yields (ton/ha)	3.79	25.3	7.32	-
Characteristics of Sindh	Cucumbers are grown mainly in southern Punjab and Balochistan, and Sindh. In Sindh, it grows as an intercrop with paddy in large farms in Badin and other districts and is supplied to urban areas such as Karachi.			

Source: Same as Table 4.2.1

Table 4.2.5 Province wise Comparison of Banana Production

	Sindh	Punjub	Balochistan	KPK
Area of Production (000 ha)	26.7	0.2	0.9	0.7
Total production (000 ton)	**112.4**	1.4	7.9	13.0
Yields (ton/ha)	3.9	-	-	-
Characteristics of Sindh	The two major production areas are the Lower Sindh, mainly in the Tatta district, and the Upper Sindh, mainly in the Kharipur district. Production is low at 4.5 tons/ha compared to the world average (20.2 tons/ha). Sedimentary soil, silty loam, and mild climate of Sindh make it suitable for banana cultivation.			

Source: Same as Table 4.2.1

Table 4.2.6 Province wise Comparison of Mango Production

	Sindh	Punjub	Balochistan	KPK
Area of Production (000ha)	62.7	107.1	0.6	0.4
Total production (000ton)	399.2	1313.6	1.1	3.0
Yields (ton/ha)	6.4	12.3	1.8	7.5
Characteristics of Sindh	The main production area of mango is around the Mirpurkhas district. It is vulnerable to damage from sandstorms in May and June and the rainy season from June to September and has less access to water resources than Punjab. Contract farming is more common than in Punjab. The main variety is Sindhuri (Chaunsa in Punjab), a large mango variety.			

Source: Same as Table 4.2.1

The production areas and production volumes of the major horticultural crops in each district surveyed in this study are shown in Table 4.2.7. As indicated in Chapter 2, most production areas

of major horticultural crops are in the south-central districts of Sindh. The two major fruit and vegetable wholesale markets in the province (Karachi and Hyderabad districts) are in relatively accessible areas from the major production areas of fragile horticultural crops. While Karachi and Hyderabad are the major consumption centers in the province, they also serve as transportation centers for agricultural products to other provinces. For chili, it has a specialized wholesale market at Kunri in Umerkot District, where transactions for it are concentrated.

Table 4.2.7 Production Volume/Area of Major Horticulture Crops

PROVINCE/ DISTRICTS	Tomato(2020-2021)		Onion(2020-2021)		Chili(2020-2021)		Cucumber(2020)		Lady Finger(2020)		Papaya(2020)		Banana(2020)		Mango(2020)	
	Area (ha)	Prod (MT)	Area (ha)	Prod (MT)	Area (ha)	Prod (MT)	Area (ha)	Prod (MT)	Area (ha)	Prod (MT)	Area (ha)	Prod (MT)	Area (ha)	Prod (MT)	Area (ha)	Prod (MT)
SINDH	**23,395**	**171,659**	**56,253**	**758,638**	**35,409**	**81,936**	**471**	**1,803**	**4,755**	**18,056**	**897**	**4,037**	**31,299**	**121,395**	**58,723**	**384,239**
Kashmore	61	434	537	7,566	13	33	--	--	445	2,199	--	--	--	--	--	--
Jacobabad	178	1,256	3,507	48,173	--	--	--	--	116	459	--	--	--	--	--	--
Ghotki	65	476	518	7,089	122	290	--	--	146	736	--	--	253	1,075	231	1,399
Sukkur	189	1,557	235	3,276	93	223	--	--	162	801	--	--	172	735	160	1,097
Shikarpur	221	1,429	149	1,947	403	802	--	--	83	427	--	--	14	58	38	238
Khairpur	134	928	377	5,296	339	759	--	--	155	674	--	--	5,550	24,017	4,396	27,944
Larkana	914	5,211	1,220	17,030	92	212	--	--	203	903	--	--	--	--	160	1,031
Kamber/Shahdad Kot	280	1,938	159	2,237	--	--	--	--	267	937	--	--	--	--	--	--
Naushero Feroze	276	2,135	1,668	22,962	65	164	--	--	288	1,345	--	--	4,013	17,279	2,650	18,660
Dadu	187	1,387	4,234	59,143	815	1,882	5	22	190	883	--	--	155	560	99	639
Shaheed Benazir Abad	199	1,604	4,380	63,204	314	822	--	--	435	1,728	--	--	3,097	13,016	3,094	21,973
Sanghar	498	2,710	5,012	68,534	1,975	3,373	--	--	187	655	9	39	976	3,280	7,322	52,739
Matiari	1,298	9,481	7,334	105,715	1,997	3,848	5	22	240	1,091	25	118	3,753	14,467	4,110	28,750
Jamshoro	154	1,249	12,272	167,978	1,964	3,514	14	60	185	768	24	85	54	204	202	1,435
Umer Kot	590	4,211	2,721	31,766	5,566	16,480	--	--	76	316	10	34	94	236	4,521	23,881
Mirpurkhas	1,860	12,208	9,530	123,494	5,077	14,843	90	340	155	570	55	199	1,850	4,572	13,230	79,600
Tando Allahyar	166	1,248	2,096	29,728	819	1,342	24	91	741	2,615	141	617	1,104	4,039	8,695	54,523
Hyderabad	210	1,627	292	4,125	367	892	4	16	85	309	18	86	368	1,554	7,308	54,090
Tharparkar	77	421	681	7,262	910	2,764	--	--	6	32	--	--	--	--	202	842
Badin	3,022	24,222	309	3,777	8,666	17,340	250	938	924	2,923	50	215	650	2,284	1,290	9,005
Tando Muhammad Khan	1,163	9,317	1,693	19,243	901	1,962	--	--	410	1,424	--	--	1,030	3,639	780	5,259
Thatta	12,217	90,749	2,211	26,536	4,734	9,966	34	138	157	691	119	548	8,571	32,083	652	3,794
Karachi	150	1,013	64	608	177	425	45	176	51	192	446	2,096	34	165	12	74

	Tomato	Onion	Chili	Cucumber	Okura	Papaya	Banana	Mango
#1 Production	Thatta	Jamshoro	Badin	Badin	Badin	Karachi	Thatta	MirpurKhas
#2 Production	Badin	Mirpurkhas	Umerkot	Mirpurkhas	TandoAllayar	TandoAllayar	Khairpur	TandoAllayar
#3 Production	Mirpurkhas	Matiari	Mirpurkhas	Karachi	Kashmore	Thatta	Naushero Feroze	Hyderabad

Source: Developed by JICA Study Team based on Crop Reporting

Farmers generally purchase inputs such as seeds, fertilizers, and pesticides from middlemen. While some vendors travel to farmers to sell their products, many have stores in local markets or regional wholesale markets. Some of the stores that sell imported inputs have trained extension staff, and many farmers get technical information from these input suppliers. According to the results of the questionnaire survey, 13% of the farmers reported that they get technical information of cultivation from input suppliers. The other farmers said they get information from farmers in the same village, indicating that the number of people getting information from authentic technical experts is very limited. On the other hand, according to the interviews, as mentioned in Section 3.1, most seeds, fertilizers, and pesticides sold in many stores are contaminated or fabricated, so quality assurance of inputs is a major issue.

Imported input store in the Wholesale Market in Karachi. Shopkeepers instruct farmers on cultivation techniques.

Input supplier in rural area in Sukkur district

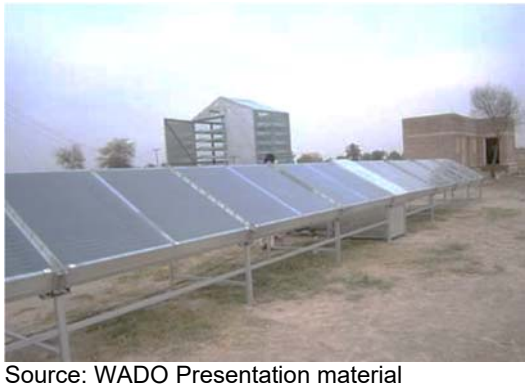
Source: JICA Study Team (November and December 2021)

Figure 4.2.2 Input Suppliers

4.2.2 Post-Harvest, Storage, and Processing

Results of the farmer interviews conducted for this study indicate that there is very little post-harvest processing, storage, and processing carried out at the farm level. Very few farmers have facilities for post-harvest crop processing and sorting, collection points, and warehouses for safe storage of crops. In the questionnaire survey of farmers, only 7 out of 148 farmers have a warehouse for their harvest (6 have their own and 1 uses a warehouse of a middleman). In most cases, farmers sell their crops to middlemen immediately after harvesting, and they are directly affected by profit and loss due to price fluctuations. When prices drop drastically, farmers dispose of harvests in the field because the transportation costs are not worth it. In addition, crop sorting by size and quality is all done at the wholesale market and not by the farmers, and since farmers depend on middlemen for these, very few have access to quality control and price information.

As for processing at the farmer level, as far as this survey could recognize, there are very few initiatives. The Women Agriculture Development Organization (WADO) introduced a solar dryer in Shikarpur District in 2012 on a trial basis with support from FAO, and the mango juice-making machine by a farmer who sold it themselves. In such cases, there are marketing challenges for processed agricultural products at the farm level. In terms of cost-effectiveness due to the difficulty in recovering the initial investment by revenue, efforts have hardly developed.

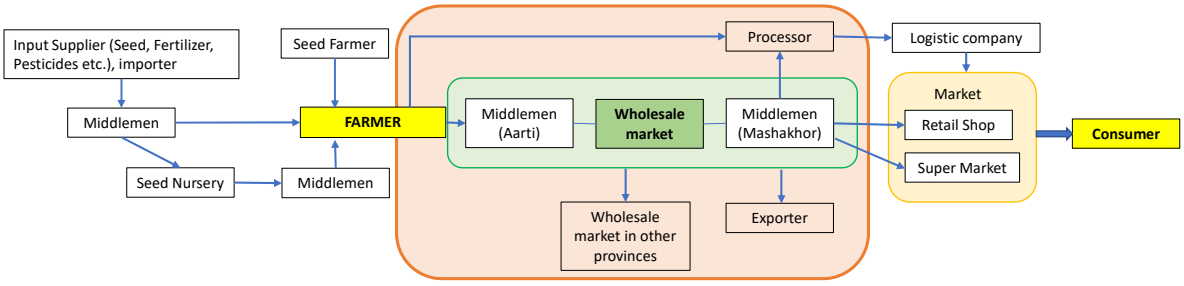


Source: WADO Presentation material

Figure 4.2.3 Solar Drier of Fruits/Veg

4.3 Distribution

Horticultural crops in Sindh are mostly distributed through fruit and vegetable wholesale markets, with various types of middlemen playing a central role. The following section provides an overview of the status of each process in horticultural crop distribution.



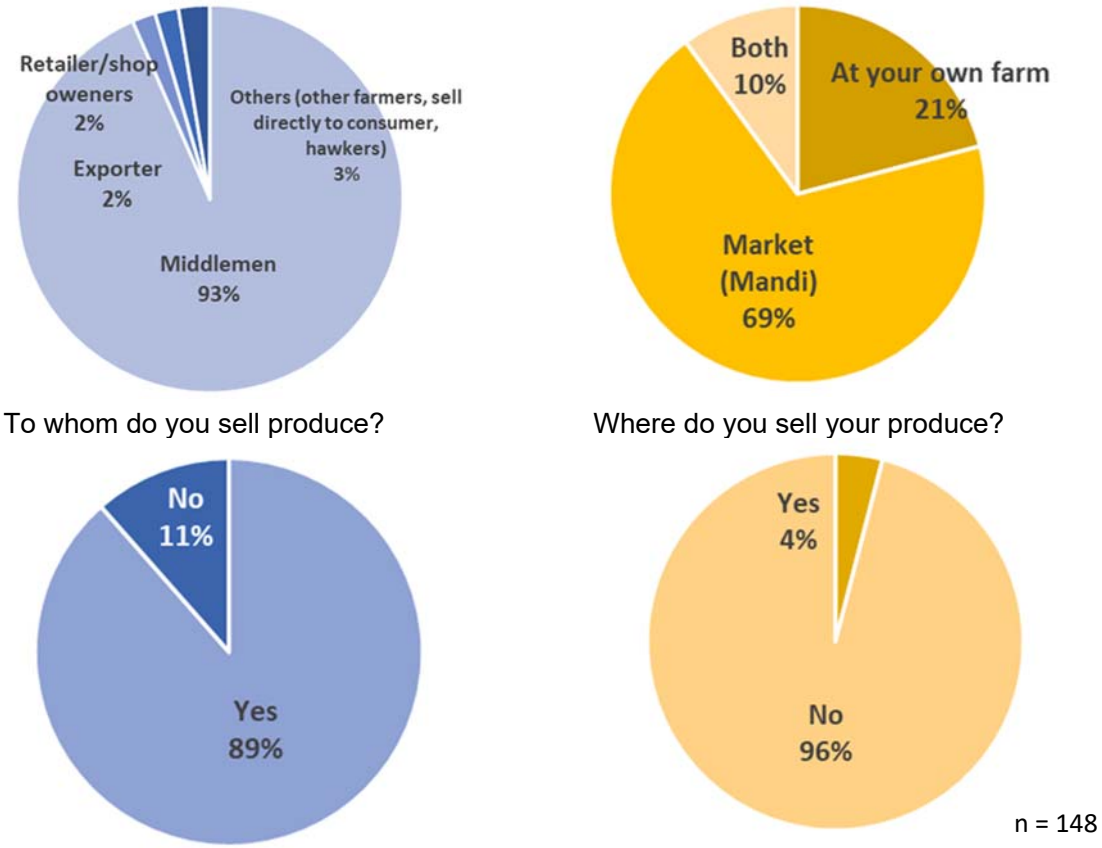
Source: JICA Study Team

Figure 4.3.1 Distribution Process of Horticultural Crop in VC

4.3.1 Sales from farmers

Results of the questionnaire survey conducted among farmers are shown in Figure 4.3.2. Ninety-three percent of the farmers sold their crops to middlemen, and only 7% sold directly to retailers or exporters (the farmers who sold directly were mango and banana farmers, not vegetable farmers). For the question “Where do you sell your produce?”, 69% answered wholesale markets, indicating that farmers often transport their crops to nearby wholesale markets and sell to middlemen there. Some middlemen come to the farmers' doorsteps to pick up their crops, but they only account for

about 20% of the total. According to the interviews with the farmers, most hire auto-rickshaws to transport their products or several neighboring farmers join together and rent small trucks. Either way, transportation costs have increased due to the recent sharp rise in fuel prices, becoming a heavy burden to farmers. Many farmers are familiar with the nearby wholesale markets. Not only do they sell their crops, but they also purchase inputs. Most of the farmers do not know where their crops go for final consumption, and the information they have on distribution was found to be very limited.



Source: JICA Study Team

Figure 4.3.2 Questions Regarding Sales from Farmers

When asked what influences the price of crops, most farmers responded about the crop size and the cost of shipping crops can at one time. Most cucumber farmers answered that it was the uniformity of the crop. As for the challenges faced in selling products, the majority answered there are no particular problems. But as previously mentioned, many farmers transport their products to the wholesale market on their own, and many answered that they do not have the means to transport their products and that the cost is high. Also, there are many cases where the price fluctuation is so high that when the price becomes too low, the transportation cost becomes not worth it, and crops are disposed of in the fields. (See 4.3.2 (2) for more information on price fluctuations.) Since farmers have limited access to information and have difficulty finding reliable buyers on their own, they become too dependent on buyers and sell at any indicated price.

Table 4.3.1 Point Influence on Sales Price and Challenges in Sales for Farmer

Points Influence to Sales Price	#	Challenge in Sales	#
Size	73	No issue	59
Volume to sell at one time	60	No transportation means, high cost	34
Season	41	Price fluctuation	25
Color	37	Non-existence of reliable buyer	24
Damage	24	Low price	23
Uniformity	14	Late payment	12
Supply in market	6	Other (lack of labor, demonstration, weather, climate)	7
Others (packaging, seeds, variety, expor	8		

Note: Total of 148 respondents with multiple answers.
Source: JICA Study Team

Table 4.3.2 Expectations by Middlemen and Challenges in Procurement

Expected Point	#	Challenges in Procurement	#
Freshness	19	No issue	17
Large size	17	Unstable price	6
Sufficient volume in season	13	Lack of supply in season	6
Taste	11	Inconsistency in quality	6
Damage	10	High price	5
Recover investment without fraud	8	Not fresh	5
Low price	7	Small size	4
Stable price	5	Others: Bad color, investment risk for farmers, water shortage, transportation	6
Consistency in production process	4		

Note: Total of 39 respondents with multiple answers.
Source: JICA Study Team

4.3.2 Wholesale Markets

(1) System of Wholesale Markets in Sindh

Market Committees (MCs) establish and manage wholesale markets at 71 locations in the province. As explained in Chapter 2 Section 2.2.1, the establishment of MCs is stipulated in the Sindh Agricultural Market Act 1939, and the private operation of wholesale markets was permitted by the 2010 amendment (Sindh Wholesale Agricultural Produce Markets [Development and Regulation] Act 2010). The current MC is being managed by a committee of farmers, middlemen, consumers, and government officials, elected by a vote of the stakeholders, and is basically a financially-independent body without government support.[4] MCs in Karachi and Hyderabad Districts are the largest in the state and consist of 18 members. The chairman and vice chairman are honorary (and unpaid) positions, the other members are paid positions, and market employees are employed separately.[5] Markets are categorized into fruit and vegetable, grain,[6] livestock, and seafood. Fruits

[4] The situation differs from place to place. For example, the markets in Karachi and Hyderabad districts are completely self-financed, while in some rural areas, the land and facilities for the market are provided by the government. The market in Tando Allahyar district, which the study team visited, was on government-provided land and buildings; in Mirpurkhas district, the market had been established on government premises.

[5] While MCs in Karachi and Hyderabad have established committees, most do not have elected members and do not seem to function (see Tribune, June 1, 2020, Sindh's market committees struggle with finances [tribune.com.pk]).

[6] Auctions are held for important crops, such as grains and sugarcane, because the government has set minimum

and vegetable markets are included in all 71 MCs.

1) Dealing System

- The farmer or middleman (Aarthi) who brings the produce to the market give the sales to the Commission Agent (CA), or the Aarthi and the CA work together. The handling fee ranges from 5 to 8%. A minimum auction price is set here. The farmer or middleman pays the MC a fee for bringing the product to the market (PKR 1 per 50 kg in Karachi Market).
- The CA sells the consigned produce to the middleman (Mashakhor) through auction. All transactions are processed in cash. Depending on the season, 500 to 1,200 auctions are held per day in Karachi and Hyderabad markets. Vegetable auctions are held from around 10:00 am to 6:00 am, followed by fruit auctions that last until around 11:00 am.
- The CA pays the farmers and middlemen (Aarthi) for the sales, minus the commission, and pays the MC for handling fees.
- Buyers include middlemen (Mashakhor) as well as exporters and retailers. No registration or license is required, and anyone who wants to buy can enter and exit the market freely.

2) Price Setting and Public Notice

- The middlemen and CAs sort the crops into two categories, Grade A and Grade B. In most markets, the quality of the produce is determined by appearance, such as size and color. There are no sorting machines or clear quality standards. Auctions determine the prices of the crops. An official from the DOA makes rounds to supervise the auctions.
- There is no signboard in the market to show the prices decided at each auction. There are announcements made over speakers, but most vendors get information by word of mouth through connections.
- The prices of each crop are published daily by the government (District Commissioner Office). The wholesale price (Mandi rate kilo) is determined by the average of all auctions held the previous day, and the retail base price (Bachat Bazzar rate Kilo) is calculated by multiplying the average auction price by a certain percentage.
- The list of determined prices is collected by the MC and posted daily at retail stores.[7] Information is consolidated at the headquarters and published. It can also be viewed on the website.[8]

Sorting of Tomato (Tando Allahyar Market)

Sorting of Papaya (Karachi Market)

guaranteed prices.

[7] Information from the DOA and MC. In the area visited by the study team, no retail stores were found to have price information posted.

[8] https://commissionerkarachi.gos.pk/pricelists.html (As of January 2022, the website is inaccessible.)

Packing Banana (Karachi Market)

Weight station for Banana (Hyderabad Market)

Source: JICA Study Team (October–November 2021)

Figure 4.3.3 Fruits and Vegetable Wholesale Market

(2) Price Fluctuation

The figure below shows the change of average wholesale prices published daily by the Karachi MC. In the questionnaire survey of farmers, 17% of the respondents cited price fluctuation as a challenge they face in marketing. Onion and cucumber prices are relatively stable throughout the year, but the price of okra is about four times higher at PKR 232/kg and lower at PKR 57/kg. Tomato is about 7.5 times higher at PKR 142/kg and lower at PKR 19/kg, and chili is about four times higher at PKR 162/kg and lower at PKR 42/kg. For chili, the highest price is PKR 162/kg and the lowest is PKR 42/kg, a price difference of about four times. As for fruits, the highest price of banana (Grade A) is PKR 112/kg and the lowest is PKR 52/kg, a difference of about two times. The highest price of papaya (Grade A) is PKR 152/kg and the lowest is PKR 102/kg, a difference is about 1.5 times. According to interviews with middlemen, these fluctuations are essentially due to seasonal variations as well as natural disasters and inconsistent import volume restrictions imposed by the government.

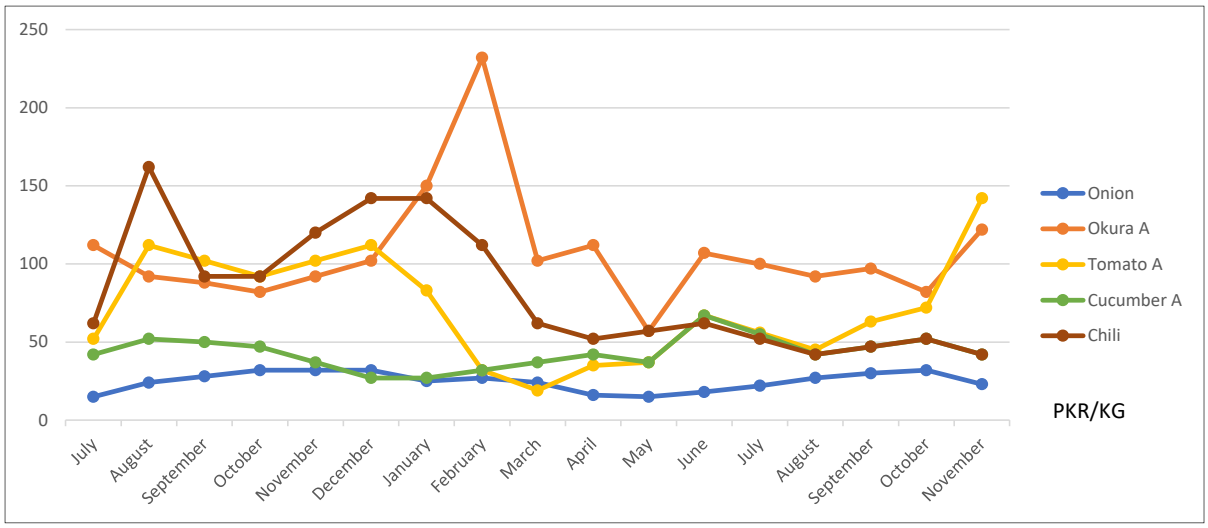
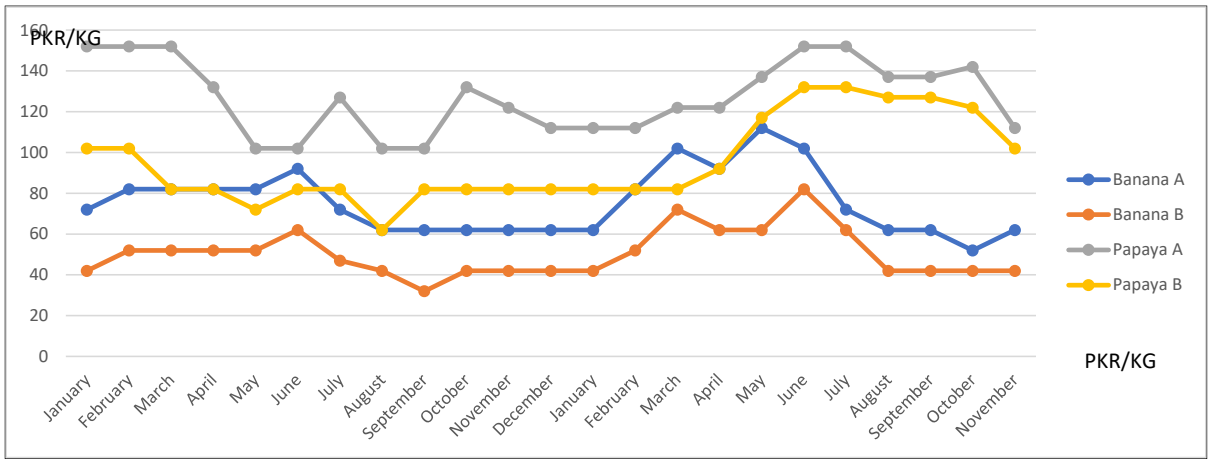


Figure 4.3.4 Changes in Average Wholesale Price of Vegetable in Karachi Market (July 2020–November 2021)



Source: Developed by JICA Study Team based on Data from Marketing Committee (Figure 4.3.4 and 4.3.5)

Figure 4.3.5 Change in Average Wholesale Price of Fruits (Banana and Papaya) in Karachi Market (January 2020–November 2021)

4.3.3 Logistic Infrastructure for Agriculture VC

As mentioned in Section 1.2.3, road infrastructure is poorly developed in the rural areas of Sindh. Most of the rural roads are unpaved and in poor condition. Many of the stakeholders interviewed in this study cited the difficulty of transporting agricultural produce due to inadequate development of roads as a VC challenge. This is related to the fact that a large amount of crop wastage is produced every day in the wholesale market, as it causes longer transportation time due to limited traveling speed and cargo damage and quality deterioration during the transportation process. In Sindh, the post-harvest loss rate of crops from production to distribution is said to be as high as 30–40%.[9] If produce could be transported to consumers in urban areas and for export in fresh condition, it would increase the value of the crop and the profitability of the farmer. At present, temperature-controlled trucks and refrigeration facilities in production areas and key distribution points are owned only by a few private exporters, and low-temperature logistics are very limited.

Most of the packing materials used were jute bags, plastic bags, and wooden boxes covered with straw, and using plastic crates to prevent transportation damage was not observed as much in the farm-to-wholesale market logistics. (Fruits imported from Iran were transported in plastic crates.) Private companies owned several cold storage warehouses for storing fruits and seed potatoes for a certain period, and middlemen and exporters owned facilities in the wholesale market. There are 10 cold storage warehouses in the Karachi fruit and vegetable market, mainly for fruits such as bananas and apples, which can be used by anyone involved in the market if they pay a fee to the warehouse owner.[10]

The fruit and vegetable wholesale markets in Karachi and Hyderabad have facilities made of concrete used for auctions and as storage warehouses. The road surface was unpaved, and as far as the study team could observe, there was no drainage system in place and garbage was scattered, making it unsanitary. The market in Karachi used to be in the center of the city, but it was moved to its current location (about 20 km from the center of Karachi) 20 years ago due to heavy traffic congestion. Traffic congestion and sanitation are serious issues because of the large

[9] ADB, Dysfunctional Horticulture Value Chains and the Need for Modern Marketing Infrastructure: The Case of Pakistan (2019).

[10] The cold storage warehouse of the middleman interviewed in the study charges PKR 60 per carton (about 15 kg) for storage without a time limit.

number of vehicles and heavy trucks that drive into the market during the trading hours.

Trader transporting cucumbers (Hyderabad Market)

Auction Facility (Tando Allahyar Market)

Cold storage for bananas

Cold storage for apples in a market

Source: JICA Study Team (October–November 2021)

Figure 4.3.1 Fruits and Vegetable Wholesale Market Facility in Sindh

4.3.4 Sales from Wholesale Market

Crops traded in the wholesale market are shipped and sold by middlemen (Mashakhor) to retailers and exporters. The following are the results of a questionnaire survey conducted among the middlemen on the factors that affect the selling price of crops when they are sold to retailers, etc., and the challenges in selling. It is mainly the appearance, such as size and color, and the off-season or high-demand time of year that sells at a higher price. The main challenges faced in selling are price fluctuation and payment problems from buyers.

Table 4.3.3 Factors Affecting Selling Price and Challenges in Selling to Retailers

Factors Affecting Selling Price	#	Challenges in Selling	#
Size	20	No issue	14
Season, High demand timing	19	Price fluctuation	12
Color	16	Late payment	12
Uniformity	6	No existence of reliable buyers	10
Volume to sell at one time	5	No transportation means, high cost	8
Damage	2	Low price	6
		Others: Low demand, loan default of farmers that lend money	5

Note: Total of 39 respondents with multiple answers.
Source: JICA Study Team

4.3.5 Processors

Section 4.2.2 mentioned there is almost no agro-products processing at the farmer or cottage industry level, and processing at the industry level has hardly developed except for a few crops, such as chili and mango. In recent years, the demand for processed tomato products, such as ketchup and puree, has been increasing drastically due to the change in eating habits in urban areas and increase in fast-food restaurants (for example, there are 20 McDonald's in Karachi alone as of January 2022[11]). Supermarkets are filled with domestically produced tomato products from major food manufacturers, such as National Foods and Shangri-La, but all of these ingredients are made from imported tomatoes. Tomato varieties grown in Sindh are not suitable for processing, so the processing yield is low. According to the tomato processors, there is no need to procure domestically grown tomatoes as the prices and supply of imported tomatoes are stable.

The following is a summary of the results of interviews with processors of chili, onion, and mango, which are the main crops processed in Sindh.

(1) Chili and Onion Processing

Table 4.3.4 Summary of Interviews with Processors (Chili and Onion)

	Mehran Foods Established 70 years ago. Manufacturer and exporter of spices and cooking spice mixes, exporting to over 45 countries. Third largest spice manufacturer in Pakistan.	**Zaiqa Foods** Established 22 years ago. Manufacturer and exporter of sauces, chutneys, and pickles by processing chili, garlic, coriander, and onion	**National Foods** Established 50 years ago. A leading manufacturer and exporter of spice mix jams, chips, and many other processed products.
Procurement of raw material	· Chili is procured from middlemen in Kunri (Umerkot) and Naukot (Tharparkar). Mehran Foods has its farms and provides technical guidance to farmers on pest control and mold poisoning reduction. · For procurement, the following are important: fungal poisoning level, pungency level, color (bright reddish color), and the need to store in a warehouse with low humidity. · The company was dissatisfied with the procured crops (inadequate post-harvest processing,	For chili, Zaiqa Foods directly buys from farmers in Kunri (Umerkot) and Jhuddu (MirpurKhas). Only 10% is from its farms. For export, the level of pesticide residues and fungal toxins is important, but the quality is not stable. The company is taking measures, such as instructing farmers to use nets during drying and sorting before processing. It needs to establish a committee to control and regulate prices and production, certify the system for seeds, and train farmers in using agricultural chemicals. It cultivates and procures	Chili is purchased directly from wholesale markets, middlemen, and farmers. They have an extension team that provides technical guidance to farmers around Kunri and Naukot. Conducted as part of corporate social responsibility (CSR). Pesticide residues and mold poisoning are caused by improper production process management. In procurement, the company focuses on bright colors, fungal poisoning levels, and stable supply. Farmers often grow a mixture of several products and varieties, and they cannot procure from such

[11] https://mcdonalds.com.pk/locate-us/

	poor hygiene, inappropriate storage, pesticide residues, etc.), so it purchased a farm and started growing crops. · The need for storage facilities at the farm level is very high. · All onions are procured from middlemen. · The focus is on crop moisture levels and microbial contamination. Less problem than in chili.	onions, sells at wholesale markets, and directly purchase from farmers. Onions need to be uniform in size for the processing machines. But at present they are almost uneven, so the onions are manually sorted. They are willing to invest in contract farming if there is an appropriate system.	farms. There are problems such as uneven pungency levels. The company distributes GeoTextile to farmers and instructs them on proper drying. Farmers should be allowed to store their harvest in warehouses, and the government should monitor the quality and quantity of the stored crops to control appropriate prices and cultivation plans.
Sales	Exports to Middle East, Europe, US, Australia, Malaysia, etc. The domestic market has its own distribution channels. They also export to Japan and Korea, but the standards are strict. Due to inappropriate management in the production process of raw materials, the problems of pesticide residues and mold poisoning cannot be solved. The government should improve production efficiency by promoting the cultivation of appropriate crops through soil mapping.	All the products are sold to logistic sellers who distribute domestically and export them. They are facing the problem of being unable to compete with cheap crops from India and China. The supply of raw materials is very unstable. The government should implement appropriate production management based on regional characteristics to stabilize prices and supply.	Exports to the Middle East, Europe, and the US have been declining due to the recent sharp rise in the price of (raw) chili. Since a license is required for retail distribution, all distribution is outsourced to logistic sellers. Guidance is needed to ensure that post-harvest processing, sorting, and packing to reduce fungal toxins are properly implemented at the farm level. The procedures and documents for exporting agricultural products are complicated, and a one-stop service from the government is requested.

Source: JICA Study Team

(2) Mango Processing

Table 4.3.5 Summary of Interview with Processors (Mango)

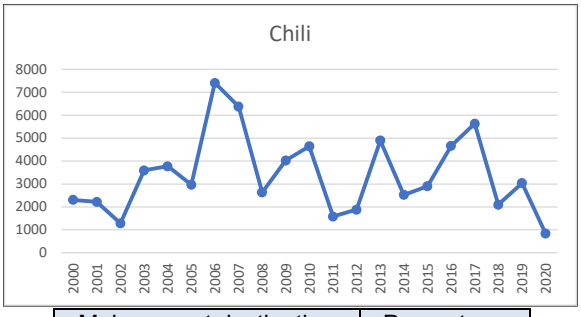
	Popular Juice Established in 1987. Processing plants in five locations in the country. In Sindh, there are plants in Karachi and Tando Aram. Main business is production of Tetra Pak and juice.	**Ifthkhar and Co** Established 60 years ago, the CEO is the Patron Chief of Pakistan Fruits Vegetable Association. Produces a variety of juices and tomato peels.	**National Foods** Established 50 years ago, it is a leading manufacturer and exporter of many processed products such as spice mix jams and chips.
Procurement of raw material	Mangoes are easily damaged, so they are procured from a farm within 100 km around the factory. There are three types of mangoes: (i) for export, (ii) for domestic fresh consumption, and (iii) for processing (lowest quality, fully ripe on the tree). Procured from 40–50 middlemen. Each vendor is in charge of a certain area and collects the products from farmers and brings them to the factory. There is no direct purchase from farmers because of the complicated procedures. The purchase price is determined by checking the price every day at the wholesale market. The rejection rate is about 10%. Size is based on a minimum of 3 inches. They provide funds (advance payment) and crates free of charge to vendors. The issue is transportation loss due to inadequate transportation infrastructure (roads). Procurement quantity and quality have no problems. The pulp production capacity is 20 tons/hr. The mango pulp processing unit operates only two months per season, and the processed products are stored under refrigeration for sequential juice production.	The company has contracts with several farmers, who are paid in advance, and the company's staff regularly visit the plots to manage the cultivation. The company also procures from middlemen in the Karachi wholesale market. They also procure from middlemen in the Karachi wholesale market. They check the prices of the products to procure from the market every day, but since most of them are paid in advance to the farmers, price fluctuations do not affect very much. Currently, there is often a shortage of supply, so they are hoping to introduce new varieties that have higher yields and are resistant to pests and diseases.	Most of them are procured from middlemen. Some directly purchase from farmers. The variety of mangoes (Desi) used in the company's processed products (pickles) is required to be unripe and green. The purchase price of Desi is lower than that of other varieties, so the number of farmers who want to grow Desi is decreasing, making it difficult to procure. Mangoes for pickling need to be transported to factories quickly while still unripe, but it takes time due to lack of road infrastructure, which causes damage. Research and development and incentives for the production of Desi varieties are needed.

Sales	The company's share of the domestic mango juice market is 33%. Six to seven percent of its production is exported to the US, Australia, and Afghanistan. All sales are outsourced to distributors. Dumping due to price competition is an issue. There are no training opportunities for staff on processing and manufacturing techniques.	They are currently selling only in the domestic market. They have recently invested PKR 500 million in equipment and hope to start exporting this year. Native varieties of fruit trees have high production costs and are not internationally competitive. Low-temperature transportation and lack of GAP also have an impact.	・ Mango pickles are only sold in domestic market.

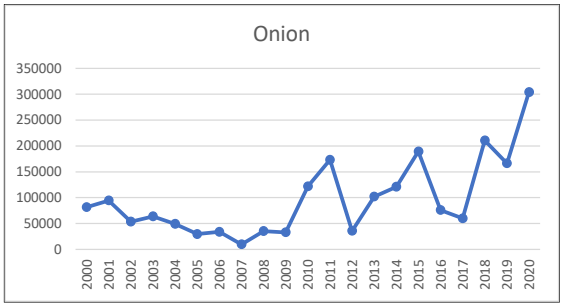
Source: JICA Study Team

4.3.6 External Trade

The figure below shows the trend of export volume of the surveyed crops.[12] Although there has been an increasing trend over the past 20 years, there has been sharp fluctuation. Chili was leading in crop exports in the 1970s and 1980s, but it lost its position drastically when export to Europe was suspended due to the detection of pesticide residues and aflatoxin (a type of fungal poison) caused by improper post-harvest processing. Currently, exports are mainly to countries with less stringent quality standards, and the export volume is unstable. Banana exports to neighbouring countries have been growing rapidly in recent years. For mangoes, there are three grades, with only the highest quality (Grade A) destined for export, Grade B for the domestic market, and Grade C for pulp processing plants. In order for farmers to increase their profits by adding value to their crops, they need to improve the quality of their products to meet the standards of those destination countries.

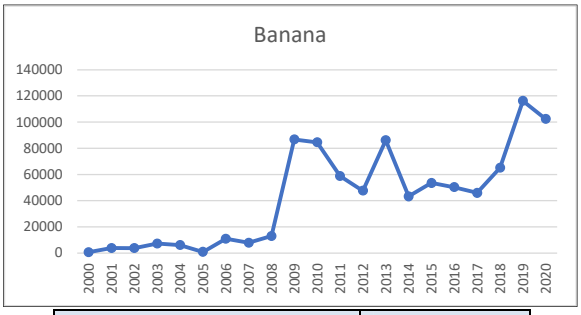


Major export destination (2019-20)	Percentage
India	50.4%
China	21.4%
Spain	7.3%
Peru	3.7%
Others	17.2%

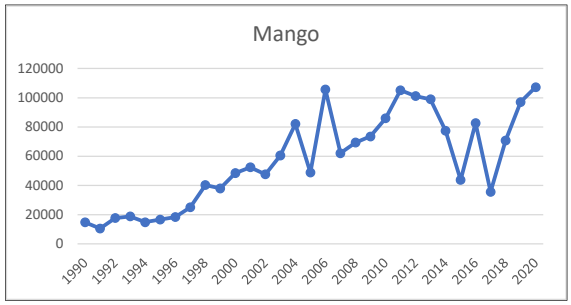


Major export destination (2019-20)	Percentage
Malaysia	35.4%
Sri Lanka	20.4%
UAE	15.5%
Bangladesh	8.6%
Others	20.1%

[12] It is the export volume for Pakistan. Data for Sindh only was not available.



Major export destination (2019–2020)	Percentage
Afghanistan	95.4%
Uzbekistan	3.2%
Others	1.4%



Major export destination (2019–2020)	Percentage
UAE	27.4%
UK	15.1%
Afghanistan	10.6%
Oman	9.4%
Others	37.4%

Source: JICA Study Team developed by FAOSTAT

Figure 4.3.6 Change in Export Volume of Major Horticulture Crops

In this study, interviews were conducted with several exporters in Sindh to understand their procurement status, export destinations, challenges, and needs. The summary of the interviews is as follows.

Table 4.3.6 Interview Result Summary with Exporters

Chili	
Procurement	Most exporters source their products from the wholesale chili market in Kunri, Umerkot District. In recent years, some exporters have hired smallholders to grow crops on their farms. These exporters supply seeds, fertilizers, and cultivation technology. The purchase price varies widely depending on the quality required by the trader and the season, ranging from PKR 30 to 300 per kilogram. Last year, the price even rose to PKR 500 per kilogram due to flooding.
Export destination	Main destinations are Middle Eastern countries, Singapore, Malaysia, and Sri Lanka. They sell directly to importers in these countries. Exports to the US and Europe are decreasing, so they shifted to countries with less stringent quality standards.
Challenges	・ More than 90% of the crops distributed in the domestic market do not meet international export standards for fungal toxins, moisture content (less than 10%), and pesticide residues. ・ Native varieties have many problems, such as low pungency and susceptibility to pests and diseases. ・ Many farmers, research institutes, and traders are unaware of the low international competitiveness of Pakistani chili. ・ Transportation cost doubled before and after the pandemic.
Counter-measures	・ Farmers supported by NGOs, such as NRSP,[13] receive guidance on appropriate cultivation techniques and post-harvest treatment, so they try to procure from such farmers as much as possible. ・ Results of research and development overseas should be utilized to introduce new varieties that are resistant to pests and diseases. ・ Support is needed to organize farmers' groups and have them obtain GAP certification.
Onion, Okra	
Procurement	Onion: Half is purchased from middlemen in the wholesale market, and the other half directly from farmers. The purchase price ranges from PKR 20 to PKR 30/kg, with the highest at PKR 40/kg. Prices are stable compared to other crops. Buying directly from the

[13] For details of NRSP, refer to 8.4.1 of Chapter 8.

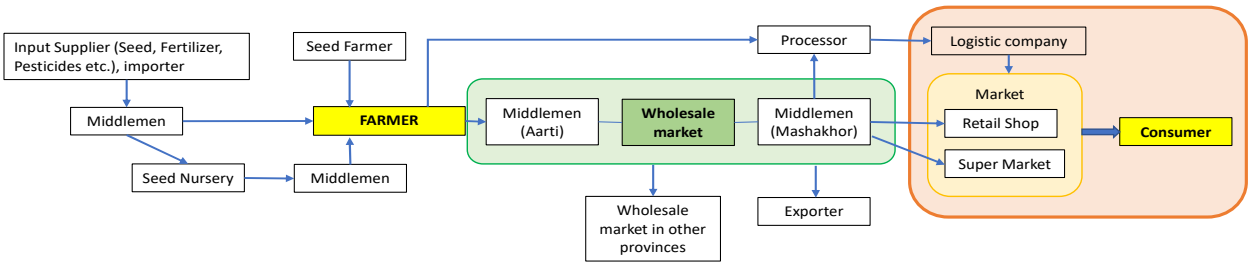
	farmer saves the farmer 10% of the market commission. Red color onions have a higher value. Okra: It is mainly procured from middlemen, but many exporters grow under contract with farmers. The purchase price is PKR 100–150 per kilogram, and the price does not drop significantly.
Export destination	Onion: Singapore, Malaysia, Brunei, and some traders are negotiating with Indonesia. Okura: The demand in Europe is increasing. Some suppliers export only to traders in Frankfurt. Exports from India dominate the world market.
Challenges	・ Lack of facilities to test for pesticide residues has made it difficult to develop new export markets. ・ Shelf life of indigenous varieties is short. ・ Cost of domestic and international transportation is rising, and there is domestic demand, so toiling for exports is unnecessary.
Countermeasures	・ Introduction of high yielding varieties. ・ Promote contract farming with farmers to reduce domestic transportation time. ・ Special export zones are needed.
Fruits	
Procurement	Papaya: In some cases, exporters buy directly from farmers. But usually only a certain amount is needed, so they procure from middlemen who can gather large quantities. There is a high demand for seedless varieties of papaya and less for native varieties. A uniform size is desirable. Banana: There is a major intermediary (Nizami Group) in the region, and they collect and sell the bananas for export. Mango: During the harvest season, middlemen bring in many workers from other areas to harvest and pack. In most cases, the middleman manages the entire process of harvesting, packing, transportation, and sales. Exporters buy from middlemen or may also act as middlemen. The average purchase price is PKR 80–50/kg, but it can range from PKR 20–100. The preferred varieties for export are Sindhri and Chaunsa.
Export destination	Papaya: Mainly to Gulf countries. It was exported to Europe before, but demand is decreasing. Banana: Afghanistan, Iran Mango: Gulf countries, UK, etc.
Challenges	Papaya: In the international market, they are sorted and traded by size, but local varieties are of different sizes, which is costly to sort and difficult to trade. Local varieties are susceptible to fungus. Banana: Four main varieties grow in Sindh, but farmers sometimes mix them up because they look similar. Exporters bear the cost of cold storage, and the cost has gone up due to rising fuel prices. Exports to Iran and Afghanistan often suffer crop losses due to unannounced and sudden border closures. Mango: There are many cases where exports are rejected due to the detection of fruit flies at the destination. There is a shortage of refrigerated containers due to the pandemic. Mangoes from Pakistan are not known to the international market.
Counter-measures	・ The government should import seeds and conduct seedling breeding and sampling. Uniformity in size through the introduction of proper cultivation techniques is needed. Introduction of guidance on cultivation techniques to improve quality is also required. It is urgent to introduce the GAP certification system for export. ・ The government should provide advance notice of border closure information.

	・ Branding of Pakistani products such as mangoes is needed. ・ The number of heat treatment facilities for fruit flies has increased and the cost is lower than before, but the flavor changes, so fumigation facilities are preferred, but there are none in Sindh at present. Fumigation treatment is also required for export to Japan.

Source: JICA Study Team developed based on Interviews

Regarding the problems of pesticide residues, fungal toxin (aflatoxin, etc.), heavy metals (cadmium, etc.), and insect pests (fruit flies, etc.) in agricultural products, which many exporters pointed out as major issues, the Plant Protection Department was also interviewed. They pointed out that there are many cases when agricultural products exported from Pakistan are rejected due to the detection of harmful substances that do not meet the standards of the importing country. The department also mentioned that implementing appropriate farm management and post-harvest treatment at the field level is the most important measure, but this information is not well communicated to farmers. In addition, the government and the private sector should work together to improve facilities and provide guidance to farmers, but such cooperation is insufficient and the situation is not improving. Another one pointed out was the lack of awareness among exporters. There is a need to provide incentives for exporters and farmers who practice safe crop cultivation management and strengthen the capacity of inspection labs and inspections facility at ports.[14]

4.4 Sales and Consumption



Source: JICA Study Team

Figure 4.4.1 Sales and Consumption in Horticulture Crop VC

Crops shipped from wholesale markets are mostly distributed to retailers through middlemen (Mashakhor). In urban areas, such as Karachi and Hyderabad, the types of retailers include local markets with multiple stores, fruit and vegetable stores on street corners, street vendors with hand carts, supermarkets, and so on. In Karachi, foreign retail chains like Carrefour, Metro, Spar, etc., are opening stores one after another. Local companies such as Imtiaz, Naheed, Agha's Super Market, etc., are also increasing stores. According to the results of the consumer survey conducted for this study, 17–23% purchase vegetables from supermarkets, and this consumption trend is expected to increase. However, most consumers purchase vegetables at local markets or fruit and vegetable retailers. For fruits, due to their seasonal nature, many people buy from street carts. In recent years, more and more major supermarkets have introduced online sales. In Naheed Supermarket, where the interview was also conducted, 25% of its total sales are from online.

[14] Interview with the Principal Science Officer of Food Quality and Safety Research Institute, Karachi University.

Table 4.4.1 Place to Buy Fruits and Vegetable

	Local Market /Mandi	Grocery Stores	Supermarket	From Farmers	Self-cultivation	Street vendors/ Street Cart	Others	NA	Respond
Cucumber, Okra, Tomato	30% (20)	50% (33)	17% (11)	0% (0)	2% (1)	39% (26)	3% (2)	0% (0)	100% (66)
Chili, Onion	36% (40)	54% (63)	23% (24)	4% (2)	2% (2)	21% (38)	2% (3)	0% (0)	100% (56)
Banana, Mango, Papaya	20% (8)	28% (11)	13% (5)	0% (0)	3% (1)	50% (20)	5% (2)	0% (2)	100% (40)

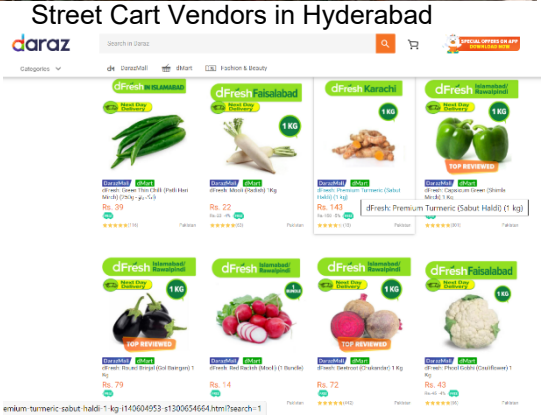
Source: JICA Study Team

Local Market in Karachi

Street Cart Vendors in Hyderabad

Fresh corner in supermarket

Local grocery shop



Vegetable shop page in the largest EC site in Pakistan

Source：JICA Study Team (Oct-Nov, 2021)

Figure 4.4.2 Consumers Market

Many supermarkets procure perishable goods through their channels, while others outsource their sales floor to vendors (this was the case for most of the supermarkets in the Hyderabad area). According to the supermarket manager, customers of supermarkets place more importance on the quality, such as freshness, rather than price. The supermarket once tried to buy directly from farmers through contract farming, but the quality and supply were not stable. It was concluded that it would be better to outsource to a reliable supplier.

Table 4.4.2 Comparison of Local Market and Supermarket

	Local Market/Grocery Shop	Supermarket
Customers	・ All level. Other than general consumers, restaurants/food industries also are clients.	・ Middle-upper income level
Quality	・ Generally unsanitary environment with exposure to dust and outside air and possibility of bacterial contamination. ・ Freshness is normally higher than in supermarkets (especially leafy greens). ・ Quality and size may vary.	・ Products are displayed in refrigerated cases, and hygiene is normally good. Quality standards are set so a certain level of hygiene is maintained. ・ In many cases, freshness is lower than local market.
Price	Prices are not indicated, and one can negotiate the price (lower).	・ There is a price label. ・ Prices are generally more expensive than in the local market. However, if the price is much higher than set price by MC, a fine will be imposed. Credit cards are accepted for purchases.
Issues	・ Sanitary condition is bad. ・ Traffic congestion and lack of parking space in many cases. ・ No storage or cold storage facilities.	・ Securing a stable supply of quality and fresh crops. ・ High quality goods require additional costs, such as packaging, but they cannot charge significantly higher than the set price by MC.

Source: JICA Study Team

Results from the interview of consumers show that many consumers feel that freshness is a challenge, but in the case of fruits, they expect better taste. According to the retailers, customers buy products for freshness and appearance, and very few customers want organically grown products because not many people are concerned about the safety of pesticide residues. Only a couple of stores in Karachi sell organically grown products. The overall awareness of food safety by the general public is low.

Table 4.4.3 Issues of Horticulture Crops Sold from the Consumers' Perspective

	Size	Price	Appearance (Color)	Taste	Freshness	Volume	Shape, uniformity	Others	No issue	NA	Respondents
Banana, Mango, Papaya	20% (8)	45% (18)	25% (10)	23% (9)	43% (17)	5% (2)	13% (5)	0% (0)	20% (8)	0% (0)	100% (40)
Cucumber, Okura, Tomato	23% (15)	42% (28)	17% (11)	6% (4)	50% (33)	9% (6)	14% (9)	3% (2)	27% (18)	0% (0)	100% (66)
Chili, Onion	13% (7)	29% (16)	11% (6)	2% (1)	23% (13)	4% (2)	5% (3)	0% (0)	46% (26)	0% (0)	100% (56)

Source: Consumers Survey by JICA Study Team

Table 4.4.4 Future Expectation from Consumers

	Big size	Small size	Low price	Stable price	Nice color	Good taste	No damage	Freshness	Good supply in season	Shape uniformity	Organic	Safety	Others	Respond-ents
Banana, Mango, Papaya	45% (18)	0% (0)	53% (21)	18% (7)	13% (5)	70% (28)	25% (10)	63% (25)	3% (1)	3% (1)	0% (0)	5% (2)	5% (2)	100% (40)
Cucumber, Okura, Tomato	18% (12)	21% (14)	47% (31)	29% (19)	8% (5)	30% (20)	23% (15)	74% (49)	0% (0)	3% (2)	0% (0)	12% (8)	2% (1)	100% (66)
Chili, Onion	34% (19)	5% (17)	45% (56)	27% (34)	4% (7)	23% (33)	11% (21)	54% (79)	0% (0)	2% (3)	2% (1)	16% (17)	7% (5)	100% (56)

Source: Consumers Survey by JICA Study Team

4.5 Issues and Potential related to VC of Horticulture Crops

Summarizing the situation stated, the issues and potentials in each process of the horticultural crop food value chain (FVC) in Sindh can be outlined as follows.

Table 4.5.1 Issues and Potentials of Each Process in the Horticulture Crop VC

	Issues	Potential	Countermeasures
Production	・ Lack of efficient use of water and irrigation facilities, rising pump fuel costs ・ Salinity, soil degradation ・ Soaring prices of inputs and difficulty in obtaining in the market ・ Fabricated and defective fertilizers and pesticides in the market ・ Difficulty in obtaining seeds of profitable varieties and certified seeds in the market ・ Lack of dissemination of cultivation technology, lack of access to information by farmers ・ No farmer organizations to practice collective purchase, product sales, and information sharing	・ Climate and soil suitable for growing horticultural crops ・ Much room for improvement in quality and yield through technology diffusion ・ Availability of organic fertilizers such as cow dung ・ Extensive irrigated land ・ Some degree of agricultural mechanization ・ Development of ICT agricultural extension and information services by public and private sectors	・ Promotion of water-saving irrigation technology in collaboration with SIAPEP/SWAT ・ Increase productivity by introducing new technologies of solar and IT agricultural equipment (sensors, etc.) ・ Guidance on cultivation techniques ・ Support for the introduction of soil improvement and organic compost production technologies, etc. ・ Support for improving farmers' digital literacy to collect information ・ ICT dissemination and provision of financial services in collaboration with the private sector ・ Collective purchase of input and peer extension among

	Issues	Potential	Countermeasures
			farmers by forming farmers groups
Logistics	・A strong network of middlemen and their role in the complex crop VC system, the high dependence of small-scale farmers on middlemen, and the lack of marketing flexibility and freedom of farmers themselves ・Inadequate logistic infrastructures, such as roads and cold transport, lack of facilities for post-harvest processing, lack of cold storage facilities, and inadequate farmer-level processing facilities ・Increase in transportation costs due to rising international fuel costs, absence of efficient means of transportation ・Crop loss and high waste rate due to lack of appropriate packaging materials ・Inefficiency in wholesale markets due to lack of information systems for price information, vendor information, etc. ・High price volatility ・Rampant irregularities such as late and defaulted payments due to the transactions made by cash.[15]	・Existence of huge consumer markets in neighboring large cities ・Existence of a dynamic VC system with a variety of traditional and inter-city and inter-state actors (middlemen) ・Willingness and effort by the government to adopt ICT/new technologies (e.g., price information systems)	・Breaking away from dependence on middlemen through financial support ・Support for reducing logistical costs and expanding sales channels through forming farmer organizations ・Support for processing technology at the farmer level ・Development of distribution infrastructure ・Development of information infrastructure, including dissemination of market information such as prices through the introduction of ICT
Processing/ Export	・Inability to comply with quality standards required by the importing country. Inadequate implementation and monitoring system by the government. ・Lack of uniformity in size, supply, etc. ・Lack of international competitiveness of indigenous varieties in terms of taste, quality and yield, and lack of varieties for processing ・Government policies for the	・High international demand for Sindh's specialty crops such as mangoes and chili ・Cultivation of popular mango varieties such as Shindhuri and Chaunsa	・Introduction of GAP, HACCP, ISO, etc., and technical support for quality control ・Introduction of varieties suitable for export and processing ・Branding of Sindh products to add value ・Improvement of facilities for plant quarantine

[15] According to the interviewees, due to the safety concerns of bringing large amounts of cash into the market, transactions are often through cash on delivery or written agreements, but they often get away with it.

	Issues	Potential	Countermeasures
	import and export of agricultural products can be more consistent ・ Underdeveloped processing industry, no factories, not enough production for processing ・ Uncertainty due to Chinese companies entering the processing industry		
Sales	・ Lack of link between farmers and consumers ・ Low awareness of food safety among consumers ・ Difficulty for value addition due to price control and restriction imposed by the government	・ Increasing mid-upper income population, Increase in demand ・ Rapid growth of e-commerce	・ Dissemination of safe food, such as organic produce by consumer advocacy and education ・ Promotion of direct marketing between farmers and consumers

Source: JICA Study Team

5 Current Condition of Water Resources in Sindh Province

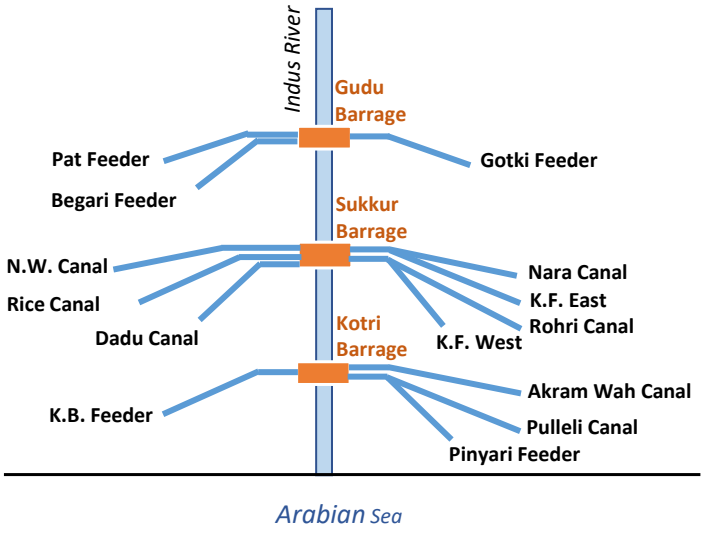
5.1 Sectoral Overview

5.1.1 Irrigation System

Sindh Province is mainly dry and relatively arider than the upcountry areas. Irrigation is therefore critical for agriculture in the province, as the contribution of rain towards crop water requirements is negligible.

Irrigation has been practiced in Sindh for 5,000 years based on inundation canals and floods. However, the history of modern irrigation systems with controlled canal systems is rather recent (i.e., 90 years old). Sukkur Barrage, the first barrage, was commissioned in 1932, followed by Kotri and Guddu Barrages in 1955 and 1962, respectively. These three barrages command a total area of 6.046 million ha at present.

The three major barrages on the Indus River in Sindh divert approximately 48 million acre-feet (MAF) or 59.0 billion cubic meters (BCM) of water annually to the 14 main canal commands in the province. These canal systems have an aggregate length of 13,325 miles (21,445 km), which serves a gross command area (GCA) of 14.391 million acres (5.8 million ha). There are about 42,000 watercourses (tertiary channels) with an aggregate length of about 75,000 miles (120,000 km). Over half of the Sindh command area is supplied by Sukkur Barrage through four left-bank and three right-bank canals. Guddu supplies around a quarter of the Sindh command area, and Kotri supplies less than a quarter.



Source: JICA Study Team

Figure 5.1.1 Schematic Diagram of Irrigation System in Sindh Province

5.1.2 Water Resources/Water Use (Surface Water)

The Indus drains an area of about 950,000 km^2 and generates a mean annual discharge of 6,682 m^3/s. The hydrograph of the river at Sukkur is strongly seasonal with a long low-water season known as *Rabi* between October and March (low flow season) and a high water season known as *Kharif* between April and September (high flow season), driven primarily by summer snowmelt in the upper catchment and monsoon rainfall. The river usually peaks in mid-August or early September. River flow upstream of Sukkur barrage varies from a monthly average flow of

approximately 22.83 MAF (28.16 BCM) in August to approximately 1.44 MAF (1.78 BCM) in January.

Table 5.1.1 Records of Water Abstraction from the Barrages in Sindh Province

Unit: Acre-feet

	Kharif	Rabi	Annual
2010-11	22.70	14.38	37.08
2011-12	25.13	11.28	36.41
2012-13	27.01	14.23	41.24
2013-14	30.75	14.64	45.39
2014-15	33.20	15.54	48.74
2015-16	32.88	15.56	48.44
2016-17	34.06	13.13	47.19
2017-18	33.45	10.80	44.25
2018-19	29.43	11.03	40.46
2019-20	29.71	14.01	43.72

Source: Water Management Directorate, WAPDA

5.1.3 Water Resources/Water Use (Groundwater)

Another important and increasingly used source of water both in the dryland and the canal area is groundwater. Groundwater resources complement available water resources in Sindh, and its safe yield has been estimated to range between 4.4 and 8.1 MAF. However, groundwater use is comparatively less (4.3 BCM) for two primary reasons. Firstly, most of the area lies on saline or brackish water, and secondly, canal command areas are being provided with surface irrigation supplies. More than 80% of the irrigated land in Sindh is underlain by brackish water unfit for agriculture.

5.1.4 Irrigation Area

The irrigation area from years 2010–2011 to 2019–2020 is shown in the table below.

Table 5.1.2 Irrigated Area in Sindh Province

Unit: Mill ha

	Total	Canals	Tubewells
2010-11	2.09	1.73	0.36
2011-12	1.74	1.40	0.34
2012-13	1.72	1.36	0.36
2013-14	1.68	1.32	0.36
2014-15	1.68	1.32	0.36
2015-16	1.69	1.33	0.36
2016-17	1.69	1.33	0.36
2017-18	1.69	1.33	0.36
2018-19	1.65	1.29	0.36
2019-20	1.65	1.29	0.36

Source: JICA Study Team prepared based on a material of DoA

From 2016 to 2019, the irrigation area of Sindh is as shown in Table 5.1.3.

Table 5.1.3 District-wise Irrigated Area in Sindh Province

Unit: 1000 ha

Sr. No	Districts	Reported Area	Currnt Fallows	Net Area Sown	Un-Irrigated Area	Irrigated Area			
						Total	%	Canal	Tubewell
		(1)	(2)	(3)	(4)	(5)	(6)= (5)/(1)	(7)	(8)
	Sindh	5,083	2,481	2,602	948	1,654	33%	1,300	354
1	Kashmore	117	35	82	48	34	29%	27	7
2	Jacobabad	121	43	78	69	9	7%	5	4
3	Ghotki	238	54	184	79	105	44%	1	104
4	Sukkur	163	92	71	10	61	37%	50	11
5	Shikarpur	113	15	98	45	53	47%	51	2
6	Khairpur	269	78	191	28	163	61%	136	27
7	Larkana	50	2	48	23	25	50%	17	8
8	Kambar Shahdadkot	324	234	90	32	58	18%	56	2
9	Nausheroferoze	209	49	160	13	147	70%	134	13
10	Dadu	320	178	142	80	62	19%	55	7
11	S.B. Abad	385	219	166	74	92	24%	80	12
12	Sanghar	404	184	220	94	126	31%	123	3
13	Matari	86	10	76	20	56	65%	15	41
14	Jamshoro	98	30	68	20	48	49%	40	8
15	Umerkot	335	245	90	41	49	15%	36	13
16	Mirpurkhas	309	143	166	33	133	43%	89	44
17	T.A. Yar	116	46	70	18	52	45%	29	23
18	Hyderabad	61	30	31	5	26	43%	19	7
19	Tharparkar	352	198	154	119	35	10%	29	6
20	Badin	591	300	291	109	182	31%	181	1
21	T.M. Khan	144	94	50	19	31	22%	21	10
22	Thatta	338	183	155	17	138	41%	131	7
23	Karachi	57	54	3	0	3	5%	2	1

Source: Crop Reporting Service Centre, Hyderabad edited by JICA Study Team

The table above shows that about 30% of the farmlands are irrigated. Therefore, measures like developing new water sources and improving irrigation efficiency are necessary to expand irrigated areas and subsequent agricultural production.

The reliance on a single river basin system, the Indus, makes Pakistan's water resource base highly vulnerable to climate change. About 40–50% of the total average flow in the Indus system is from snow and glacial melt, with the remainder coming from monsoon rains over the plains. In the future, experts predict that the temperature increase will be higher in the region compared to the global average increase. As a result, it is expected that intra-seasonal variability will increase the likelihood of extreme events, such as droughts and floods. Given the implications of climate change on temperature and precipitation variations, Pakistan's water availability is projected to become more unreliable.

Under the prevailing situation, substantial quantities of water savings will come from reducing surface water supply losses, particularly in the watercourse command and fields where losses are highest. As a response to the issue of water loss, DOA and World Bank implemented the Sindh Irrigated Agriculture Productivity Enhancement Project (SIAPEP) to reduce water loss at the field level by terminal waterway rsehabilitation. The High Efficient Irrigation System (HEIS) was also introduced. The project is designed to capture this potential and make water use more efficient at the farm level and diversify crops, considering farm size, soil condition, agro-ecological zone as well as farmers' intentions, impacts by drought and flood, and improved agronomic practices.

5.1.5 Drainage

Sindh is the furthest downstream in the Indus basin, bordering the Arabian Sea and located at the delta of the Indus River. The delta is in an essentially flat terrain in which the river in some places is higher than the surrounding lands. For this reason, the river cannot drain areas throughout much of Sindh, and the province is subject to drainage deposits from both upstream and semidiurnal oceanic tides. The average groundwater table is also very shallow, around 2.5 m beneath the surface. In 25% of the province, the groundwater table is even shallower and the land is waterlogged. Surface and sub-surface drainage systems are inadequate, resulting in much of the drainage effluent being either retained in the basin or discharged into rivers and canals.

5.2 Infrastructure for Water Resources

5.2.1 Overview

The table below shows the outline of the irrigation system in Sindh.

Table 5.2.1 Salient Features of Irrigation Systems in Sindh Province

Barrage	Main Canal	Name of AWB	Design Discharge (Cusec)	Length of Main Canal (Miles)	Command Area (1000 acres)
Gudu Barrage	Gotki Feeder	Ghotki Feeder Canal	8,490	79	889
	D.P. Feeder		13,275	7	422
	Pat Feeder		14,764	70	930
Sukkur Barrage	Rohiri		10,887	208	2,546
	Nara	Nara Canal	13,602	217	2,069
	Rice		10,215	82	480
	N. West		5,042	36	933
	Dadu		2,837	132	498
	K.F. East		2,094	13	335
	K.F. West		1,940	45	315
Kotri Barrage	K.B. Feeder		9,100	58	604
	Fileli	Left Bank Canal	13,800	60	929
	Pinyari		14,350	56	786
	Akran Wah	Left Bank Canal	4,100	76	487
Total				1,139	12,223

Source: Mustaqur Rahman Professor, Land and Life in Sindh

5.2.2 Current Status of Irrigation Infrastructure

(1) Barrage

The barrages under operation in Sindh is outlined in Table 5.2.2.

Table 5.2.2 Salient Features of the Barrages in Sindh Province

Sr. No.	Name of Barrage	Year of Completion	Dimension of Barrage	Discharge (Cu.ft/sec)	Current Status
1	Gudu	1962	64 bays (60 ft. Gate)	1.200	Rehabilitation works, replacement of the gates, being implemented under SBIP
2	Sukkur	1932	66 bays (60 ft. Gate)	1.150	Rehabilitation works is under procurement stage and to be commenced under SBIP
3	Kotri	1955	44 bays (60 ft. Gate)	0.875	Rehabilitation works was completed in 2001. Condition of the Barrage is being monitored

Source: Sindh Irrigation Department (SID) and SBIP Office

The Sindh Barrage Improvement Project (SBIP) is currently renovating Gudu and Sukkur Barrages.

Kotri Barrage

Intake Structure at the Right Bank of Kotri Barrage

Source: JICA Study Team

Figure 5.2.1 Kotri Barrage

(2) Main/Branch Canal

Out of the 14 main canals, 1,139 miles long in total, 5 are on the Right Bank and 9 on the Left Bank of the Indus River. The culturable command areas (CCA) of the canals (12,223 acres in total) differ significantly from one another. Rohri Canal covers the largest CCA as opposed to KF west with the smallest CCA. Rice Canal and Beghari Feeder on the Right Bank and Pinyari and Fuleli on the Left Bank were originally non-perennial canals. However, except Rice Canal, the canals have been converted into more or less perennial systems.

Target areas of improvement for the main and branch canals in the Water Sector Improvement Project (WSIP), funded by the World Bank, are Ghotki Feeder, Nara, and Fuleli. Improvement works. The main and branch canals would generally include the following type of works: (i) remodeling of feeder canals, main canals, and branch canals on the basis of latest sanctioned discharges, determined based on the actual flows at the head of the canal over the last ten years; (ii) constructing proper section of the canal and strengthening of banks and inspection paths; (iii) rehabilitating or reconstructing the regulating structures and repairing/replacing/motorization of regulator gates; (iv) installing gauges and control structures for measuring flows in the main and branch canals and at the distributary off-take points; (v) reparing or reconstructing operational buildings near the regulators, field offices, and guest houses that are necessary for the operation of the canal system; (vi) rehabilitating or replacing road bridges where necessary; (vii) constructing escapes, where necessary, to avoid overtopping; (viii) planting trees in the right-of-way beyond the inspection and non inspection paths; (ix) restoring markers to show distance from the head of the canal (RD markers); and (x) other crucial rehabilitating and remodeling works identified during the

design preparation.

Fuleli Main Canal

Regulator at Fuleli Main Canal

Source: JICA Study Team

Figure 5.2.2 Fuleli Main Canal

(3) Distributary/Minor Canal

The works at the distributary channels may cover the following:

(i) desilting, creating a proper section of the distributary channel;

(ii) reconstructing channel banks, berms, and inspection path and strengthening of the non-inspection path bank;

(iii) reconstructing outlets;

(iv) repairing and reconstructing any regulating structures in the distributary;

(v) constructing measuring sections, buffalo wallows, and washing ghats where necessary;

(vi) rehabilitating and constructing foot and road bridges, constructing of the RD markers, and any other works identified by FOs;

(vii) tree planting on land available along the distributary;

(viii) rehabilitating and constructing offices of FOs, providing office equipment, furniture, facilities, and stationery; and

(ix) lining selected distributaries.

The FOs would be involved in all stages of work on the distributary/minor canals, including identification, planning, prioritizing, designing, and constructing rehabilitation and improvement works. The field survey results in the distributary canals are in Section 5.2 4 (3).

(4) Water Course

There are about 46,699 watercourses, with an aggregated length of about 120,000 km (75,000 miles). An estimated 40–50% of the water delivered through the community watercourse networks is lost mainly because of seepage, spillage, and side-leakage at watercourse banks due to the following factors:

(i) irregular profile and zigzag alignment of banks and weak sections of the earthen channels;

(ii) variable cross-section and bed slope of water channels, causing stagnant water in channels;

(iii) silt deposition, causing restrictions inflows and resulting in overtopping;

(iv) trees, shrubs, and vegetative growths in watercourses;

(v) damage caused by rodents and farm animals;

(vi) frequent bank cutting and plugging for water abstraction unruly; and

(vii) loosening earthen banks and beds over time without regular maintenance.

The field survey results in the watercourse are in Section 5.2 4 (4).

Watercourse improvement and renovation will consist of complete demolition of the community channel and reshaping or realigning and compaction of banks according to the engineering design to increase conveyance efficiency by reducing seepage, spillage, and operational losses. A secondary benefit to reduced seepage will be less waterlogging in some areas.

Seminars, media campaigns, and social mobilization are needed to create awareness for the adaption of farmers' participatory works before the implementation. The participatory works include (i) compacting earthen sections in line with the rectification and realignment of watercourses; (ii) lining of 30% of watercourse either by precast concrete parabolic lining (PCPL) segments or rectangular brick masonry depending on choice of farmer and availability of construction material in the area; and (iii) replacement of water outlet structures with properly designed concrete structures (pucca nakas) on the entire length of the watercourse. WCA shares rehabilitation cost of water courses through labor contribution (about 20% of the total cost) to earth works, consisting of excavation, reshaping of canal section, compaction and finishing works, and concrete lining works, such as placing of precast concrete blocks, and plastering works. Meanwhile, cost of construction material and deployment machinery and equipment is borne by the Project.

The recent impact assessment of the lining of watercourses in general, and in Sindh particularly, has shown three advantages: (i) decreases conveyance losses and prevents seepage to groundwater aquifers; (ii) helps deliver water faster to the fields so farmers can take advantage of the full duration of an irrigation cycle under the *Warabandi* system; and (iii) ensures equity in water distribution.

About 5,500 watercourses were improved under SIAPEP by providing lining on an average of 30% of its length. As of the end of November 2021, improvement of approximately 4,900 watercourses has been completed.

Table 5.2.3 Progress of Improvement of Water Courses under SIAPEP

Activity	Achievement upto 30th June 2021			Target for 2021-22 (upto Dec-2021)	Achievement for 2021-22		Cumulative Achievement (upto Nov 01, 2021)
	Project Targets	Numbers	%age		Completed	Under Lining	
Improvement of Watercourses	5,500	4,700	85%	800	208	539	4,908
							89%

Source: SIAPEP Office

The progress of the improvement of watercourses of each district in SIAPEP is shown in Table 5.2.4.

Table 5.2.4 District-wise Progress of Improvement of Water Courses under SIAPEP[1]

DIRECTORATE LOWER SINDH			DIRECTORATE UPPER SINDH		
District	Improvement of WCs		District	Improvement of WCs	
	WCs Improved	Under Lining		WCs Improved	Under Lining
Dadu	368	39	Sukkur	192	39
Jamshoro	131	21	Khairpur	621	52
Hyderabad	170	8	Ghotki	343	46
Matiari	34	4	Naushero Feroz	263	14
T.A Yar	56	5	S.Benazirabad	233	32
T.M. Khan	270	15	Shikarpur	206	7
Badin	278	46	Larkana	156	16
Thatta	203	28	Kambar @ S.Kot	155	18
Sujjawal	165	16	Kashmore @ K.Kot	175	36
Sanghar	152	24	Jacobabad	127	16
Mirpurkhas	484	23			
Umarkot	93	32			
Tharparkar	33	2			
TOTAL	2437	263	TOTAL	2471	276

Source: SIAPEP Office

(5) Wells for Irrigation

As per the Pakistan Bureau of Statistics Agricultural Statistics of Pakistan 2010–2011, the number of tube wells and lift pumps in Sindh is 38,330 and 7,809, respectively. The number of private farms reported to own tube wells in Sindh is 30,644, according to the Agriculture Census of 2010. From 2011 to 2017, the following wells were being constructed.

Table 5.2.5 Wells for Irrigation Constructed from the Year 2010–2011 to 2016–2017

Unit: Numbers

Year	Public			Private			Total		
	Electric	Diesel	Total	Electric	Diesel	Total	Electric	Diesel	Total
2010-11	20	16	36	23	303	326	43	319	362
2011-12	11	7	18	12	290	302	23	297	320
2012-13	8	7	15	11	220	231	19	227	246
2013-14	1	4	5	24	328	352	25	332	357
2014-15	0	0	0	3	171	174	3	171	174
2015-16	0	0	0	2	176	178	2	176	178
2016-17	2	0	2	2	84	86	4	84	88
Total	42	34	76	77	1572	1649	119	1606	1725

Source: Director General of Agriculture Extension, Hyderabad

The fuel cost becomes the burden of the farmer in maintaining wells. Therefore, the DG of Agriculture Engineering and DOA are trying to spread wells with solar panels with 20% of beneficiaries' contribution to the construction cost. In addition, Sindh Irrigation and Drainage Authority (SIDA) is also considering constructing communal wells for irrigation, which it mandates per SWMO 2002.

5.2.3 Needs for Improvement of Irrigation Infrastructure

A meeting was held on 16 November 2021 at the office of Left Bank Canal Area Water Board Badin,

[1] The classification of Upper Sindh and Lower Sindh in the table is SIAPEP's original category. The Upper Sindh, Central Sindh, and Lower Sindh classifications in this study are shown in 1.4.3 of Chapter 1.

with the JICA Study Team, SIDA, and Sindh Irrigation Department (SID),[2] to discuss the proposed works in the command area. They stressed that the downstream area of Fuleli and Akran Wah Main Canal systems was constrained by water scarcity caused by the deteriorated condition of the irrigation system. All have highlighted that the rehabilitation/improvement of the following canals would be prioritized to improve agricultural productivity and farm income.

Fuleli Canal Division

- Desilting of Naseer Branch Canal
- Rehabilitation of Arain Regulator, and branch Dada, Naseer Down, and Sultani Down
- Concrete Lining of Naseer Link
- Concrete Lining of Ali Bahr

Akran Wah Division

- Desilting and Lining of Shadi Small
- Desilting and Lining of Dubni Minor
- Desilting and Lining of Sunni Gunni
- Desilting and Lining of Kamaro Branch

Guni Canal Division

- Desilting and Lining of Khorwah Branch

5.2.4 Survey on Irrigation System

(1) Overview of the Survey

JICA Study Team outsourced a part of the study on irrigation systems to a local consultant to identify the current conditions of the irrigation infrastructure in the selected Area Water Board (AWB) areas and the need for rehabilitation or improvement for the formation of an irrigation development plan. Out of the 14 irrigation systems in Sindh Province, 2 irrigation blocks covered by distributary/ minor canals were selected for the survey. The Ali Bahar Wah and Shah Wah distributaries in the Phuleli canal were chosen for the survey after several discussions with SIDA and the Left Bank Canal AWB.

The salient features of these canals are provided in Table 5.2.6.

Table 5.2.6 Salient Futures of Distributary Canals for the Field Survey

Name	Ali Bahar Wah	Shah Wah
Division	Fuleli	Fuleli
SubDivisio	Matli	Matli
CanalType	Distry	Distry
Parent Chanel	Fuleli	Fuleli
OffTakeRD	164.00	219.90
Length (Mile)	11.00	9.00
Discharge (Cusecs)	145.99	159.62

[2] SID is also called Department of Irrigation (DOI). In this chapter and other ones, SID and DOI are interchangeably used.

Name	Ali Bahar Wah	Shah Wah
GCA (Acres)	10276.0	21041.0
CCA (Acres)	10043.0	11941.0
Outlets	71	69
Outlets Discharge (Cusecs)	136.8	151.1

Source: JICA Study Team

Due to inadequate allocations and use of O&M budgets, the maintenance of water sector infrastructure has declined. Also, the canals operating at higher than the design discharges have resulted in deterioration of the system. The following observations/problems/defects were noted during the inspection in the survey.

(2) Off-take to Distributary Canal

The situation of the off-take structure on the Phulleli Main Canal to Ali Bahar Wah is as follows.

- Jammed gates not in operation mode
- Corroded gate bodies
- Completely damaged upstream floor
- Damaged sill beams of both gates
- Damaged side guides of both gates
- Hoisting system not in operation mode

Source：JICA Study Team

Figure 5.2.3 Current Condition of Off-take at the Head of Ali Bahar Distributary Canal

(3) Distributary/Minor Canal

The current situation of the surveyed distributary canals is outlined below.

Canal section

- Canal bed width is widened and nonuniform from the regulator to tail
- Bed level of canal varies due to silting and trash material deposit
- Both banks of the canal are weak due to continuous extraction of soil from banks by locally residing people near to banks
- Blockage of water due to unnecessary growth of weed and shrubs inside the canal bed at various locations

Off-take structures to watercourses

- Concrete pipes or intake structures are used as outlets. As most outlet structures (intake and outlet) are damaged, the irrigation water cannot properly flow to the watercourses.
- Most outlets are not functioning due to the farmer land bed level being higher than the canal bed level.
- No scale of water discharge measurement at apparently tempered outlet structure.
- Several illegal outlets were observed during the inspection.

Illegal water abstraction

- Some villagers practice Direct Outlets (DOs) or lifting by pump from canals, causing a problem of over-withdrawals in excess of the quota. This is one of the principal causes of inequitable distribution within the system due to withdrawals over their authorized discharges. Even if the discharges of the canal systems were increased, the DOs and lift schemes will proportionally draw increased supplies. The problem of inequitable distribution will continue.


Eroded Section of Distributary Canal


Silted Distributary Canal


Damaged Regulator


Damaged Off-take to Water Course

Source: JICA Study Team

Figure 5.2.4 Current Condition of Distributary Canal

(4) O&M Road and Access Road

The condition of the road is not good for both canals, especially in the area surrounding Ali Bahar Canal, where only 0.8 mi (1.3 km) is accessible by vehicles. There is no proper approach road or access on both sides of the canal banks for farmers shifting machinery or transporting crops to the market.

There is no proper crossing bridge for the people to move from left to right, taking more time for them to reach their destination. In some locations, the local communities arrange a temporary crossing by putting wooden planks or beams, which can be dangerous. Some existing temporary steel bridges used for crossing the canal are rusty and weak.


Damaged O&M Road


Temporary Wooden Footpath

Source: JICA Study Team

Figure 5.2.5 Current Condition of Roads

(5) Watercourse

Watercourses were lined from 15% to 30% of the total length under the National Program of Improvement Water Courses 2004–2005. However, their water carrying efficiency was considerably reduced with poor maintenance and aging. The main causes of water losses from the watercourses are seepage, spillage, and side leakage, resulting from factors described in section 5.2.2 (4).

Due to varying farmer land bed levels and canal bed levels at different locations, the existing watercourses are nonoperational. Farmers must use pumps for water supply.

Water Course with insufficient Maintenance

Water Course with insufficient Maintenance

Source: JICA Study Team

Figure 5.2.6 Current Condition of Water Courses

(6) Drainage Canal

The existing peak surface drainage discharges a three-year return period in the drain, which is the main drain in the area. The surface drainage discharge from the command water management outfall has been added directly to the existing drain. Drains have been clogged and non-functional either due to thick aquatic growth or construction of earthen dikes across the drain by the farmers who pond up the water to use for irrigation.

The water level has risen due to seepage from the canal and the return flow of irrigation water from the irrigated fields. The situation further worsened when the drainage system along the canal became inoperative; thus, the water logging issue occurred.

The drainage system in the entire area is not properly working due to weed growth. After execution of bed clearance, the ground water will be depleted from the water-logged area into drains.

There are sufficient drainage facilities observed on both sides of the canal, however no proper maintenance was carried out. It is also observed that sewer from nearby villages is directly entering into the canal.

Drainage Canal

Drainage Canal

Source: JICA Study Team

Figure 5.2.7 Current Condition of Drainage Canals

(7) Approach for Improvement of Infrastructure

Existing gates, embedded parts, and hoisting system installed at the head regulators and cross regulators will be replaced with new ones. Rehabilitation works, such as de-silting, and bund forming are immediately required due to deterioration caused by siltation and erosion. The option of canal lining can be explored to possibly reduce losses. However, there may be a significant increase in irrigation efficiency through improved water management and system rehabilitation and control of waterlogging and salinity.

For proper monitoring and record-keeping, the water level or discharge measurement gauges and devices would be installed, which will be helpful to increase revenue collection.

Constructing access or farm roads will be incorporated in the construction plan. The proper approach road or access on the right side of the canal banks for farmers shifting machinery or transporting crops to the market will be beneficial for the community.

Drainage canals and watercourses need to be regularly cleaned and maintained by farmers. It is necessary to plan and design irrigation canals and watercourses, taking into account the elevation of the farmland and the design water level of the irrigation canals.

5.3 Organization for Irrigation Sector

5.3.1 Overview of Institutional Reform for Irrigation Sector

Sindh has taken some bold steps in the move towards irrigation and drainage reforms. The long-term goal of the proposed reforms is to ensure farmers' participation in the system at successively higher levels.

After the irrigation and drainage strategy of 1994, there has been a major change in the direction of the sector. The government adopted a completely new approach to address the irrigation system issues and started an institutional reform program to revamp I&D institutions to establish an efficient and self-sustaining I&D system.

The Sindh Assembly passed the SIDA Act in 1997. This SIDA Act empowers SIDA to control all the rivers, canals, drains, streams, hill torrents, public springs, natural lakes, reservoirs (except such reservoirs as are under the control of WAPDA), and underground water resources within the Sindh Province to give effect to schemes to be prepared under the Act for public purposes.

As a result, SIDA was established in 1998, followed by one AWB in Nara Canal in 1999. As part of the reforms, each canal command area created AWB.

In 2002, another attempt was made to decentralize the Irrigation Department by promulgating Sindh Water Management Ordinance (SWMO). The process involved the formation of four distinct bodies: SIDA, AWBs based on the command area of all 14 canals originating from three barrages of the province, FOs that would control the water management (including the collection of Abiana) within the command area of the tertiary channels, and the Watercourse Associations (WCAs) at the watercourse level.

5.3.2 Current Status of the Sector Reform

The reforms were expected to be completed by 2005 as per SWMO 2002. However, even with the passing of the ordinance, a dual institutional arrangement continues to exist in the irrigation sector. The Irrigation Department has an irrigation minister, whereas SIDA is a corporate body. To date, other than Nara AWB, two more AWBs have been established in Ghotki Feeder and Fuleli/Akram Wah Canals. The three AWBs on the left bank are responsible for the operation and management of the four canals, where farmers are represented on the boards. FOs were established at the distributary/minor canals level to take over the responsibility of O&M and collect water charges under formal irrigation and drainage management transfer (IDMT) agreements.

5.3.3 Sindh Irrigation and Drainage Authority (SIDA)

(1) General

The SIDA is the leading organization in the transition process in the irrigation and drainage sector of Sindh. SIDA is an autonomous body, governed by the Sindh Water Management Ordinance 2002 and its own regulations.

The SIDA has its headquarters at Hyderabad.

This institution is to look after the overall Irrigation and Drainage operations in the province as well as control, operate and manage all three barrages in Sindh and the drainage system assigned to it, including spinal drains and the inter-AWB drains

Subsequent functions and composition of SIDA, AWB, FO, and WCA are subject to SWMO 2002.

(2) Function

The functions of SIDA are as follows:

- operate and maintain parts of the irrigation system, such as barrages and outlets assigned to it;
- operate and maintain parts of the drainage system, including spinal drains and inter-AWB drains, assigned to it,
- carry out river flood protection and maintain the infrastructure in Sindh;
- advise the government on matters related to its functions and tasks or the water management system as a whole, e.g., irrigation or drainage contribution rates, drought management, and seawater intrusion;
- manage the transition process to promote the formation, growth, and development of the AWBs and FOs into self-supporting and financially self-sustaining entities within a period of seven to ten years of their establishment; and

- perform any other functions conferred on it under SWMO 2002.

(3) Composition

SIDA is composed of five members nominated by the GOS, including the chairman and four academicians, one from each of the five FOs receiving water from Guddu and Kotri Barrages, three from each FOs receiving water from Sukkur Barrage, and six ex-officio members. It is responsible for the budget and the annual reports, as well as policy guidelines and regulations.

The Board of Management, consisting of the four general managers, assists the managing director.

- The General Manager of Operations is responsible for the technical tasks of the SIDA, operation and maintenance (O&M) of the irrigation, drainage, and flood protection.
- The General Manager of Finance is responsible for all financial matters concerning the annual budget, accounts, income, and expenditure of the SIDA.
- The General Manager of Transition is responsible for the assistance to be given to the Area Water Boards and the establishment and development of the Farmers' Organizations.
- The General Manager of Research and Development is responsible for assisting the water users through practice-oriented research.

(4) Collaboration between SIDA and AWBs

The SIDA may coordinate the administrative procedures of the AWBs by setting generally applicable standards for annual and multi-annual budget plans, business plans, annual reports, accounting systems, staff regulations, IT, information on water distribution to stakeholders, management transfer agreements between AWBs and FOs, and the like.

Such standards shall be given only concerning formal and procedural aspects but shall not in any way affect the independent judgment of the AWBs, after consultation of the AWBs, and after agreement by a majority of the AWBs to the standards.

The SIDA may report non-compliance of AWBs with duly set standards to the Regulatory Authority, which in turn may decide on the action to take against the AWB.

5.3.4 AWB

(1) General

The AWB implements the irrigation and drainage reforms in Sindh. It is an autonomous body governed by the Sindh Water Management Ordinance 2002 and regulations. The first Nara Canal AWB was established at Mirpurkhas in 1999, while two more AWBs, Left Bank Canal Area Water Board in November 2001 at Badin and Ghotki Feeder Canal Area Water Board in January 2002 at Ghotki, were established.

The AWBs are responsible for the O&M of canals, branch canals, and related infrastructure under their jurisdiction, including the drainage system as well as the collection of their share of Abiana from respective FOs.

(2) Function

The functions of AWB are as follows:

- operate and maintain the parts of the irrigation system conferred on it including but not limited to main canals and branch canals;
- operate and maintain parts of the drainage system conferred on it, including but not limited to

drainage tube-well drains but not spinal and inter-AWB drains;

- carry out flood protection and maintain infrastructure within its command area;
- advise provincial and or local government on any matter strategic or tactical, related to its functions and tasks; and
- fulfill any other function conferred on it by this Ordinance or by any subsequent enactment.

(3) Composition

An AWB consists of 12 members: (i) nominated member from SIDA, (ii) nominated member from the Local Chamber of Agriculture, (iii) four elected representatives from Fos, (iv) four academicians as co-opted members, (v) Naib Nazim or his nominee of the Taluka, having largest area within AWB jurisdiction–Ex Officio, and (vi) Director of the AWB – Advisory Member and Secretary.

The board is responsible for important decisions, such as approving the budget, annual reports, policy guidelines, and regulations. The chairman is elected by the representatives of farmers.

5.3.5 Farmers Organization (FO)

(1) General

Fos are responsible for the operation and maintenance of their respective minors/distributaries as well as collection of abiana. Equitable water distribution within minors is also the responsibility of the FO apart from carrying out the flood protection works and drainage and sewerage system conferred on it.

(2) Function

The functions of an FO are to:

- operate and maintain the parts of the irrigation system assigned to it to ensure equitable/judicious distribution of water including to small and tail-end farmers, to supply non-agricultural users to guarantee minimum drinking water;
- operate and maintain the parts of the drainage and sewerage system conferred on it;
- carry out flood protection and maintain infrastructure within its command area;
- advise local councils on any matter strategic or tactical, related to its role and functions; and
- fulfill any other function conferred on it by the ordinance or any subsequent enactment.

The FO promotes and facilitates as much as possible its member WCAs and member DBGs. It delegates its tasks to WCAs and DBGs as much as possible and acts following their advice and decision.

(3) Composition

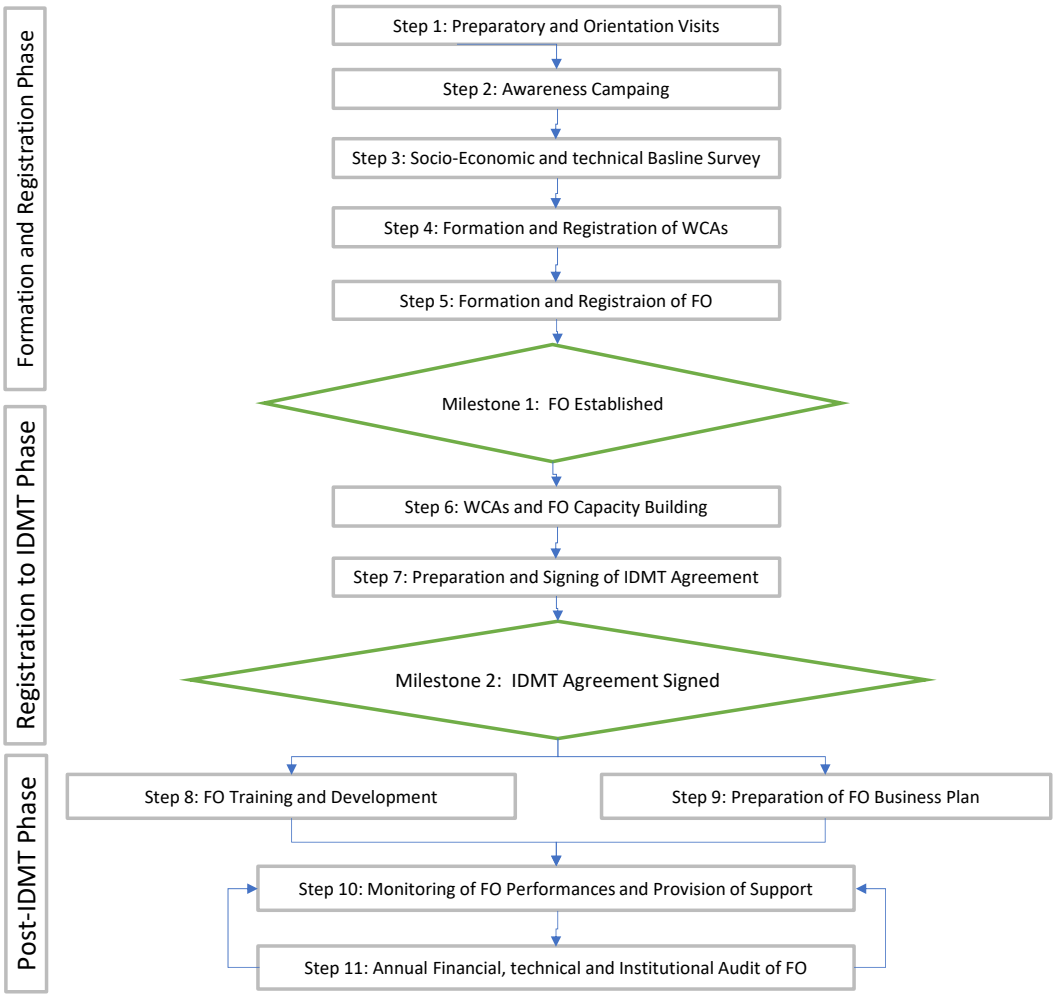
The Board of Management of the FO consists of nine members, including those elected by the general body (chairman, vice-chairman, secretary, treasurer, and two other members). Three out of the six members above should be the representatives of WCAs or DBGs at the tail-end of the distributary or minor or small farmers.

The other three members are from ex-Officio and advisory, and the co-opted members include Nazims of Taluka, having the largest cultivable command area, senior staff of FOs, and a technical expert from the Irrigation Department.

(4) Process to Establish and Strengthen FO

Social Mobilization and FO Development Process consists of three phases.

- Phase 1: Formation and Registration Phase (Steps 1 to 5)
- Phase 2: Registration to IDMT Phase (Steps 6 and 7)
- Phase 3: Post IDMT Phase (Steps 8 to 11)



Source: Social Development Cell, Transition, SIDA

Figure 5.3.1 Flow of Establishment and Strengthening of FOs

(5) Registration of FO

An FO acquires legal status through registration. Its members apply to the Regulatory Authority, which is subject to the conditions of 2/3 of the command area of the FO is covered by WCAs.

The application for registration furnishes the information as may be prescribed by regulations framed by the Regulatory Authority.

On receiving an application under sub-section 1), the Regulatory Authority shall serve a notice on the relevant AWB or, if there is no AWB, on the SIDA. Within three weeks, the Regulatory Authority shall present its comments on the application in writing.

The Regulatory Authority, on receipt of the comments of the AWB, or as case may be the SIDA,

shall register the FOs if the objections of AWB and SIDA are resolved and the FO has fulfilled the conditions laid down in the regulations.

The progress of FO Registration is in Table 5.3.1.

Table 5.3.1 Registration of FOs

Area Water Boards	Total FOs to be Registered	Registered upto Sep.2021	Balance
Ghotoki Feeder Canal AWB	91	89	2
Nara Canal AWB	172	162	10
Left Bank Canal AWB	104	94	10
Sub-total	367	345	22
Others (Non-AWBs)	0	24	
Total		369	

Source：Social Development Cell, Transition, SIDA

(6) Members of FOs

The following table shows the distribution of FO members in each AWB, the total number of members, and the average number of members per FO.

Table 5.3.2 Members of FOs

Area Water Boards	Nos. of FO as per the Number of Members									Total FO Members (Persons)	Average FO Members (Persons)
	-100	101-200	201-300	301-400	401-500	501-1000	1000-	Un-known	Total		
Ghotki Feeder Canal	12	22	24	8	1	9	8	5	89	56,870	677
Nara Canal	24	56	32	15	12	18	1	4	162	41,721	264
Left Bank Canal	8	24	20	15	10	9	5	3	94	34,158	375
Total	44	102	76	38	23	36	14	12	345	132,749	399

Source：Social Development Cell, Transition, SIDA

The table above shows that the average number of members per FO is about 400. On the other hand, FOs with less than 300 members account for 65% of the total. There are about 130,000 members and about 12% of the total farmers in Sindh Province.

(7) IDMT

SIDA stipulates the IDMT procedures, as shown in the table below.

Table 5.3.3 Process of IDMT

S#	Operation	No. of Days	Remarks
1	Registration of Farmers Organization	-	SIDA (GMT/Regulatory Authority)
2	Completion of Basic Training (All 7 Modules)	25	SIDA (SMG-SDC)
3	FO Willingness & Capacity Assessment	7	SIDA (SMG-SDC)
4	Letter to Director AWB for Preparing Documents/Record of Rights for IDMT	2	SIDA(SDS)
5	Preparation of Documents and Joint Survey of FO Channel to Assess the Physical Assets (Trees, Bungalows, Regulator etc)	12	FO & AWB
6	IDMT Confirmation From Director AWB	5	AWB
7	IDMT Signing Ceremony	9	SIDA/AWB
TOTAL		60	

Source: Social Development Cell, Transition, SIDA

The progress of the IDMT in the three AWBs is shown in Table 5.3.3

Table 5.3.4 Progress of IDMT

Area Water Boards	Total Fos Registered	Management Transferred	Balance
Ghotoki Feeder Canal AWB	89	76	13
Nara Canal AWB	162	159	3
Left Bank Canal AWB	94	94	0
Total	345	329	16

Source: Social Development Cell, Transition, SIDA

5.3.6 Water Course Association (WCA)

(1) Overview

Watercourses are the joint property of the Irrigation Department and landowners. Traditionally, they have been informally managed by farmers. The Ordinance calls for the establishment of WCAs to institute joint operation and management of the watercourse.

(2) Function

The functions of a WCA shall, in addition to those delegated to it by an FO, include:

- operating, maintaining, improving, and rehabilitating the watercourse and ancillary structures;
- improving the water supply from surface or sub-soil water-sources;
- sanctioning upgrading and maintenance of field outlets;
- locating, owning, operating, and maintaining tube-wells and lift pumps;
- establishing schedules of water delivery and supervising water allocation and distribution, and ensuring that each member gets his entitled share of water at appropriate times;
- locating, constructing, maintaining, and improving field drains;
- removing obstructions in the watercourse during realignment, operation, and maintenance;
- organizing labor for general or emergency repairs of the watercourse and allied purposes;
- ensuring that all members of the WCA contribute in the agreed manner their share of labour

or money to the improvement, maintenance and operation of the watercourse; and

- participating in programs to improve water use and drainage practices at field and watercourse command area level.

(3) Composition

WCA consists of a chairman, secretary and a treasurer. It is responsible for the operation and maintenance of the watercourse as well as equitable distribution of water within the command area of the watercourse. WCAs include at least two-thirds of landowners and leaseholders on that particular watercourse.

5.3.7 Needs to Enhance Collaboration among the Organizations

FOs were formed on all 94 irrigation canals of the Left Bank Canal Area Water Board. An IDMT Agreement has also been signed with all FOs by the AWBs. Better working relations exist within associated FOs and Water Course Associations (WCAs) among the FOs, AWB, and SIDA, and that yielded good and visible results but still with room for improvement. Working relationships can be further enhanced and improved through strengthening coordination and capacity building, such as regular general body (GB) meetings of FOs and AWBs at a subdivisional level, also known as FO Assemblies. FO Assemblies have proven to be a better platform where FOs and AWB interact with each other to resolve issues like service delivery and revenue generation.

5.4 Water Management and O&M

5.4.1 Roles and Responsibilities for Irrigation and Drainage System

As decribed in the Section 5.3.3, out of the 14 irrigation systems, SIDA is responsible for management of 4 irrigation systems. Table 5.4.1 presents the roles and responsibilities of irrigation, drainage, and flood protection systems before and after the management transfer.

Table 5.4.1 Role and Responsibilities for Management of Infrastructures

Irrigation/Drainage Facilities	Conventional Management System (10 Systems)	Management under Institutional Reform (4 Systems)
Barrage	SID	SID
Main and branch canals	SID	AWB
Distributary and minor	SID	FO
Watercourses	Farmers	WCA
Drainage canal	SID	SID
On-farm level drainage	Farmers	FO
Flood control	SID	SID

Source: JICA Study Team

5.4.2 Irrigation Planning

In accordance with the Water Accord 1991, water abstraction from the barrages to each main canal is carried out. Table 5.4.2 shows the actual water abstraction to the main canals from 2014–2015 to 2020–2021.

Table 5.4.2 Irrigation Water Abstraction Records for each Irrigation System

Barrage Canal	2014-15			2015-16			2016-17			2017-18			2018-19			2019-20			2020-21		
	Kharif 2014	Rabi 2014-	Total	Kharif 2015	Rabi 2015-	Total	Kharif 2016	Rabi 2016-	Total	Kharif 2017	Rabi 2017-	Total	Kharif 2018	Rabi 2018-	Total	Kharif 2019	Rabi 2019-	Total	Kharif 2020	Rabi 2020-	Total
SINDH TOTAL	**30.8**	**14.2**	**45.1**	**30.1**	**14.2**	**44.3**	**31.5**	**11.8**	**43.3**	**30.9**	**9.5**	**40.5**	**27.3**	**9.9**	**37.2**	**27.7**	**12.7**	**40.3**	**28.7**	**11.9**	**40.6**
GUDU BARRAGE	5.9	1.4	7.3	5.0	1.7	6.7	5.4	1.4	6.8	5.9	1.2	7.1	5.8	1.1	6.9	5.9	1.5	7.4	6.0	1.7	7.7
Ghotki Feeder	2.454	1.040	3.494	2.030	1.223	3.253	2.162	1.108	3.270	2.358	0.996	3.354	2.267	0.939	3.206	2.410	1.190	3.600	2.499	1.286	3.785
Bagari Sindh Feeder	2.538	0.192	2.730	2.159	0.229	2.388	2.400	0.118	2.518	2.542	0.137	2.679	2.569	0.088	2.657	2.351	0.107	2.458	2.146	0.138	2.284
Desertpat Feeder	0.860	0.168	1.028	0.793	0.235	1.028	0.874	0.183	1.057	1.013	0.081	1.094	0.975	0.058	1.033	1.021	0.213	1.234	1.233	0.232	1.465
Rainee canal	-	-	-	-	-	-	-	-	-	-	-	-	0.013	0.000	0.013	0.129	0.025	0.154	0.110	0.006	0.116
SUKKUR BARRAGE	16.0	8.9	24.9	15.4	8.7	24.1	15.8	8.3	24.1	15.8	6.7	22.5	13.1	6.6	19.8	14.5	7.6	22.1	14.3	7.8	22.1
Nara Canal	4.987	3.612	8.599	4.619	3.496	8.115	4.779	2.942	7.721	4.860	2.306	7.166	3.881	2.361	6.242	4.204	2.813	7.017	3.609	2.655	6.264
Rohri Canal	5.087	3.210	8.297	4.733	3.144	7.877	4.719	3.216	7.935	4.978	2.380	7.358	3.674	2.192	5.866	3.943	2.899	6.842	4.488	3.004	7.492
Khairpur West	0.510	0.286	0.796	0.420	0.325	0.745	0.430	0.297	0.727	0.448	0.287	0.735	0.405	0.241	0.646	0.430	0.277	0.707	0.433	0.346	0.779
Khairpur East	0.733	0.420	1.153	0.609	0.436	1.045	0.589	0.369	0.958	0.609	0.368	0.977	0.541	0.314	0.855	0.638	0.442	1.080	0.642	0.464	1.106
Dadu Canal	0.912	0.600	1.512	0.901	0.676	1.577	0.989	0.614	1.603	0.960	0.651	1.611	0.928	0.637	1.565	1.060	0.534	1.594	1.033	0.581	1.614
Rice Canal	2.742	0.285	3.027	2.953	0.182	3.135	3.095	0.251	3.346	2.712	0.190	2.902	2.625	0.282	2.907	2.940	0.221	3.161	2.862	0.283	3.145
N.W Canal	1.007	0.487	1.494	1.150	0.469	1.619	1.234	0.604	1.838	1.277	0.477	1.754	1.071	0.613	1.684	1.331	0.409	1.740	1.238	0.458	1.696
KOTRI BARRAGE	9.0	3.9	12.9	9.7	3.8	13.5	10.2	2.1	12.4	9.2	1.7	10.8	8.3	2.2	10.5	7.2	3.5	10.7	8.4	2.4	10.8
Kalri Baghar	1.985	1.425	3.410	2.133	1.331	3.464	2.345	0.885	3.230	1.985	0.85	2.835	1.807	0.945	2.752	1.563	1.247	2.810	1.868	1.164	3.032
Fullali Canal	4.005	1.205	5.210	4.167	1.204	5.371	4.447	0.446	4.893	4.014	0.277	4.291	3.491	0.437	3.928	3.029	1.001	4.030	3.670	0.401	4.071
Pinyari Canal	2.282	0.747	3.029	2.484	0.686	3.170	2.604	0.331	2.935	2.392	0.210	2.602	2.358	0.359	2.717	1.917	0.677	2.594	2.199	0.348	2.547
Akram Wah	0.734	0.562	1.296	0.907	0.557	1.464	0.853	0.448	1.301	0.766	0.335	1.101	0.666	0.448	1.114	0.705	0.607	1.312	0.694	0.500	1.194

Source: SID

5.4.3 Water Distribution and Monitoring

Under the jurisdiction of SIDA, water management and flow monitoring for each facility were carried out in the following manner.

Table 5.4.3 Roles and Responsibilities of Water Distribution and Monitoring

Irrigation Facilities	Responsible Persons (Organization)	Supporting Persons (Organization)
Barrage	Executive Engineer of Irrigation	
Main Canal	AWB	Executive engineer SID
Branch Canal	AWB	Sub Divisional Engineer of SID
Distributary/Minor canal	FO	AWB
WC	WCA	FO

Source: JICA Study Team

While SID officers operate the intake gates at the barrages, the AWB staff operates the gates at the off-takes from the main canals to the branch canals and from branch canals to distributary/minor canals. Operation rules, including rotational water distribution to the branch canals, are decided by AWB under the guidance of SID.

Daily discharge records at the main canals are collected, compiled, and disclosed on the Facebook pages of the AWBs. SID officers check the discharge measurements at the intake gates. Furthermore, the planned and actual discharge records at the intake are presented by AWB. The IT section of SIDA does the digitization of the collected discharge records, which have been compiled with hard copies, for sharing among various stakeholders in irrigation system management.

FO leaders, as well as SIDA officers, remarked that there are few cases of practicing rotational irrigation with distributary/minor canals.

5.4.4 Maintenance

Under the jurisdiction of SIDA, each organization (officer) is responsible for the maintenance of the irrigation and drainage infrastructures, as indicated below.

Table 5.4.4 Roles and Responsibilities of Maintenance

Irrigation Facilities	Responsible Persons (Organization)	Supporting Persons (Organization)
Barrage	Executive Engineer of SID	
Main Canal	AWB	Executive engineer of SID
Branch Canal	AWB	Sub Divisional Engineer of SID
Distributary/minor canal	FO	AWB
WC	WCA	FO
Drainage Canal	Executive Engineer of SID	
On-farm Drainage Canal	FO	AWB

Source: JICA Study Team

An O&M fee (Abiana) is for the maintenance of the irrigation system by AWBs and FOs. Under the technical guidance of AWB and SIDA, FOs implement maintenance works, deploying voluntary farmers as well as hired machines.

5.4.5 Collection of O&M Fee (Abiana)

The procedure for collecting the O&M fee(Abiana) is as follows.

- Assess the fees for each farmer based on the rate according to crop and cropping season as well as actual cultivated area.
- FO will collect the fee from the farmers in cooperation with AWB.
- For maintenance activities by both FO and AWB, the FO keeps 40% of the collected funds, and the rest is transferred to a bank account of AWB.

The current rate of O&M fee per crop and season is shown in Table 5.4.5.

Table 5.4.5 Rate of O&M Fee (Abiana) for Each Crop and Season

Unit: Rs/acre

Kharif Season Crops					Rabi Season Crops				
S.No:	Name of Crops	Flow area Rates (Moki) in Rs.	Private Lift Area Rates (Charkhi) in Rs.	Govt: Lift Channel Rates in Rs.	S.No:	Name of Crops	Flow area Rates (Moki) in Rs.	Private Lift Area Rates (Charkhi) in Rs.	Govt: Lift Channel Rates in Rs.
1	Cotton	93.09	46.55	186.3	1	Wheat	53.3	26.65	106.61
2	Rice	88.78	44.39	177.62	2	Garden	142.14	71.07	284.17
3	Garden	142.14	71.07	284.17	3	Fodder	53.3	26.65	106.61
4	Vegetable	142.14	71.07		4	Vegetable	142.14	71.07	284.17
5	Pulses	39.85	19.93		5	Pulses	53.3	26.65	106.61
6	Gowar/Bajra	39.85	19.93	79.58	6	Oil Seed	53.3	26.65	106.61
7	Maize	39.85	19.93	79.58	7	Hurries	27.03	13.52	53.99
8	Sugarcane	181.87	90.94	363.69	8	Banana	142.14	71.07	284.17
9	Oil Seed	75.33	37.66	150.65	9	Maize	39.85	19.93	79.58
10	Chillies	75.33	37.66	150.65	10	Melion	75.33	37.67	
11	Banana	142.14	71.07	284.71	11	Chillies	75.33	37.67	
12	Hurries	27.02	13.51		12	Onion	142.14	71.07	
13	Other Kharif Crops	39.85	19.93	79.58	13	Other Rabi Crops	53.3	26.65	106.61

Source: GM (Transition), SIDA

SIDA officers pointed out that the rate of Abiana under the four irrigation systems is approximately 55%, adding the following issues to be addressed.

As the calculation of the amount, as well as the assessment of the extent of cultivation, is manually done and the results are documented (hard copies), a computerized management system of Abiana should be accessible early on to avoid arithmetic errors and to compile the collected information into the system. The information should be available to stakeholders.

Developing the system is essential to keep transparency and accountability for those reluctant to pay Abiana due to the current ambiguous accounting system.

For the development of the Abiana Management System, to assess the cultivation level of each farm plot, the utilization of satellite images would be effective.

Furthermore, for the improvement of the collection rate of Abiana, it is a prerequisite to ensure irrigation water delivery to farmers who will be motivated to pay the fees.

5.4.6 Capacity development of Officers and Farmers

Institutional Development Team under the Transition Wing of SIDA has been organizing training sessions for FO members, consisting of (1) basic training, (2) special training, and (3) refresher training. The training programs are listed in Table 5.4.6.

Table 5.4.6 Training Program Conducted by SIDA

Category	Subject of Trainings	Category	Subject of Trainings
Basic Training	Organizational Management	Special Training	Crop Asessment & Abiana Collection
	Abiana Assessment & Collection		Accounting & Financial Management
	Financial Management		Gendar Mainstreaming
	Conflict Management		Position & Role of Women in Irrigation Management
	Irrigation & Drainage Management		Effective use of Irrigation Water
	Canal Operation and Maintenance		Modern Practice of Agriculture
	Project Awareness & Demand Promotion		**For SIDA Staff**
Special Training	**For Farmers**		Social Mobilization & FO Formation
	Financial Management		FO partnership & Agri business Management
	Conflict Management		Management Leadership & Communication Skill
	Contract Management		SWMO-2002 and IDMTA and FO Regulation
	Discharge Measurement		

Source: GM (Transition), SIDA

SIDA highlighted that, in particular, the following should continue for the FOs in the future:

- financial training;
- O&M;
- organization strengthening; and
- communication skills.

In addition, FOs will have a new generation of leaders that will need training. SIDA stressed that the following training for the staff in the future is necessary.

- Project Management (Community-based project)
- Monitoring & Evaluation
- Remote sensing
- Contract Management
- Hydraulic Simulation

5.4.7 ICT Technologies for Irrigation System Management

The IT section of SIDA currently develops and pilots the Water Information System. The system consists of the following subsystems:

- database for irrigation system GIS (application is complete and under data verification);
- flow data at Barrage (the daily discharge records of the barrages are collected from AWBs and encoded in the system);
- well information (application is under development); and
- Abiana collection (application is under development).

In the future, it is necessary to develop an Abiana Collection Management System, consisting of a compilation of land information, support to calculate cultivation area of each farmer, filing of Abiana collection records, etc., in order to improve the collection rate.

5.5 Water Management at Field Level

5.5.1 Flood Irrigation

Flood irrigation in field application is a traditional method adopted by most farmers in Pakistan. A significant amount (20–25%) of irrigation water is lost during its use due to the unevenness of fields and poor field designs, leading to excessive water use in low-lying areas and under-irrigation in the more elevated areas of fields. Over-irrigation leaches soluble nutrients from the crop root zone, makes the soil less productive, and degrades groundwater quality. The under-irrigation of elevated parts of fields results in the accumulation of salts in such patches and causes water stress and osmosis due to applied fertilizer.

5.5.2 High Efficiency Irrigation System (HEIS)

The efficiency of the field irrigation method ranges from 40–70%, while the HEIS such as drip and sprinkler irrigation systems are up to 90% efficient.

The main benefits of the HEIS are the increase in crop yield due to better water management practices and readily available plant nutrients through injection in the system, i.e., nutrients are supplied directly to the plant root zone.

Under SIAPEP, the drip irrigation farms will be equipped with a pond or water storage tank, a head unit including pump, fertilizer tank, filters, and delivery fittings, as well as the main pipeline, delivery lines, and drippers. Wherever water will be drawn from watercourses, water storage tanks will be built to store a sufficient amount of water for a weekly irrigation cycle. The size of the storage tank will be proportionate to a week's supply of irrigation water to the field.

The common size of water storage tank is 30 m x 30 m x 2 m with an approximate volume of 1.5 ac·ft at 3.376 M PKR. Its construction is through a private contractor. The contribution of farmers is 20% of the total cost. Thus, the total cost is about 5 million PKR for each unit.

Farm with HEIS

Regulating Pond

Drip Irrigation

Irrigation with Bubble Jet Kit

Source: JICA Study Team

Figure 5.5.1 Farm Adopting HEIS

The status of implementation of HEIS under SIAPEP is shown below.

Table 5.5.1 Progress of HEIS under SIAPEP

Activity	Project Targets		Cumulative upto 8-Nov-21	Under Installation
Installation of High Efficiency Irrigation	Units	2,648	487	46
	Acres	35,000	7,614	856

Source: SIAPEP Office

District-wise progress of implementation of HEIS as of November 08, 2021 is indicated below.

Table 5.5.2 District-wise Progress of HEIS under SIAPEP as of November 2021[3]

DIRECTORATE LOWER SINDH					DIRECTORATE UPPER SINDH				
District	Installation of HEIS				District	Installation of HEIS			
	Installed		Under Installation			Installed		Under Installation	
	Unit	Acre	Unit	Acre		Unit	Acre	Unit	Acre
Dadu	2	50	-	-	Sukkur	8	152	1	25
Jamshoro	26	509	2	10	Khairpur	22	396	5	117
Hyderabad	23	384	3	74	Ghotki	4	72	-	-
Matiari	12	146	1	20	Naushero Feroz	11	190	6	135
T.A Yar	34	499	2	50	SBA	37	518	1	25
T.M. Khan	20	324	2	42	Shikarpur	4	57	-	-
Badin	22	355	4	85	Larkama	1	5	-	-
Thatta	34	508	-	-	Kambar@ S,Kot	7	154	1	3
Sujjawal	6	79	-	-	Kashmore @K.Kot	1	25	-	-
Karachi	104	1230	8	84	Jacobabad	-	-	-	-
Sanghar	13	204	2	31					
Mirpurkhas	50	970	7	133					
Umarkot	35	610	1	21					
Tharparkar	11	175	-	-					
TOTAL	392	6,043	32	551	TOTAL	95	1,569	14	305

Source: SIAPEP Office

Officers in SIAPEP remarked that the following are the current challenges in implementing HIES:

- cost-intensive technology;

[3] The classification of Upper and Lower in the table is SIAPEP' original category. The classification of Upper Sindh, Central Sindh and Lower Sindh in this study is shown in 1.4.3 of Chapter 1.

- higher operational and maintenance cost;
- relatively a new intervention, for the farming community; and
- variation of costs for imported HEIS material due to change in dollar rupee parity.

5.6 Reuse of Water Resources in Urban Area

Press indicated that 300 acres of land on the Malir riverbed, where up to 15% of vegetables sold across Karachi are grown, is irrigated with toxic water.[4]

Officials and environmental experts say the cultivation is illegal and vegetables grown on the riverbed are unsafe for human consumption.

5.7 Issues, Actions and Potential for Water Resources Management

Issues, actions, and potential for water resources management is presented in Table 5.7.1.

Table 5.7.1 Issues, Actions, and Potential for Water Resources Management

Issues	Actions	Potentials
Efficient use of irrigated water resources in the irrigated area	To implement improvement of Distributary/Minor Canals and Water Courses, including concrete lining, for improving irrigation water conveyance efficiency.	SIDA, AWB, and FO have experience in rehabilitation works in the previous projects, although they currently have insufficient funds and technical capabilities.
	To promote the introduction of HEIS.	In past projects, such as SIAPEP, the HEIS is implemented in some areas.
	To review methods for monitoring water allocation in up and downstream areas of irrigation systems and to aim for fair water allocation.	Although the collaboration between SIDA and AWB is to be enhanced present), there is a certain experience and skills of monitoring water allocation among the organizations.
	To review the method of water allocation in irrigation blocks of the distributary /minor canals and to aim for fair water allocation.	FOs have basic knowledge and experience in water allocation from past training and activities.
	To improve the rate of fund collection for Abiana and contribute to upgraded maintenance.	While FO and AWB currently collect and manage Abiana, SIDA has also commenced establishing a monitoring system for the management.
Improve drainage system in the irrigated area	To promote the improvement of on-farm drainage canals in each area of Fos.	Some FOs, through previous World Bank-funded projects, such as WSIP, have experience in improving on-farm level drainage canals.
	To improve rehabilitation/improvement of main and branch drainage canals.	In past projects, SID experienced rehabilitation/improvement works of drainage canals.

Source: JICA Study Team

[4] Haider, Zeeshan. 2021. “Vegetables Grown in Sewage in Malir, Korangi Destroyed, SHC Told.” By News. February 16, 2021. https://bynews786.blogspot.com/2021/02/vegetables-grown-in-sewage-in-malir.html.

6 Agricultural Finance

6.1 Financial Inclusion in Pakistan

6.1.2 Status of Financial Inclusion

In Pakistan, access to financial services is limited, and account ownership is low by international standards, although access has been increasing. According to Global Findex in 2017, account ownership is 21%, account ownership by gender is 35% male and 7% female. The numbers have been increasing since, compared to 2011 and 2014, but still low.

As shown in Table 6.1.2, the figures of access to financial services, such as account ownership, savings in financial institutions, and borrowing from financial institutions, are low compared with other South Asian countries. Ownership of mobile money accounts is the second highest, following Bangladesh, and using the internet to pay bills and items is the highest among the four countries. Thus, digital financial services have been relatively developed and penetrated. However, digital payment, including receipts, is 18% is lower than in India and Bangladesh. Payment by consumers is now digital, but in governmental institutions, the processes of salaries and pensions are still slower than in other countries.

Table 6.1.1 Account Ownership in Pakistan

	Account	Males with Account	Females with Account	Account in Financial Institution	Mobile Money Account
2011	10%	17%	3%	10%	-
2014	13%	21%	5%	9%	6%
2017	21%	35%	7%	18%	7%

Source: Global Findex Database (2017)

Table 6.1.2 Access to Financial Service in South Asia (2017)

	Pakistan	India	Bangladesh	Nepal
Account (all)	21%	80%	50%	45%
Account (male)	35%	83%	65%	50%
Account (female)	7%	77%	36%	32%
Mobile money account	7%	2%	21%	0.3% (2014)
Financial Institution Account	18%	80%	41%	45%
Financial Institution Account (rural area)	16%	79%	40%	43%
Saved any money in the past year	35%	34%	28%	46%
Saved any money in the past year, rural	33%	32%	26%	45%
Saved at a financial institution	6%	20%	10%	17%
Borrowed any money in the past year	37%	42%	37%	66%
Borrowed from a financial institution	2%	7%	9%	13%
Made or received digital payments in the past year	18%	29%	34%	16%
Used the internet to pay bills or to buy something online in the past year	8%	4%	4%	2%

Source: Global Findex Database 2017

Financial literacy has been improving also but the figure is still low. According to the Financial

Inclusion Insight Survey (FII Survey),[1] the share of those with financial knowledge[2] is 19% in 2020.

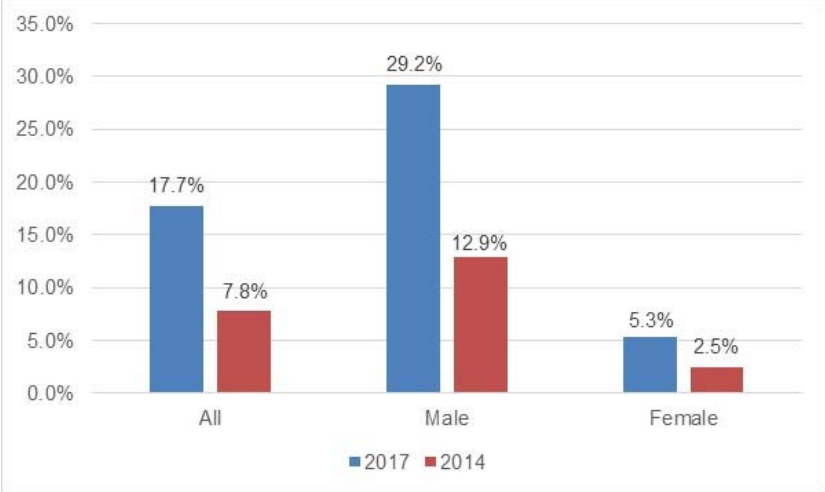
Table 6.1.3 Financial Literacy

	2016	2017	2020
Financial Literacy	16%	14%	19%

Source: Karandaaz Portal Site

6.1.3 Status of Digital Finance

In Pakistan, digital finance, such as mobile accounts and branchless banking (BB[3]), has been developed. Figure 6.1.1 shows that the accessibility of digital finance has been increasing, and the rate was 17.7% in 2017, which is double more than that in 2014. However, according to the data by gender, male users have increased more than females from 2014 to 2017. Female user was only at 5.3% in 2017, although that was double the rate in 2014.



Source: JICA Study Team based on Karandaaz Portal Site.

Figure 6.1.1 Accessibility to Digital Finance

The three major service providers of digital finance are Mobilink, Telenor, and UBL. In addition, many commercial banks and MFB provide digital financial services.

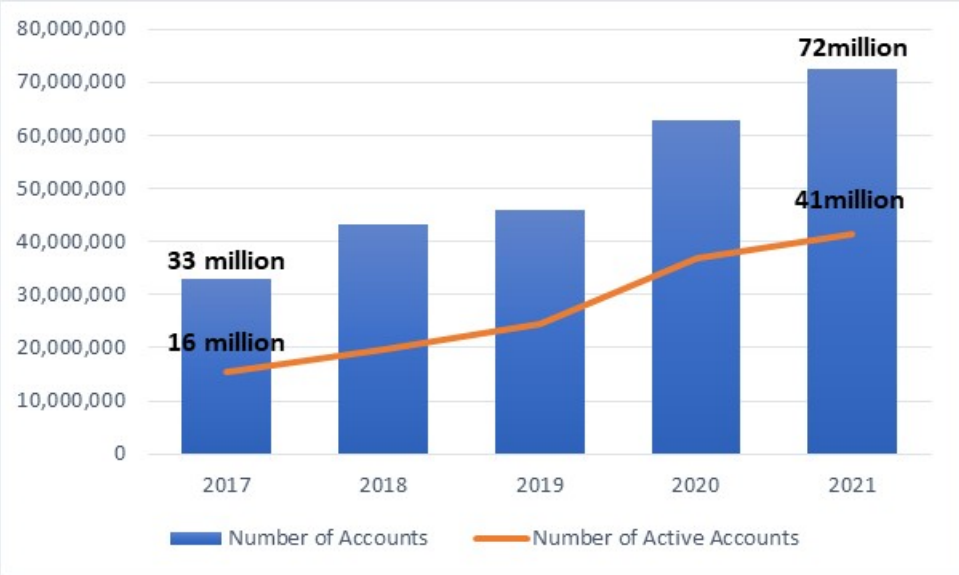
According to Branchless Banking Newsletter published by SBP, the BB accounts have doubled in the last five years, and the number of active accounts in 2021 is 2.6 times higher than in 2017. The share of active BB accounts is 57% as of September 2021. In 2017, it was 47%.

Table 6.1.4 Branchless Banking

	2017	2018	2019	2020	2021
Number of Agents	420,107	413,177	537,182	481,837	560,556
Number of Active Agents	181,377	–	189,991	201,702	260,859
Number of Accounts	33,070,736	43,102,952	46,103,017	62,755,479	72,406,011
Number of Active Accounts	15,526,367	19,800,000	24,529,731	37,019,687	41,300,260

Source: Branchless Banking Newsletter (July–September 2021)

[1] Karandaaz, a non-profit organization doing activities to promote financial inclusion, conducted the survey from October to December in 2020.
[2] FII Survey defines financial literacy as having basic knowledge of four fundamental concepts in financial decision-making (interest rates, interest compounding, inflation, and risk diversification).
[3] According to the Branchless Banking Regulation (2008) published by SBP, BB means conduct of banking activities as outlined in these Regulations by Authorized Financial Institutions for customers having a branchless banking account. It does not include the information services already being provided by various FI's to their existing customers using channels like phone, internet, SMS, etc.



Source: JICA Study Team based on Branchless Banking Newsletter Jul-Sep 2021

Figure 6.1.2 Number of BB Account and BB Active Account

According to data by province, the share of BB accounts in Sindh is 21%. By gender, the share of males is 73.6%, and the share of females is 26.4% (the highest among provinces).

Table 6.1.5 BB Account, Transaction and Agents by Province (June to September in 2021)

Province	BB Account		BB Transaction		BB Agents	
	Number	Share	Number	Share	Number	Share
Balochistan	1,590,090	2%	13,822,918	2%	12,085	2%
Khyber Pakhynkhwa	8,569,629	12%	95,873,120	16%	87,358	16%
Punjab (including ISB)	45,865,450	63%	380,215,302	62%	333,179	59%
Sindh	**14,915,087**	**21%**	**111,593,919**	**18%**	**113,665**	**20%**
Total	72,406,011	100%	616,971,562	100%	560,556	100%

Source: Branchless Banking Newsletter (July–September 2021)

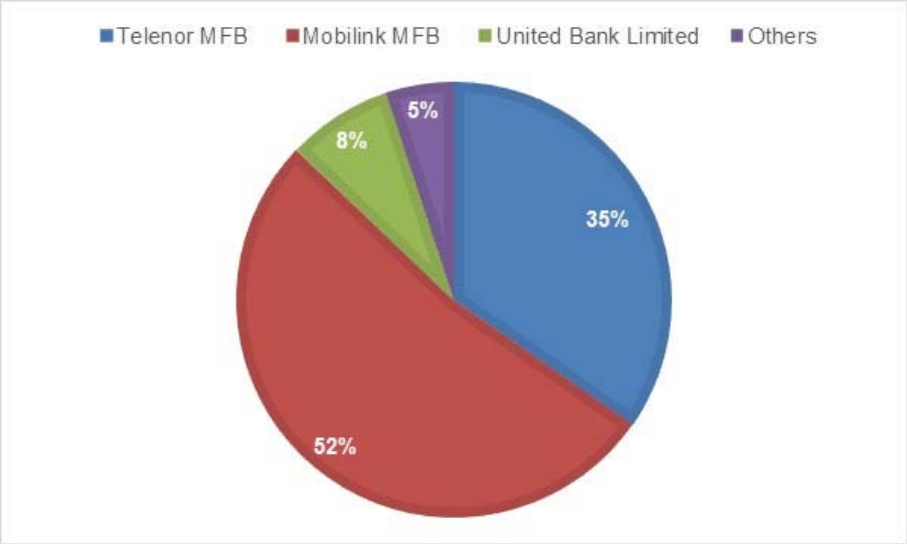
Table 6.1.6 BB Account by Gender

Province	Male	Female	Total	Share within Province		Share across Pakistan	
				Male	Female	Male	Female
Balochistan	1,324,918	266,325	1,591,243	83.3%	16.7%	1.8%	0.4%
Khyber Pakhynkhwa	6,808,895	1,760,714	8,569,609	79.5%	20.5%	9.4%	2.4%
Punjab (including ISB)	33,947,682	11,909,986	45,857,668	74.0%	26.0%	46.9%	16.4%
Sindh	**10,985,598**	**3,934,395**	**14,919,993**	**73.6%**	**26.4%**	**15.2%**	**5.4%**
Total	54,209,933	18,196,078	72,406,011	74.9%	25.1%	74.9%	25.1%

Source: Branchless Banking Newsletter (July–September 2021)

The market share of mobile money operators[4] in 2018 is shown in Figure 6.1.3. Mobilink was more than 50% followed by Telenor MFB at 35%. The total share of three operators is 95%.

[4] Mobile money service providers that develop and deliver financial services through mobile phones.



Source: JICA Study Team based on Karandaaz Portal Site.

Figure 6.1.3 Market Share of Mobile Money Operator

6.1.4 National Financial Inclusion Strategy

In Pakistan, to achieve sustainable and inclusive economic development, microfinance is considered critical. The National Financial Inclusion Strategy (NFIS) was developed in 2015 to improve the current situation, as shown in the tables above.

Firstly, NFIS set the goals by 2020, but many were accomplished before 2020, and a revised action plan (Action Plan within its first 100 days) was formulated.[5] The action plan set six targets and KPI to attain by 2023. Target 1 is "Enhance Usage of Digital Payments (65 million active digital transaction accounts)," Target 2 is "Enhance Deposit Base (Deposit to GDP ratio to 55%)," and Target 4 is "Increase Agricultural Finance (Serve 6 million farmers through digitalized solutions)." The outline of the action plan is shown in Table 6.1.7.

Table 6.1.7 Target and KPI of NFIS

Target		KPI to be achieved by 2023
1.	Enhance usage of Digital Payments	・Full digitalization of government payments and receipts along with backend automation ・Digitalization of Pakistan Post (PP) and Central Directorate of National Savings (CDNS) double the access points ・Create one million new jobs ・65 million active transactional accounts of which 20 million will be owned by women
2.	Enhance Deposit Base	・Deposit to GDP ratio to 55% ・25% branches in rural areas and 5% in unbanked areas
3.	Promotion of Small & Medium Enterprises	・Increase SME share in private sector credit from 7% to 17% ・Enhance access to finance to SME borrowers from 173,510 to 700,000 ・Increase SME financing from Rs. 416 billion to Rs. 1.9 trillion ・Enhance share of SMEs in exports to USD 11 billion ・Create 2 million new job opportunities
4.	Increase Agricultural	・Access of 6 million farmers to formal agricultural financing ・Collect database of 10 million farmers

[5] Pakistan Microfinance Review, 2019.

	Finance	・Provide agricultural inputs subsidy to 3 million small farmers ・Safeguard around 9 million farm households in case of loss of crops due to natural calamities and disaster ・Increase area by 25% under cultivation of oilseed/pulses ・Reduce post-harvest losses by 50% ・Reduce the existing water losses from 60% to 40%
5.	Promotion of Financial Inclusion through Low Cost Housing Finance	KPI is not set, but actions include legal and regulatory environment development, scale-up of housing microfinance, and the establishment of housing finance companies (HFCs).
6.	Promotion of Financial Inclusion through Islamic Finance	・Increase share of assets to 25% and share of deposits to 25%. ・Increase branch network to 30% of the overall banking industry with an enhanced focus on underserved areas ・Legal amendments related to Islamic banking and other related laws approved by the Parliament ・Regular issuance of Sukuk ・Include Islamic finance in the curriculum of schools, colleges, and universities ・Improve perception about Islamic banking and enhance awareness among the masses

Source: Government's 100-Days Agenda National Financial Inclusion Strategy.

As for digital finance, the State Bank of Pakistan (SBP) launched Asaan Mobile Account (AMA) on 13 December 2021 in accordance with the action plan. AMA is a scheme that allows users with feature and non-feature phones to open a bank account through Unstructured Supplementary Service Data (USSD)[6] channels without the need for an internet connection. This service aims to enable low-income groups to use a mobile account. Users can open an account by dialing a short code, *2262#, and selecting among 13 BB service providers. Thanks to AMA, 81 million mobile phone users is expected that can use BB.[7]

In addition, the Securities and Exchange Committee of Pakistan (SECP) is responsible for the development of the National Crop Insurance Scheme (NCIS). It proposed a new scheme to the Ministry of Finance (MOF) (refer to Section 6.3). SECP is also conducting activities on Electronic Warehouse Receipt Financing (WHRF) mechanism. The establishment of the Collateral Management Companies for WHRF is delayed due to the COVID-19 pandemic.[8]

6.2 Microfinance

6.2.1 Overview of Microfinance Sector

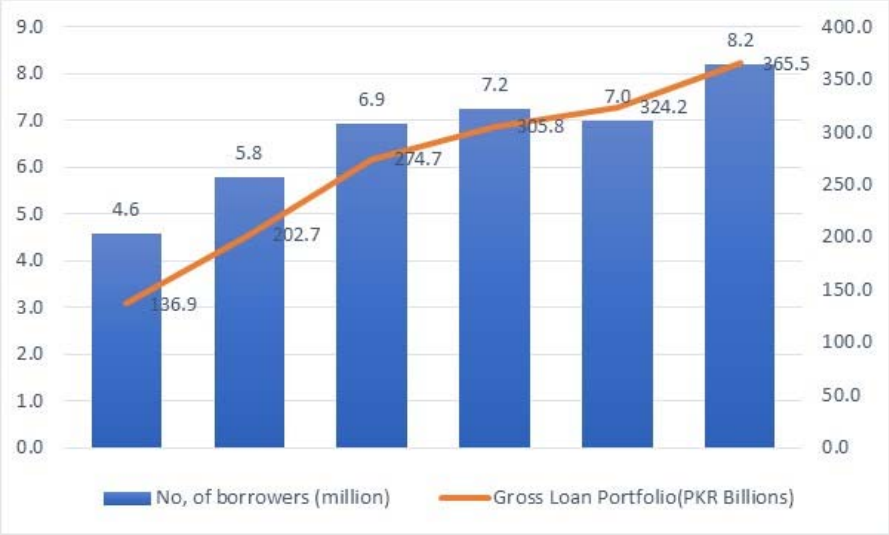
This section provides the current situation of the microfinance (MF) sector targeting low-income group including small-scale farmers, which is a main actor of financial inclusion.

(1) Overview of Microfinance

In Pakistan, the MF sector has been growing yearly, and the number of borrowers from MF is over 8 million as of September 2021. As shown in Table 6.3.1, the number of borrowers, policyholders,

[6] USSD is a communication protocol to transmit data with a simple code enabling anyone to have access to information, data, and application provided by any services.
[7] "Asaan Mobile Account to Bring 50m under Banking Net: SBP Chief." 2021. Dawn. December 14, 2021. https://www.dawn.com/news/1663738.
[8] Interview with SECP, December 2021.

and offices decreased in 2020 due to the COVID-19 pandemic, but the numbers increased again and reached the highest number ever in 2021. According to Pakistan Microfinance Network (PMN), 41 million people need MF loans, yet the outreach is still 20%. It is desired that MF continues to grow to provide financial services to the rest.



Source: Microfinance Review (2020)

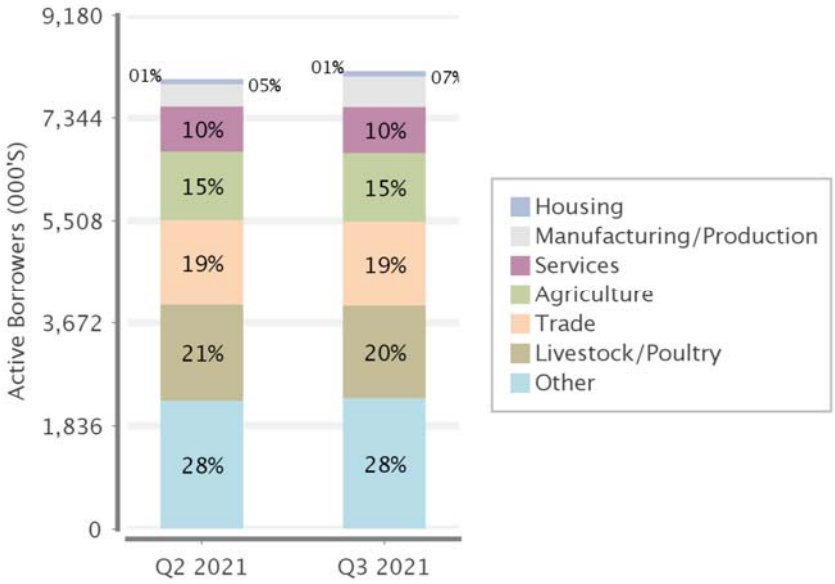
Figure 6.2.1 Borrowers and Gross Loan Portfolio

Table 6.2.1 Outreach of MF

		2016	2017	2018	2019	2020	2021*
Loans	No, of borrowers	4,572,245	5,800,457	6,936,544	7,249,943	7,005,885	8,193,259
	Gross Loan Portfolio (PKR Millions)	136,943	202,699	274,707	305,753	324,155	365,531
Saving	No, of savers	23,091,250	30,984,717	35,293,602	47,642,271	64,112,657	72,485,320
	Value of Savings (PKR Millions)	121,383	186,941	239,963	267,591	374,362	384,384
Insurance	Number of Policy Holders	5,855,668	7,313,029	8,456,430	8,479,576	7,324,379	8,485,673
	Sum Insured (PKR Millions)	150,544	198,680	248,783	266,748	244,650	322,091
No. of branches		3220	3,673	4,239	4,036	3,828	3,795
No. of district covered		104	106	139	138	139	139
Penetration Rate (%)		22.3	-	33.8	35.4	34.2	39.9

*The figure is from the third quarter of 2021.
Source: Microwatch Issue 42, 46, 50, 54, 58, 61

MF loans by sector show that the share of agriculture is only 15% and is lower than livestock.



Source: Microwatch Issue 61

Figure 6.2.2 Borrowers by Sector

Table 6.3.2 shows the outreach by province as of September 2021. The largest outreach is in Punjab Province, where 67% of offices are, including 18 mobile branches. The number of borrowers in Sindh is 1.2 million, accounting for 15% of Pakistan, and the GLP share is 19%. The rate of borrowers to the population[9] in Punjab is 4.4% and 2.5% in Sindh, showing a larger difference between the two provinces.

The number of micro-saving users is 1.75 million as of September 2021, second to Punjab. In 2017, the rate of savers to the population is 36% in Sindh, lower than Punjab which is at 42%.

Over time, the number of borrowers decreased since 2020, but the number of savers and policyholders has greatly increased. The former is 1.7 times more, but the latter is 2 times more in the last five years.

Table 6.2.2 MF Outreach by Province (September 2021)

Province	Offices		Microcredit		Micro-Savings		Micro-Insurance	
	Fixed	Mobile	Active Borrowers	Gross Loan Portfolio (PKR)	Active Savers	Value of Savings (PKR)	Policy Holders	Sum Insured (PKR)
Balochistan	48	-	43,635	2,825,781,396	1,086,678	1,873,673,510	48,007	2,749,930,946
FATA	26	-	24,223	746,475,239	161,357	157,081,915	24,223	746,475,239
ICT	32	6	1,778,985	4,552,163,550	534,253	42,514,729,793	115,565	6,021,919,161
Khyber-Pakhtunkhwa	187	17	182,774	14,759,137,057	6,121,371	24,091,614,556	237,540	11,612,856,259
Punjab	2,493	18	4,793,872	263,417,878,231	45,796,815	152,510,787,785	6,037,427	234,253,126,989
Sindh	782	1	1,204,796	68,267,661,096	17,451,667	136,865,955,488	1,643,560	54,460,913,417
TOTAL	3,726	43	8,193,259	365,529,975,765	72,485,320	384,383,775,075	8,461,575	322,110,063,238

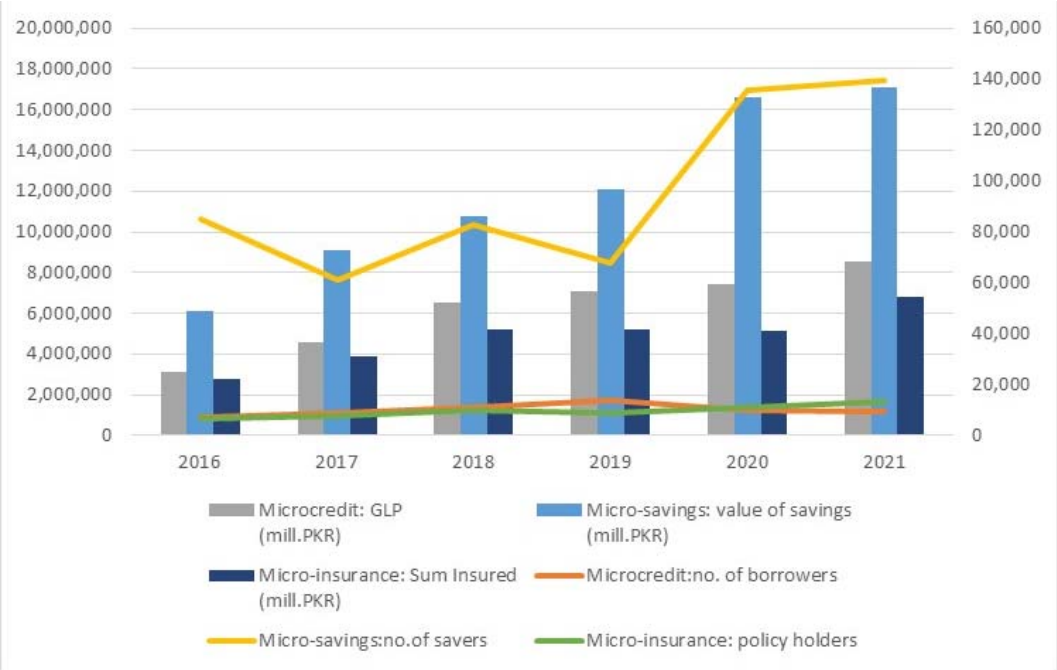
Source：Microwatch Issue 61

[9] Population Census. 2017.
https://www.pbs.gov.pk/sites/default/files//population_census/census_2017_tables/pakistan/Table01n.pdf

Table 6.2.3 MF Outreach of Sindh

	2016	2017	2018	2019	2020	2021
Office	651	754	854	828	802	782
Microcredit: No. of borrowers	904,892	1,092,360	1,385,633	1,746,321	1,231,058	1,204,796
Microcredit: GLP (mill.PKR)	24,854	36,599	52,484	56,785	59,269	68,268
Micro-savings:no.of savers	10,620,891	7,604,635	10,329,131	8,486,622	16,945,498	17,451,667
Micro-savings: value of savings (mill.PKR)	49,080	72,827	86,230	96,810	132,606	136,866
Micro-insurance: policy holders	836,042	993,070	1,220,232	1,112,073	1,358,112	1,643,560
Micro-insurance: Sum Insured (mill.PKR)	22,010	30,945	41,463	41,891	41,272	54,461

Source: Microwatch Issue 61



Source: Microwatch Issue 61

Figure 6.2.3 Outreach of MF in Sindh Province

(2) Laws, Regulations and Related Agencies for MF

In Pakistan, laws and regulations on microfinancing have been developed. Microfinance provider (MFP) is divided into microfinance bank (MFB) and non-bank microfinance company (NBMFC). The Microfinance Institution Ordinance in 2001 stipulates that SBP Non-Banking Finance Companies and Notified Entities Regulations (2008) (NBFC regulation) stipulates that SECP regulates NBMFC. Afterwards, the NBFC regulation was amended to introduce the license of NBMFC in 2016. As for digital finance, Branchless Banking Regulation was established in 2008, and Electric Money Institution (EMI) Regulation was formulated.

Table 6.2.4 Legal Framework related to MF

Year	Laws/Regulation	Description
2001	Microfinance Institution Ordinance	Regulation for MFB.
2007	Payment Systems and Electronic Fund Transfers Act	Regulation for payment system and electric fund transfer. It specifies the protection of consumers and the rights and responsibilities of service providers, such as financial institutions.
2008	Non-Banking Finance Companies and Notified Entities Regulations, 2008	Regulation for non-bank institutions. It was amended in 2016 to introduce a license of NBMFC.
2008	Branchless Banking Regulations	It stipulates activities on BB and standards of services, security, etc.
2014	Securities and Exchange Commission (Microinsurance) Rules	It stipulates provisions followed by financial institutions, including protection of consumers and responsibilities of insurance companies related to microinsurance.
2019	EMI Regulations	It stipulates standards and requirements for EMIs to provide electric money services safely and efficiently.
2019	Amended Prudential Regulations of Agriculture Financing, SME Financing, and Corporate and Commercial Banking	It was amended to approve Electronic Warehouse Receipts (EWR) as collateral for loans to the storage of agricultural products. EWR is defined in Collateral Management Companies Regulations developed by SECP in 2019.

Source: JICA Study Team based on SBP website and report of KPMG, "The State of Financial in Pakistan" (a survey report for the "Project for Improvement of Livelihoods and Well-being of Female Home-Based Workers in the Informal Economic Sector in Sindh Province" by JICA).

Regarding other related institutions, Pakistan Microfinance Investment Company Limited (PMIC) was established in 2016 to mobilize the private fund as an action of NFIS. PMIC took over microfinance from Pakistan Poverty Alleviation Fund (PPAF) and was established with investment by PPAF, KfW, and Karandaaz (Department for International Development [DFID][10]). PMIC conducts various activities, such as providing funds to MFPs, initiating the growth of the MF sector, etc. As of November 2021, PMIC provided loans to 26 institutions, GLP is PKR2.4 billion, 86% of loans are by women, and 55% of loans are from rural areas. About 800,000 people have received loans through 26 institutions.

Pakistan Microfinance Network (PMN) was established as a microfinance apex institution in 1997 and registered with SECP in 2001 as its activities and members increased. Currently, it has 45 members, of which 11 are MFBs and 34 are NBMFCs, which conduct activities such as policy advocacy, information collection and analysis, knowledge sharing, capacity building, and environment development for microfinance. PMN issues Microwatch (quarterly) and Microfinance Review (annual) to provide information and updates to the public.

(3) Microfinance Provider (MFP)

As mentioned above, MFP includes MFB and NBMFC and NBMFC includes Microfinance Institution (MFI) and Rural Support Program (RSP). MFB is regulated by the SBP and has a bank license. NBMFC is required to be registered with the SECP as NBMFC but some NBMFCs are under registration.

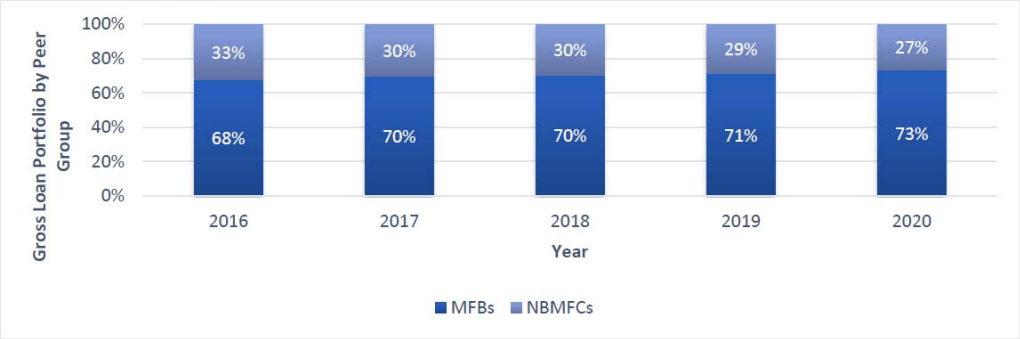
[10] DFID was replaced by the Foreign, Commonwealth & Development Office (FCDO) in June 2020.

Table 6.2.5 Classification of MF Provider

Category	Details
Microfinance Bank (MFB)	A bank licensed and prudentially regulated by the SBP to exclusively service the microfinance market. The first MFB was established in 2000 under a presidential decree. Since then, 11 MFBs have been licensed under the Microfinance Institutions Ordinance, 2001. MFBs are legally empowered to accept and intermediate deposits from the public. The MFBs are also members of PMN.
Non-Bank Microfinance Company (NBMFC)	Institutions carrying out microfinance services which include Microfinance Institution (MFI) and Rural Support Program (RSP) focusing on rural areas. 17 MFIs were registered with SECP and six MFIs are under registration. Six RSP was already registered. 34 institutions are members of PMN.

Source: JICA Study Team based on Microfinance Review (2019–2020)

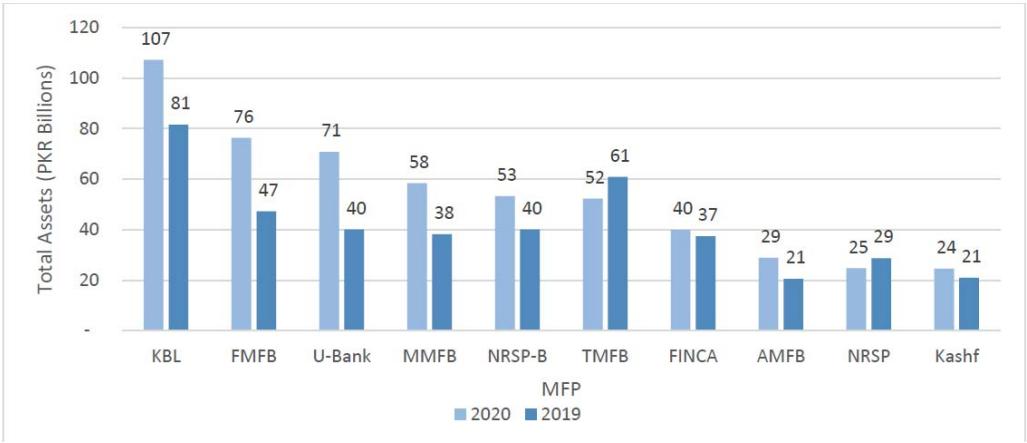
The target clients and areas of MFB and NBMFC are different. NBMFC targets more vulnerable people such as the lower-income group, women, and rural areas. According to the 2019 and 2020 data, overall GLP has increased. As for the GLP by status of MFP, it increased from PKR57,781 in 2019 to PKR63,726 in 2020 while NBMFCs increased from PKR23,411 to PKR25,586,[11] which shows that the latter provides smaller loans and outreach the lower-income group. As for the share between MFB and NBMFC, MFBs provide 70% and NBMFC for the remaining 30% (Figure 6.2.4).



Source: Pakistan Microfinance Review (2020)

Figure 6.2.4 Gross Loan Portfolio by MFP status (MFB and NBMFC)

The ten largest MFPs based on the total assets are shown in Figure 6.2.5. All are MFPs, except NRSP (Rank 9) and Kashf Foundation (Rank 10) that are MFBs. Khushhali Bank (KBL) has held the largest assets for two years in a row since 2019. Its assets largely grew in 2020.



Source: Pakistan Microfinance Review (2020)

Figure 6.2.5 Total Assets of the Ten Largest MFPs

[11] Pakistan Microfinance Review, 2020.

In Sindh, as shown in the table below, each of its district has branches of MFB and NBMFC. Most districts have more than 10 MFPs. Karachi has the most branches, accounting for 15–16% in branches and GLP.

Table 6.2.6 Office, Active Borrowers, Gross Loan Portfolio and MF Providers in Districts of Sindh (September 2021)

District	Office	Active Borrowers	Gross Loan Portfolio (PKR)	Microfinance Providers
Badin	38	44,239	2,274,341,036	AKHU, ASA, FMFB, KASHF, KBL, MMFB, NRSP, OCT, POMFB, SMFB, TMF, TMFB, UBANK,
Dadu	38	55,431	3,924,646,548	AMFB, ASA, FMFB, KASHF, KBL, MMFB, OCT, SMFB, SRSO, TMF, TMFB, UBANK,
Ghotki	25	49,154	3,390,239,519	AKHU, AMFB, ASA, FINCA, FMFB, KBL, MCBIB, MMFB, SMFB, SRSO, TMFB, UBANK,
Hyderabad	39	65,551	3,057,762,895	AKHU, AMFB, ASA, FINCA, FMFB, KASHF, KBL, MMFB, NRSP, NRSP-B, OCT, POMFB, SMFB, SSF, TMF, TMFB, UBANK
Jacobabad	7	15,960	1,034,045,208	AKHU, FMFB, KBL, MMFB, SRSO, TMFB, UBANK
Jamshoro	18	24,645	687,340,715	ASA, MMFB, OCT, POMFB, SMFB, SRSO, SSF, TMF, TMFB
Karachi	124	198,343	6,822,681,889	AKHU, AMFB, ASA, FINCA, FMFB, KASHF, KBL, MMFB, NRSP, NRSP-B, OCT, POMFB, SMFB, TMFB, UBANK
Kashmore	7	19,880	1,616,652,122	FMFB, KBL, MMFB, SRSO, TMFB, UBANK
Khairpur	40	64,912	4,739,934,727	AKHU, AMFB, ASA, FINCA, FMFB, KASHF, KBL, MMFB, SMFB, SRSO, TMF, TMFB, UBANK
Larkana	35	63,863	4,373,670,179	AMFB, ASA, FINCA, FMFB, KASHF, KBL, MMFB, SMFB, SRSO, TMF, TMFB, UBANK,
Matyari	19	30,823	1,871,310,489	ASA, FMFB, KASHF, KBL, MMFB, NRSP-B, SMFB, SRSO, SSF, TMF, TMFB, UBANK
Mirpur Khas	45	58,502	3,360,221,675	AKHU, AMFB, ASA, FINCA, FMFB, KASHF, KBL, MMFB, NRSP, POMFB, SMFB, SSF, TMF, TMFB, UBANK,
Naushahro Feroze	45	71,508	4,236,247,816	AMFB, ASA, FMFB, KASHF, KBL, MMFB, NRSP-B, OLP, POMFB, SMFB, SRSO, SSF, TMF, TMFB, UBANK,
Nawabshah	25	36,863	1,784,094,014	ASA, FINCA, FMFB, KASHF, KBL, NRSP, NRSP-B, SMFB, SSF, TMF, TMFB
Sanghar	60 Mobile 1	90,346	4,404,678,029	AMFB, ASA, FMFB, KASHF, KBL, MMFB, NRSP, POMFB, SMFB, SRSO, SSF, TMF, TMFB, UBANK, VDO,
Sehwan Sharif	–	–	–	MMFB, TMFB,
Shaheed Benazirabad	10	10,525	998,064,636	AMFB, FINCA, FMFB, MMFB, SRSO, TMFB, UBANK,
Shehdad Kot	29	42,602	3,023,468,997	ASA, KASHF, KBL, MMFB, SMFB, SRSO, TMF, TMFB, UBANK,
Shikarpur	14	29,759	1,791,943,173	AMFB, ASA, FMFB, KASHF, KBL, MMFB, SMFB, SRSO, TMF, TMFB, UBANK,

Sujawal	14	7,386	321,716,337	AKHU, ASA, MMFB, POMFB, SMFB, TMF, TMFB, UBANK,
Sukkur	43	69,448	4,411,353,179	AKHU, AMFB, ASA, FINCA, FMFB, KASHF, KBL, MMFB, NRSP-B, POMFB, SMFB, SRSO, TMF, TMFB, UBANK,
Tando Allahyar	18	26,334	1,678,093,875	AKHU, AMFB, ASA, FINCA, FMFB, KASHF, KBL, MMFB, NRSP, NRSP-B, OCT, POMFB, SMFB, SSF, TMF, TMFB, UBANK,
Tando Jam	1	1,250	25,265,234	MMFB, OCT, TMFB,
Tando Muhammad Khan	11	17,425	1,305,496,755	AKHU, AMFB, FMFB, KASHF, KBL, MMFB, NRSP, SMFB, SSF, TMFB, UBANK,
Tharparkar	21	27,845	2,190,535,128	AKHU, ASA, FMFB, KBL, MMFB, SMFB, TMF, TMFB, UBANK,
Thatta	27	35,407	1,909,680,139	AKHU, ASA, FMFB, KASHF, KBL, MMFB, NRSP, SMFB, SSF, TMF, TMFB, UBANK,
Umer Kot	29	46,795	3,034,176,780	AMFB, ASA, FINCA, FMFB, KBL, MMFB, POMFB, SMFB, TMF, TMFB, UBANK,
Total	782 Mobile 1	1,204,796	68,267,661,096	

Source: Microwatch Issue 61

This study conducted interviews with a few MFPs. The outline of MFPs based on the interviews is summarized in Table 6.2.8. Many MFPs provide loans for the agricultural sector, but Kashf Foundation does not have financial products for agriculture. Basically, NMMFCs focus on women, not agriculture.

As for capacity building, all MFPs conduct training programs for clients or staff. However, Kashf Foundation mentioned issues on training, such as budget constraints and local customs disallowing participation of women. Regarding digitalization, many MFBs provide digital financial services, and FMFB, KMB, and Kashf Foundation also introduced digital financial products. There is an issue with the delivery of services, however. ASA plans to introduce digital financial services and has raised needing assistance.

Table 6.2.7 Outline of MFP

	First Microfinance Bank (FMFB)	Khushhali Microfinance Bank (KMB)	Kashf Foundation	ASA
Status	MFB	MFB	MFI	MFI (under application for MFB license)
Target	- Poor population in urban and rural area with special focus on women. - % of women clients: 40% in total and 65% in Karachi	- % of women clients: 23%	- The poor (2$/day/per capita) - Uses a poverty score card. 32% of the clients are below score of 30. 14.5% are below 15, which is the ultra-poor. - % of female clients: 100% - Share of rural area is 33% (2021)	- Poor household unprivileged women. Loan eligibility criteria is household monthly income less than 30,000 PKR。 - % of women clients: 99%

Financial Services	Many kinds of loan, deposit and insurance. It has collateral/guarantee free loan for women's group (minimum 3 members).	Various financial products, such as agricultural group loan, individual VC finance, saving, insurance, remittance, etc.	- No agricultural loan or insurance but other insurances (health insurance and livestock insurance). - 92.4% is business loan (2021)	Three types of loans (small, small business, and SME loans) and more than 90% is small loan. (18,000 PKR–59,000 PKR) Life insurance is attached to all loan products.
Status of Business	- Interest rate: 26–36% - Default rate: 0–2%	- Repayment rate is 95% - Interest rate: 15–33% - Retention rate: 80% - PAR30: 4.6%	- Collecting information.	- Repayment rate: 99.7% - Interest rate: 40%
Capacity Building (CB)	- Capacity building for staff - Participate in National Financial Literacy Program (NFLP)	- Conduct training program for clients - Conduct training program on new services, portfolio management, customer service, financial inclusion for staff.	- Conduct training programs for clients with assistance of CIDA - Has 180 trainers and they developed training modules. 1 million clients covered in gender empowerment, financial etc. - All trainers are not full-time but contract-based - 100 million clients take training program on gender and financial literacy. - Organize online training program due to COVID-19.	- Regularly conduct training programs - Conduct training program on loans and repayment schedule for clients.
Digital Services	- Launched the first BB with SBP and PP for postal service. - Started trial BB with Telenor in 2020. - Planning to provide BB on a full scale in the near future.	- Mobile banking services through Khushhali Mobile App, which includes funds transfer, bill payments, checkbooks, and debit card. - Use of digital payment: 1.2% - Aiming to increase BB accounts	- Has a partnership with UBL Omni for agent-led mobile cash program (clients can put and transfer money via mobile phones with biometric authentication). - Provide Easypaisa of Telenor	Digital financial product is yet to be introduced. It is good if any assistance is provided for it.
Issues	- Capacity development on cultivation techniques and advanced technology. - Budget for training. - Budget for BB promotion.	- 50% of clients are illiterate - Shortage of budget for training - Decreased in repayment rate due to COVID-19 - Over-indebtedness of clients as family credit history is not available. - High cost of funds (deposit rate) - Decrease in filed staff.	- Clients cannot afford to pay for training costs - Women are not allowed to go out for training - Shortage of trainers - Women do not have means of transport to go to training.	COVID-19 pandemic
Others	JICA is a shareholder. Investment ratio is	- Largest MFB. - KMB was established as a state-owned bank	- Received ADB's syndicated loan in 2019.	

	8.8% and has been decreasing.	for Microfinance Sector Development Program (MSDP) implemented by the Government Poverty Alleviation Strategy and ADB.	- Received assistance for CB from CIDA	

Source: JICA Study Team based on interviews with MFPs and website of MFPs

The study team also conducted interviews with an RSP, National Rural Support Programme (NRSP), and Sindh Agricultural & Forestry Worker's Coordinating Organization (SAFWCO). SAFWCO is an NGO under the same group as Safco Support Foundation (MFI). Details of each are described in Chapter 8 of this report.

Regarding digital financial services by MFPs, as explained in 6.1.2, Jazz Cash of Mobilink and Easypaisa of Telenor MFB account for a large share in the market. Upaisa of U Microfinance Bank has been growing as well. An overview of the MFPs and commercial bank United Bank Limited that provides mobile money account services is shown in Table 6.2.8. According to a field survey, Telenor MFB focuses on microenterprises and entrepreneurs and so small-scale farmers are not targeted, while Mobilink provides agricultural loans and is expected to deliver such services to small-scale farmers.

Table 6.2.8 Major Mobile Money Provider

	Telenor Microfinance Bank	Mobilink Bank	U-Bank	United Bank Limited (UBL)
Head Office	Islamabad	Islamabad	Islamabad	Karachi
Digital Financial Service	EasyPaisa: Started in 2009 Financial services such as remittance, deposit, insurance through mobile phones.	Jazz Cash: Started in 2012 Financial services such as remittance, deposit, insurance through mobile phones. It started partnership with VISA (credit card).	UPaisa: Started in 2013 Financial services such as repayment, payment, debit, donation etc.	SimSim: Financial services such as remittance and payment through smartphones Free of charge if the transactions are made between SimSim accounts.
Opening Account	Account opening cost is zero. CNIC and Mobile Number is required.	Account opening cost is zero. CNIC and Mobile Number is required.	Account opening cost is PKR100. CNIC and Mobile Number is required.	Account opening cost is PKR100. CNIC and Mobile Number is required.
Others		Aiming to increase female clients in recent years.	U-Bank is a wholly owned subsidiary of Pakistan Telecommunication Company Limited (PTCL).	MFINJA, IT company launched mobile wallet product, “SimSim” with FINCA. Not MFB.

Source: Study Team prepared based on each company’s website and “the State of Finance in Pakistan,” *Project for Improvement of Livelihoods and Well-being of Female Home-Based Workers in the Informal Economic Sector in Sindh Province*, JICA

6.2.2 Advanced Cases in Other Area: Punjab Province

In Punjab, to enhance governance and improve digital literacy, the Punjab Information Technology Board (PITB) was established in 1999, which created IT systems for various sectors. PITB formulated some IT systems for the agricultural sector and established the Agriculture E-Credit

Scheme[12] to address the financial issues of farmers.

One of the critical issues for small-scale farmers in Punjab is also financing. They cannot receive loans from banks and must borrow money from the middlemen with an interest rate of more than 35%. In order to address these issues, the Punjab government introduced interest-free loans for small-scale farmers with lands less than 12.5 acres together with three MFBs and two commercial banks. The loan process was digitalized.

PITB has developed a centralized system for managing a database of farmers to provide subsidies for fertilizers before the introduction of the e-credit scheme, and all stakeholders can access the database. Loans for ten kinds of crops were provided to 560,000 farmers through e-credit. In addition, a program to give farmers mobile phones with 10 applications to enhance their capacity is undergoing, but applications are under development as of December 2021.[13]

6.3 Overview of Financial Access of Farmers in Sindh

As stated in Section 6.2, the prevalence of microfinance in Sindh is far lower than Punjab. In this section, this study analyzes the financial access of the farmers in Sindh.

6.3.1 Agricultural Loans

Crop loan, which is the loan for purchasing inputs, is the mainstream in agricultural finance in Sindh. It can be categorized into two types: working capital from commercial banks for economically affordable farmers and what MFP provides small-scale farmers with (Table 6.3.1).

Table 6.3.1 Comparison between Agricultural Loans of Commercial Bank and that of MFP

Provider*1	Collateral	Loan Size	Tenure	Repayment schedule
Commercial bank	Tangible assets such as land	PKR50,000–10 million	3 years	Revolving loan *2
MFP	In some cases, clients are required to guarantors by grouping or guardian for individual borrowers.	PKR20,000‐350,000	3–36 months depending on the crop type	Repayment of interest and principle all at once

*1 There is one sovereign agricultural bank.

*2 After agreeing on the maximum amount that can be borrowed (extreme amount), one can apply for borrowing anytime within the range of the balance obtained by deducting the principal balance loan from the maximum amount. The lender is obliged to approve and lend.

Source: JICA Study Team prepared from the interviews and various materials.

Crop loans offered by commercial banks include loan products for relatively expensive equipment, such as drip irrigation equipment and solar panels. This is a large sum borrowing, and the maturity is generally as long as about 3 years, with collateral requirements.

[12] *Agriculture e-Credit Scheme*. PITB. Retrieved February 28, 2022, from https://www.pitb.gov.pk/acs.
[13] Interview with PITB (8 December 2021).

Box: HBL, the Leading Commercial Bank in Agricultural Credit

Out of all commercial banks in Pakistan, HBL, based in Karachi, is the leading bank in agricultural loans. Founded in 1947, HBL has more than 1,650 branches nationwide, outreaching small cities and towns in Sindh. HBL's loan portfolio reaches around PKR40 billion, accounting for 20% of its gross asset, making it first place among commercial banks. Out of HBL's total 50,000 borrowing clients, around 40,000 clients are crop loan borrowers. The bank typically offers crop loans, named Running Finance Farm Production, tailored to finance working capitals of farmers, besides loan products for dairy and livestock, poultry loans, fishery loans, tractor loans, and farm irrigation loans.

（Running Finance Farm Production）

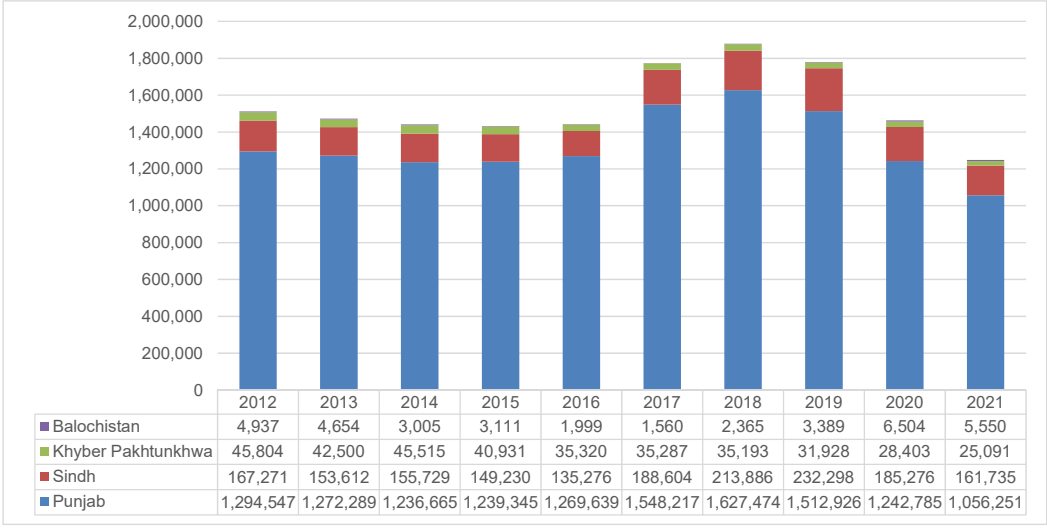
Collateral	Tangible assets
Loan Amount	PKR10 million at maximum (revolving loan)
Tenure	3 years, with call option
Commission	Varies between PKR2,000 and PKR8,500 depending on the loan ticket size
Typical mark-up rate	KIBOR + 6% (subject to change)

HBL holds around 600 loan officers, who visit farmer clients to consult on the loan application procedures or loan repayment plans. To put the process short, the loan officers are equipped with smartphones. For a large part of the rural areas are out of phone coverage area, loan officers upload data collected on the field all at once only when they are in coverage areas.

HBL has also conducted financial literacy education programs for farmers to develop their capacities to manage loans for more than 3 years. Through the program, a one-day training was carried out in 10 places, with around 150 farmer participants for each training. The bank continues the training even with the COVID-19 pandemic by going online. HBL is the prime shareholder of the First Microfinance Bank (FMFB), through which it promotes the financial inclusion of small-scale farmers that are typically not eligible clients of commercial banks.

MFP typically offers farmers a crop loan with a tenure aligned with the period from the input purchase until the harvest season of a particular crop with relatively small loan ticket sizes. Client eligibility typically requires an annual income of less than PKR120,000, while other criteria such as the size of land owned might apply. MFP's loan type branches into two categories that are individual loans and group loans. Some individual loan products require post-dated checks as collateral, while others require no collateral. In the group loan scheme, in case a member of the group defaults, the other members will be liable for the debt. In any case, loan products of MFPs are more suitable for small-scale farmers typically without enough assets since MFPs do not require tangible assets as collateral.

Looking at the changes in the number of agricultural loan borrowers combined with commercial banks and MFPs over the past 10 years in Pakistan, it has been on a downward trend after peaking in 2018. After 2020, the number of new loans may have decreased due to the impacts of the COVID-19 pandemic. The number of borrowers in Sindh is 161,735 as of the end of FY2021. Taking the agricultural, forestry, and fisheries population of each province, calculated from the Labor Force Census FY2018 as a denominator, the proportion of agricultural loan users in Punjab is 6.82% and 2.87% in Sindh.

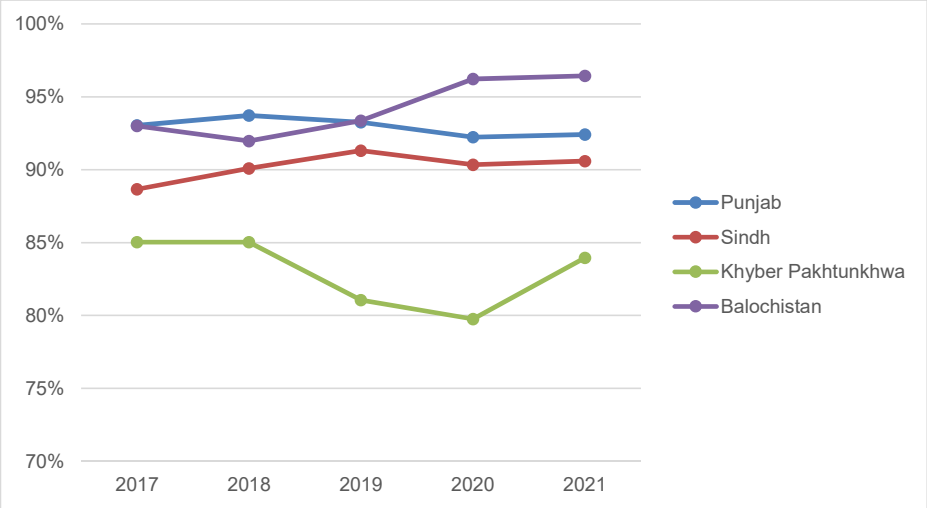


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Balochistan	4,937	4,654	3,005	3,111	1,999	1,560	2,365	3,389	6,504	5,550
Khyber Pakhtunkhwa	45,804	42,500	45,515	40,931	35,320	35,287	35,193	31,928	28,403	25,091
Sindh	167,271	153,612	155,729	149,230	135,276	188,604	213,886	232,298	185,276	161,735
Punjab	1,294,547	1,272,289	1,236,665	1,239,345	1,269,639	1,548,217	1,627,474	1,512,926	1,242,785	1,056,251

Source: JICA Study Team prepared from the SBP's website, Agricultural Credit & Microfinance Department（https://www.sbp.org.pk/acd/dist-Summary.asp）

Figure 6.3.1 Trends in Agricultural Loan Borrowers

Out of the number of agricultural loan borrowers, the percentage of "substituent holdings[14]," which indicates farmers with farmland of 12.5 acres or less, has remained at around 90% in Sindh. The remaining 10% are medium-sized and large-scale farmers, and in Sindh, they are farmers with more than 16 acres of farmland.



Source: JICA Study Team prepared from the SBP's website, Agricultural Credit & Microfinance Department (https://www.sbp.org.pk/acd/dist-Summary.asp)

Figure 6.3.2 Ratio of Substituent Holders to Agricultural Loan Borrowers

6.3.2 Agricultural Insurance

The current agricultural insurance is the Crop Loan Insurance Scheme (CLIS), which was first introduced nationwide by the Pakistani government in 2008. The insurance scheme covers the balance of agricultural loans on five major crops (wheat, rice, sugar cane, cotton, and corn) in the

[14] SBP statistically classifies famers into three categories based on their economic level, The lowest, substituent holdings includes farmers with land less than 12.5 acre in Punjab and KP, those with land less than 16 acre in Sindh and those with land less than 21 acre in Balochistan.

event of natural disasters (Table 6.3.2). This is compulsory insurance that all agricultural loan users must take out, and the insurance premiums are paid by subsidies, so there is no burden on farmers. If the harvest is less than 50% of the standard yield due to a specific disaster, the insurance money equivalent to the loan amount will be paid to the commercial bank or MFB.

Table 6.3.2 Overview of the Crop Loan Insurance Scheme (CLIS)

Client Eligibility	Farmers getting loans from banks or MFBs (obligatory insurance)
Insured Crop Types	Wheat, rice, sugarcane, cotton, maize
Risk Covered	Damages on crop production due to the following causes: 1) Natural disasters, such as torrential rain, hailstorm, frost, cyclone, flood, and draught 2) Crop diseases caused by viruses or bacteria and invasion of locusts.
Insurance Term	Period between sowing and harvesting for the crops except for sugarcanes
Sum Insured	Outstanding agricultural loan amount
Premium	2% (subsidy)
Premium payment	For farmers with farmland of 25 acres or less, the banks and MFBs pay premiums to insurance companies in advance and apply for the same amount of the subsidy. Farmers with farmland of more than 25 acres pay premiums to the bank or MFB upfront, then apply for the subsidy.
Claim settlement	When 50% of the damaged crops due to the abovementioned reasons is confirmed.

Source: JICA Study Team prepared from the interviews with SECP and HBL and materials provided by SECP.

Throughout the interview surveys, several financial experts pointed out the issues of the ongoing insurance scheme. A particularly big issue is that the insured has as a small risk covered as the loan amount. Moreover, the insurance amount is paid to banks or MFBs, so it does not directly benefit the farmers. Most importantly, the farmers who do not get loans are excluded from the insurance scheme.

NFIS plans to introduce the National Crop Insurance Scheme (NCIS), a yield index insurance, as a new agricultural insurance scheme to replace CLIS, and based on the current CLIS review, SECP is currently working on subsidies[15] for the scheme. Coordination is being made with the MOF. NFIS states that NCIS will provide safeguards for 9 million farmers. One improvement of NFIS over CLIS is that it can also be used by farmers who are not loan customers. Compensation is also greater because up to 80% of the yield loss is compensated. The insured crops are the same as the current scheme.

Table 6.3.3 Major Rectifications of NCIS

Client Eligibility	All farmers including sharecroppers (farmers with 5 acres or less registered with the Agricultural Bureau are automatically enrolled, and other farmers are voluntarily enrolled.)
Sum Insured	80% of total value of crops Where: Total value of crops = area under cultivation x relevant price Relevant price = either the minimum support price or wholesale price (subject to further consideration and finalization)
Risk Covered	Climatic, natural, or biological peril that singly or in combination or any other

[15] According to an interview with SECP, it is a new scheme providing subsidies according to farmland size. Small-scale farmers with less than 5 acres are 100% subsidized, medium-scale with 5–25 acres are 50% subsidized, and large-scale farmers with over 25 acres have no subsidy. Currently, MOF is discussing the scheme.

	that cause the actual average yield of the insured crop in the unit area of Insurance, to fall short of the reference yield.
Claim settlement	Insurance company pays to the policy holder
Claims Trigger	If the actual yield during current year or season in unit area of insurance is less than 80% of the reference yield

Source: JICA Study Team prepared from the interview with SCEP

NCIS is not complete compulsory insurance like CLIS, but it covers a wide range of farmers who have never used a loan. Therefore, educational activities involving MFI, MFB, RSP, NGOs, etc., to promote insurance coverage becomes important. In the interview with SECP, one had hoped for cooperation with JICA in such activities to scale up NCIS.

6.3.3 Actual Financial Situation of Small-Scale Farmers

The JICA Survey Team conducted a survey on the finance of small-scale farmers with subcontractors. In addition, to complement this survey, the study team interviewed the peasants or sharecroppers in association with an NGO. The interview confirmed that small-scale farmers are heavily influenced by intermediaries, not only in farming but also in finance, and have virtually no access to formal finance. In particular, it was revealed that females do not have an account at a financial institution and have almost no contact with financial institutions for purposes other than receiving cash benefits from the government, and they are strongly dissatisfied with the bank's response when receiving cash benefits.

Furthermore, the interview survey revealed that both men and women are significantly anxious about crop failures due to climate change and natural disasters and are vulnerable to unforeseen circumstances because they frequently experience financial losses due to illness and injury.

(1) Small-Scale Farmers

1) Qualitative Survey

As a part of the subcontracted survey, the surveys on financial status were carried out through focus group discussions (FGDs) with two-pair groups of male and female from each of the four villages in Hyderabad District and Karachi District. The background of each village is described in the following table.

Table 6.3.4 Status of Livelihood of Each Sample Village

	Village A, Hyderabad District	Village B, Hyderabad District	Village A, Karachi District	Village B, Karachi District
Ratio of income from farming to total income	95%	70%	80‐90%	25%
High-income season and its reason	Jun.–Jul.: Cotton harvest season	May: Wheat harvest season Oct.: Cotton harvest season	Dec.: Papaya harvest season	Dec.: Papaya harvest season
Low-income season and its reason	Sep.–Nov.: Sowing	–	May–Jun.: Cleaning costs during rainy season, weeding costs	Mar.–Nov.: Preparation for harvest

Source: JICA Study Team

Table 6.3.5 shows the main financial findings of male small-scale farmers in each village, and Table

6.3.6 shows that for female small-scale farmers.

Table 6.3.5 Findings on Finance of Male Small-Scale Farmers

Item	Findings
Financial Access	All groups loan from middlemen. Furthermore, the group of Village B from Hyderabad District receives loans from an MFB and NGO. Village B from Karachi District has experience in receiving bank remittances. None of the villages have experience in saving and insurance of formal financial providers.
Financial issues	Every group receives loans with “high interest rate,” the primary issue in the financial aspect, from middlemen. · Interest rate is high, forcing farmers unable to repay · Loan for purchasing 1 bag of fertilizer = PKR7,000 for principal, 46 months tenure, and interest of PKR2,500 (interest rate of 70% quoted annually) · A vicious cycle develops when one must borrow from another to pay loans from middlemen.
Possible solution	Soft loan from the government is recognized to help reduce reliance on the middlemen.
Worrisome event	· Crop failure due to harsh summer heat and water shortage · Shift of harvesting season of cotton · Huge economic loss incurred by crop failures of vegetables that used to be a good harvest, given the climate change

Source: JICA Study Team

Table 6.3.6 Findings on Finance of Female Small-Scale Farmers

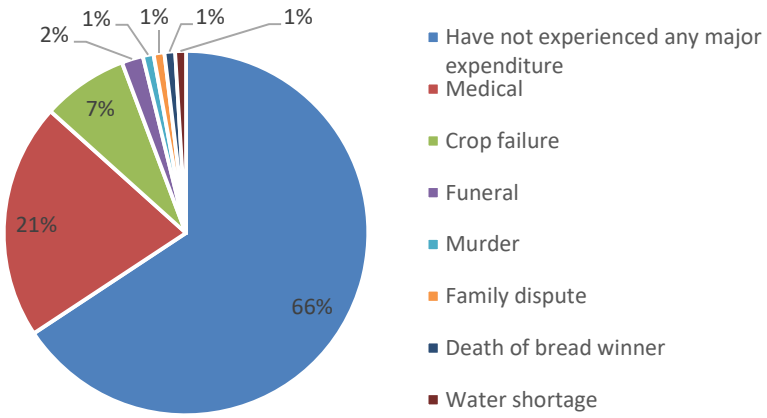
Item	Findings
Financial Access	Three out of the 4 groups are recipients of the cash benefit Ehsaas Programme.* There is no other financial access for all groups.
Financial issues	· Do not know how to use ATMs. "When I asked a man who was nearby to teach me how to operate it, I was asked to pay for it." · Dissatisfaction with the bank's response. “PKR500–1,000 are requested every time by a bank clerk who withdraws cash.” “I visit the bank more than 10 times a month, but the bank clerk tells me that I haven't received the cash and I can't withdraw. Transportation costs to the bank are squeezing and children are hungry.” Claims saying, “PKR500–1,000 are requested every time” and “I visit the bank more than 10 times a month only to fail to withdraw money,” were raised from two separate groups. · The authentication method of the bank is not suitable for female farmer customers. “I was asked to authenticate my fingerprint, but I couldn't authenticate because I didn't have a fingerprint because of farm work.”
Possible solution	· Participants want “trainings on how to use ATM” · Participants want SMS notification of arrival of money in account
Worrisome event	· Seasonal natural disasters, such as strong wind and torrential rain · Crop failure caused by extreme cold and extreme heat · Crop loss caused by locust attack

*Government's poverty alleviation policy to provide PKR2,000 monthly to 7 million poorest women in the country.
Source: JICA Study Team

2) Quantitative Survey

A financial survey was conducted for 105 small-scale male farmers in the four villages. The findings on savings and financial access are shown in Section 3.7.2 Expenditure of this report.

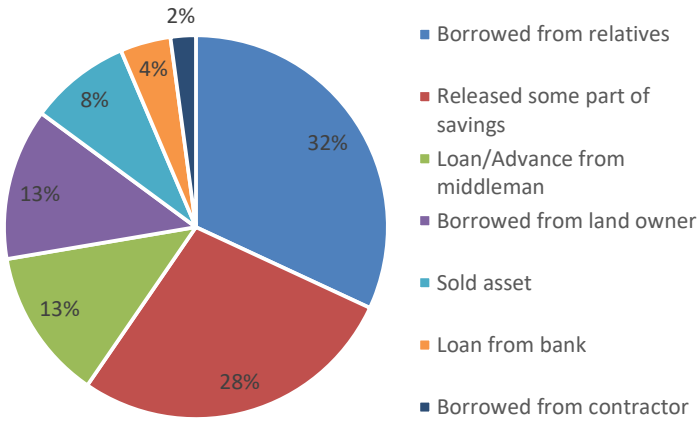
Regarding unexpected large expenses incurred in the last 3 years, 66% have not experienced any major expenditure but 21% had unexpected medical expenses (Figure 6.3.3).



Source: JICA Study Team

Figure 6.3.3 Unexpected Large Sum Expenses in the Last 3 Years

In response to how respondents deal with heavy expenses due to unexpected events, 32% responded borrowing from relatives. Other reasons have possibly long-lasting negative impacts on farming activities, such as cutting deposits (28%) and selling assets (8%).



Source: JICA Study Team

Figure 6.3.4 How to Deal with Unexpected Financial Losses

(2) Sharecroppers

Besides the status survey targeting small-scale farmers, the JICA Study Team also conducted individual (6 males and 3 females) and group interview surveys (a group of 5 males and another group of 6 females) for so-called sharecroppers who rent and cultivate land to learn their actual situation of financial access.

The main findings on the finances of sharecroppers are as follows.

- Very high financial dependence reliance on landowners and intermediaries.
- Literacy rate is low, and often no household account book is kept.
- There are high conscious hurdles in accessing public finance. There is widespread awareness that “collateral is required," "fear of not being able to repay," and "procedures take time."
- The existence of collateral-free loan products provided by MFPs and RSPs is unknown.
- Agricultural input is provided to the landowner in kind. About half of the cost is shared and deducted from sales, and at least 50% of sales are generally in the hands of landowners.
- Losses due to natural disasters, illnesses, and falling prices must be carried over to the next year as debt to the landowner.
- Almost live on a tongue deposit. There is no interest in opening a bank account because I don't have enough income in the first place.
- Sometimes, sharecroppers sell their produces with the landowner in the market through an intermediary.

These findings direct us to the conclusion that sharecroppers are forced to rely on landowners in all aspects, from the in-kind supply of agricultural materials to the deduction of sales. On top of this, their sales involve intermediaries, so they have very little freedom in terms of income and expenditure planning and finance. Furthermore, sharecroppers generally lack literacy and accounting skills.

6.4 Issues on Finance of Small-Scale Farmer in Sindh

Having learned the status of the financial services in the agriculture sector of Sindh Province, the JICA Study Team concluded that the excessive reliance of small-scale farmers to middlemen for financing inputs and farm management in informal ways is a bottleneck. Meanwhile, the formal financial service providers attempt to outreach them yet still have much to do. Meaning, in a way, they have not succeeded in developing a financial product that is clearly more valuable than the loans by the quick loans from middlemen that do not require screening.

In this situation, the Study Team recommends developing a value chain finance that enables outreaching small-scale farmers by leveraging middlemen who typically have rich information and a network of small-scale farmers. With value chain finance, financial providers such as MFPs can reduce risks by leveraging the information and relationships of VC actors and developing products referring to the status of information and relationships. For example, there are products, such as a loan based on the contractual relationship between processing firms and farmers and a loan that takes advantage of brokers with plenty of information on farmers. The typical methods include the trader credit that makes use of middlemen and input suppliers, the contract farming, and the warehouse receipt issued for inventory in a warehouse that can be collateral for loans.[16] In the case of Kenya, the introduction of digital technology enabled the compilation of data on sales quality and yield of crops by small-scale farmers and lending of financial institutions to small-scale farmers with invoices issued to processors by small-scale farmers[17]. This means immediate payments for

[16] SPB is currently preparing to introduce electronic warehouse receipts, but the target crops are limited to grains.

[17] https://www.cgap.org/sites/default/files/researches/documents/Focus-Note-Digitizing-Value-Chain-Finance-Apr-2017.pdf

small-scale farmers and allowing processors to retain good quality farmers. In this way, value chain finance can benefit both smallholders and VC players. Along with the development of such innovative financial products, promoting dissemination activities through financial education is considered a direction of problem solving.

7 Application of ICT for Agriculture in Sindh

7.1 Trends of ICT in Pakistan

Pakistan's ICT-related exports had grown six-fold in the decade until 2020, reaching USD 1.23 billion,[1] the highest growth rate among South Asian countries. The number of domestic ICT companies is about 5,000, and business process outsourcing (BPO) services, such as software development, system integration, and call centers, are thriving. Pakistan accepted many well-known multinational ICT companies, such as Teradata, CISCO, ORACLE, IBM, Samsung, and Intel as outsourcing destinations with high price competitiveness. It is developing local services and offshore development. The country is also known as a supply center for ICT entrepreneurs in South Asia after India.

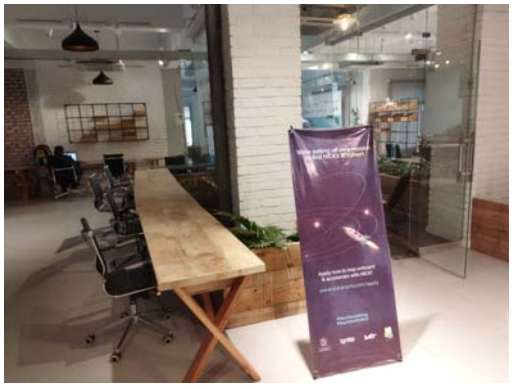
The Pakistani government is supporting the promotion of the domestic ICT industry from a policy perspective. In 2018, the government formulated the "Digital Pakistan Policy" and launched various support measures for ICT companies.

7.1.1 Incubation Center

In 2016, the first batch of the National Incubation Centers (NIC) for fostering ICT entrepreneurs was established in five cities (Islamabad metropolitan area, Karachi, Lahore, Peshawar, Quetta). The NIC selects promising entrepreneurs and offers a 12-month incubation program, acceleration program, mentor advice, networking events, funding programs, and more. A total of 230 startups[2] have undergone incubation programs through the NIC, and 173 startups have graduated. Currently, there are plans to establish more centers in two cities, Hyderabad and Faisalabad. The center in Faisalabad is planned to specialize in the agricultural field.

NIC in Karachi, Sindh is funded by the Ignite National Technology Fund (Ignite), a non-profit company-operated and supervised by the Ministry of IT and Communications. According to the interview, the International Trade Center (ITC)[3] is considering providing NIC Karachi with seed funding for agrotech[4] entrepreneurs.

One of the facilities of NIC Karachi



Workspace for startups under the incubation program. Startups tend to work late in the day

[1] JICA, *Next Generation's ICT Advanced Country, Pakistan*

[2] A startup is a relatively new company that has not been in business for many years, often referred to as a company that creates new value with innovative ideas and originality and has an impact on society.

[3] ITC is a multinational body jointly delegated by the World Trade Organization (WTO) and the United Nations (UN) through the United Nations Conference on Trade and Development (UNCTAD).

[4] In general, agrotech (or agritech) utilizes ICT in the agricultural field, such as using IoT, big data, and drones. In this report, entrepreneurs and companies engaged in such activities are called "agrotech."

because most of them work for the US market.

Panels of particpating firms for matching events. NIC holds matching events to promote investment and business alliance with participating firms. Careem, the leading firm of e-hailing founded by Pakistani, also participates.

List of guraduates from NIC Karachi. Crrently, 7 generations graduated from NIC Karachi.

Source: JICA Study Team. Photos taken in December 2021.

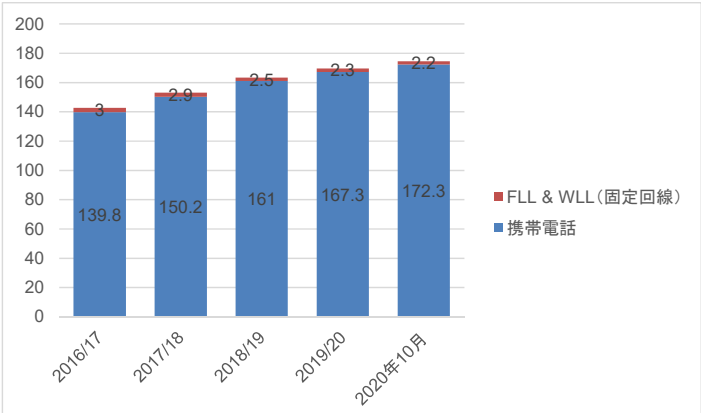
Figure 7.1.1 NIC Karachi

The biggest challenges NIC Karachi faces are seeding funds and grants. The center also expects external support.

The largest private sector incubation center was Nest I/O, run by the Pakistan Software Association (also known as P@SHA), an ICT industry group, which closed in mid-2021. However, there are other incubators, accelerators, angels, and venture capital firms in the private sector of Pakistan.

7.1.2 Telecommunication Prevalence

The number of telephone subscribers in Pakistan continues to grow every year, reaching approximately 175 million as of October 2020. Mobile phone subscribers also increased with an annual rate of about 7% in 2018 and 2019. Recently, it increased by about 3% in the four months from June to October 2020. On the contrary, telephone or fixed lines subscribers are decreasing each year.

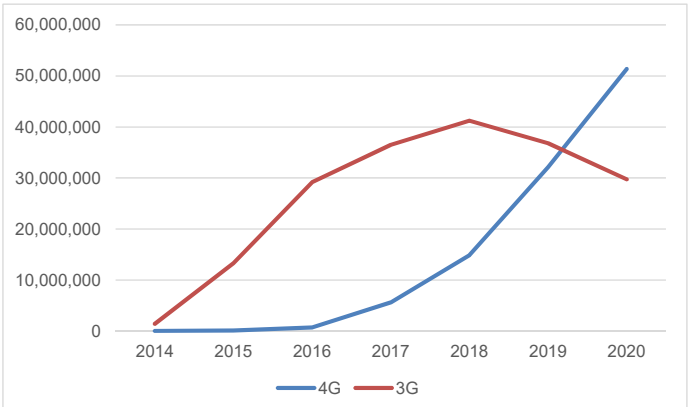


Source: JICA Study Team prepared from Pakistan Telecommunication Authority (PTA) Annual Report 2020

Figure 7.1.2 Telephone Subscribers

By line type, while the number of 4G subscribers has increased sharply in recent years, the number

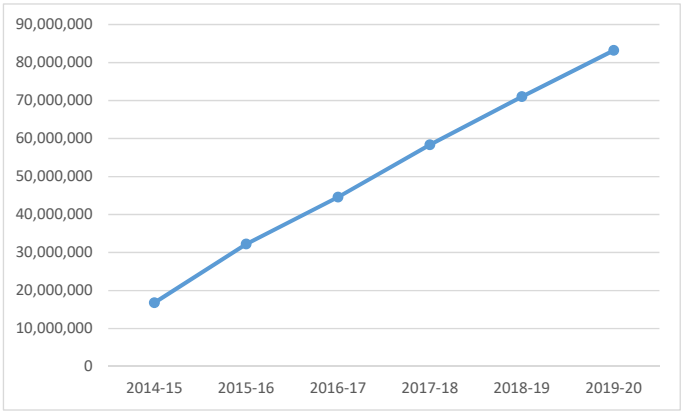
of 3G subscribers has been declining since peaking in 2018, indicating that replacement with 4G lines is progressing.



Source: JICA Study Team prepared from PTA Annual Report 2020

Figure 7.1.3 Telephone Subscribers by Line Type

Broadband is progressing rapidly, and in 2020, it increased by 17% from the previous year. Most broadband subscribers are 3G and 4G mobile phone subscribers.



Source: JICA Study Team prepared from PTA Annual Report 2020

Figure 7.1.4 Broadband Subscribers

According to a survey by the Pakistan Statistics Bureau, the rural area of Sindh has the lowest mobile phone ownership rate of 39.3% by region. Sindh also has the second lowest female mobile phone ownership rate after Balochistan at 24.5%.

Table 7.1.1 Ratio of Mobile Phone Ownership

	Rural	Urban	Male	Female	Total
Pakistan	39.25	55.13	64.83	26.35	45.3
Sindh	32.34	56.65	65.36	24.50	44.68
KP	42.83	53.54	63.21	27.83	46.2
Punjab	40.53	55.33	65.82	27.83	45.56
Balochistan	34.76	43.56	58.21	13.72	37.26

Source: Pakistan Bureau of Statistics, PSLM Survey 2018-19

7.2 Trends in Agrotech

In Pakistan, which promotes the ICT industry nationwide, there are a small number of agrotech companies targeting small-scale farmers. Many are start-ups. Table 7.2.1 summarizes the technologies of these agrotech companies. Some companies are working on developing mobile apps that combine multiple technologies.

Table 7.2.1 Agrotech Targeting Small-Scale Farmers in Pakistan

Application	Function	Core Technology
Weather forecasts/ Yield forecasts	Forecast timing of rains for specific spots and send information through mobile apps to farmers. It also forecasts the best harvesting periods and yields and advice farmers based on the forecasts.	AI, satellite imaginary, etc.
Agricultural extension advice	Agricultural experts provide farming advice. There are various methods such as radio program formats, individual video calls, and forums.	Satellite imaginary, IVR*, SMS, USSD**, etc.
Crop monitoring	Monitoring health of crops with a function of early alerting of crop diseases.	Satellite imaginary
Market linkage	Reporting market price trends, opportunities for purchasing agricultural inputs, inform bid price of buyers, opportunities for sales, information on a variety of suppliers	SMS, USSD, etc.
Irrigation management	Enabling efficient management of irrigation by mobile and save water and costs. Uses can remotely control water flows, irrigation timing, irrigation schedule based on data such as soil moisture, raining volume, sun shine volume, and others.	AI, IoT, remote sensing, etc.

Notes: (*) Interactive Video Response, (**) Unstructured Supplementary Service Data

JICA Study Team carried out interviews with some agrotech companies that have client bases in Sindh or the potential to tap the Sindhi market.

7.2.1 Industrus

Industrus is a private company that provides agricultural extension radio programs via mobile phones nationwide, including Sindh. For small-scale farmers without smartphones, Industrus developed services using technologies, including SMS, USSD, and IVR, compatible with conventional mobile phones. Since the launch of the radio program in November 2019, the number of audiences has grown to about 3 million as of November 2021, and apparently, it keeps increasing at a pace of 5,000 new enrolments a day.

The residence breakdown of client farmers is 46% from Punjab, 32% from Sindh, 18% from KP, and 4% from other provinces.

Agricultural experts provide timely agricultural information based on the National Agricultural Research Center (NARC) crop calendar. Viewers can ask questions directly to experts via SMS, etc. while watching on their mobile phones. (Photographed in November 2021)

Figure 7.2.1 Agricultural Extension Radio Program

The source of revenue is the customer's subscription fee. The customer can choose from PKR 1 for one day or PKR 5 for one week. The company also provides medical advice from specialists as ancillary services for an extra PKR 1. Payments are via mobile money or paid together with mobile phone bills. Currently, Industrus is developing a partnership with a telecommunications company and is planning to increase partnerships with other companies.

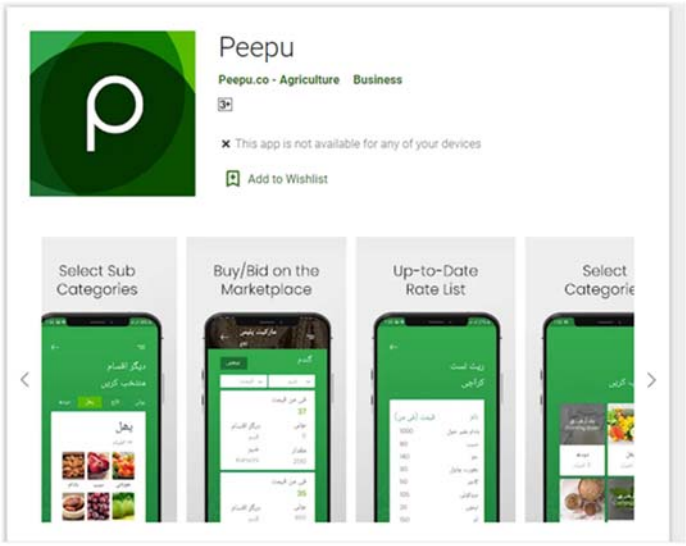
For future business development, the company is working on building a farm directory, such as attribute information of customer farmers, CNIC, farmland area, cultivated crop varieties, seed varieties to be used, and yield. In order to create this directory, the firm plans to place data points at 20 locations nationwide to build a database.

Industrus is also working on developing an e-wallet tailored for farmers. Currently, mobile money provided by MFB or MFI exists, but the firm determined there is nothing specialized for farmers. In addition, it is considering introducing zero interest rate micro-loans or nano-loan products to boost their customer base.

The challenge for the company is even if it tries to disseminate correct agricultural knowledge to small-scale farmers, the farmers become suspicious of such activities, affecting the speed of dissemination. This is why the firm expects JICA to take on activities, such as financial support and enlightenment, to promote agricultural radio programs.

7.2.2 PEEPU

PEEPU is a six-year-old start-up that provides market matching apps for small-scale farmers, founded by a graduate of NIC Karachi's incubation program. They developed an app with the goal of enabling small-scale farmers to sell at competitive prices in a timely manner.



Source: Download site of PEEPU

Figure 7.2.2 Application of PEEPU

The CEO is also a farmer, and the PEEPU app is thoroughly and simply structured so even small-scale farmers new to mobile apps can operate it.

The current main product is mango for export to the United States. In 2014, the company started research on quality and certification acquisition and developed the package ensuring the qualities. The firm started exporting in the next few years.

PEEPU makes a point of enabling farmers to purchase quality inputs, claiming there are many fake products for trade in the market and small farmers have no access to quality inputs.

Currently, the firm earns by commission from large farmers affluent enough to pay. It does not charge small farmers. For the time being, the company is focusing on expanding the customer base of small-scale farmers and plans to start receiving commission income.

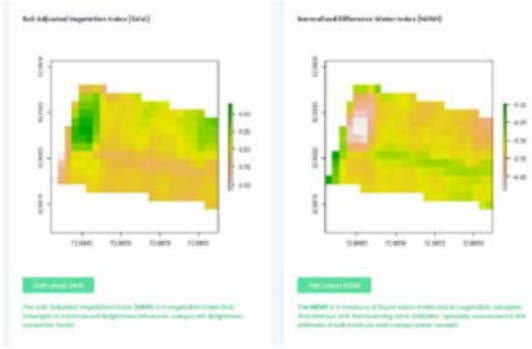
The major challenges of PEEPU are logistics and payment. It currently rents trucks to transport contracted crops each time, but they are not efficient. It also needs a freezing and refrigerating facility to transport horticultural crops to maintain freshness. As for payments, PEEPU plans to introduce digital payments, such as mobile money, in collaboration with financial institutions. In terms of management, the company is currently managed by only one CEO and three co-founders, but they recognize that more human resources will be needed to scale up in the future.

As an expectation for JICA, the funds for expanding the business in the future were mentioned. Currently, many donors offer to finance, but it is not so attractive for PEEPU because conditions like collateral, guarantees, and insurance attached to the offers are too strict.

7.2.3 SAWiE

SAWiE is an institution that provides farmers with farming knowledge and advisory services in association with universities, research institutes, and financial institutions. With remote sensing and AI, SAWiE provides a wide range of advice on farming activities. Its app makes it possible to monitor the growth stage and health status of crops based on precise location information of small-scale farmers. The app also combines a series of useful functions, including weather forecasts specific to the land, early warning of disasters, and input materials suitable for specific agricultural land.

Image of the mobile application



Map showing the health status of crops using the satelite image

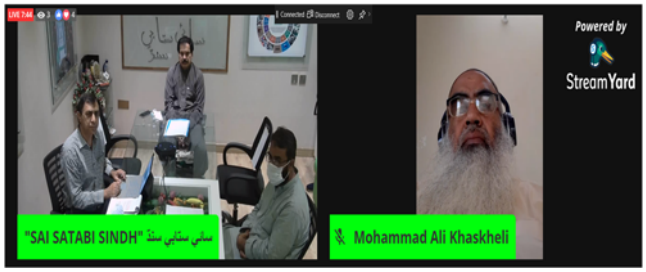
Source: Materials provided by SAWiE

Figure 7.2.3 SAWiE

Currently, SAWiE is in the process of recruiting a wide range of small-scale farmers to receive the company's services as pilots and preparing for a competition in which small-scale farmers compete for the quality, yield, and efficiency of their crops. The expectation of SAWiE for JICA includes support for disseminating the company's technology.

7.3 ICT Agricultural Extension Services Center in Sindh

Founded in Hyderabad in 2018, ICT Agricultural Extension Services Center (hereafter “ICT Center”) was a response to the scarcity of field extension officers. It eventually established sub-centers in Larkana District, Mirpur Khas District, and Sukkur District.



Live image of Sai Satabi Sindh, an agricultural advice distribution service (top) (ICT Center Headquarters’ material) and ICT Center Mirpur Khas branch (right) (photographed on November 2021)

The ICT Center broadcasts a live video program called "Sai Satabi Sindh" on Facebook, where officers of the DOA Extension Department and agricultural experts answer questions from viewers. Questions are sent in advance by SNS messages, and each question is answered individually, so there is no live dialogue with the viewers. According to the ICT Center Headquarters (Hyderabad District), the number of viewers per day was about 3,000 to 4,000. However, the audience of small-scale farmers seems to be limited at present.

Moreover, the YouTube program of ICT Centre offers TV channels for each theme of agricultural extension. A call center is also set up at each ICT center, and the Farmer's Helpline is in place to

answer individual questions from farmers. The market price of agricultural products is only provided in PDF format through social media. The development of a real-time market information system is an issue for the future.

Under the name "Cinema Show," an agricultural extension worker from the ICT Center travels around the country in a vehicle with a monitor that plays a video for agricultural extension, introducing various tools of the ICT Center, such as Sai Satabi Sindh.

ICT Center has conducted Cinema Show for agriculture extension in 543 villages.

Source: ICT Center

Figure 7.3.1 Agricultural Extension by Cinema Show

Regarding information on farmers, about 1,000 extension workers dedicated to the ICT Center use mobile tablets and smartphones, and information on the farming status of farmers is collected with GPS information at the headquarters. However, data such as farmland area and cultivated crops are not linked, and the farmer directory is unavailable.

Through the interviews, the JICA Study Team heard of an organizational issue in the ICT Center. It has no budget allocation of its own, and the activity costs are paid for by the budget allocated to the DG Agriculture Extension. The study team also received information that the World Bank is planning to expand the ICT Center.

ICT Center expects financing for the center, technical cooperation to improve “Sai Satabi Sindh,” support for market information system development, capacity building of ICT staff, development of mobile apps, and the development of and the promotion of agrotech startups from Japan.

7.4 ICT Use in Small-Scale Farmers

Group interviews were conducted to learn the ICT usage status in the small-scale farmer fact-finding survey of this survey. The table below shows the situation regarding ICT use.

Table 7.4.1 ICT Use in Farmers

	Hyderabad Village A	Hyderabad Village B	Karachi Village A	Karachi Village B
Ownership ratio of smart phone	25%	One third	More than half	Most residents
Experience in using ICT for agriculture	None	None. Main purpose of mobile phone is entertainment.	Few residents send pictures to ask advice from a supplier or a middleman through mobile phone.	None

Source: JICA Study Team

As for the smartphone ownership rate, the access rate in Hyderabad is significantly lower than that in Karachi. Apparently, the main use of smartphone is entertainment, and rarely for farming-related

purposes.

Despite the existence of innovative mobile apps of agrotech companies and digital tools of ICT Centers, it can be said that there is a big challenge for ICT to penetrate the small farms in Sindh.

7.5 Case Studies in Other Areas and Countries

7.5.1 Punjab Province

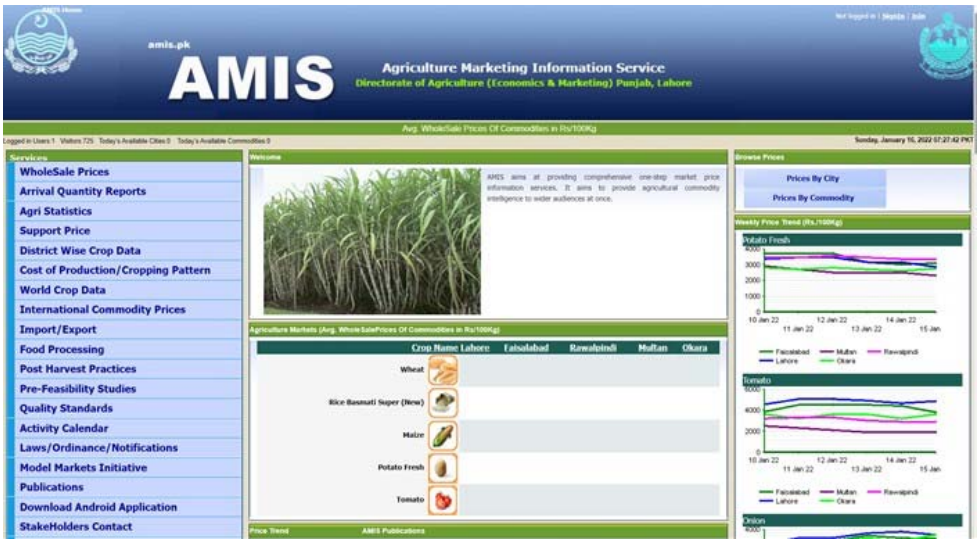
In Punjab, as explained in Chapter 6, PITB is responsible for ICT promotion in the agricultural sector, including applications for agriculture. PITB built a database of farmers, providing various digital services to farmers by using the database. IT systems for agriculture developed by PITB is summarized in Table 7.5.1.

PITB is planning to build a virtual market for direct trading between retailers and farmers to solve relationship issues with middlemen.[5] Currently, the Punjab Department of Agriculture (PDOA) is considering specific functions of the application.

Table 7.5.1 ICT Systems for Agriculture by PITB

ICT	Description
Kissan Card (farmers' database)	Kissan Cards were issued to farmers benefiting from various government programs. PITB has developed a digital platform and has provided all district administrations with user logins to enter details of farmers in their jurisdictions. The information added to the system pertains to demographics, contact details, crops and landholding patterns, livestock, irrigation system, and mechanization. Thanks to this system, the government obtains correct information on farmers, and recipients (farmers) can benefit efficiently and transparently by government interventions, such as subsidies, E-Credit, Crop Insurance.
E-Credit	PDOA has initiated an interest-free loan scheme for small-scale farmers with lands less than 12.5 acres. The loan process was digitalized. PITB has developed a centralized system for managing the database of farmers before introducing the E-Credit scheme, and all stakeholders can access the database. Loans through E-credit were provided to 560,000 farmers for ten kinds of crops. In addition, a program to give farmers mobile phones with 10 applications to enhance their capacity is in progress, but applications are under development as of December 2021.
Modern Farmer Extension Service through AgriSmart	AgriSmart application to record agricultural data for agricultural extension workers has been developed for the Punjab Public Management Reform Programme (PPMRP) supported by World Bank. The application has been used to create a digital database of: ・ farmer advisory services, ・ plant clinics, ・ crop reporting, ・ pest scouting and warnings, ・ farmer training,

[5] The ICT Center in Sindh is also expected to do the same activity in the future.

ICT	Description
	・ monitoring of agricultural inputs, ・ soil sampling and testing, ・ fertilizer monitoring and testing, and ・ research trials. Field workers assigned in each district, equipped with smartphones installed with the AgriSmart app, have sent details of extension activities and accurate information daily. The application also has a feedback option to enable farmers to share ideas with the government. In addition, the field staff's time taken in departmental tasks has been reduced, saving them some time.
Agriculture Marketing Information Service (AMIS)	AMIS was established to disseminate the prices of agriculture commodities rates from 135 markets located across the province of Punjab in 2007. International agricultural commodity prices are also available, and it is possible to compare international prices with internal prices since 2011. Real-time conversion of international commodity prices from U.S Dollars and Indian Rupee to Pakistani Rupee is shown. International commodity prices are shown in the Urdu language, helping more farmers use the information. 
Fertilizer and Pesticide Monitoring System	The Fertilizer and Pesticide Monitoring System was developed to automate the price monitoring mechanism for agriculture inputs. It would take DOA at least a week to finish the inspection drive in a market as the staff needs to visit the site. It takes a lot of time and costs one labour. Fertilizer and pesticide companies have now been provided with user logins to enter their product details and base price onto the website. Once the price is entered, it automatically syncs to the mobile application given to the inspection staff. The staff visits various dealers and uploads the evaluated price and other identification credentials against each product quantity of fertilizers and pesticides. The system then analyses the difference between the base price and evaluated price and automatically sends an SMS of the variation to the concerned authorities, including the designated tehsil price magistrates, which secures transparency of the prices

Source: JICA Study Team based on PITB website, AMIS website and interview with PITB.

7.5.2 Cases in Other Countries

Governments of other South Asian countries also promote digitalization, putting efforts to utilize ICT in the agricultural sector. Cases in India, Bangladesh, and Nepal are shared below.

(1) India

Modi administration, established in May 2014, approved and announced a basic national ICT policy called “Digital India” on 20 August 2014 to build digital infrastructure and digital literacy, including agriculture. In India, both the government and the private sector have been making efforts to utilize ICT to support farmers, particularly to share knowledge and information. Specific ICT tools developed are summarized in the table below.

Table 7.5.2 Examples of ICT Tools for Agriculture in India

ICT tool	Outline
Kisan call centers	The Ministry of Agriculture and Farmers Welfare (MAFW) established the Kisan call centers in 2004 to utilize ICT in the agricultural sector. Call centers are under the Department of Agriculture and Farmers Welfare, and farmers can contact Farm Tele Advisor (FTAs) via a toll-free number for information on agriculture. The system was improved in 2012. Services like phone call recordings, SMS, voice mail, as well as a centralized management system, were added. In addition, the capacity of FTA was enhanced, and the number of calls has increased since 2013.
m-Kisan	The m-Kisan is an SMS service developed by MAFW in 2013. Farmers can register for the service through the Kisan call center, website, and agricultural extension workers. After farmers input basic data, such as language and agricultural methods, they can obtain information and advice ask questions on agriculture.
iKisan	A large Indian manufacturer, Nagarjuna Fertilizers and Chemicals Ltd. (NFCL), developed the agricultural portal site, one-stop service for farmers. The portal site provides agriculture-related information, such as crops, crop management, fertilizers, pesticides, market, weather forecast, as well as rural finance, insurance, machinery, etc.
Green Sim	A joint venture of Indian Farmers’ Fertiliser Cooperative Ltd (IFFCO), and the largest Mobile Network Operator (MNO), Bharti Airtel provides the information sharing service. Farmers purchase a SIM card which enable them to receive voice and text messages regarding information on crops, local areas, weather forecast.
eSagu	The eSagu system aims to increase the efficiency of agricultural extension. It regularly provides advice by a specialist with pictures to promote understanding.

Source: JICA Study Team based on websites of each scheme, FAO “Use of ICTs in Indian Agriculture” in November 2015, P. Krishna Reddy, G.Syamasundar Reddy, A.Sudarshan Reddy, and B.Venkateshwar Rao, ”eSagu: An IT-Based Personalized Agricultural Extension System-- A Prototype Experience”

Projects related to ICT for agriculture by donors are shown in Table 7.5.3.

Table 7.5.3 Cases of ICT Utilization for Agriculture by Donors in India

Project	Outline	Implementing Agency
SMS service for small-scale holders(2013–2017)	● Target area: Uttarakhand Province ● Customized information including weather forecast, local crops, prices, and cultivation are provided to each farmer through SMS by Reuter Market Light. ● Information on 300 kinds of crops and 1,300 markets in 13 provinces are available.	GIZ
Climate Change Knowledge Network in Indian Agriculture	● Target area: Jharkhand Province, Maharashtra Province. ● An open-source platform, “Network for Information on Climate Change (NICE)” was developed. ● The system distributes market prices, weather forecast, and agricultural news through SMS, voice video, fact sheets, and	GIZ

	posters. Information is accessible via website and mobile application. ● Training program for farmers and administrative staff with the introduction of the system.	

Source: JICA, "Examples of Utilization of Digital Tools in Technical Assistance Project for Agricultural Sector" (27 December 2021).

In addition, a Japanese company introduced an ICT system for farmers in India. India also faces a problem that farmers do not easily have access to funds. Financial institutions cannot easily loan to farmers since farmers have no credit information (cultivated area, yield, etc.). Farmers borrow money from middlemen instead at high interest rates and will have issues on payments.[6] To address these issues, Japanese start-up Sagri Co., Lt.d (Sagri) started a microfinance-related business providing agricultural data using satellite photos with financial institutions to enable farmers to have loans from formal financial institutions at a lower interest rate.

Sagri has been supporting organizing local governments and farmers' organizations in whole India, which are popular among local farmers' organizations.

(2) Bangladesh

The Bangladesh government has been promoting ICT under the national policy, "Digital Bangladesh." According to a concept paper in 2009, the policy has four pillars, "Digital Government", "IT Industry Promotion", "Connecting Citizen" and "Human Resource Development." The Connecting Citizen includes E-Agriculture such as agricultural extension, increase in access points for farmers' organizations[7].

ICT services for farmers developed by the government and the private sector are summarized below.

Table 7.5.4 Examples of ICT Tools for Agriculture in Bangladesh

ICT Tool	Outline
Agricultural Information Communication Center (AICC)	AICC was established as an access point to share information in local areas in the whole country. Agricultural cooperative members manage the centres and ICT infrastructure, like computers, digital cameras, internet, projectors, etc., are installed in each AICC. The staff of the Department of Agricultural Extension (DAE) and Agricultural Information Service (AIS) provides how to use the ICT infrastructure, such as using a printer.
Krishi Batayan (Agriculture Portal)/ Krishak Bahdhu Call Service	The portal site provides various agricultural information, such as detailed crop information and Q&A. Farmers registered with the portal site can use "Krishak Bahdhu Call Service" to obtain necessary information on agriculture by calling 3331.
Agricultural products pirce portal sites[8]	Department of Agricultural Marketing (DAM) created a website to share pricing information on agricultural products in 64 districts. Bengali is also available. Additionally, AIS provides agricultural information on its website.
Agricultural Research Management Information System (ARMIS)	Knowledge sharing website provided by Bangladesh Agricultural Research Council (BARC). It contributes to enhance efficiency of researches and studies as well as increase in farmers' income.
Banglalink Krishi bazaar/ Krishi Jigyasha	Private MNO Banglalink established an interactive voice response (IVR) service. Farmers can obtain market information, without middlemen, by just dialling 2474. Banglalink also provides different services for

[6] JICA. "Final Report of Data Collection Survey on Smart Food Chain in Developing Countries."

[7] Digital Bangladesh Concept Note, 11 May 2009.

[8] http://www.dam.gov.bd/damweb/PublicPortal/MarketDisplayFullScreenBangla.php

	solutions on issues as well as agricultural information by dialling 7676.
Mati-o-Mnush (TV program)	Bangladesh TV and AIS created a TV program related to agriculture, which broadcasts five times a week. AIS shares information through YouTube and other private TV companies also provide agricultural-related programs.
Krishoker (Farmers) App	Application for rice farmers to trade products without middlemen.
e-Purjee	A procurement system for sugarcane. The system transmits purchase orders to local farmers via SMS from state-owned sugar manufacturers. The manufacturers can purchase fresh sugarcanes timely and quickly. Costs and labour are also saved, a win-win for both manufacturers and farmers. By introducing this system, no manufacturers have had an issue on No Cane Hour (raw materials unavailable due to delay in purchase) since 2010.

Source: Sushan Chowhan and Shapla Rani Ghosh," Role of ICT on Agriculture and Its Future Scope in Bangladesh." Journal of Scientific Research and Reports, 18 June 2020. AIIC website. JETRO's Report of BOP Situation Survey: Digital Bangladesh in January 2016.

An example of a donor project is the Grassroot Technical Cooperation Project by JICA. It provides agricultural information using ICT. The project utilized the existing telecentres in villages, which were intended as general information centres or community centres and not as an agricultural extension. However, using the telecentre was effective for agricultural extension with ICT. Other than that, the Access to Information program supported by USAID and UNDP developed three kinds of mobile applications for agriculture.

Table 7.5.5 Cases of ICT Utilization for Agriculture by Donors in Bangladesh

Project	Outline	Implementing Agency
Project for Increase in Income of the Poor Farmers by Providing Agricultural Information with ICT (2010–2013)	● The project aims to increase income by acquiring cultivation techniques of semi-organic vegetables and improve agricultural activities by using ICT. ● The partner organizations is Banga Bandhu Mujinur Rahman Agricultural University which is in charge of agricultural techniques, Grameen Communications is in charge of ICT software, and Win-Incorporate in charge of ICT contents. ● Five kinds of ICT applications were developed, and training programs on ICT for famers were organized in local telecentres.	JICA Grassroot Technical Cooperation Project/ Kyushu University
Access to Information (a2i) program	● The program developed three kinds of mobile applications in 2017.[9] ● "KrishokerDigitalThikana" aims to share techniques and information on cultivation. ● "Krishoker Janala" aims to provide eco-friendly solutions to issues on pests and fertilizers in cultivation. ● "Pesticide Prescriber" aims to share information on pesticide ● When launching the three applications, training for administrative staff of 15,000 was organized for them to learn how to use the applications in their jurisdiction. Over five million farmers use the applications.	USAID, UNDP

Source: JICA "Examples of Utilization of Digital Tools in Technical Assistance Project for Agricultural Sector (27 December 2021)"

[9] "3 Mobile Apps for Agricultural Extension Service Launched." A2I. https://a2i.gov.bd/agricultural-extension-service-mobile-apps-2/.

(3) Nepal

In Nepal, utilization of ICT for agriculture has been promoted and an example of donor projects is shown in the table below.

Table 7.5.6 Cases of ICT Utilization for Agriculture by Donors in Nepal

Project	Outline	Implementing Agency
Nepal Seed and Fertilizer (NSAF) project（2016-2021）	● Digitally Enabled Seed Information System (DESIS) was developed, and a digital catalog of seeds was prepared. ● Farmers can have access on information on seeds in both English and Nepali through Android App.	Headed by the International Maize and Wheat Improvement Center (CIMMYT) and funded by USAID

Source: JICA “Examples of Utilization of Digital Tools in Technical Assistance Project for Agricultural Sector (December 27 2021)”

As an effort by the Japanese company, GVE Ltd., JICA decided to support its proposed “Development of a Digital Platform for Immediate Payment.” GVE will establish a special purpose company (SPC) with the Government of Nepal and start the project in 2022. JICA provides funding of JPY 30 million at the maximum for a preparatory survey to understand the status of finance, IT, and legal framework in Nepal. JICA aims to implement the project by using overseas investment loans or ODA loans.[10] Currently, this is at the survey stage, but it is expected that the introduction of mobile accounts will be promoted through this project.

[10] Nikkei Shimbun, “Digital Payment Infrastructure Development in Nepal by JICA etc.” (March 5, 2020)

8 Current and Past Projects of JICA, Other Donors, and NGOs on Agriculture and Rural Development

The World Bank has had a central role to play in Sindh's agriculture sector in recent years.

8.1 World Bank

The World Bank has a long history of cooperating in the areas of water resources management and agricultural development throughout Pakistan, including Sindh Province. The Sindh Water Resources Sector Improvement Project (WSIP), completed in 2020, funded the refurbishment of three major AWB canal networks. The World Bank-sponsored Sindh Resilience Project (SRP) is a project to strengthen infrastructure and resilience systems such as floods.

Meanwhile, the Sindh Water Resources and Agricultural Transformation (SWAT) Project has completed the "final connection" of the watercourse network improved and constructed through the implementation of the WSIP and the Sindh Barrage Improvement Project (SBIP). On top of that, SWAT will introduce the concept of waterway operation and modernization of irrigation services to help Sindh make better use of these infrastructure investments. The Sindh Agricultural Growth Project (SAGP) was completed in 2021 and focuses on the development of value chains (VCs) for high-value crops. The Sindh Irrigation Agricultural Productivity Enhancement Project (SIAPEP) consists of irrigation and agricultural components and focuses on investment in on-farm water management. Although SIAPEP was initially scheduled to end at the end of 2021, it was extended for another year, ending in 2022.

In the following sub-sections, each of the projects is outlined.

8.1.1 SIAPEP

SIAPEP was implemented in 2015 to improve irrigation water management at the tertiary- and field-level in Sindh. It has four components, namely (A) Community Water Infrastructure Improvement; (B) Promotion and Installation of High-Efficiency Irrigation Systems (HEIS); (C) Improved Agriculture Practices; and (D) Project Management, M&E, etc.

Table 8.1.1 Outline of SIAPEP

Items	Contents
Project Purpose	To improve irrigation water management at tertiary and field level in Sindh
Project Components	Component A: Community Water Infrastructure Improvement A1. Community Water Course Improvement A2. Mitigation of Flood Risks for the Poor A3. Project Supervision & Implementation Assistance Consultants Component B: Promotion and Installation of HEIS B1. Small & Medium Size HEIS (2–10 ha) B2. HIS Demonstration Sites & Kitchen Garden HEIS Kits Component C: Improved Agriculture Practices C1. Laser Land Levelling & Deep Plowing C2. Improved Agriculture Production technology C3. Technical Assistance & Training Consultants Component D: Project Management, T.A Studies, M&E D1. M&E of Project Impact D2. Project Management Administrative Costs
Period	2015 to 2021 (the one-year extension is under consideration between the Government of

	Sindh (GOS) and World Bank)
Project Budget	USD187 million (International Development Association: IDA) USD55.2 million (GOS)
Beneficiaries	Farmers and DOA-GOS
Target Areas	All districts of Sindh
Implementation Agency	[Federal-level] None [Provincial-level] DOA, DG of On-Farm Water Management (OFWM), etc.
Lessons Learned/ Good Practices	◆ It is necessary to examine effective measures to disseminate the technology of HEIS over small-scale farmers. Furthermore, it is required to examine the optimum farming plan using HEIS in each farm size. ◆ It is highly considered to technically survey, design, and construct watercourses together with those in the Distributary/Minor Canals as an irrigation block. It is necessary to aim at the improvement of the quality of the construction work conducted by farmers through proper technical guidance to them. ◆ There is a need to consider an appropriate farm management plan in accordance with the size of fields. ◆ It is necessary to enhance the initial social mobilization process to the farmer from the planning stage so that the farmer can voluntarily maintain and manage the water courses after the rehabilitation/ improvement works. ◆ Small-scale farmers have difficulties in introducing water-saving technologies due to high initial costs. ◆ However, once they are introduced, their cost-effectiveness is expected to be high. ◆ Due to the delay in dissemination of successful cases of their introduction, few farmers attempt to do so despite high costs, etc. ◆ It is said that as for SIAPEP, only the introduction of water-saving technologies is unlikely to be achieved. ◆ The amount of investment per unit area is small. ◆ Operation and maintenance fees are high. ◆ The advantages and disadvantages of new technologies to be introduced are difficult for farmers to understand. ◆ The prices of imported equipment and raw materials are changeable according to the fluctuation of foreign exchange rates.

Source: JICA Study Team

8.1.2 SWAT

The SWAT Project was proposed by the Government of Sindh (GOS).[1] The comprehensive theme of its concept is the coordination of water resources and agriculture to support rural economies and promote efficient water resources management. The project will support the agricultural development and water resources management by the GOS and promote changes in the three aspects of agriculture, water resources, and the provision of water services. The outline (expected) of SWAT is shown in the table below.

Table 8.1.2 Outline of SWAT

Items	Contents
Project Purpose	To increase agricultural water productivity in selected project areas and establish the institutional framework for water resources management

[1] For details, please refer to World Bank (2021) “Sindh Water and Agriculture Transformation (SWAT) Project: Environmental and Social Management Framework.” As of January 2022, this project is expected to start in the second half of 2022.

Project Components	Component 1: Water Resources Management (i) A Hydro-Agro Informatics (HAI) program (ii) The development of a Sindh Strategic Water Plan (SWP) and supporting studies (iii) The formulation of a new water law and the restructuring of the Irrigation Department into the Irrigation and Water resources Department. Component 2: Water Service Delivery (i) Renovation of multi-purpose Akram Wah Main Canal (ii) Modernization of approximately 50 FO canal networks (iii) Technical assistance to SIDA and three AWBs on the left bank of the Indus River (iv) Preparatory technical, environmental, and social studies for main canal renovation on the right bank of the Indus River. Component 3: Agricultural Subsidies and Investments (i) "smart subsidies" and wheat procurement reform (ii) enhancing agriculture information and technology (iii) improving the agricultural value chain (iv) integrated FO subprojects (v) support to an Agriculture Delivery Unit (ADU)
Period	From 2022 (scheduled)
Project Budget	USD340 million (IDA) USD35 million (GOS)
Beneficiaries	Farmers, GOS, SIDA, AWBs, and FOs
Target Areas	To be decided
Implementation Agency	[Federal-level] None [Province-level] GOS (SID, DOA)
Remarks	In order to formulate future projects, it is necessary to collect information on the detailed description of the components, such as implementation area and activities related to the project.

Source: JICA Study Team

8.1.3 SAGP

The project purpose of SAGP is to improve the productivity and market access of small and medium producers in important commodity VCs. It has three components: (i) capacity building of producers, (ii) modernization of extension services and agricultural research, and (iii) strategic planning for the agricultural sector.

The table below shows the outline of the project.

Table 8.1.3 Outline of SAGP

Item	Contents
Project Purpose	To improve the productivity and market access of small and medium producers in important commodity value chains
Project Components	(i) Capacity building of producers; (ii) Modernization of extension services and agricultural research; and (iii) Strategic planning for the agricultural sector
Period	July 2014 to May 2021
Project Budget	USD 88.7 million
Beneficiaries	Sindh's farmers, Departments of Agriculture and Livestock and Fisheries
Target Areas	Districts of Khairpur, Larkana, Umerkot, Mirpurkhas, Tando allahya, Hyderabad, Tharparkar, Badin, and Tando Muhammad Khan

Implementation Agency	[Federal-level] None [Province-level] Departments of Agriculture and of Livestock and Fisheries
Lessons Learned/ Good Practices	◆ The environment for farmers and the agribusiness has been improved to some extent[2]. Although Sindh did not have a comprehensive agricultural policy, the formulation of the policy framework "Sindh Agricultural Policy (SAP) 2018–30" was a great achievement. ◆ However, the Agricultural Policy Implementation Committee (SAPIC), which monitors the implementation of SAP, is insufficiently active and the formulation of the "Sindh Agricultural Development Strategy" seems to have not progressed. ◆ As mentioned above, it is not easy to grasp the realization of results or outputs because the beneficiaries consist of a broad range of actors. Likewise, there are many target districts.

Source: JICA Study Team

8.1.4 SRP

The Sindh Irrigation Department (SID)[3] has implemented the World Bank-sponsored Sindh Resilience Project (SRP) to strengthen its infrastructure and resilience systems from disasters (floods and droughts). The SRP focuses on improving the organizational capacity, performance, and readiness of the major agencies responsible for managing disaster risk in Sindh. One of the pillars of the project is strengthening resilience against hydrological and meteorological disasters, such as floods and droughts, through investment in infrastructure.

The outline of SRP is shown in the table below.

Table 8.1.4 Outline of SRP

Items	Contents
Project Purpose	To reduce the risk of floods and droughts in the target area and to strengthen the management capacity of provincial agencies related to natural disasters and public health
Project Components	Component 1: Strengthening Disaster and Climate Risk Management 1.1: Improving Risk Identification and Using Risk Information for Development Decision-making 1.2: Strengthening Disaster Risk Management Agencies 1.3: Enhancing Fiscal Resilience 1.4: Project Implementation Support to PDMA Sindh Component 2: Improving Infrastructure and Systems For Resilience 2.1: Flood Protection Works 2.2: Construction of Small Recharge Dams to Address Drought and Flash Flooding Risks 2.3: Technical Assistance to Sindh Irrigation Department 2.4: Project Implementation Support to Sindh Irrigation Department Component 3: Contingent Emergency Response Component
Period	2016 to 2024
Project Budget	USD100 million (IDA) USD20 million (GOS)
Beneficiaries	Farmers, SID, Provincial Disaster Management Authority (PDMA)
Target Areas	All districts of Sindh
Implementation Agency	[Federal level] None [Provincial level] SID and PDMA

Source: JICA Study Team

[2] World Bank (2014), PROJECT APPRAISAL DOCUMENT ON A PROPOSED CREDIT

[3] SID is also called Department of Irrigation (DOI). In this chapter and other ones, SID and DOI are interchangeably used.

8.1.5 WSIP

The Water Sector Improvement Project (WSIP) was implemented from 2008 until 2020 with assistance from the International Development Association (IDA) as the main implementing agency.[4] The comprehensive goal of WSIP is to improve the water distribution in the three AWBs (i.e., Ghotki Feeder Canal, Nara Canal, and Left Bank Canal), especially on the reliability, equity, and user satisfaction, by improving the efficiency and effectiveness of irrigation. The outline of WSIP is shown in the table below.

Table 8.1.5 Outline of WSIP

Items	Contents
Project Purpose	To improve the efficiency and effectiveness of irrigation water distribution in three AWBs (Ghotki Feeder Canal, Nara Canal, and Left Bank Canal), particularly with respect to the reliability, equity, and user satisfaction.
Project Components	Component A: Community Development and Capacity Building A1. Capacity building of SIDA A2. Capacity building of AWBs A3. Capacity building of FOs Component B: Improvement of Irrigation and Drainage System B1. Improvement of main and branch canals B2. Improvement of distributaries and minors B3. Improvement of drainage systems in FO areas B4. Preparation of design, engineering & construction supervision Component C: Management Plan for major I&D Infrastructure C1. Feasibility studies/designs for rehabilitation of barrages C2. Preparation of a master plan for left bank of Indus Component D: Project Monitoring, Evaluation, and Supervision of EMP Component E: Project Coordination, Monitoring, Technical Assistance, and Training E1. Project coordination, monitoring, and supervision of project management consultants/procurement agent E2. Future project preparation in water sector including WSIP-II E3. Technical assistance, training, and strategic studies
Period	2008 to 2020
Project Budget	USD150.2 million (IDA) USD24.8 million (GOS)
Beneficiaries	Farmers, SID, SIDA, AWB, FOs
Target Areas	Areas under jurisdiction of SIDA and AWBs (Ghotki Feeder Canal, Nara Canal, and Left Bank Canal)
Implementation Agency	[Federal level] None [Provincial level] SID, SIDA
Lessons Learned/ Good Practices	◆ Establishment of systems such as the establishment and capacity building for FOs and Irrigation and Drainage Management Transfer (IDMT). SIDA and AWB continue supporting FOs in irrigation system management. ◆ It is necessary to assess the capabilities of the FO's irrigation system management and, if necessary, conduct additional training. ◆ Strengthening the linkage of SIDA-AWB-FO is necessary to carry out the irrigation system management. ◆ In the command area supplied by the Fuleli Main Canal region, the rehabilitation/improvement

[4] For details, please refer to 5.2.2 of Chapter 5.

	of some distributary/minor canals has not been undertaken, so it is necessary to investigate urgently to prepare a rehabilitation/improvement plan for the canal systems.

Source: JICA Study Team

8.2 Other International Donors

In the sub-sections below, projects of other international donors (except World Bank) are outlined, such as Asian Development Bank (ADB), European Union (EU), International Trade Center (ITC), Australian Aid, Australian Centre for International Agricultural Research (ACIAR), etc.

8.2.1 ADB

ADB has implemented the Enhancing Technology-Based Agriculture and Marketing in Rural Punjab (ETBAMRP) since November 2019.[5] The outline of this project is in the following table. Meanwhile, since COVID-19 broke out across the world shortly after the outset of ETBAMRP, the project team decided to conduct a survey through "The Impact of COVID-19 and Locust Invasion on Farm Households in Punjab and Sindh: Analysis from Cross-Sectional Surveys in Pakistan"[6] as part of ETBAMRP. The surveys were carried out in Sindh (8 districts) and Punjab (4 districts) in May and June 2020.

Table 8.2.1 Outline of ETBAMRP

Items	Contents
Project Purpose	◆ Farmers' adoption advanced technologies increased in TA pilot sites
Project Components	◆ Demonstration of advanced harvest and postharvest technologies conducted ◆ ICT-based direct marketing platform developed and installed ◆ Capacity of stakeholders in developing and adopting advanced technologies increased ◆ Investment opportunities to scale up the adoption of technologies formulated
Period	November 2019 to December 2022
Project Budget	USD 2.5 million (ADB) (USD 0.5 million from Technical Assistance Special Fund and USD 2.0 million from Japan Fund for Poverty Reduction: JFPR)
Beneficiaries	Punjab Agriculture Department (PAD) and Punjab's farmers
Target Areas	[Punjab] Districts of Hafizabad, Sheikhupura, Okara, and Pakpattan [Sindh] Districts of Kashmore, Jacobabad, Shikarpur, Larkana, Kambar Shahdadkot, Dadu, Badin, and Thatta
Implementation Agency	[Federal level] Ministry of National Food Security & Research (MNFSR) [Provincial level] Punjab Agriculture Department
Target Products of VC	Wheat, rice and maze, and tomato
Lessons Learned/ Good Practices[7]	Lessons learned from the COVID-19 pandemic [In general] Supply chain disruptions result in economic loss for farmers and rising prices for consumers. [Production]

[5] For project details, please visit the following URL: https://www.adb.org/projects/52232-001/main. Last accessed on 8 January 2022.

[6] For project details, please visit the following URL: https://www.adb.org/publications/impact-covid-19-locust-farm-households-punjab-sindh. Last accessed on 9 January 2022.

[7] The lessons learned are taken from "The Impact of COVID-19 and Locust Invasion on Farm Households in Punjab and Sindh: Analysis from Cross-Sectional Surveys in Pakistan."

	◆ Perishables needed to be picked, packaged, and shipped daily. ◆ Delayed production. ◆ The government should monitor the production and storage of agricultural products. [Tomato] ◆ Prices fell due to declining demand. ◆ Middlemen became difficult to contact. ◆ Access to the market was difficult. ◆ Market prices fell. [Input] ◆ Input prices increased. ◆ Finding a worker became difficult. ◆ Obtaining agricultural machinery and parts became difficult. ◆ Lockdown was implemented in Sindh ahead of other states, causing transportation and market access problems. [Marketing] ◆ There were negative impacts on selling vegetables, fruits, and milk in both Sindh and Punjab. In Sindh, tomatoes were adversely affected. ◆ Farmers were unable to reach the market on time. Meeting the middleman did not go as planned. [Finance] ◆ Farmers were concerned about the inability to purchase inputs and borrowing from banks and non-banks due to financial hardship.

Source: JICA Study Team

8.2.2 FAO

Pakistan is vulnerable to the effects of climate change and, like many other developing countries, faces challenges in addressing climate change governance and strengthening relevant agencies. Future costs of climate impacts are estimated to be approximately USD 6.0 billion to USD 14.0 billion annually over the next 40 years. The Ministry of Climate Change (MCC) is currently creating the infrastructure and platforms needed for policymaking and implementation.

From the background above, United Nations Food and Agriculture Organization (FAO) has been conducting “Transforming the Indus Basin with Climate Resilient Agriculture” from 2019 until 2025. In the context of Sindh, it is necessary to improve resilience to floods caused by heavy rains, as well as also to build and strengthen the system of policy formulation and implementation for that purpose. The outline of this project is shown below.

Table 8.2.2 Transforming the Indus Basin with Climate Resilient Agriculture

Items	Contents
Project Purpose	To increase resilience to climate change among the most vulnerable farmers in the Indus Basin and strengthen the government’s capacity to support communities in adapting to climate change.
Project Components	Component 1: Enhancing information services for climate change adaptation in the water and agriculture sectors 1.1 Developing a water accounting system 1.2 Establishing an evapotranspiration-based water management system 1.3 Improving availability and use of information service Component 2: Building on-farm resilience to climate change 2.1 Improving practices for climate resilience 2.2 Training of trainers on CRA and OFWM

	2.3 Developing farmers' capacity to transform agriculture practices with CRA and OFWM Component 3: Creating an enabling environment for continued transformation 3.1 Improving information and awareness raising campaigns 3.2 Supporting policy implementation by federal and provincial governments 3.3 Developing services that enable farmers to adopt climate resilient practices
Period	2019 to 2025
Project Budget	USD 35.0 million (FAO) USD 12.7 million (Sindh Government and Punjab Government)
Beneficiaries	Farmers, SIDA, AWB, FO, GOS
Target Areas	Districts of Badin, Sanghar, and Umerkot
Implementation Agency	[Federal level] MCC [Province level] SID and DOA
Remarks	Survey of details design of TOR is required.

Source: JICA Study Team

8.2.3 EU and ITC

The EU/ ITC-funded Growth for Rural Advancement and Sustainable Progress (GRASP) project is being implemented in 11 target districts beginning 2019 until 2024. One of the features of GRASP is that its main target is "small and medium-sized enterprises (SMEs)."[8] In this project, the concept of SMEs is broad and includes a wide range of beneficiaries. It includes farmers and farmers' groups and agribusiness service providers (e.g., input providers, middlemen, transporters).[9]

The GRASP project is outlined in the table below.

Table 8.2.3 Outline of the GRASP Project

Items	Contents
Project Purpose	To help SMEs in horticulture and livestock become more competitive by making improvements at all levels of the value chain.
Project Components	◆ Improve the institutional and policy environment for small firms by enhancing policy dialogue, reforming policies, making the firm registration process more efficient, and improving quality infrastructure. GRASP will also improve coordination through value chain roadmaps, business development strategies, and new private sector-led alliances. ◆ Support small-scale farmers and producers in a holistic way by promoting climate-smart agriculture, improving dissemination of market information through a digital tool, and improving access to financing. ◆ Boost the competitiveness of small-scale firms by building inclusive supply chains, providing access to finance, grants and technical assistance, and improving quality. There will be a special focus on improving sustainability by enabling firms to acquire the appropriate technology.
Period	July 2019 to December 2024
Project Budget	USD 54.1 million (€48 million)[10]
Beneficiaries	SMEs and agribusiness (including farmer groups, service providers involved in agribusiness [input providers, middlemen, transporters, etc.], as well as federal and provincial government officials)

[8] For details of the definition of SMEs in Pakistan, please refer to 2.2.4 (1) of Chapter 2.

[9] The introduction of ITC (2019) "Project Brief: Growth for Rural Advancement and Sustainable Progress" states " The beneficiaries of GRASP are SMEs, including farmers and farmers' groups, agribusiness service providers, federal and provincial public sector actors."

[10] December 2021 (JICA rate): 128.1350/ Euro, JPY113.603/ USD

Target Areas	Districts of Khairpur, Sanghar, Shaheed Benazirabad, Matiari, Hyderabad, Tando Allahyar, Mirpurkhas, Tharparkar, Thatta, Karachi, and Tando Muhammad Khan
Implementation Agency	[Federal level] National Project Steering Committee (NPSC), Ministry of Commerce (MOC), Ministry of National Food Security and Research (MNFSR), Ministry of Industry and Production (MOIP), Ministry of Science and Technology (MOST), and Board of Investment (BOI), etc. [Provincial level] Provincial Steering Committee (PSC), Planning and Development Department (PDD), DOA, Department of Livestock and Fisheries, Provincial branch of Small and Medium Enterprise Development Agency (SMEDA), and district commissioners, etc.
Target Products of VC	Banana, mango, onion, tomato, dates, cattle, and goat meat
Lessons Learned/ Good Practices	◆ Since many parties are concerned, coordination of project activities has been challenging, as well as the guarantee of project sustainability if the number of beneficiaries is also excessively large. ◆ It is not easy to grasp the degree of the realization of results because beneficiaries are agribusinesses including farmer groups and consist of a wide spectrum of actors and many target districts as shown in Table 8.2.4.

Source: JICA Study Team (based on EU and ITC (2019), GRASP: Project Brief)

The log frame of this project is shown in Table 8.2.4.

Table 8.2.4 Outline of GRASP's Log Frame

Items	Contents
GRASP impact	To support poverty reduction and sustainable and inclusive economic growth in the rural areas of Pakistan.
Outcome	To support gender-inclusive income and employment generation by enhanced productivity and profitability of SMEs involved in primary production, service provision, and value addition in and around selected clusters of production.
Output 1	1. Institutional capacity strengthening and business environment improvement for rural SME development 1.1 Domestic commerce policy 1.2 Agricultural policies 1.3 Rural SME strategies 1.4 SPS and quality
Output 2	2. Agribusiness service providing SMEs (run by male/female) and their business support organizations (BSOs) are capacitated to enhance primary production and quality. 2.1 Climate-smart agriculture 2.2 Value addition, including quality 2.3 Agribusiness services 2.4 Rural women empowerment
Output 3	3. Commercially operating SMEs (male/female) are trained in appropriate environmentally sustainable technologies and enhanced marketing volumes 3.1 Farmer business management and marketing 3.2 Agribusiness management and marketing Business management, 3.3 Agro-entrepreneurship 3.4 Market Information 3.5 Access to finance/institution 3.6 Access to finance/SME

Source: ITC (2019), Project Brief: Growth for Rural Advancement and Sustainable Progress

8.2.4 CABI and Australian Donor Agencies

Strengthening Vegetable Value Chain in Pakistan (SVVCP) is a project that started in February 2018 and is scheduled to be implemented until the end of 2022 by Australian aid agencies, NPOs, universities (i.e., Australian Aid, ACIAR and Queensland University, and UK-based Center for Agriculture and Bioscience International (CABI).[11] Details of SVVCP are shown in the table below.

Table 8.2.5 Outline of SVVCP

Items	Contents
Project Purpose	Strengthening vegetable value chains in Pakistan
Project Components	• To Identify opportunities for increasing community engagement and developing rural entrepreneurship; • To establish sustainable production and marketing opportunities for small-scale vegetable farmers and traders; • To test and develop technical innovations for selected vegetables value chains; and • To scale-out improvements in vegetable value chains and sustain and maximize community benefits.
Period	February 2018 to December 2022
Project Budget	USD 2.1 million (AUD 2.9 million)[12]
Beneficiaries	Small-scale farmers
Target Areas	Districts of Hyderabad and Khairpur
Implementation Agency	[Federal level] National Agricultural Research Centre (NARC) [Provincial level] Department of Agriculture Extension Sindh, Agriculture Research Sindh, Sindh Agriculture University, Tandojam, Hyderabad, [Others] Engro Foundation, The University of Queensland, Australia, Women Agriculture Development Organization (WADO)
Target Products of VC	Onion, tomato, and potato
Lessons Learned/ Good Practices	Since implementing the project at the mentioned target districts, the following lessons have been learned so far. • Continuously supplying the target products to customers while maintaining a certain level of quality is difficult. • There are many problems with post-harvest processing facilities, such as storage, processing, and transportation. • Insufficient financial access. • Socio-cultural factors (social customs such as villas) should be taken into consideration.

Source: JICA Study Team (based on CABI [2017], SVVCP, etc.)

8.3 NGO

This section overviews the major projects implemented by the National Rural Support Program (NRSP), Sindh Rural Support Organization (SRSO), and Sindh Agricultural and by Forestry Workers Coordinating Organization (SAFWCO).

8.3.1 NPGP

NRSP is the implementing body of the National Poverty Graduation Program Sindh (NPGP). The

[11] For the details of CABI, please refer to the following URL: https://en.wikipedia.org/wiki/Centre_for_Agriculture_and_Bioscience_International. Last accessed on 20 December 2021.

[12] JICA exchange rate: JPY 81.1064/ AUD, JPY 113.6030/ USD

program is jointly funded by the Government of Pakistan and the International Agricultural Development Fund (IFAD). The national program, NPGP, is implemented in 23 districts in four provinces in the country with an estimated cost of US $ 150 million. Of these, the outline of NPGP in Sindh is shown in the table below. The project budget during the implementation period of about 4 years and 5 months is 16.2 million dollars (about PKR 2.8 billion).

The program has two main components: 1) graduation from poverty, and 2) social mobilization and program management. The first component focuses primarily on asset creation (or transfer), interest-free loans, and asset and IFL beneficiary training for better management of assets and interest-free loans (IFLs). The second one is responsible for social mobilization, formation, training of community resource persons (CRPs) and capacity building of community institutions (CIs).

Table 8.3.1 Outline of NPGP

Items	Contents
Project Purpose	To assist the ultra-poor and very poor in graduating out of poverty on sustainable basis
Project Components	Outcome 1: Improved livelihoods, living conditions, and income-generative capacities for poor households and the youth (with diversified assets for sustainability) Outcome 2: Women from ultra-poor and poor households experience higher levels of socio-economic empowerment and their families experience improved nutrition and food security Outcome 3: Target populations have improved access to financial services and investment opportunities Outcome 4: Strengthened dialogue and knowledge sharing on pro-poor (and climate-resilient) poverty reduction policies, supported with evidence-based research"
Period	August 2019 to December 2023
Project Budget	USD 16.2 million (PKR 2,844,068,328)[13]
Beneficiaries	Ultra-poor and very poor farmers and populations
Target Areas	Districts of Badin, Sujawal, and Thatta
Implementation Agency	NRSP
Lessons Learned/ Good Practices	• Experienced in organizing and supporting these organizations at three levels: CO, VO and LSO Being familiar with Sindh's unique social and cultural customs such as Baradari. • Experienced in helping the poorest farmers and peasants[14]. • Experienced in small-scale infrastructure development (construction of terminal canals, lining, drinking water development)[15]. • Experienced in Kitchen Garden promotion. • Experienced in collaboration with DOA, Agricultural Universities and Agricultural Research Institutes. • Experienced in introducing farmers to seed companies to obtain good quality seedlings. • Little experience in supporting VC (especially, marketing)

Source: NRSP (2021), Monthly Program Update: September 2021 and (2018), Programme Profile: NPGP-NRSP Lower Sindh

As an affiliate of NRSP, NRSP MFB is responsible for financial inclusion of the poor, including smallholders. The main financial products are loans and savings, and loans have a diverse assortment to meet various needs.

[13] JICA's exchange rate (Dec 2021): JPY 113.603/ USD, JPY 0.64603/PKR
[14] Based on the results of an interview by the JICA Study Team on 3 November 2021.
[15] Based on the results of an interview by the JICA Study Team on 3 November 2021.

Table 8.3.2 Overview of Financial Operation of NRSP MFB

Target	MSME entrepreneurs, small scale farmers, employee, pensioner
No. of Borrowers	296,291 (out of which, 161,615 borrowers of crop loan, of which small-scale farmers counts 153,523)
No. of Loan Officers	653
Loan amount	PKR3 million in maximum
Type	Bullet structure (Repay all principal and interest amount at maturity)
Interest Rate	33% (annual percentage rate: APR)
Collateral	Not required for loan amount less than PKR150,000
Tenure	Cultivation period
Payment	Cash, mobile money

Source: JICA Study Team

Every client goes into sufficient financial literacy training before borrowing. Areas that require external support include capacity building through digital finance training for employees.

8.3.2 PPRP

SRSO is the implementing body of the Peoples' Poverty Reduction Program (PPRP). PPRP is a hallmark of the Sindh government's performance in serving the poorest rural people through social mobilization and income generation. It aims to achieve the Sustainable Development Goals (SDGs) and social sector improvements by improving some provincial-level indicators that are the final outcome of this program. The program follows a three-tiered social mobilization approach developed by SRSO on the basis of community-led development.

The goal of PPRP is for the poor to live in rural areas through social mobilization, particularly to socially and economically empower women, and for the improvement of women's lives by increasing income. The program aims to support the poorest households, preferably provide employment / entrepreneurship for women, and provide low-cost shelters. The outline of PPRP is shown in the table below.

Table 8.3.3 Outline of the PPRP

Items	Contents
Project Purpose	To build up the capacity of the deprived population, living in the rural areas through social mobilization to empower the local communities paying particular attention to empowering women both socially and economically enabling them to improve their livelihoods and increase their incomes through Income Generating Grants and Community Investment Funds (CIF) i.e., interest-free loans.
Project Components	• Increased economic and social services and community benefits from upgraded community infrastructures and productive assets operated and maintained with community involvement. • An average sustainable increase of poor household incomes by 25%. • Approximately 802,036 rural households in six districts mobilized and capacitated through people's own organizations (CO/VO/LSOs,[16] including women's self-help group), of which at least 75 percent will continue to function effectively at the end of the project. • 367 Enterprise Development Value Chain Products finalized and implemented in six districts below.
Period	2017 to 2022

[16] CO stands for community organization, VO for village organization, and LSO for local support organization.

Project Budget	PKR6.35 billion (USD46.6 million)[17]
Beneficiaries	Framers in the poorest rural population
Target Areas	Districts of Khairpur, Sanghar, Umerkot, Mirpurkhas, Badin, and Thatta
Implementation Agency	SRSO
Lessons Learned/ Good Practices	◆ SRSO has extensive experience in the agricultural sector, including horticultural agriculture.[18] PPRP supports cultivating horticultural crops, such as chili, okra, onions, tomatoes, mangoes, etc., included in the target agricultural products of this survey.[19] ◆ In relation to the above points, the NGO has abundant experience in conducting technical and business training by associating (through an MOU) with Sindh Agricultural University and Sukkur IBA University, respectively. ◆ As mentioned in the project components, the NGO has extensive experience in organizing and supporting residents and organizations, including female groups. ◆ It also has a wealth of experience in organizing residents at three levels: CO, VO, and LSO, and supporting these organizations. Carrying out effective support activities seems possible.

Source: PPRP (http://www.pprp.net.pk/about.html), Ghulam Rasool Samejo (2021), SRSO

Although SRSO is also a non-banking financial company, all the loans it provides are interest-free and are only for beneficiaries of each livelihood support program. Loans are provided through its Community Investment Fund. The loan product of SRSO is not specifically designed for farmers.

Table 8.3.4 Financial Operation of SRSO

Target	Limited to the beneficiaries of each livelihood improvement project
Loan Amount	PKR15,000–40,000
Type	Revolving fund, individual loan
Interest Rate	None
Collateral	None
Tenure	12 months
Payment	Cash only

Source: JICA Study Team

8.3.3 SAFWCO

SAFWCO is an NGO aiming for sustainable social and economic development through grassroots community participation in Sindh. It has extensive experience in the agricultural sector across Sindh and works with the EU/ITC's GRASP to strengthen the capacity of micro, small, and medium enterprises (MSMEs) in the agricultural VC.

The NGO also trains small-scale farmers to improve market access and add value to crops in collaboration with Agriculture University (Tando jam). For example, technical guidance is given to farmers who dry chili peppers directly on the ground while distributing drying sheets. It also focuses on direct sales of crops and organizes farmers, working on collective sales and developing seed banks.

The most recent large-scale project carried out by SAFWCO is a livestock component in the Sindh

[17] JICA's exchange rate (December 2021): JPY113.603/ USD, JPY 0.64603/ PKR
[18] Based on the results of an interview by the JICA Study Team on 22 October 2021.
[19] Based on the results of an interview by the JICA Study Team on 22 October 2021.

Accelerated Action Plan for Reduction of Stunting and Malnutrition, a project for nutrition improvement by the GOS.

Table 8.3.5 Outline of Sindh Accelerated Action Plan for Reduction of Stunting and Malnutrition (Livestock)

Items	Contents
Overall Goal	To improve health and nutrition status of children and mothers by rapidly expanding and enhancing coverage of intervention in all districts of Sindh, both through facility and community action plan
Project Purpose	Capacity building with accelerated action plan for reduction of stunting and malnutrition in Sindh (livestock component)
Project Components	• Component A: Preparation of high quality and standardized manuals, brochures on awareness, and IEC materials for the target families of the program (in local language for the trainees). Provision of teaching aid models, demonstrations, illustrations, and hands-on practice during training sessions. • Component B: Project management of capacity development project, training sessions (awareness on human nutrition, livestock management, livestock disease management), and organization of quarterly/bi-annual/annual seminars at the district, divisional, and provincial level. • Component C: Monitoring and evaluation of the project to be conducted by the Institute of Rural Management (IRM), the JV Partner of SAFWCO.
Period	2019 to 2021
Project Budget	PKR 372 million
Beneficiaries	Parents with children of ages five and below and pregnant women
Target Areas	24 districts of Sindh Province
Implementation Agency	SAWFCO
Lessons Learned/ Good Practices	• SAFWCO has ample experiences in organizing more than 1,700 farmer groups. In the central and southern Sindh, no problems organizing farmers of multiple villages. • It also has extensive experiences in agricultural projects and food security with a track record in horticultural crops and VC support. • It has business experiences throughout Sindh (including Karachi and Hyderabad districts). Its connection with farmers can carry out the project smoothly. Some districts have baseline data.

Source: JICA Study Team

SAFCO, which provides microfinancing, is a sister organization of SAFWCO. Through the social development program implemented by SAFWCO, beneficiaries will be able to use financial services, such as loans by SAFCO, after learning the basics of business and accounting while receiving grant-based funding, which will lead to further business development. The approach of using savings after basic capacity building and having interest-bearing loans has much in common with the graduation approach.

8.4 JICA

8.4.1 Project on Sustainable Livestock Development for Rural Sindh

The overall goal of the Project on Sustainable Livestock Development for Rural Sindh is the “appropriate technology and effective utilization of livestock resources are applied by farmers in

Sindh Province" and the project purpose is "development foundations of Sindh livestock sector is built up in the pilot districts (appropriate technology development)." The project was implemented from February 2014 to September 2021. Its outline is shown in the following table.

Table 8.4.1 Outline of the Project on Sustainable Livestock Development for Rural Sindh (JICA Livestock)

Items	Contents
Project Purpose	The project purpose is "the development foundations of Sindh livestock sector is built up in the pilot districts." Development foundations means technologies, human resources, and institutions that would be the bases of long-term development of the livestock sector.
Project Components	1. Appropriate technology and management method for livestock development from a gender perspective will be developed through demonstrations to pilot farmers. 2. Systems of utilizing livestock assets are demonstrated by saving small cattle and recovering buffalo. 3. Appropriate technology and system that are developed and demonstrated are disseminated to farmers in target areas. 4. Capacity development in project management and coordination of the department.
Period	February 2014 to September 2021
Project Budget	JPY983,170 thousand
Beneficiaries	Small-scale farmers owning five pieces of livestock in the target areas
Target Areas	Districts of Matari, Hyderabad, Badin, Tandoallayar, and Tando Muhammad Khan
Implementation Agency	Livestock and Fisheries Department of GOS
Target Products of VC	Milk
Lessons Learned/ Good practice	• In improving C/P technology, the development of appropriate technology in collaboration with farmers and experts was effective. • Training female extension workers was indispensable for direct guidance to female farmers. • From the developed appropriate technologies, technologies that can be easily applied by ordinary farmers were selected. • The project management training aimed to strengthen the Livestock Bureau and improve the staff's planning and implementation management capabilities. • The Capacity Building Unit (CBU) was set up within the Livestock Bureau so it can take the initiative in all aspects of training planning, implementation, and follow-up, from understanding the training needs of the Livestock Bureau staff. • Inviting the industry, academia, and government officials to hold a livestock development platform conference, making it easier to obtain cooperation in the project.

Source: JICA Study Team

8.4.2 Project for Improvement of Livelihoods and Well-being of Female Home-Based Workers in the Informal Economic Sector in Sindh Province

The project is under implementation from March 2017 to August 2023 with the objective of "promoting the application of the toolkit developed through public-private partnerships to improve the livelihoods of Female Home Based Workers (FHBWs) and their families." A summary of the project is shown in the table below.

Table 8.4.2 Outline of the Project for Improvement of Livelihoods and Well-being of Female Home-Based Workers in the Informal Economic Sector in Sindh Province (JICA Women)

Items	Contents
Project Purpose	Promoting the application of the toolkit developed through public-private partnerships to improve the livelihoods of FHBWs and their families.
Project Components	Output 1: The capacity of the Women Development Department of Sindh Province to promote the application of the toolkit to improve the livelihoods of FHBWs and their families through public-private partnerships will be strengthened. Output 2: Capacity of target FHBW HHs in life management skills is improved. Output 3: Capacity of target FHBW HHs to access to financial services is improved. Output 4: Target FHBWs acquire knowledge and skills necessary for income generation. Output 5: Importance of promotion of female employment in the formal sector is sensitized. Output 6: The toolkit is developed based on Outputs 2 to 5.
Period	March 2017 to August 2023
Project Budget	JPY595,526 thousand
Beneficiaries	FHBWs that are the target of pilot activities and their families Women Development Department of Sindh Province and other partner organizations (SRSO), Women Development Foundation Pakistan, financial service providers, private companies, social business entities, etc.
Target Areas	Karachi, Sukkur area (District Sukkur, Khairpur, Shikarpur, etc.)
Implementation Agency	[Federal level] None [Provincial level] Women Development of GOS
Lessons Learned/ Good Practice	• The lessons learned from the livelihood enhancement activities that take into account the traditional social structure, community, and cultural customs of rural Sindh can be used for activities in rural areas. • The content of household budget management, financial education, literacy training, and business skills training can be used by small-scale farmers. • Digital financial products were developed in collaboration with a fintech company. The lessons learned from working with startups and other private companies in Sindh can be utilized. • The toolkit, which is an output from this project, can be utilized.

Source: JICA Study Team

8.4.3 Project for Capacity Development of Agriculture Extension Services in Balochistan Province

In Balochistan, which forms the southwestern part of Pakistan, about 70% of its working population is engaged in agriculture and related sectors. However, agricultural income is low because of the large mountainous areas and constant insufficient water resources. On top of that, the cultivation of fruit trees is flourishing, and the development of high value-added processed products like dried fruits is progressing. Wheat, rice, vegetables, and livestock feed are also being produced. Meanwhile, the skills and knowledge of those extension workers and supervising administrative officers of DOA have not sufficiently been developed. For such reason, there is much to improve, particularly the agricultural development and extension activities. In the target districts, this project aims to enhance the skills and knowledge of extension workers, related officials, and training trainers in cultivating fruit trees and vegetables. Another aim is to improve agricultural productivity by disseminating techniques to farmers through the extension activities of DOA. The outline of this project is shown in the table below.

Table 8.4.3 Outline of the Project for Capacity Development of Agriculture Extension Services in Balochistan Province

Items	Contents
Project Purpose	Extension activities are carried out by the Agricultural Extension Bureau staff (agricultural extension officers and agricultural extension staff) in the training area, and the technology is transmitted to the farmers.
Project Components	Output 1: A training curriculum for capacity development of trainers and staff of the DG Agricultural Extension (agricultural extension officers and agricultural extension workers) is formulated. Output 2: Trainers acquire the knowledge and skills for training through the implementation of the first session of TOT and FA training. Output 3: Agricultural extension officers acquire the skills necessary for instructing, supervising, and monitoring extension activities through training. Output 4: Agricultural extension workers acquire the knowledge and skills necessary to carry out extension activities through training. Output 5: The implementation of field dissemination activities and monitoring in Balochistan will be strengthened.
Period	March 2019 to March 2022
Project Budget	USD2.6 million (300.0 million yen)[20]
Beneficiaries	• Direct beneficiaries: 150 agricultural extension officers and 250 agricultural extension workers from the Agricultural Extension Bureau who carry out extension activities in the training target districts in Balochistan. • Final beneficiary: Farmers in the training target district
Target Areas	After the project starts, the training target districts would be selected from the 30 districts of Balochistan based on the cultivation area of fruit trees, vegetables, and grains, statistics, etc., in consultation with the Balochistan DOA's DG Agriculture Extension.
Implementation Agency	[Federal level] NARC [Provincial level] Women Development Department of Agriculture of Balochistan
Lessons Learned/ Good Practice	• The outputs can be utilized for the capacity development of the officials of DOA's DG Agriculture Extension. • This project's federal-level C/P agency is NARC; thus, advanced cultivation techniques are available.

Source: JICA Study Team

8.4.4 Project for Strengthening of Irrigated Agriculture through Participatory Irrigation Management in the Punjab Province

The Project for Strengthening of Irrigated Agriculture through Participatory Irrigation Management in Punjab Province was implemented from March 2009 to March 2013 in the target districts in Punjab (Faisalabad, Bahawalpur, and Dera Ghazi Khan). This project was requested with the goal of establishing an irrigation facility management model through demonstration activities in the pilot area. The outline of the project is shown in the table below.

[20] JICA exchange rate (December 2021): JPY 81.1064/ AUD, JPY 113.6030/ USD

Table 8.4.4 Outline of the Project for Strengthening of Irrigated Agriculture through Participatory Irrigation Management in the Punjab Province

Items	Contents
Project Purpose	The model of the appropriate irrigation management system is established through verification of activities in the pilot areas
Project Components	1. Guidelines/manuals are improved to strengthen and sustain the efforts of the AWBs/FOs. 2. Appropriate water-saving technologies established in the model areas are promoted in the pilot areas. 3. Capacity building methodologies are improved for the relevant government staff, such as the Irrigation and Power Department (IPD), Provincial Irrigation and Drainage Authority (PIDA), and Punjab Agriculture Department (PAD) personnel, as well as for the officials of the organizations at the farmer's level, such as AWBs/FOs.
Period	March 2009 to March 2013
Project Budget	Approximately JPY200 million[21]
Beneficiaries	Farmers, PIDA, AWB, FO, Government of Punjab
Target Areas	Districts of Faisalabad, Bahawalpur, and Dera Ghazi Khan
Implementation Agency	[Federal level] None [Provincial level] IPD (Punjab), PIDA (Punjab), PAD
Lessons Learned/ Good practice	• The lessons learned and outputs (including guidelines, training materials, etc.) will be very useful in implementing similar projects in Sindh.

Source: JICA Study Team

8.5 Summary and Implications from Agriculture and Rural Development Projects by Major Donors and NGOs

The preceding sections overviewed the project activities of international donors and NGOs. Meanwhile, since the donors and NGOs have already provided various support in a range of sectors and geographical areas, it is not easy to differentiate from them. In order to differentiate the future project of JICA, this section analyzes the contents of support from other donors and NGOs into five perspectives (sector, area, beneficiary class, implementation period, lessons learned / good practices).

8.5.1 By Sector

The table below shows the classification of the target sectors of each donor / NGO project categorized into six sectors: water resources and irrigation, climate change, FVC, impact of the COVID-19 improvement of livelihoods for poor farmers / food security, and others. Among those, the number of projects belonging to water resources and irrigation, FVC, and improvement of livelihoods of poor farmers / food security is relatively larger. Finance and ICT are part of the components and activities. Since these are used only as means, there are a few projects placed in the center of the project activity. Considering these, JICA can differentiate itself from others by increasing the degree of utilization of finance and ICT in each component of the project.

Table 8.5.1 Categorization by Sector

Sector	Name of Project/ Organization	
Capacity development of water resource management and irrigation	SIAPEP	SWAT
	SRP	WSIP

[21] Information based on the summary of evaluation study of this project.

Sector	Name of Project/ Organization	
Response to climate change	SRP	FAO
Improvement and strengthening of FVC	SAGP	EU/ ITC
	ADB	ADB
	CABI/ Australians	JICA Livestock
Impact of COVID-19	ADB	
Livelihood improvement of the poorest farmers/ Food security	NPGP	PRSP
	SAFWCO	JICA Women
Others	JICA livestock	JICA Women

Source: JICA Study Team

8.5.2 By District (Area-wise)

The target districts of the projects by each donor and NGO are marked with a circle (○) in Table 8.5.2. The triangle (△) indicates that the two World Bank projects (SIAPEP and SRP) and the SAFWCO project have been (or were) implemented, although all districts are the targets in the three said projects. Only two districts are without a circle (districts with no projects), namely Naushahro Feroze and Jamshoro, as shown in red.

In addition, water resources and irrigation projects are being implemented in both the Upper Sindh and Lower Sindh areas. [22] It can be said that projects that target farmers tend to be implemented in the Lower Sindh area, where there are many districts with high poverty levels due to the lack of water resources. Projects of other donors and NGOs in the districts of Naushahro Feroze and Jamshoro have not been implemented to date. Many projects in the districts of Tharparkar and Sujawal have not been implemented either. It can be said that JICA can differentiate itself to some extent by implementing projects in these districts. However, as shown in Figure 2.1.9 of Chapter 2, Tharparkar seems to have a low production capacity for horticultural crops. JICA Study Team has decided to exclude it from the candidate districts for project implementation.

Table 8.5.2 List of Project Implementation Areas (by District)

	Name of District	Name of Project or Organizatino												
		SIAPEP	SWAT	SAGP	SRP	WSIP	ADB	FAO	EU/ITC	Australia	NPGP	PPRP	SAFWCO	JICA-Livestock	JICA-Women
1	Kashmore	△			△		○						△		
2	Jacobabad	△			△		○						△		
3	Ghotki	△			△	○							△		
4	Sukkur	△			△	○							△		○
5	Shikarpur	△			△		○						△		○
6	Khairpur	△		○	△	○			○	○		○	△		○
7	Larkana	△		○	△		○						△		
8	Kambar Shahdadkot	△			△		○						△		
9	Nausheroferoze	△			△								△		
10	Dadu	△			△		○						△		
11	Shaheed Benazirabad	△			△				○				△		
12	Sanghar	△			△	○		○				○	△		
13	Matari	△			△				○				△	○	
14	Jamshoro	△			△								△		
15	Umerkot	△		○	△	○		○				○	△		
16	Mirpurkhas	△		○	△	○			○			○	△		
17	Tando Allah Yar	△		○	△	○			○				△	○	
18	Hyderabad	△		○	△	○			○	○			△	○	
19	Tharparkar	△		○	△	○			○				△		
20	Badin	△		○	△	○	○	○			○	○	△	○	
21	Tando Muhammad Khan	△		○	△	○			○				△	○	
22	Sujawal	△			△						○		△		
23	Thatta	△			△		○		○		○	○	△		
24	Karachi	△			△				○				△		

Source: JICA Study Team

[22] For the details of the areas of Upper Sindh, Central Sindh and Lower Sindh, please refer to 1.4 of Chapter 1.

8.5.3 Target Beneficiary

The table below categorizes the beneficiaries of each project into "Farmers/ Producers," "Agribusiness / SMEs," "Small-Scale Farmers," "Poorest Farmers," and "Vulnerable Women/ Household Workers." Among those, "Farmers/ Producers" seem to target mainly small- and medium-scale ones, while especially in irrigation projects, considering the nature of irrigation facilities as public goods, some large-scale farmers are also considered to be included.

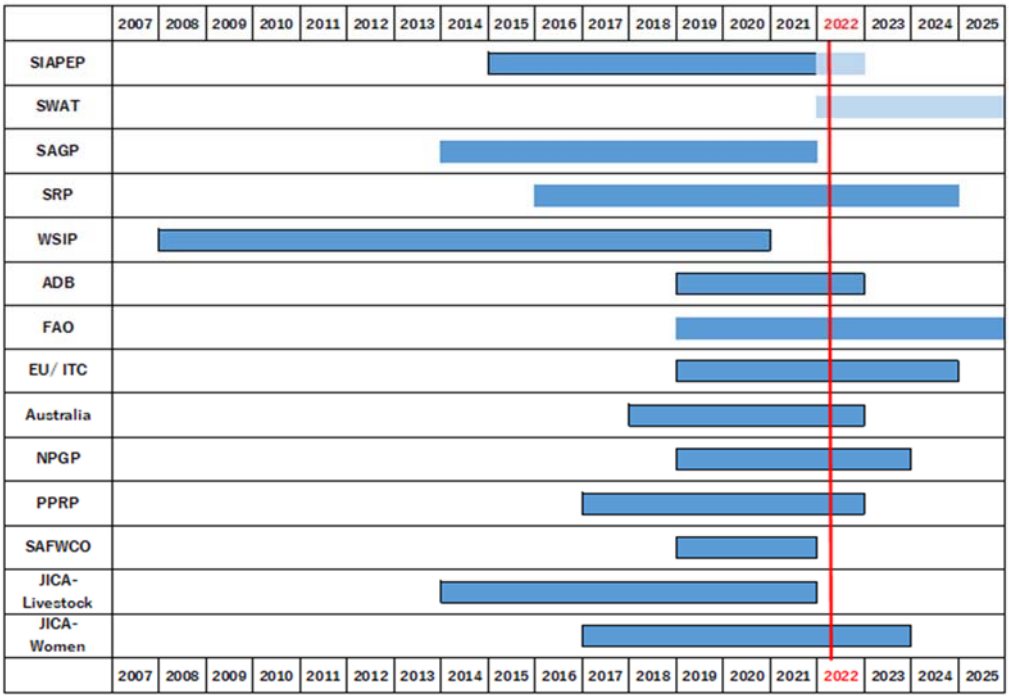
Table 8.5.3 Categorization of Target Beneficiaries of Each Project

Type of Beneficiary	Name of Project/Organization	
Farmers/ Producers	SIAPEP	SWAT
	SAGP	SRP
	WSIP	ADB
	FAO	
Agribusiness/SMEs	EU/ ITC	CABI Australian
Small-Scale Farmers	CABI/Australian	JICA Livestock
Poorest Farmers	NPGP	PRSP
Vulnerable Women/ Household Workers	SAFWCO	JICA Women
Others	JICA Women	

Source: JICA Study Team

8.5.4 Implementation Periods (Order of Timeline)

The average implementation period of projects reviewed in Chapter 8 is approximately 5.5 years. Currently, there are a few similar projects of other donors after 2023 focusing on strengthening FVC for small-scale farmers.



Source: JICA Study Team

Figure 8.5.1 Implementation Periods of the Projects

8.5.5 Lessons Learned/ Good Practices

The lessons learned or good practices of each project are listed in the table below.

Table 8.5.4 Lessons Learned/ Good Practices of Each Project

Project/ Organization	Lessons Learned/ Good Practices
SIAPEP	・ It is necessary to examine effective measures to disseminate the technology of HEIS over small-scale farmers. Furthermore, it is required to examine the optimum farming plan using HEIS in each farm size. ・ It is highly considered to technically survey, design, and construct watercourses with those in the Distributary/Minor Canals as an irrigation block. It is necessary to aim of the quality of construction work conducted by farmers with proper technical guidance . ・ An appropriate farm management plan per the size of fields must be considered. ・ Small-scale farmers have difficulties in introducing water-saving technologies due to high initial costs. ・ However, once introduced, their cost-effectiveness is expected to be high. ・ Due to the delay in disseminating successful cases of their introduction, few farmers attempt to do so despite high costs, etc. ・ It is said that only the introduction of water-saving technologies is unlikely to be achieved in SIAPEP. ・ The amount of investment per unit area is small. ・ Operation and maintenance fees are high.
SAGP	・ It is not easy to grasp the degree of the realization of results because beneficiaries consist of a broad range of actors, and the number of target districts is too large.
WSIP	・ Related systems (e.g., FOs establishment, farmers' capacity development, and facility maintenance transfer) have been established, and support activities for FOs by SIDA and AWB have been underway. ・ There is a need to evaluate the management capacity in irrigation systems of FOs and to provide necessary additional training. ・ The amount of investment per unit area is small.
ADB	・ The disruption of supply chain (SC) leads to farmers' economic loss as well as to a price hike from consumers' point of view.
EU/ ITC	・ Since many parties are concerned, coordination of project activities has been challenging, as well as the guarantee of project sustainability if beneficiaries are also too broad. ・ It is not easy to grasp the degree of the realization of results because beneficiaries consist of a wide spectrum of actors and the number of target districts is too large.
CABI/ Australians	・ Few effective measures against the issues in the production stage (e.g., pest and disease control) and few good practices in the post-harvest stage (including marketing). ・ Post-harvest facilities (e.g., warehouse), processing, and means of transportation are problematic.
NPGP	・ Highly experienced in establishing farmers' groups at the grass-roots level ・ Highly experienced in assisting the poorest farmers and share-croppers ・ Experienced in developing small-scale irrigation infrastructure (e.g., lining, distributary/ minor canals, etc.)
PRSP	・ Experienced in agriculture project and in the development of horticulture VC ・ Highly experienced in technical and business training in cooperation with universities ・ Experienced in community organization and familiar with the social and cultural practices peculiar to Sindh

Project/ Organization	Lessons Learned/ Good Practices
SAFWCO	・ Highly experienced in establishing farmers' groups (including successful experiences in central and southern Sindh by combining some *Biradari*-based groups) ・ Experienced in agriculture/food security project and in development of horticulture VC
JICA Livestock	・ Development of appropriate technology was effective in improving C/P's technology ・ Training of female extension workers was indispensable for direct guidance to female farmers. ・ Platform was effective in the industry-academia-government dialogue
JICA Women	・ Possibility to apply lessons learned from this project's livelihood improvement activities to rural activities ・ Possibility to apply the contents of household management, financial education, literacy training, and business ability training to other projects ・ Developed digital financial products in collaboration with fintech firms. It is possible to take advantage of the lessons learned from working with private firms ・ Possibility to utilize the toolkit (result of this project)

Source: JICA Study Team

8.5.6 Summary

Given the preceding analyses of this chapter, the table below is the summary of projects implemented by major donors and NGOs, which provides implications for JICA's new project formulation.

Table 8.5.5 Summary of Analysis of Projects by Major Donors and NGOs

Items	Contents
Areas of Cooperation	・ More projects have been implemented in the areas of "water resources/ irrigation," "FVC" and "livelihood improvement of poor farmers/ food security." ・ JICA will be able to differentiate its own project from others by focusing more on the improvement of financial access and on the utilization of ICT.
Districts	・ International donors and NGOs have so far implemented projects in all the districts of Sindh, while less projects in the districts of Nausheroferonze, Jamshoro, Tharparkar, Sujawal, etc. ・ It is difficult to make regional demarcations between JICA and other donors. Therefore, it is preferable to select appropriate districts in accordance with the project purpose, etc.
Beneficiaries	・ JICA's candidate beneficiaries can be small-scale farmers, agribusinesses, the poorest populations, female farmers, etc. ・ NGOs' target beneficiaries are mostly small-scale farmers. ・ Some of World Bank's target beneficiaries are "small-scale farmers," while most of them are, in practice, those with land of about 25 acres.
Period	・ The currently major projects are supposed to be over in 2022.

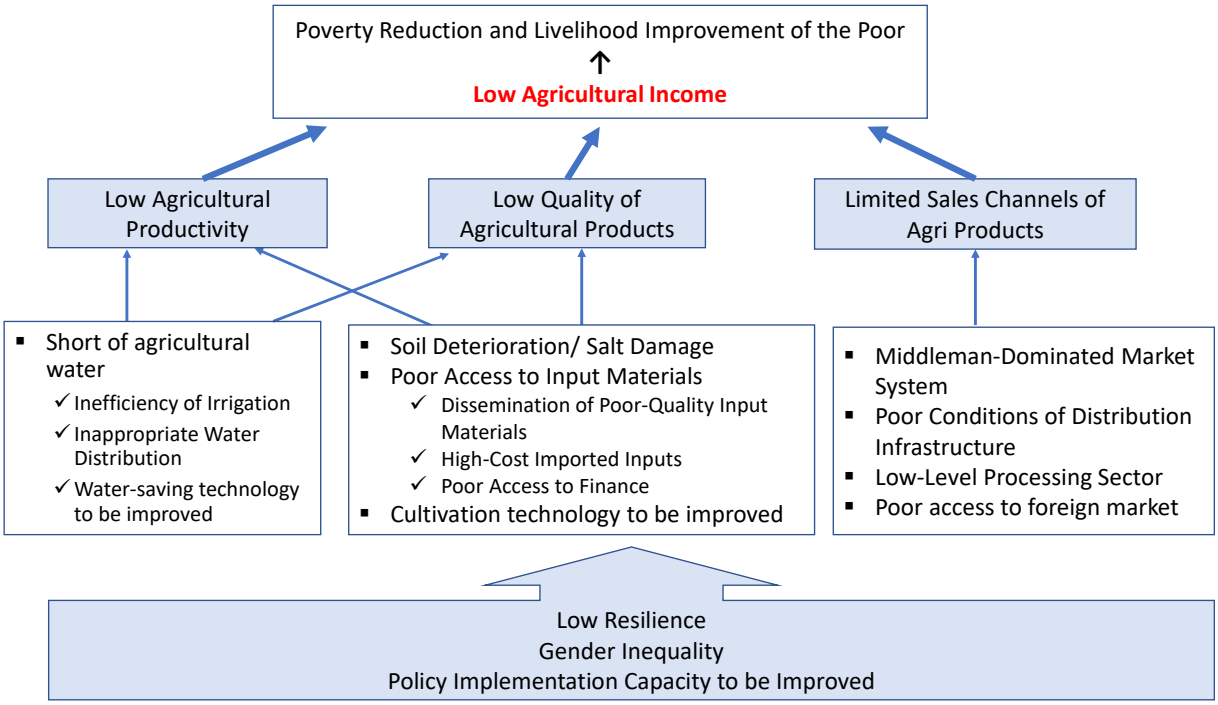
Source: JICA Study Team

9 Potentials for JICA's Future Cooperation

9.1 Reviewing the Challenges of Sindh's Agricultural Sector

9.1.1 Problem Analysis

By analyzing the current status and challenges given the results of Chapters 1 to 8, it has been found out that the central challenge in the livelihood of small-scale horticultural farmers is "low agricultural income," and the problems are analyzed as shown in the Figure 9.1.1 below. Due to small production volume and low productivity of Sindh's agricultural products, farmers' agricultural profitability is very low in the province. Likewise, their income increase through sales channel development has been obstructed by the unique distribution system to Sindh. On top of those, there are three following cross-cutting challenges: namely, (i) small-scale farmers' low resilience, (ii) gender gap and (iii) government's capacity of policy implementation and institutional aspects to be improved. The contents of each challenge are indicated in the Table 9.1.1 below.



Source: JICA Study Team

Figure 9.1.1 Problem Analysis of Sindh Province's Agriculture Sector

Table 9.1.1 Related Challenges to the Central Challenge

Related Challenges		Contents
Low Agricultural Productivity/ Low Quality of Agricultural Products	Shortage of Agriculture Water	・Desert climate ・Low efficiency of irrigation ・Imbalanced water distribution among water courses ・Low-level technology of on-farm water management ・Low-level dissemination of water-saving technology
	Soil Deterioration / Salt Damage	・Excessive use of chemical fertilizers ・Inadequate use of organic fertilizers ・Inadequate use of specific fertilizers (e.g., phosphoric acid) ・Inadequate maintenance of minor canals. Distributaries (salt damage)
	Input Materials (Seed)	・Shortage of certified seeds ・Dissemination of low-quality input materials ・High costs of high-quality input materials ・Inadequate efforts on bulk purchase
	Input Materials (Fertilizer, Patricide, etc.)	・Dissemination of low-quality input materials ・High costs of high-quality input materials ・Inadequate efforts on bulk purchase ・Inadequate use of organic fertilizer and organic repellent
	Low Cultivation Technology	・Lack of budget for extension officers ・Efficiency of extension officers' activities to be improved ・Farmers' inadequate knowledge about cultivation ・Farmers' inadequate knowledge about management ・Inadequate cooperation among farmers
	Low Managerial Mindset	
Limited Sales Channels of Agricultural Products	Unchangeable Distribution System	・Limited sales channels under middlemen's influence
	Inadequate Distribution Infrastructure	・Poor conditions of road infrastructure ・Inadequate warehouses, post-harvest facilities, etc.
	Inadequate Transport Service	・Limited capacity of transport service providers (e.g., trucking companies) ・Inadequate cooperation among farmers
	Inadequate Market Information	・Inadequate and inefficient dissemination of information on prices, etc. ・Inadequate cooperation among farmers

Cross-cutting Challenges

Low Resilience	・Poor access to finance and inadequate public financial services ・Inadequate financial assets in response to contingencies ・Inadequate cultivation technology in response to external shocks ・Inadequate non-agricultural opportunities for income increase	
Gender Gap	Women's Lack of Technology	・Few opportunities for women to participate in training despite their active participation in agricultural activities
	Women's Limited Participation in Agriculture	・Few opportunities for women to participate in decision-making on agriculture despite their active participation in the related agricultural activities ・Societal norms by which women have difficulty in sales
Policy Implementation Capacity and	Inadequate agricultural digitalization and analysis	・Institutional framework (to define scale of framers, to collect and update basic data and information, etc.) to be improved ・Specialist personnel to be nurtured within DOA

Institutional Aspects to be Improved	Capacity of planning and monitoring to be improved	・Inadequate monitoring mechanisms on SAP implementation ・Capacity of Planning and Monitoring Cell (PMC) to be improved
	Limited use of private sector initiative for agriculture development	・Lack of platform where public-private policy dialogues take place

Source: JICA Study Team

9.1.2 Main Challenges and Measures

In the light of the analysis in the preceding sub-section, the key challenges to enhancing small-scale farmers' agricultural profitability include (1) low agricultural productivity and low quality of agricultural produce and (2) limited sales channels of agricultural products. On top of those, there are three following challenges namely, low resilience of the poor populations, gender gap and policy implementation capacity to be improved.

The above-stated challenges and the related measures are as follows;

(1) Low Agricultural Productivity and Low Quality of Agricultural Products

1) Shortage of Agricultural Water

When it comes to Sindh's challenge of water resource management, first of all, the supply-demand balance of water resources is expected to be tightened in the coming years ahead. This is partly because of the shortage of water resources regulated by various related policies, and partly because of the fluctuations in the flow of the Indus River caused by climate change. In the second place, over-irrigation and water shortage occur simultaneously in the province. In other words, low efficiency of irrigation and imbalanced water distribution between up- and down-streams are brought about by water distribution loss due to water loss from water courses, as well as by managerial loss due to poor water management on-farm and in the water courses (for details, please refer to Table 5.7.1).

In order to address the above-stated situations and to contribute to appropriate water resource management across the province, both tangible and intangible approaches are very critical. The former approach is to rehabilitate irrigation facilities. For instance, construction of water course rehabilitation and/or improvement (e.g., lining construction) is needed so that the said water losses may be reduced. Simultaneously, the latter approach is to enhance the capacity of water resource management, to raise the awareness, and to develop the collection system of operation and management fee on the parts of FOs and related governmental agencies (i.e., SIDA and AWBs): that is to say, water distribution planning, operation of water distribution facilities, water distribution monitoring.

2) Soil Deterioration and Salt Damage

Since soil organic constituents are very small in Sindh province, the production volume and quality of agricultural produce have negatively been affected. Although organic fertilizers are also used to some extent in combination with chemical ones, there is room to be improved in the amount and quality of use of organic ones. On top of that, the phosphate constituent of the soil is also insufficient. Soil salinity is also high throughout the province. Especially in irrigated areas, salt-damaged areas have extended from the upper to lower Sindh. Salt damage is caused by the poor conditions and inadequate maintenance of drainage facilities, by over-irrigation, and by the high salinity of groundwater.

Insufficient nutrients (e.g., organic constituents and phosphoric acid) in soil can be improved by

increasing the input of applicable fertilizers and introducing a fallow cycle. In response to salt damage, there is a need to take control of over-irrigation by improving water distribution facilities, improving irrigation technology, and introducing water-saving irrigation.

In view of the high value addition of horticultural crop cultivation, soil improvement by adding organic fertilizer is well worth the expected improvement in its yields and quality, although adding organic one is time-consuming and laborious. On top of those, it is possible to reduce the cost of fertilizers by producing organic fertilizers using local resources (e.g., cattle feces and crop residues). Taking this measure is applicable to small-scale farmers. Therefore, there is a need to disseminate among the farmers the related information not only on the said measure but also on how to address the shortage of phosphoric acid.

It should be noted that developing water distribution facilities is indispensable for the drastic resolution of salt damage, which requires a large amount of cost and a long period, hence medium- to long-term countermeasures should be developed.

3) Challenges Relating to Input Materials (e.g., fertilizers and pesticides)

Regarding input materials, the challenge is that both poor-quality and certified ones are distributed in the market and small-scale farmers have insufficient knowledge about them. On top of that, DOA's capacity development is another challenge; its capacity to monitor their quality is to be improved. The farmers are unwilling to buy good-quality materials because the cost of good-quality ones is higher than that of low-quality ones and because their access to finance is limited. There are few farmers' organiations in the province which carry out bulk purchase of such materials, etc. Few efforts have been made to utilize local resources such as organic fertilizers using cattle feces and organic repellent using native herbs. Although farmers' organizations normally have a central role to play in group purchasing, slow progress has been made on the establishment of farmers' organizations in Sindh's rural societies where the connection is strong within the clan called Biradari, and which consists of small-, medium- and large-scale farmers and share-croppers.

In order to improve the above-mentioned situations, effective measures include holding trainings for farmers and DOA officials, and disseminating related information to farmers through the mass media. In particular, the use of the mass media may be effective to prevent poor-quality input materials from spreading among the farmers. When it comes to the formation of a farmers' association, it is important to take into consideration the homogeneous nature of farmers as well as Biradari-based stringent societal norms (lower Sindh districts have less stringent norms than in upper Sindh ones).

4) Challenges Relating to Input Materials (Seeds)

When it comes to seeds, the related challenge is that most of them are imported for horticultural crops and is also that domestically-made seeds are short due to limited fields for seeds and seedlings. In order to deal with this challenge, the measure to be taken is to nurture producers of seeds and seedlings and to enhance capacity of DOA officials who is in charge of certified seeds.

5) Low-Level Cultivation Technology and Low Managerial Mindset on the Part of Small-Scale Farmers

Agricultural extension activities have been obstructed partly by budgetary constraints and partly by shortage of extension workers. Limited means of transportation and the poor conditions of infrastructure (e.g., roads) in the rural areas are also obstructions to efficient extension activities. Because of these, they have worked on agricultural products with limited information.

Managerial mindset is also low on the part of small-scale farmers partly because of little managerial

knowledge (e.g., simple bookkeeping) and partly because of limited alternatives caused by unchangeable distribution system. It is also said that the farmers do not attempt to collect and analyze necessary information by themselves.

In the light of these situations, DOA established the ICT Extension Center (hereinafter referred to as "ICT Center") and has made efforts on extension activities using ICT. Due to constraints on budget and human resources, however, there are only several district-level branch offices of ICT Center and thus there are not a number of beneficiaries. Although a small-scale farmer's source of information is normally other neighboring farmers, know-how and knowledge about cultivation technology and farm management have not been accumulated systematically among themselves because farmers' organizations are not formed.

It is important to enhance capacity of DOA's extension worders by providing them with refreshment training and to improve the efficiency of extension activities. There is also a need to improve farmers' access to information in collaboration with private companies and NGOs, as well as to nurture the farmers who are able to consider and make a decision by themselves. In order to improve the efficiency of extension activities, it is also vital to utilize ICT by taking into consideration the utilization of tools that reach farmers with low digital literacy and lower-income.

(2) Limited Sales Channels of Agricultural Produce

1) Unchangeable Distribution System

Sindh's distribution system of agricultural products is characterized by wholesale market and middlemen; namely, before the retail market, most of horticultural crops come to the wholesale market and middlemen. Despite poor conditions of infrastructure (e.g., cold chain), the network of middlemen is effective in transporting a large amount of crops swiftly to the market where there are needs.

A number of farmers (especially, small-scale ones) are dependent on middlemen in the distribution system that consists of the established wholesale market and the network of middlemen. Therefore, their degree of freedom is very low when they sell products, and their sales channel is limited to particular middlemen. On top of those, farmers have almost neither option to sell product in the local market nor to provide them for processing factories, because the processing sector is not well-developed and farm-level processing techniques are very low. As for the foreign market, it is very difficult for the farmers to meet destinations' quality requirements and their export potentials are also very low. Since prices are regarded as more crucial than product quality in the domestic market, farmers have very weak incentives to quality improvement.

In order to address the said challenges, farmers are required to collect the related information and to develop new sales channels by themselves by analyzing it. Likewise, there is a need for them to carry out a market survey so that they may learn price fluctuation of major horticultural crops, which crops to be in demand in the market and price differences according to varieties and quality levels. It is recommended that, by enhancing their financial capability,[1] farmers should mitigate their financial reliance on middlemen, develop new sales channels and strengthen bargaining power of price. Considering farmers' excessive reliance on middlemen, another possible measure should be considered to increase incentives to enhancing product quality in effective collaboration with middlemen.

[1] Financial capabilities are a step forward from "financial literacy" to acquire "knowledge" about finance, and to acquire the ability to practice financial-related actions. It consists of the four following components: daily asset management, business and household planning, proper selection of financial products, and understanding about financial knowledge.

2) Inadequate Distribution Infrastructure and Limited Means of Transport

In recent years, the road network has gradually been developed in the province. In particular, steady progress has been made on the development of national arterial roads. However, most rural roads are problematic: namely, unpaved roads and underdeveloped drains due to inadequate regulation and implementation, overloading, inadequate repairs, and budget shortages. Particularly, most roads in rural areas are unpaved and are left unmaintained. Poor conditions of rural roads have been a major obstacle to farmers' market access and, consequently, they have no option but to rely on middlemen who go around the villages to collect agricultural products by truck. Even when farmers rent motor vehicles to transport the products, many efforts have not been made on joint transportation because of the delay in the formation of farmers' organizations in the province. Facilities are also very limited (e.g., post-harvest treatment facilities and warehouses for storing crops for a certain period). Cold chains such as cold storage warehouses are almost underdeveloped due to frequent blackout. Physical infrastructure (e.g., road) should be developed from the medium- and long-term point of view.

In the meantime, one of alternative possible measures is to reduce costs by forming farers' organizations, by developing post-harvest treatment facilities and warehouses and by conducting joint transportation. Since there are not many successful cases of farmers' association formation in Sindh, it is crucial to enhance farmers' capacity of information collection and their financial capabilities.

3) Inadequate Market Information

The information on the wholesale price is compiled by the Market Committee (MC) and is made to publicize itself in DOA's official website. However, since the access to this kind of information is limited for small-scale farmers, in general, small-scale farmers have no option but to sell their products at the price offered by middlemen. According to the result of interviews with small-scale farmers, few of them knew the market where their products would be sold finally. Likewise, few of them knew the information about varieties, quality and prices to be in high demands in the market. It is critical to enhance the capacity to collect the information on the market so that farm management may be conducted in accordance with market needs.

Meanwhile, the development of the information system seems to have been under way,[2] the aim of which is to collect and make public the information on wholesale prices on a real-time basis. In order to appropriately operate this kind of system, it is important to improve farmers' digital literacy as well as to develop DOA's capacity of information analysis. On top of those, since farmers' access to the information is poor, there is a need to raise their awareness and to enrich their knowledge about the market through carrying out a market survey simultaneously.

(3) Cross-Cutting Challenge: Low Resilience

The study team identified one of the key causes of poor livelihood of the small-scale farmers as low resilience to the external shocks including natural disasters of draughts and floods, crop disease, crop loss from insects, rainy seasons shifted by climate change, fluctuate market price of crops, illness, injuries, and others. Arrival of COVID-19 made matters worse in Sindh province, where natural disasters such as droughts and floods occur frequently. Through the SAP project, the World Bank takes on securing resilience by the development of irrigation infrastructure in the Indus River basin.

[2] According to the result of the October 2021 interview with the personnel of DOA's DG Agriculture Extension who is in charge of marketing, the information system would be completed in the coming months, although the details of the present situation are unknown.

Small-scale farmers in Sindh have extremely limited access to formal financial services, so once they are hit by an external shock, they would resort to measures such as cutting their savings, selling their assets, and borrowing money from their relatives, either of which would take a long time to recover. Hence, improving access to financial services is sheer importance for small-scale farmers to protect their livelihoods from all external shocks such as natural disasters, crop price fluctuations, illnesses and injuries, and to improve resilience. In addition, the reasons why financial services are not widespread, especially among small-scale farmers in Sindh, include that they have a scarcity of comprehensive ability to use finance, known as financial capabilities and that the financial products responding to the demands of small-scale farmers have not been fully developed yet. Currently, the government of Pakistan is taking on the introduction of financial products such as yield index insurance and electronic warehouse receipts to improve the resilience of farmers under the National Financial Inclusion Strategy (NFIS). Accelerating these efforts is a pressing needs.

Low resilience of small-scale farmers relates to the causes for low agricultural productivity and low produce quality, and limited sales channels in cross sectional way. When it comes to improvement of cultivating techniques and inputs, measures to enhance resilience should be taken into considerations, for example, improving access to the technologies or inputs responding to a climate change, introduction of ICT to prevent crop loss from natural disasters, and using apps to support saving water in on-farm irrigation. It is also necessary to consider how to deal with an increasing volatility of the Indus River flows due to the climate change.

Lastly, diversity of the income sources is an integral part of enhancing resilience of small-scale farmers and it should be taken into consideration toward improvement of the business mind of small-scale farmers.

(4) Cross-Cutting Challenge: Gender Gap

One of the important challenges is women's inadequate technical skills and their limited involvement in agriculture. In practice, even though they are engaged in farm work, it is difficult for them to obtain an opportunity to participate in training to improve their knowledge and skills. They also face other challenges such as difficulty in participating in agricultural decision-making and in sales of agricultural products due to the societal norms. There is a need to tackle the above-mentioned challenges from the perspective of gender gap.

(5) Cross-Cutting Challenge: Capacity of Appropriate Policy Implementation to Be Improved

The Planning and Monitoring Cell (PMC) is in charge of project planning and monitoring within DOA. The challenge relating to PMC is improvement of its capacity of planning and monitoring of agricultural project. Specifically, PMC should review the monitoring and information sharing mechanisms / the flow (including the positioning of PMC) of each directorate general and the entire DOA, and should consider measures about how to improve them. There is a need for the Cell to proceed with efforts toward developing a PDCA cycle. At the same time, it is necessary to review the staff training curriculum of the DOA, as well as to consider measures to improve the capacity of staff to conduct cycle of plan, do check and action (PDCA), such as monitoring methods.

9.1.3 Potentials of Sindh's Agriculture

On top of the above-stated challenges, Sindh Province has a broad range of potentials below. In the next section, approaches using them are proposed to addressing the challenges.

Table 9.1.2 Potentials of Sindh's Agricultural Sector

Level of Nature, Environment and Geography	Climate suitable for cultivation of horticultural crops and fertile soil along the Indus River in the Lower Sindh
	Vast areas of irrigation
	Geographically advantageous location with a port facing the Arabian Sea
	Good access to the huge consumption market (i.e., Karachi and Hyderabad districts)
	Large population of the youth
Level of Provincial Government	Agricultural extension workers stationed in each district and holding of trainings on a regular basis
	Governmental initiatives in introducing ICT and other advanced technologies (DOA's ICT Center)
	Rich experiences in rehabilitation works of water courses
Level of Area and Private Sector	Several FOs having basic knowledge and experiences in water distribution and drainage canal rehabilitation
	Several NGOs having wealth of experiences in agricultural extension, business support and social development
	Several MFPs providing assistance for small-scale farmers
	Active ICT start-ups and several Agri-tech businesses specializing in market linkages, agricultural technologies, harvest / weather forecast, water-saving technology and management, etc.
	Prompt advancement of E-commerce

Source: JICA Study Team

9.2 Approaches to Addressing the Key Challenges

In this section, the JICA Study Team prioritizes the key challenges to be tackled and considered effective approaches to address them.

The World Bank, other donors and NGOs have tackled Sindh's agricultural sector for more than a decade. JICA likewise has worked on livestock development to improve its small-scale farmers' livelihood in Sindh province and on agricultural extension workers' capacity development in Balochistan province. When the details of contents of cooperation are considered, there is a need to take account of the achievements and lessons learned of other donors and NGOs, as well as JICA's past experiences. The eight following approaches are overviewed in the Table 9.2.1 and the contents of each approach is shown in the Tables 9.2.2 to 9.2.9.

When those potential projects are implemented, it is critical to conduct monitoring for each project's status of implementation and achievement and to reflect them in the following year's planning. When it comes to using the following approaches to the key challenges, there is also a need to take into consideration the said cross-cutting challenges such as gender gap and DOA-PMC's capacity development.

Table 9.2.1 Key Challenges and Approaches

Key Challenges	Contents
1) Low Efficiency of Irrigation	● To improve the efficiency of irrigation
2) Dissemination of low-quality input materials	● To improve small-scale farmers' cultivation technology through capacity development of DOA's extension workers
3) Low Cultivation Technology	● To enrich small-scale farmers' knowledge about input materials through capacity development of DOA's extension workers
4) Inadequate and inefficient dissemination of information on prices, etc.	● To develop price information system ● To improve small-scale farmers' access to the related information
5) Imbalanced water distribution among water courses	● To develop capacity of irrigation management of parties interested
6) Poor access to finance and inadequate public financial services	● To improve small-scale farmers' access to finance
7) Inadequate use of organic fertilizers	● To facilitate small-scale farmers' use of organic fertilizers through capacity development of DOA's extension workers
8) Inadequate cooperation among farmers	● To help to form farmers' organizations so that they may enjoy various advantages of the formation

Source: JICA Study Team

Table 9.2.2 Approach to the Improvement of Irrigation Efficiency

Item	Content
Key Challenge	● Since the irrigation ratio out of total agricultural land is only about 30% in Sindh province, the supply-demand situations of water resources are very tight. On top of that, the shortage of agricultural water has come to the surface due partly to deterioration of existing water courses as well as partly to low efficiency of on-farm methods of irrigation. ● It is necessary for JICA to develop DOA's capacity of irrigation planning (e.g., selection of target water courses) in order to formulate plans of water course rehabilitation in JICA's target areas that are not targeted by the World Bank. There is also a need to involve local residents in the planning stage of the project, so that their opinions and requests may be reflected in the plan.
Achievement	■ World Bank ● WSIP (completed): improvement and rehabilitation construction of main to minor canals ● SWAT (planning stage): Under formulation in the light of lessons learned from WSIP
Possible Approach	● To formulate the plans of the improvement and rehabilitation construction of distributaries/ minor canals in collaboration with local residents

Source: JICA Study Team

Table 9.2.3 Approach to the Enhancement of Knowledge about Input Materials

Item	Content
Key Challenge	● The current input market consists of uncertified low-quality and officially-certified materials. ● Since farmers have little knowledge about input materials, farmers tend to purchase uncertified low-quality ones. As a result, the quality and production volume of agricultural produce has been negatively affected. ● DOA is in the position to monitor the input material market to exclude uncertified low-quality materials. DOA's capacity of monitoring is to be enhanced.
Achievement	■ CABI and Australian agencies ● SVVCP's activities include enhancing small-scale farmers' knowledge about input materials
Possible Approach	● To strengthen DOA's capacity of monitoring through trainings, to diversify the means of

Item	Content
	information dissemination and to improve the contents of the information

Source: JICA Study Team

Table 9.2.4 Approach to Improvement of Cultivation Techniques

Item	Content
Key Challenge	● Inadequate provision of extension services due to understaffing of extension workers, to shortage of budget and to poor conditions of rural infrastructure ● Reliance on limited information sources (i.e., neighboring farmers) due to slow progress in the formation of farmers' groups
Achievement	■ DOA (1,675 extension workers as of January 2022) ● To provide face-to-face technical guidance, field demonstration and transfer of knowledge by using ICT and through the mass media ● To establish the ICT Center to make extension service more efficient, etc. ■ World Bank ● Guidance as to improving horticultural techniques in SIAPEP, SAGP, etc.
Possible Approach	● To strengthen extension workers' capacity through a series of training, to improve methods for dissemination of information on farm management through public-private cooperation, and to facilitate extension service among farmers

Source: JICA Study Team

Table 9.2.5 Approach to Improvement of Access to Market Information

Item	Content
Key Challenge	● Small-scale farmers' poor access to the information on wholesale prices provided by DOA
Achievement	■ DOA ● To strengthen information dissemination system through the development of AMIS (planning stage) ■ SVVCP[3], GRASP[4] ● To share price information as part of guidance for farmers
Possible Approach	● To improve small-scale farmers' digital literacy ● To enhance their capacity of information collection

Source: JICA Study Team

Table 9.2.6 Approach to Balancing Water Distribution among Water Courses

Item	**Content**
Key Challenge	● Related agencies' decision-making mechanisms (e.g., SIDA , AWB and FOs) about water distribution planning and monitoring system to be improved ● Over-irrigation and water shortages caused by imbalances of water distribution between up- and down-streams of irrigation system
Achievement	■ World Bank ● WSIP (completed): Improvement of related agencies' capacity (e.g., SIDA, AWB, FOs and WCA) of management of agricultural water and of maintenance of irrigation facilities ● SWAT (planning stage): Under formulation in the light of lessons learned from WSIP
Possible Approach	● To strengthen related agencies' capacity of water distribution planning and monitoring

Source: JICA Study Team

[3] For details of SVVCP, please refer to 8.3.4 of Chapter 8.
[4] For details of GRASP, please refer to 8.3.3 of Chapter 8.

Table 9.2.7 Approach to Improvement of Access to Finance

Item	Content
Key Challenge	● Fragility to the external shocks including natural disasters, fluctuate crop price, illness, injuries, and others due to inadequate financial service. ● Financial products other than crop loans such as value chain finance and agricultural insurance are underdeveloped.
Achievement	■ Federal Government ● Coordination between the provincial government of Sindh, SBP, and financial institutions in the frame of NFIS ■ World Bank ● Assist in implementing NFIS by development of digital financial infrastructure, access points of digital money transactions, improvement of financial access of MSMEs, etc. ■ ADB ● Assist in financial inclusion of private sector including small-scale farmers through financing MFBs ■ GRASP ● Assist rural SMEs mainly comprising farmers and agri-businesses in securing sustainability and obtaining techniques in association with financial institutions.
Possible Approach	To enhance the financial capability of small-scale farmers, development of financial products including value chain finance and agricultural insurance, promotion of agricultural finance, and institutionalize promotion system within DG Agriculture Extension of DOA.

Source: JICA Study Team

Table 9.2.8 Approach to Facilitation of Use of Organic Fertilizers

Item	Content
Key Challenge	● Low organic constituents in Sindh's soil and inadequate use of organic fertilizers (34% of small-scale farmers use only chemical fertilizers, 58 % use mixture of chemical and organic ones, 6% only organic ones and 2% no fertilizers)
Achievement	● n/a
Possible Approach	● To facilitate small-scale horticultural farmers' use of organic fertilizers through capacity development of DOA's extension workers

Source: JICA Study Team

Table 9.2.9 Approach to the Formation of Farmers' Association

Item	Content
Key Challenge	● Slow progress has been made on the formation of farmers' groups due to strong ties within clan called Biradari and to mixed composition of small-, medium- and large-scale farmers and sharecroppers
Achievement	■ DOA ● n/a ■ NGO (1) ● 1,700 groups organized by SAFWCO ■ NGO (2) ● Farmers' groups organized by NRSP at the three-levels: namely, Community Organization, Village Organization and Local Support Organization
Possible Approach	● To facilitate the formation of farmers' groups through extension workers' activities in cooperation with NRSP

Source: JICA Study Team

9.2.1 Potential Partners for Implementation

The list below indicates potential partners for DOA and SID in order to implement the abovementioned approaches.

Table 9.2.10 List of Potential Partners for Implementation

Category	Name	Advantage	Expected Roll
Financial Institution	Kunshhali MFB	• Rich line-up of loan products for small-scale farmers • Large outreach to small-scale farmers	• Awareness-raising activities to improve financial literacy • Develop capabilities to improve livelihoods such as accounting training and business plans • Promote agricultural financial products in association with agro-tech firms
	First MFB	• Posses financial products for small-scale farmers • Posses financial products for female group • Experience in corporation with JICA, share held by JICA	
	Mobilink MFB	• Branchless banking by mobile money • Large outreach to small-scale farmers	
	NRSP MFB	• Rich line-up of loan products for small-scale farmers • Large outreach to small-scale farmers • Coordination with livelihood assistance programs of NGOs	
NGO	NRSP	• Abundant achievements in the agricultural field including horticultural crops • Extensive experience in community mobilization • Experience in small-scale infrastructure development (construction of terminal canals, lining, drinking water development) • livelihood assistance programs in assistance with the financial department	• Livelihood improvement support through a graduation approach to the poorest farmers • Organize residence • Knowledge sharing and collaboration in small-scale irrigation infrastructure development
	SAFWCO	• Project experience in the agricultural field across Sindh Province (including Karachi and Hyderabad) • Experience in organizing farmers from different Baradari in middle and Southern Sindh • livelihood assistance programs in assistance with the financial department	• Livelihood improvement support through a graduation approach to the poorest farmers • Organize residence • Strengthening capabilities to improve livelihoods such as accounting training and business plans
Agro-tech	PEEPU	• Market linkage app tailored for small-scale farmers • Sells quality inputs for reasonable prices • Sales channels of mango for exports	• Providing linkage (market information / sales opportunities) with the crop market of small-scale farmers • Providing options for input goods and purchasing opportunities
	Industrus	• Radio agricultural extension program for small-scale farmers without internet access • Efforts to develop a customer database (farmer directory) for small-scale farmers • Product development for interest-free loans	• Providing advice that suits the actual situation of individual farmers by sharing the farm directory. • Dissemination of agriculture to farmers in areas with poor communication conditions • Improving farmers' credit by supplying working capital
	SAWiE	• Combine the crop health monitoring service using satellite image and agricultural advisory services • Crop yield forecasts and weather forecasts using AI	• Providing detailed agricultural advice according to the environment of individual farmers • Weather alert service

Source: JICA Study Team

Appendices

JICA Study Team Member List

Name	Responsibility
Hiromichi Hara (Mr.)	Team Leader/ Agricultural Development Planning
Kenichi MACHIDA (Mr.)	Farm Management / Food value Chain 1
Yoshiko HONDA (Ms.)	Farm Management / Food value Chain 2
Takuya IGAWA (Mr.)	Water Use / Irrigation Planning
Kenta OHNO (Mr.)	Agricultural Finance / ICT
Rie TSUCHIYA (Ms.)	Agricultural Finance / ICT

Data Collection Survey on the Agricultural Sector in Sindh Province in the Islamic Republic of Pakistan

Itenerary of Field Acticities

		Hiromichi Hara (Mr.)		Kenichi MACHIDA (Mr.)		Yoshiko HONDA (Ms.)		Takuya IGAWA (Mr.)		Kenta OHNO (Mr.)	
Company E-mail address		ALMEC CORPORATION hara.hiromichi@almec.co.jp		KMC machida.kenichi@kmcinc.co.jp		KMC honda.yoshiko@kmcinc.co.jp		Nippon Koei a3014@n-koei.co.jp		ALMEC CORPORATION kenta.ohno@almec.co.jp	
Date	Day	activities	stay	activities	stay	activities	stay	activities	stay	activities	stay
7-Oct-21	Thu					EK 319 NRT 22:30 - DBX 4:50					
8-Oct-21	Fri					EK 330 DBX7:30 - KHI10:40	KHI4				
9-Oct-21	Sat	EK 319 NRT 22:30 - DBX 4:50		EK 319 NRT 22:30 - DBX 4:50							
10-Oct-21	Sun	EK 600 DBX7:50 - KHI10:55	KHI4	EK 600 DBX7:50 - KHI10:55	KHI4						
11-Oct-21	Mon	Working in Karachi	KHI4	Working in Karachi	KHI4						
12-Oct-21	Tue	Working in Karachi	KHI4	Working in Karachi	KHI4						
13-Oct-21	Wed	Working in Karachi	KHI4	Working in Karachi	KHI4						
14-Oct-21	Thu	Working in Karachi	KHI4	Working in Karachi	KHI4						
15-Oct-21	Fri	Working in Karachi	KHI4	Working in Karachi	KHI4						
16-Oct-21	Sat	Staying at Hotel	KHI4	Staying at Hotel	KHI4						
17-Oct-21	Sun	Staying at Hotel	KHI4	Staying at Hotel	KHI4						
18-Oct-21	Mon	Working in Karachi	KHI4	Working in Karachi	KHI4						
19-Oct-21	Tue	Working in Karachi	KHI4	Working in Karachi	KHI4						
20-Oct-21	Wed	Working in Karachi	KHI4	Working in Karachi	KHI4						
21-Oct-21	Thu	Working in Karachi	KHI4	Working in Karachi	KHI4						
22-Oct-21	Fri	Working in Karachi	KHI4	Working in Karachi	KHI4						
23-Oct-21	Sat	Staying at Hotel	KHI4	Working in Karachi	KHI4					EK319 NRT22:30-DXB04:50	
24-Oct-21	Sun	KHI-HYD by car	HYD	KHI-HYD by car	HYD					EK927 DXB08:15-CAI10:05	
25-Oct-21	Mon	Working in Hyderabad	HYD	Working in Hyderabad	HYD						
26-Oct-21	Tue	Working in Hyderabad	HYD	Working in Hyderabad	HYD					PCR Test	
27-Oct-21	Wed	Working in Hyderabad	HYD	Working in Hyderabad	HYD						
28-Oct-21	Thu	Working in Hyderabad HYD-KHI by car	HYD	Working in Hyderabad HYD-KHI by car	KHI4					EK927 CAI19:05-DXB00:40	
29-Oct-21	Fri	Working in Karachi	KHI4	Working in Karachi	KHI4					EK600 DXB07:50-KHI10:55	KHI4
30-Oct-21	Sat	Staying at Hotel	KHI4	Working in Karachi, PCR Test	KHI4					Staying at Hotel	KHI4
31-Oct-21	Sun	Staying at Hotel	KHI4	EK603 KHI 22:30- DBX 23:59		Working in Karachi	KHI4			Staying at Hotel	KHI4
1-Nov-21	Mon	Working in Karachi	KHI4	EK318 DBX 02:55 - NRT 17:20		Working in Karachi	KHI4			Working in Karachi	KHI4
2-Nov-21	Tue	Working in Karachi	KHI4			Working in Karachi	KHI4			Working in Karachi	KHI4

		Hiromichi Hara (Mr.)		Kenichi MACHIDA (Mr.)		Yoshiko HONDA (Ms.)		Takuya IGAWA (Mr.)		Kenta OHNO (Mr.)	
Company E-mail address		ALMEC CORPORATION hara.hiromichi@almec.co.jp		KMC machida.kenichi@kmcinc.co.jp		KMC honda.yoshiko@kmcinc.co.jp		Nippon Koei a3014@n-koei.co.jp		ALMEC CORPORATION kenta.ohno@almec.co.jp	
Date	Day	activities	stay	activities	stay	activities	stay	activities	stay	activities	stay
3-Nov-21	Wed	Working in Karachi	KHI4			Working in Karachi	KHI4	EK 319 NRT 22:30 - DBX 4:50		Working in Karachi	KHI4
4-Nov-21	Thu	Working in Karachi	KHI4			Working in Karachi	KHI4	EK 600 DBX7:50 - KHI10:55	KHI4	Working in Karachi	KHI4
5-Nov-21	Fri	Working in Karachi	KHI4			Working in Karachi	KHI4	Working in Karachi	KHI4	Working in Karachi	KHI4
6-Nov-21	Sat	Staying at Hotel	KHI4			Working in Karachi	KHI4	Staying at Hotel	KHI4	Staying at Hotel	KHI4
7-Nov-21	Sun	Staying at Hotel	KHI4			PK536 KHI 20:45-SKZ 21:50	SKZ2	Staying at Hotel	KHI4	Staying in Hotel	~~SKZ2~~ KHI4
8-Nov-21	Mon	Working in Karachi	KHI4			Working at SRSO	SKZ2	Working in Karachi	KHI4	Working in Karachi	KHI4
9-Nov-21	Tue	Working in Karachi	KHI4			Working at SRSO	SKZ2	Working in Karachi	KHI4	Working in Karachi	KHI4
10-Nov-21	Wed	Working in Karachi	KHI4			Working at SRSO	SKZ2	Working in Karachi	KHI4	Working in Karachi	KHI4
11-Nov-21	Thu	Working in Karachi	KHI4			Working at SRSO	SKZ2	Working in Karachi	KHI4	Working in Karachi	KHI4
12-Nov-21	Fri	Working in Karachi	KHI4			SKZ-KHI PK537 SKZ 14:35-KHI 15:40	KHI4	Working in Karachi	KHI4	Working in Karachi	KHI4
13-Nov-21	Sat	Staying at Hotel	KHI4			Staying at Hotel	KHI4	Staying at Hotel	KHI4	Staying at Hotel	KHI4
14-Nov-21	Sun	KHI-Islamabad PKPK368 KHI1315-ISB1510	ISB1			Working in Karachi	KHI4	KHI-HYD by car	HYD	KHI-Islamabad PK368 KHI1315-ISB1510	ISB1
15-Nov-21	Mon	Working in Islamabad	ISB1			Working in hotel in Karachi	KHI4	9:00 SIDA in Hyderabad	HYD	Working in Islamabad	ISB1
16-Nov-21	Tue	Working in Islamabad	ISB1			Working in hotel in Karachi	KHI4	9:00 AWB and SIDA in Hyderabad	HYD	Working in Islamabad	ISB1
17-Nov-21	Wed	Islamabad-KHI PK309 ISB1900-2055	KHI4			Working in hotel in Karachi	KHI4	9:00 AWB and SIDA in Hyderabad	HYD	Working in Islamabad	ISB1
18-Nov-21	Thu	Working in Karachi	KHI4			Working in hotel in Karachi	KHI4	9:00 Chief Engineer's Office and SIDA in Hyderabad	HYD	Working in Islamabad	ISB1
19-Nov-21	Fri	15:00 Planning and Monitoring Cell (PMC) Bureau of Supply and Prices, DOA	KHI4			Working in hotel in Karachi	KHI4	9:00 Kotri Barrage Operation Office and SIDA in Hyderabad	HYD	Islamabad-KHI PK309 ISB1900-2055	KHI4
20-Nov-21	Sat	Staying at Hotel, PCR Test	KHI4			Working in hotel in Karachi	KHI4	Staying at Hotel	HYD	Staying at Hotel	KHI4
21-Nov-21	Sun	EK603 KHI 22:30- DBX 23:59				KHI-HYD by car	HYD	Staying at Hotel	HYD	KHI-HYD by car	HYD

		Hiromichi Hara (Mr.)		Kenichi MACHIDA (Mr.)		Yoshiko HONDA (Ms.)		Takuya IGAWA (Mr.)		Kenta OHNO (Mr.)	
Company E-mail address		ALMEC CORPORATION hara.hiromichi@almec.co.jp		KMC machida.kenichi@kmcinc.co.jp		KMC honda.yoshiko@kmcinc.co.jp		Nippon Koei a3014@n-koei.co.jp		ALMEC CORPORATION kenta.ohno@almec.co.jp	
Date	Day	activities	stay	activities	stay	activities	stay	activities	stay	activities	stay
22-Nov-21	Mon	EK318 DBX 02:55 - NRT 17:20				9:00 Sindh Irrigated Agriculture Productivity Enhancement Project(SIAPEP) Project Office 13:00 DOA Water Management	HYD	9:00 Sindh Irrigated Agriculture Productivity Enhancement Project(SIAPEP) Project Office 13:00 DOA Water Management	HYD	9:00 Sindh Irrigated Agriculture Productivity Enhancement Project(SIAPEP) Project Office 13:00 DOA Water Management	HYD
23-Nov-21	Tue					10:00 SAFCO Support Foundation 14:00 Khushhali Bank	HYD	9:00 AWB and SIDA in Hyderabad	HYD	10:00 SAFCO Support Foundation 14:00 Khushali Bank	HYD
24-Nov-21	Wed					9:00 DOA Extension MirpurKhas 13:00 DOA Extension Tando Allayah	HYD	9:00 AWB and SIDA in Hyderabad	HYD	9:00 DOA Extension MirpurKhas 13:00 DOA Extension Tando Allayah	HYD
25-Nov-21	Thu					10:00 DG Agriculture Engineering	HYD	10:00 DG Agriculture Engineering 11:30 SIDA IT Section	HYD	10:00 DG Agriculture Engineering 11:30 SIDA IT Section	HYD
26-Nov-21	Fri					10:00 DOA Extension TM Khan Market Committee TM Khan	HYD	9:00 AWB and SIDA in Hyderabad	HYD	10:00 DOA Extension TM Khan Market Committee TM Khan	HYD
27-Nov-21	Sat					Staying at Hotel	HYD	Staying at Hotel	HYD	Staying at Hotel	HYD
28-Nov-21	Sun					Staying at Hotel	HYD	Staying at Hotel	HYD	Staying at Hotel	HYD
29-Nov-21	Mon					10:00 SPO 12:00 Qasim Solangi (Husri)	HYD	10:30: Discussion with Farmers' Leader and Field survey for canal Village: Kalro Vighamal Union Council: Naango Shah Taluka: Tando Muhammad Khan	HYD	10:00 SPO 12:00 Qasim Solangi (Husri)	HYD
30-Nov-21	Tue					10:00 Sindh Agriculture University TandoJam	HYD	11:00: Discussion with Farmers' Leader and Field survey for canal Village: Memo Taluka: Tando Bago	HYD	Working in Hotel in Hyderabad	HYD
1-Dec-21	Wed					11:00 : SIAPEP site Farooque (near village Buxo Laghari) Taluka: Hyderabad, District: Badin	HYD	11:00 : SIAPEP site Farooque (near village Buxo Laghari) Taluka: Hyderabad, District: Badin	HYD	11:00 : SIAPEP site Farooque (near village Buxo Laghari) Taluka: Hyderabad, District: Badin	HYD
2-Dec-21	Thu					Working in Hotel in Hyderabad	HYD	Working in Hyderabad	HYD	Working in Hotel in Hyderabad	HYD

		Hiromichi Hara (Mr.)		Kenichi MACHIDA (Mr.)		Yoshiko HONDA (Ms.)		Takuya IGAWA (Mr.)		Kenta OHNO (Mr.)	
Company E-mail address		ALMEC CORPORATION hara.hiromichi@almec.co.jp		KMC machida.kenichi@kmcinc.co.jp		KMC honda.yoshiko@kmcinc.co.jp		Nippon Koei a3014@n-koei.co.jp		ALMEC CORPORATION kenta.ohno@almec.co.jp	
Date	Day	activities	stay	activities	stay	activities	stay	activities	stay	activities	stay
3-Dec-21	Fri					09:00 SAFCO Support Foundation	HYD	9:00 SIDA in Hyderabad	HYD	09:00 SAFCO Support Foundation	HYD
4-Dec-21	Sat					HYD-KHI by car	KHI4	HYD-KHI by car	KHI4	Staying at Hotel	HYD
5-Dec-21	Sun					Visit EarthGold farm Makli Thatta	KHI4	Staying at Hotel	KHI4	Staying at Hotel	HYD
6-Dec-21	Mon					Working in Karachi	KHI4	9:00 Sindh Barrage Improvement Project in Karachi	KHI4	Working in Hyderabad	HYD
7-Dec-21	Tue					Working in Karachi	KHI4	9:00 Right Bank Outfall Drainage (RBOD) Project office in Karachi	KHI4	Working in Hyderabad	HYD
8-Dec-21	Wed					Working in Karachi	KHI4	Working in Karachi	KHI4	Working in Hyderabad	HYD
9-Dec-21	Thu					Working in Karachi, PCR Test	KHI4	Working in Karachi	KHI4	13:00 DG Agriculture ICT Extension Center	HYD
10-Dec-21	Fri					EK603 KHI 22:30- DBX 23:59	KHI4	Working in Karachi	KHI4	Working in Hyderabad	HYD
11-Dec-21	Sat					EK318 DBX 02:55 - NRT 17:20	KHI4	Working in Karachi	KHI4	HYD-KHI by car	HYD
12-Dec-21	Sun							Working in Karachi	KHI4	Staying at Hotel	KHI4
13-Dec-21	Mon							Working in Karachi	KHI4	Working in Karachi	KHI4
14-Dec-21	Tue							Working in Karachi	KHI4	10:00 Habib Bank Limited (HBL)	KHI4
15-Dec-21	Wed							Working in Karachi, PCR Test	KHI4	Working in Karachi	KHI4
16-Dec-21	Thu							EK603 KHI 22:30- DBX 23:59		Working in Karachi	KHI4
17-Dec-21	Fri							EK318 DBX 02:55 - NRT 17:20		Working in Karachi	KHI4
18-Dec-21	Sat									Staying at Hotel	KHI4
19-Dec-21	Sun									Staying at Hotel	KHI4
20-Dec-21	Mon									10:00 PEEPU, NED University of Engineering and Technology - National Incubation Center	KHI4
21-Dec-21	Tue									Working in Karachi	KHI4
22-Dec-21	Wed									Working in Karachi	KHI4
23-Dec-21	Thu									Working in Karachi	KHI4
24-Dec-21	Fri									Working in Karachi	KHI4
25-Dec-21	Sat									Staying at Hotel, PCR Test	KHI4
26-Dec-21	Sun									EK603 KHI2230-DBX2359	KHI4

		Hiromichi Hara (Mr.)		Kenichi MACHIDA (Mr.)		Yoshiko HONDA (Ms.)		Takuya IGAWA (Mr.)		Kenta OHNO (Mr.)	
Company E-mail address		ALMEC CORPORATION hara.hiromichi@almec.co.jp		KMC machida.kenichi@kmcinc.co.jp		KMC honda.yoshiko@kmcinc.co.jp		Nippon Koei a3014@n-koei.co.jp		ALMEC CORPORATION kenta.ohno@almec.co.jp	
Date	Day	activities	stay	activities	stay	activities	stay	activities	stay	activities	stay
27-Dec-21	Mon									EK318 DXB0255-NRT1720	
28-Dec-21	Tue										
29-Dec-21	Wed										

…. Assingnment in the other projects

Organization	Leading Participant *
Government of Sindh	
Department of Agriculture (DOA)	Mr. Pervez Ahmed, Secretary
Agriculture Research, Office of DG Extension, Hyderabad	Dr. Ghulam Mustafa, Director
Additonal Director (Agri. Extension) for Karachi District Office	Mr. Sartas Ahmed Tariq, Additional Director
DOA Extension Mirpurkhas	Mr. Chetan Mal, Director Extension Mirpurkhas Division
DOA Extension Tando Allayah	Mr. Saleem Suhag, Additional Director
DOA Extension Tando M Muhammad Khan	Dr. Sohail Taldur, Deputy Director
Engineering, Office of DG Extension, Hyderabad	Director
ICT Center, Office of DG Extension, Hyderabad	Mr. Gola Mustafa, Director, Director
Marketing, Office of DG Extension, Hyderabad	Mr. Mansour Ahmed Baloch, Director
On-Farm Water Management, Office of the Directorate General, Hyderabad	Mr. Shaneel Memon, Deputy Director
Department of Irrigation	Mr. Sohail Ahmed Qureshi, Secretary
Kotri Barrage Operation Office	Chief Engineer
Other Governmental Body	
SIDA	Managing Director
SIDA Institutional Development Team	General Manager, Deputy General Manager (Transition)
Left Bank Area Water Board (AWB)	Chairman
Information Science & Technology Department (ISTD)	Mr. Muhammad Yousuf, Director General
National Incubation Center (NIC) Karachi	Mr. Syed Azfar Hussain, Additional Joint Director, International Relations
National Institute of Banking & Finance (NIBAF)	Mr. Sardar Shah

Pakistan Agricultural Research Council (PARC)	Dr. Gulam Muhammad Ali Chiarman
Punjab Information Technology Board (PITB)	Faizan Khalid Siddiqui, Senior Programme Manager
Security Exchange Commission of Pakistan (SECP)	Mr. Muhammad Assad, Additional Joint Director
Small and Medium Enterprises Development Authority (SMEDA)	Mr. Mukesh Kumar, Provincial Chief-Sindh
State Bank of Pakistan (SBP)	Mr. Noor Ahmed, Director, Agricultural Credit & Microfinance Department (AC & MFD)
Private Company and Organization	
Better Grain	Mr. Zafar Iqbal Bhatti
Earth Gold	Mr. Basant Kumar, Managing Director
Industrus	Mr.Saad Khan, CEO
Karachi Farmers Market Shop	Ms. Sara Nasir
Local Market in Karachi	-
Market Committee Tando Muhammad Khan	Mr. Sayeed Hussain, Chairman
PEEPU	Mr. Anas Shaikh, Founder
Popular Juice	Dr. Mohammad Naeemullah Naeem, Food Technologist
Sabzi Mandi Hyderabad	Mr. Abdul Haq Mansour, Secretary
Sabzi Mandi Super Highway Market Committee Office	-
Sabzi Mandi Tando Allayar	Manzoor Ahmed Barochi, Director
SAWiE	Dr. Khalid Mahmood, Founder
NGO	
NRSP	Mr. Ghulam Mustafa Haider Jamro, General Manager, Regional Office Hyderabad
SAFWCO	Mr. Suleman G. Abro, CEO, Mr. Zeeshan Memon

SPO	Mr. Amjad Baloch, Regional Coordinator
SRSO	Dr. Ghulam Rasool Samejo, Regional Manager
Women Agriculture Development Office	Ms. Zahida Parveen, Chairperson
Financial Institution	
ASA Pakistan	Mr. Malik Tasawar Hussain, Deputy CEO
FINCA	Mr. Ijaz Khan, CEO
First Microfinance Bank	Mr. Sarfraz Ahmad, Product & Research Dept.
HBL	Mr. Tahir Habib, Product Manager, Rural Banking
Karandaaz	Mr. Asif Chugtae, Value Chain Expert
Kunshaali Microfinance Bank (KBL), Hyderabad	Ali Basharat, Head of Operations
Pakistan Microfinance Network (PMN)	Mr. Ali Basharat, Head of Operations
Pakistan Microfinance Investment Company (PMIC)	Mr. Saqib Siqqiqui, Head Sector Development
Development Partner	
ADB	Mr. Asado Zafar, Ms. Noriko Sato
Financial Inclusion and Infrastructure Project, World Bank	Mr. Andrei Popovic
GRASP	Ms. Shabnam Balouch, Team Leader GRASP
Private Sector Development, ADB	Mr. Shaheryar A. Choudhry, Senior Investment Officer
SIAPEP	Mr. Muhammad Burdi, Director
Sindh Barrage Improvement Project (SBIP), World Bank	Project Director, Deputy Project Director
Academia	
Sindh Agriculture University	Dr Sadar Ali Wahcho, Assistant professor

Note: (*) The table shows only one representative from each participant organization. For information of all participants from each interviewee grope, please refer to the meeting minuets.

File name:
Supplementary Data--Meeting Minutes, Collected Materials, and Outline of Proposed Project

- 01_Meeting Minutes
  - 20211012_Sindh Agriculture University.docx
  - 20211016_Karachi Farmers Market.docx
  - 20211016_Women Agriculture Development Organization (WADO).docx
  - 20211018_SAFWCO.docx
  - 20211021_Kick off with DOA.docx
  - 20211021_Kick off with DOI.docx
  - 20211022_SIAPEP.docx
  - 20211022_SRSO.docx
  - 20211025_DOA_water management.docx
  - 20211026_DOA_Extension.docx
  - 20211027_DOA Research, Soil List.jpg
  - 20211027_DOA_Marketing DG_List.jpg
  - 20211027_DOA_Marketing.docx
  - 20211027_DOA_Research_Soil, Horticulture, Hyderabad.docx
  - 20211028_Sabzi Mandi Hyderabad_List.jpg
  - 20211028_Sabzi Mandi.docx
  - 20211029_ADB team.docx
  - 20211029_DOA_Additional director Karachi.docx
  - 20211029_DOA_List_Karachi District Office.jpg
  - 20211102_ASA.docx
  - 20211103_ISTD Sindh.docx
  - 20211103_Local market in Karachi.docx
  - 20211103_NRSP.docx
  - 20211104_Sabzi Mandi superhighway.docx
  - 20211104_SPO.docx
  - 20211105_Earth Gold.docx
  - 20211109_DOI_Secretary Special.docx
  - 20211115_PARC.docx
  - 20211115_SIDA.docx
  - 20211116_Area Water Board.docx
  - 20211116_PMN.DOCX
  - 20211117_Industrus.docx
  - 20211117_KARANDAZ.docx
  - 20211118_Chief Engineers Office Kori Barrage.docx
  - 20211118_FMFB.docx
  - 20211118_PMC DOA.docx
  - 20211118_PMIC Meeting Minutes.docx
  - 20211118_SIDA Institutional Development Team.docx
  - 20211120_Popular Juice.docx
  - 20211121 Kashf Foundation Meeting Minutes.docx
  - 20211122_DOA DG of OFWM.docx
  - 20211122_SIAPEP.docx
  - 20211123_Kunshaali.docx
  - 20211124_DOA Mirpurkhas.docx
  - 20211124_DOA Tando Allahyar.docx
  - 20211124_Market Committee Tando Allahyar.docx
  - 20211126_DOA Agri Engineering.docx
  - 20211126_DOA TM Khan.docx
  - 20211126_Market Committee TM Khan.docx
  - 20211128_NIBAF.docx
  - 20211129_SPO and Husri village.docx
  - 20211205_SBIP.docx
  - 20211208_PITB.docx
  - 20211208_SMEDA.docx

```
│   ├── 20211209_ICT Center Hyderabad.docx
│   ├── 20211210_Better Grain.docx
│   ├── 20211214_HBL.docx
│   ├── 20211214_World Bank.docx
│   ├── 20211216_GRASP Meeting Minutes.docx
│   ├── 20211216_SECP.docx
│   ├── 20211218_SAWiE.docx
│   ├── 20211220_NIC.docx
│   ├── 20211220_PEEPUrev.docx
│   ├── 20211221_Meeting Minutes Asian Development Bank.docx
│   ├── 20211223_FINCA.docx
│   ├── 20211228_SBP.docx
│   ├── Answers to Questionnaire Sheet
│   │   ├── Questionnaire for NRSP BANK 0116.docx
│   │   └── SRSO'filled Questionniare.docx
│   └── Interviews with Farmers (Individual and Group)
│       ├── 2021120201_Individual Interview (First Mail).docx
│       ├── 2021120202_Individual Interview (Second Mail).docx
│       ├── 2021120203_Individual Interview (Third Mail).docx
│       ├── 2021120204_Individual Interview (Fourth Mail).docx
│       ├── 20211203_Group Interview (Mail).docx
│       ├── List of Research Respondents.xlsx
│       ├── Group Interview (Femail)_Individual_Group.docx
│       └── 20211202_Individual Interview (Fifth Male and Sixth Mail).docx
├── 02_Collected Materials
│   ├── 00_Subcontracted Survey
│   │   ├── 01_Survey on Status of Farmers
│   │   │   ├── Draft Presentation Preliminary Findings_071221.pdf
│   │   │   ├── Qualitative Component
│   │   │   │   ├── Final Processors, Exporters, Retailers, Supermarkets and Middlemen Notes_Dec21.xlsx
│   │   │   │   └── Notes_ Farmer FGDs and Financial Institutions Interviews_12421.xlsx
│   │   │   └── Quantitative Component
│   │   │       ├── Consumer_Quant Dataset.xlsx
│   │   │       ├── Farmers_Quant Dataset.xlsx
│   │   │       └── Middleman_Quant Dataset.xlsx
│   │   └── 02_Survey on Irrigation Facility
│   │       └── JICA Agricultural Study_EGC_Irrigation_Final Report.pdf
│   ├── 01_Related Policies
│   │   ├── Agricultural Development in KPK_2012.pdf
│   │   ├── Agriculture and Food Security Policy (Draft) 29 September.pdf
│   │   ├── DDWP- Working Paper format.docx
│   │   ├── Definition of SMEs.pdf
│   │   ├── Draft_Agriculture and Food Security Policy.pdf
│   │   ├── Impact_of_Credit_on_Agricultural_Productivity.pdf
│   │   ├── Manual for Development Projects_2019.pdf
│   │   ├── National Food Security Policy  2018.pdf
│   │   ├── Pakistans_Dairy_Mango_and_Citrus_Sub_se_2014.pdf
│   │   ├── PMC Presentation for JICA_18 Nov 2021.pptx
│   │   ├── Punjab Agriculture Policy
│   │   │   ├── Draft_Agriculture-Policy-of-Punjab_2013.pdf
│   │   │   └── Punjab Agriculture Policy 2017 (Final).pdf
│   │   ├── Seed Registration and Certification System in Pakistan_2003.pdf
│   │   ├── Sindh Agriculture Policy
│   │   │   ├── PEAR_Pakistan_nologo.pdf
│   │   │   ├── SAP_Abstract_2018-30.docx
│   │   │   └── Sindh Agriculture Policy_pak191432.pdf
│   │   ├── Sindh Public Procurement Act_2009
```

```
│   │   │   ├── PPP_Policy_2018_p10 13 15.pdf
│   │   │   ├── Sindh Public Procurement Rules Act2009 with Rules2010 (Amended 2019).pdf
│   │   │   └── Sindh-Public-Procurement-Rules-2010.pdf
│   │   └── Sindh Wholesale Market Act No.XIV of 2010.pdf
│   ├── 02_Horticulture
│   │   ├── Banana
│   │   │   └── Banana_Cluster_Report.pdf
│   │   ├── Mango
│   │   │   └── Mango_Cluster_Report.pdf
│   │   ├── Onion
│   │   │   └── Onion_Cluster_Report.pdf
│   │   ├── Cucumber
│   │   │   └── Cucumber_Cluster_Report.pdf
│   │   ├── Chili
│   │   │   ├── Chili_Cluster_Report.pdf
│   │   │   ├── SCENARIO OF CHILI IN PAKISTAN_2019.pdf
│   │   │   └── USAID.-Chili_VCA_Pakistan_2014_23.pdf
│   │   └── Tomato
│   │       └── Tomato_Cluster_Report.pdf
│   ├── 03_FVC
│   │   ├── CABI_Strengthening vegetable value chains in Pakistan.pdf
│   │   ├── Data Vegetable and fruits input and out put cost.pdf
│   │   ├── FVC_MLIT of Japan_2019.pdf
│   │   ├── Improving Vegetable Value Chains in Pakistan_2019.PDF
│   │   ├── Pakistan_s_Dairy_Mango_and_Citrus_Sub_se_2014.pdf
│   │   ├── Price List of vegetable and fruit.xlsx
│   │   └── Supply_Chain_Analysis_from_Pakistan_Marine Fisheries_2005.pdf
│   ├── 04_Irrigation and Water Resources
│   │   ├── 37923 World Bank 2007.pdf
│   │   ├── Canal Network Sindh.xlsx
│   │   ├── Canal Withdrawals (Rabi and Kharif) in Sindh 2015-2021.xlsx
│   │   ├── CAS 2005.pdf
│   │   ├── EPCL
│   │   │   ├── 20211008 EPCL introduction to Sindh investigation team.pdf
│   │   │   └── EPCL- Initiatives in Water Conservation & Sanitation domain.pdf
│   │   ├── Final Report_Sindh Resilience Project.pdf
│   │   ├── List of FOs
│   │   │   ├── (18-12-12) list of idmt FOs-315 FOs-datewise in All AWBs.pdf
│   │   │   ├── 355 FO Profiles.pdf
│   │   │   ├── GFCAWB FO Aug 09.pdf
│   │   │   ├── LBCAWB FO Aug 09.pdf
│   │   │   └── NCAWB FO Aug 09.pdf
│   │   ├── National-Water-Policy 2018.pdf
│   │   ├── Sindh Map Irrigation Network.pdf
│   │   ├── Sindh_Irrig_Map_GIS.pdf
│   │   ├── USAID Water Productivity.pdf
│   │   └── WB Sindh Resilience Project.pdf
│   ├── 05_Agriculture Finance
│   │   ├── Information as of 2017
│   │   │   ├── 170816 Meeting with ASA.docx
│   │   │   ├── 170818 Meeting with SAFCO.docx
│   │   │   ├── 171025 Meeting with OPP.docx
│   │   │   └── 171030 Telenor.docx
│   │   ├── FMFB
│   │   │   ├── AnnualReport_2020.pdf
│   │   │   └── FMFB Presentation_31May21.pptx
│   │   ├── Material provided by NRSP_04 Nov
```

```
│   │   │   ├── NPGP programme update.docx
│   │   │   ├── Organizational_Profile_NRSP_ April_2021.docx
│   │   │   ├── PINs programme update.docx
│   │   │   ├── Programme-Update-as-of-September-2021.pdf
│   │   │   └── SUCCESS Project Update.docx
│   │   ├── Material Provided by PMN
│   │   │   ├── Annual_Report_2020.pdf
│   │   │   ├── Microwatch Issue 61.pdf
│   │   │   └── Options for Managing Disaster Risk.pdf
│   │   ├── Material Provided by SECP
│   │   │   ├── CLIS Circular 2014 and CLIS Features.pdf
│   │   │   ├── Non Banking Regulations Oct 25 2021.pdf
│   │   │   └── Report on Proposed National Crop Insurance Scheme- December 2021.pdf
│   │   ├── NFIS.pdf
│   │   ├── SBP Regulations
│   │   │   ├── Key conditions to obtain loans from microfinance banks withdrawn - Newspaper - DAWN.COM.pdf
│   │   │   ├── Prudential regulations for microfinance banks institutions 2001.pdf
│   │   │   ├── SBP Regulatory Relief against COVID19.pdf
│   │   │   └── State Bank revises regulations for MFBs Jul 2020.pdf
│   │   ├── The State of Financial Access Pakistan 1.pdf
│   │   ├── The State of Financial Access Pakistan 2.pdf
│   │   ├── WAVE 6 Report_Financial Inclusion_Jun 2020.pdf
│   │   └── World Bank_FIIP PAD.pdf
│   ├── 06_ICT
│   │   ├── Agriculture-Innovation-in-Pakistan-2021_NIC.pdf
│   │   ├── Better Grain_Rice Partner_Presentation_Dec 2021.pdf
│   │   ├── DIGITAL_PAKISTAN_POLICY(22-05-2018).pdf
│   │   ├── Fintech-Innovation-in-Pakistan_NIC_V2.pdf
│   │   ├── ICT Agricultural Ext Services Sindh_20211026.pptx
│   │   ├── IT Policies & Projects in Pakista_MOITT.pdf
│   │   ├── JICA Showcase of Digital Application in Agriculture.pdf
│   │   ├── Khushaal-Zamindar-A-mobile-agriculture-service-by-Telenor-Pakistan.pdf
│   │   ├── Presentation material of ICT Center Hyderabad.pptx
│   │   └── Stats_Cellular Mobile Subscribers (2015-2020)_PTI.pdf
│   ├── 07_Developing Partners and NGOs
│   │   ├── ADB
│   │   │   └── Rural Punjab_2019.pdf
│   │   ├── Australia
│   │   │   ├── 00_Strengthening vegetable VCs in Pakistan.pdf
│   │   │   ├── 20211116_web meeting
│   │   │   │   ├── CABI Capability statement.pdf
│   │   │   │   ├── CABI History.pdf
│   │   │   │   ├── Cotton Categorization.pdf
│   │   │   │   ├── IP Workshop -2021-CABI.pdf
│   │   │   │   └── Onion Achievement.docx
│   │   │   ├── CABI_Strengthening vegetable VCs in Pakistan.pdf
│   │   │   ├── CABI-News-Bulletin_Asia_Issue-1_Mar 2021.pdf
│   │   │   ├── CABI-News-Bulletin_Asia_Issue-2-3-Apr-Aug-2021.pdf
│   │   │   ├── CWA-Blog-Report-2020_Sep2021update.pdf
│   │   │   ├── Information about onion_CABI_18 Nov 2021.docx
│   │   │   └── Tomato Flagship Initiative-Case-Study.pdf
│   │   ├── EU and ITC
│   │   │   ├── 00_GRASP Project Brief Print version Oct 17.pdf
│   │   │   ├── 01_GRASP-Sindh Survey Report 2020.pdf
│   │   │   ├── Definition of SMEs.pdf
│   │   │   ├── EU_GRASP.pdf
│   │   │   └── GRASP Leaflet Final.pdf
```

```
|   |   |   |   └── GRASP-8-Market Information System-2020 report.pdf
|   |   |   ├── FAO
|   |   |   |   ├── FAO_Transformation of the Indus Basin with.pdf
|   |   |   |   ├── PEAR_Pakistan_nologo.pdf
|   |   |   |   └── SMART in Punjab_2020.pdf
|   |   |   ├── NRSP
|   |   |   |   ├── NPGP programme update.docx
|   |   |   |   ├── Organizational_Profile_NRSP_ April_2021.docx
|   |   |   |   ├── PINs programme update.docx
|   |   |   |   ├── Programme-Update-as-of-September-2021.pdf
|   |   |   |   └── SUCCESS Project Update.docx
|   |   |   ├── SAWFCO
|   |   |   |   ├── Re_ _ SAFWCO's Projects_ Request for Meeting and Information Collection.msg
|   |   |   |   ├── SAFWCO food security and Agriculture Profile 2021.pdf
|   |   |   |   ├── SAFWCO Presentation  value chain specific experience.pdf
|   |   |   |   └── email from SAWFCO.docx
|   |   |   ├── SPO
|   |   |   |   ├── PPT JICA.pptx
|   |   |   |   ├── SPO Profile and ongoing project in Agriculture (1).docx
|   |   |   |   └── SPO Profile and ongoing project in Agriculture.docx
|   |   |   ├── SRSO
|   |   |   |   └── BoD Meeting Presentation Oct 22, 2021.pptx
|   |   |   ├── WADO
|   |   |   |   ├── Greeting from WADO.docx
|   |   |   |   ├── Wado Staff.docx
|   |   |   |   └── WADO-PROFILE.pdf
|   |   |   └── WB
|   |   |       ├── (WSIP_page 3.pdf
|   |   |       ├── 1 Fianl Report_Sindh Resilience Project.pdf
|   |   |       ├── SAGP
|   |   |       |   ├── 00_SAGP_Social_Assessment_Report_Final_2015.pdf
|   |   |       |   ├── 01_Project Appraisal Document 2014.pdf
|   |   |       |   ├── 02_SAGP-Agriculture.pdf
|   |   |       |   └── Pakistan-Sindh-Agricultural-Growth-Project-Restructuring-Paper_2016.pdf
|   |   |       ├── SIAPEP
|   |   |       |   ├── 02-Opportunities for working together 1.pptx
|   |   |       |   ├── FS Report SIAPEP_Phase 1.pdf
|   |   |       |   ├── SIAPEP Presentation JICA (20-Nov-21).pptx
|   |   |       |   └── SIAPEP_Appraisal Document.pdf
|   |   |       ├── SRP.pdf
|   |   |       ├── SWAT
|   |   |       |   ├── 01_ESMF SWAT Project - draft.pdf
|   |   |       |   ├── 02_SWAT Project Description_29 Nov 2021.pdf
|   |   |       |   └── SWAT_Concept-Project-Information-Document.pdf
|   |   |       ├── Water Sector Improvement Project.pdf
|   |   |       └── World Bank_FIIP PAD.pdf
|   |   ├── 08_Gender
|   |   |   ├── 1. bisp.pdf
|   |   |   ├── 2. WIEGO_Statistical_Brief_N26_Pakistan_final.pdf
|   |   |   └── 3_Gender Training_Agriculture × Infrastracture.pdf
|   |   ├── 09_Covid 19
|   |   |   ├── ADB_Brief_Covid-19-farm-households-Punjab-Pakistan_2020.pdf
|   |   |   ├── ADB_Full report_Covid 19 Impact-covid-19-locust-farm-households_2021.pdf
|   |   |   ├── MSME
|   |   |   |   ├── Impact of COVID-19 pandemic on MSME in Pakistan.pdf
|   |   |   |   └── UNIDO COVID19 Assessment_Pakistan_2020.pdf
|   |   |   └── Pakistan_Covid 19_Survey_Dec 2020.pdf
```

```
│   ├── 10_Saline
│   │   ├── resources-04-00831.pdf
│   │   ├── Saline Agriculture.pdf - MH Panhwar.pdf
│   │   └── Surface_Water_and_Groundwater_Nexus_Grou.pdf
│   └── 11_Statistics
│       ├── Agricultural Development-Statistics-of-Sindh-2018.pdf
│       ├── Agriculture-Statistics-of-Sindh-2009.pdf
│       ├── Data Vegetable and fruits input and out put cost.pdf
│       ├── Development-Statistics-of-Sindh-2019.pdf
│       ├── F&V Statistics 2015-16.pdf
│       ├── FAOSTAT_data_8-9-2021.csv
│       ├── Farms_Area_Ownership.xlsx
│       ├── Geography of Poverty_UPDATE.pdf
│       ├── no. of farmer by land size.docx
│       ├── Pakistan Fruits and Vegetables Market _ 2021 - 26 _ Industry Share, Size, Growth - Mordor Intelligence.pdf
│       ├── PBC-Horticulture-Sector-Study-Report_compressed-compressed.pdf
│       ├── Poverty-Profile-1.pdf
│       ├── Punjub_Fruits 2010-11.xlsx
│       ├── Punjub_Vegetables 2010-11.xlsx
│       ├── Sindh Fact File June 2021.pdf
│       ├── Sindh_Agricultural Census 2010.pdf
│       ├── Sindh-at-Glance-2019.pdf
│       ├── Table 13 Approved Crop Calendar (Kharif).pdf
│       ├── Table 14 Approved Crop Calendar (Rabi).pdf
│       ├── Table 3  Land_Utilization_Statistics.pdf
│       ├── Target_Crops.xlsx
│       ├── Target_Crops_rank.xlsx
│       ├── Rabi and Kharif.xlsx
│       └── Saliniate.xlsx
└── 03 Outline of Proposed Project
```