EXECUTIVE SUMMARY

Pakistan: Climate-smart technologies for horticulture and livestock

International Trade Centre

In collaboration with

LUMS | Centre for Water Informatics and Technology

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Street address: ITC
54-56, rue de Montbrillant
1202 Geneva, Switzerland

Postal address: ITC
Palais des Nations
1211 Geneva 10, Switzerland

Telephone: +41 22 730 0111

E-mail: itcreg@intracen.org

Internet: www.intracen.org/publications

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About the paper

Many climate-smart technologies exist in Pakistan to help farmers adapt to climate change. These include commercially available technologies and those developed locally. Various factors hinder their uptake, limiting climate resilience.

This report provides an inventory of available technologies and their suppliers in Pakistan. With a focus on the horticulture and livestock sectors in Balochistan and Sindh, the publication offers recommendations to improve climate technology uptake and enable more regenerative agriculture.

The report highlights that women lack access to climate-smart technologies, skills and land, and work mainly in labour-intensive roles. Yet there are cases of successful women in agribusiness.

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Foreword

Pakistan is one of South Asia's most vulnerable countries to climate change. With an agricultural sector that contributes 19% to gross domestic product and absorbs more than 42% of the labour force, Pakistan is at risk from rising temperatures, variable precipitation, frequent and intense extreme weather events, and water scarcity – all of which threaten farming and livestock productivity.

Climate change has already reduced the production of some staple crops in Pakistan, such as wheat and rice. Food security risks are growing, and Pakistani farming systems urgently need to build their resilience to climate change by adopting climate-smart technologies and practices.

This study assesses climate-smart farming technologies in Pakistan, links them to commercial strategies for adoption and provides insight for relevant climate and agricultural policy debates.

Climate-smart technologies are available in Pakistan. Few farmers adopt them because of financial constraints and limited understanding about their benefits. This study offers pathways to make indigenous and commercial climate technologies both affordable and available. These include a rental model to lower costs and demonstration sites to train farmers, build capacity and raise awareness.

The Centre for Water Informatics and Technology at Lahore University of Management Sciences, in partnership with the International Trade Centre (ITC), carried out this research to explore the state of climate technology for horticulture and livestock in Pakistan's Balochistan and Sindh provinces.

ITC systematically incorporates climate risk and opportunity assessments in project and corporate planning. We help countries build their climate competitiveness and provide the tools for them to stay on the leading edge of the low carbon transition.

The recommendations from this study seek to guide the Government of Pakistan and the Growth for Rural Advancement and Sustainable Progress (GRASP) project to support climate technology innovation, commercialization and adaption in horticulture and livestock value chains.

GRASP, funded by the European Union, aims to strengthen small-scale agribusiness competitiveness in the horticulture and livestock sectors in Balochistan and Sindh provinces. ITC implements this six-year project (2019–2024) in partnership with the Pakistan Poverty Alleviation Fund and the Food and Agriculture Organization of the United Nations.

I hope this study will support the efforts of national partners to improve Pakistan's climate resilience and competitiveness and encourage continued cooperation to meet the challenge of the climate crisis.

Pamela Coke-Hamilton
Executive Director
International Trade Centre

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Unless otherwise specified, all references to dollars ($) are to United States dollars, and all references to tons are to metric tons.

Pakistan is among the top 10 countries most affected by climate catastrophes such as floods, droughts, heatwaves and earthquakes. This is due mainly to the country's geography, reliance on glaciers as a natural regulator of regional water supplies, and heavy dependence on agriculture for livelihoods and food security.

Agriculture is central to its economy, contributing 19% to gross domestic product and absorbing more than 42% of the labour force. Farmers need climate-smart technologies to increase agricultural productivity and incomes, adapt and build resilience to climate change, and reduce or remove greenhouse gas emissions.

This report assesses the state of climate-smart technology for horticulture and livestock in Balochistan, the largest province by area, and Sindh, the third-biggest province by area. It offers a menu of options to policymakers and technical assistance activities under the International Trade Centre's Growth for Rural Advancement and Sustainable Progress project to support innovation, commercialization and the adoption of climate-smart technologies in these two value chains.

Researchers examined value chains in Karachi and 11 districts, namely Quetta, Pishin, Khuzdar, Panjgur, Lasbela, Noshki, Hyderabad, Thatta, Khairpur, Mirpurkhas and Tharparkar.

Overview: Climate-smart technology market

Many climate-smart technologies are available in Pakistan, including information and communication technology (ICT). This report examines them in detail.

In horticulture value chains, hybrid seeds are crucial inputs. Production technologies include high-efficiency irrigation systems, raised beds, mulching, solar-based irrigation, laser land levelling, tunnel farming and bunch covers. Postharvest technologies include dehydration, cold chains (including precooling) and hot water treatment, and packaging technologies include hermetic and modified atmosphere packaging.

In the livestock sector, climate-smart technologies improve breeds, milking, fodder and feed (silage baling and wrapping as well as total mixed ration) and waste management (biogas).

The study found that:

- Nearly all technology providers in Pakistan are based in the Punjab province, which accounts for two-thirds of total national agriculture output and climate-smart technologies;
- Most technologies being commercialized are imported, though some are homegrown or being indigenized in the private sector;
- Government cost-sharing programmes and donor projects play an important role in spreading use of agriculture technologies;
- A wide variety of climate-smart technology is available in Pakistan. However, few farmers use these tools, mainly because they have limited capacity to invest, lack technical capacity and are not aware of the benefits and availability of this technology.

Other obstacles include:

- Inadequate credit access;
- Small farm size;
- Difficulty accessing commodity markets;
- Market price distortions;
- Limited service providers and technical support services;
- Non-existence of model farms with a business plan or cost–benefit analysis;
- Lack of farmer organizations and farmer marketing collectives for joint action.

Scale up indigenous practices

Indigenous practices combine local knowledge with modern technologies. Their importance cannot be overlooked in building climate-change resilience across farming communities.

Close observation over generations is valuable in climate change mitigation. Indigenous methods to manage land and resources contribute to greater biodiversity and help reduce deforestation, carbon emissions and the risk of wildfires.

The study examined practices that have been adapted or indigenized, and technological solutions that are being prepared locally (indigenized technology) for informed decision-making and early warning. They ranged from biopesticides and biofertilizer to water quality sensors, cooling sheds, artificial intelligence for pests, forest health apps, rehabilitation of saline soil, homemade remedies to address livestock illness, local irrigation techniques and more.

The report recommends ways to improve uptake of indigenous and indigenized technologies and practices:

- Scientific research should demonstrate and document regenerative practices. Regenerative agriculture practices that combine ridges, mulching, irrigation efficiency and input reduction and open design machinery such as Pedaver's intervention are examples.
- Academia and research organizations have created low-cost indigenous technology that can revolutionize data and decision-making for building climate resilience. Create supporting organizations to help academia scale up and generate such products at factory rates rather than lab bench rates.
- Lack of coordination dilutes impact, from grassroots groups to academia. Use a unique number (Computerized National Identity Card) to document capacity-building programmes and offer follow-up trainings, with proper tracking.
- Ensure that farmer field school curricula are relevant to local contexts and cultures, so technologies and practices are adopted quickly.
- Create seed banks with local varieties and digitize the records. Retain and document local species in horticulture and livestock.

Extend, coordinate support services

The absence of robust support services in both the public and private domains limits the spread of climate-smart technologies and practices in the horticulture and livestock sectors. Public support services lack capacity and resources for climate-smart technologies. Private sector firms offer support services only to clients who buy their products.

Research

Academics and research and development organizations in Pakistan are usually unable to spread information about climate-smart technologies and practices for horticulture and livestock. Most lack sufficient funding and are disconnected from farmers. As a result, their work does not reflect the needs of