

Pakistan: Climate-smart technologies for horticulture and livestock

Executive summary

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.



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EXECUTIVE SUMMARY

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 farmers.

Little to no written material exists on the benefits of different climate-smart technologies and practices that farmers can use. The information that does exist is more academic in nature and not easily digestible by or relevant to farmers.

Cost-benefit analyses and impact studies for various climate-smart technologies need to be conducted and disseminated in a form that farmers can easily digest. It is also important that, in cooperation with interested private sector entrepreneurs, business models be created for various technologies to make them attractive and self-sustaining.

Finance and sales

Microfinance institutes have made advances in ensuring that finance is more accessible, but little has been done to promote climate-smart technologies. Farmers rely on unverified and informal information providers

such as WhatsApp, Facebook and YouTube for information on agriculture (market, technology, practices and products) – often to their detriment.

Rental models for climate-smart technologies can increase the private sector's engagement to commercialize climate-smart technologies and practices. This would make these technologies more affordable. It could be done directly or by establishing common facility centres and farmers' service centres. Public–private partnerships can support the formation and leverage existing resources most effectively.

Grants and technical assistance should be offered to entrepreneurs to set up private farmer service companies. These companies could improve responsiveness to farmers' needs in terms of input supply (e.g. fertilizers, seeds and pesticides), services (e.g. mechanized labour, technical advice, certification and marketing) and information, especially regarding climate-smart technologies.

To complement this, farmer marketing collectives could be formed for collective selling, making it convenient for buyers to access volume-based products through a single source.

Rules and regulations

A growing number of federal and provincial policies address climate change, food and agriculture. Federal initiatives are in place to build evidence-based research and guidelines for climate-smart interventions and technologies. They should take into consideration strategies and actions that have proven to be effective in specific locations.

The National Climate Change Policy, the National Water Policy¹ and other national policies mention climate change and technology adoption to improve irrigation efficiency. Details are not provided and action plan implementation has been limited.

- **National Climate Change policy** aims to mainstream climate change in the economically and socially vulnerable sectors, to steer Pakistan towards climate-resilient development. The policy recommends using local technologies, based on innovation and technological advancement climate change to implement adaptation and mitigation measures, and capture renewable energy.
- **National Water Policy** focuses on the 'more crop per drop' concept, which calls for better irrigation methods, a modernized irrigation network, banning flood irrigation and participatory management for decision-making. These have associated benefits for productivity and nutrient-use efficiency.
- **Climate-smart Livestock Production Strategy** acknowledges that mitigation options are available along the livestock supply chain. They are mostly associated with feed production, enteric fermentation and manure management. It mentions climate-smart agriculture practices such as grassland restoration and management (e.g. sylvo-pastoral systems), manure management (e.g. recycling and bio-digestion) and crop-livestock integration.
- **Agricultural policy of Balochistan** highlights rangeland development and water resources management as two areas of critical importance.
- **Sindh Agriculture Policy** (2018–2030) proposes government focus on producing and promoting public goods, in particular new technologies for processing, transport, storage and production. These include new seed varieties and high-yielding milk and meat animals.
- **Sindh Drought Mitigation and Management Policy** makes forecasting and early warning a top priority, particularly for the most vulnerable populations (such as those that would lose their crops and livestock). The policy mentions several opportunities, such as addressing soil degradation, modernizing irrigation techniques and planting new crops to increase soil fertility.

Certain Pakistani policies on agriculture and the water sector – for example, supporting water-intensive agriculture – conflict with climate-smart agriculture and thwart mitigation and adaptation objectives.

¹ See <http://waterbeyondborders.net/wp-content/uploads/2018/07/Pakistan-National-Water-Policy-2018.pdf>.

Improving women's access to climate-smart technologies

Women workers in horticulture are typically involved in sowing, transplanting, weeding, harvesting and post-harvest operations such as threshing, winnowing, drying, grinding, husking and storage. For livestock, women milk and feed; treat sick animals; herd; cut and collect fodder; care for poultry; breed; wean; clean shelters; convert manure into fuel or fertilizer; and process milk and wool hair, among others.

These activities are cumbersome and require manual and repetitive efforts. Women carry out these activities in addition to all their household chores. Men undertake activities such as land preparation, threshing, marketing and transport – most of which depend on machines.

Some women have started small or medium-sized businesses in horticulture and livestock and are looking for support from agencies, often adopting sustainable practices and technologies. The factors for their success include:

- Access to education
- Support from the male family members
- Initial capital (own funds or external sources)
- Initial skill set (e.g. making jam, ice cream or access to technology)

The main obstacles women face are:

- Land constraints: Most women and members of marginalized communities often do not own any land.
- Credit constraints: The cases highlighted in the report show that, despite capabilities, women have not been able to scale up their businesses because they lack credit.
- Socioeconomic constraints: Women need the support of the men as it is not easy for them to access technology and markets, both in urban and rural settings. Men in the families therefore have a key role to play in the success of women-owned agribusinesses.

To help women access climate-smart agricultural technologies, the report suggests:

- Improve access to finance and capital for women;
- Build the capacity of institutions such as social welfare, commerce or women departments alongside agriculture, livestock and extension departments;
- Introduce private–public partnerships to support women;
- Help scale up existing start-ups and businesses through field-based incubation and seed grants and loans;
- Offer continuous monitoring and mentoring sessions with the help of organizations working with women at the grassroots level.

Recommendations to improve climate smart-technology adoption rates

These steps can promote climate-smart technologies and practices for horticulture and livestock in Pakistan:

- Develop a rental model to help farmers afford technology;
- Create demonstration sites to train farmers, build capacity and raise awareness, not only for technology, but also for regenerative agricultural practices;
- Provide verified and authentic information through ICT;
- Carry out cost–benefit analyses of technologies and practices for farmer uptake;
- Develop viable business cases to commercialize private sector technology;
- Build the capacity of all stakeholders.

There is a need for more coordinated research, awareness and action at all levels of the value chain for agricultural technologies and practices to be climate-smart.