Study Report
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INNOVATIVE CLIMATE ADAPTATION & RESILIENCE STRATEGIES IN PAKISTAN

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1. Executive Summary

This report delivers an in-depth evaluation of climate-related threats, adaptation efforts, institutional hurdles, and potential strategies for fostering climate-resilient farming in Pakistan. Agriculture plays a vital role in ensuring food security, economic balance, and rural livelihoods in the country, but it is becoming increasingly vulnerable to unpredictable rainfall, recurring heatwaves, sudden floods, escalating soil salinity, and the declining quality of soil and water. To analyze these issues and find viable solutions, the study utilized a mixed-method approach that included reviewing existing literature, conducting Focus Group Discussions (FGDs) with agricultural researchers and extension workers, and surveying farmers in three districts: Rajanpur, DI Khan, and Ghotki. This multifaceted methodology allowed for a comprehensive integration of scientific research, on-the-ground insights, and farmers' perspectives into a cohesive and evidence-driven research framework.

The FGDs highlighted strong agreement among researchers and extension staff about the nature of evolving climate risks. Both groups noted the increasing unpredictability and severity of monsoon patterns, rising average temperatures, extended dry periods, and more frequent extreme weather events. They also identified local issues such as salinity, water stagnation, soil erosion, and deteriorating groundwater quality as persistent and worsening threats. Crops like cotton and wheat were found to be particularly vulnerable, while farming practices like monocropping, traditional flood irrigation, and poor soil management were cited as factors that reduce resilience. Farmers are already taking small steps to adapt – changing planting times, using ridge and bed sowing methods, modifying irrigation routines, and switching to fast-growing crop varieties – but these efforts fall short without broader improvements to land and water systems. FGDs also pointed out systemic barriers hindering adaptation, including poor dissemination of technology, a lack of practical demonstrations, limited funding, and few locally proven success stories.

The institutional review further uncovered serious shortcomings in the agricultural extension system, including staff shortage, inadequate transportation, limited budgets, and a lack of training. These issues prevent the effective scaling of climate-smart techniques. Government extension officials who took part in FGDs acknowledged that such limitations hinder timely outreach to farmers, disrupt feedback loops, and impair the system's ability to provide prompt, practical guidance during climate emergencies. They also pointed out that extension workers are often burdened with non-agricultural administrative duties, which further hampers their effectiveness. Participation of women and youth in climate adaptation remains low due to cultural barriers, mobility issues, and the lack of female extension workers.

The farmer survey further confirmed broad exposure to climate-related dangers: 73% reported erratic or excessive rainfall, 62% experienced flooding, and 38% dealt with heatwaves. Key crops like wheat, sugarcane, cotton, and rice have suffered due to pests, diseases, and weather-related damage. The use of climate-resilient farming methods varies between regions – Ghotki showed higher adoption due to larger landholdings and better resources, whereas DI Khan lagged behind. Farmers are trying adaptive strategies like diversifying crops, altering planting schedules, and adjusting irrigation patterns, but they face significant challenges, including high input costs (89%), limited access to farming supplies (87%), and inadequate technical knowledge (71%). Many are under financial strain, with 67% reporting income instability and 47% struggling to repay loans caused by climate-related losses. Farmers also cited weak institutions and market systems – such as unreliable access to quality seeds and inputs, minimal support during climate shocks, and insufficient services for testing soil and water quality – as contributors to their vulnerability.

Farmers expressed a strong interest in learning about climate-smart practices, pest and disease control, water-saving methods, and soil health. They also asked for institutional help like subsidies (73%), improved water systems (60%), low-interest loans (51%), and crop insurance (38%). Beyond farm techniques, farmers called for systemic reforms, such as better funding for extension services, timely climate and market data, consistent input supplies, and practical demonstrations to reduce the risks of adopting new methods.

Drawing on these findings, the report offers a set of linked recommendations. At the farm level, promoting climate-resilient seeds, restoring soil health, enhancing irrigation efficiency, introducing diverse cropping patterns, and encouraging agroforestry are crucial. Institutionally, strengthening the agricultural extension network through hiring, training, digital tools, and better coordination with research bodies is essential. A more robust climate information and advisory system is also needed, delivering localized forecasts and practical tips in local languages via SMS, WhatsApp, radio, and cable TV, backed by interactive feedback between farmers and extension agents. Expanding access to climate finance – through targeted subsidies, affordable loans, and index-based insurance – can help reduce the risks and costs of adopting new practices. Training programs for both farmers and extension workers, along with strategies that are inclusive of women and youth, are key to increasing participation. To encourage hands-on learning and widespread adoption, the report recommends structured training initiatives like farmer field schools, demo plots, and repeated practical sessions; regular exchanges between experts and field staff; and exposure visits to successful farming models and technical centers. Specific district-level plans include tackling salinity and drainage in Rajanpur, implementing drought and water-saving techniques in DI Khan, and driving technology-based innovation and field demonstrations in Ghotki.

In conclusion, the study shows that farmers, researchers, and extension workers are all aware of the climate crisis and have valuable knowledge to combat it. However, without better institutions, reliable climate information, financial backing, and targeted programs, efforts to build climate-resilient agriculture will remain limited. The comprehensive recommendations in this report lay out a clear roadmap for transitioning Pakistan's farming sector toward greater resilience, productivity, and sustainability in the face of ongoing climate change.

2. Introduction/Background

Climate change is now one of the biggest challenges affecting farming systems around the world. Rising temperatures, unpredictable rainfall, more frequent extreme weather events, and ongoing soil and water degradation are all changing how food is produced globally. Agriculture, which heavily relies on a stable climate, is both affected by and contributes to climate change. Because it's so sensitive to changes in temperature, water cycles, and environmental pressures, farming is especially vulnerable – especially in developing nations where most people rely on agriculture for their income. As the world's population and demand for food continue to grow, farmers must now adjust to new and unpredictable environmental conditions. This shift has made climate-resilient farming a top priority for governments, researchers, and development programs, all of whom are looking for innovative ways to help farmers cope with climate stress while keeping productivity high and protecting natural resources.

In many regions, climate change has already changed when seasons start and end, reduced the amount of available water, worsened soil quality, increased the presence of pests and diseases, and thrown off planting schedules. Scientists warn that continued warming could further cut the yields of essential crops, particularly in areas that depend on rain or don't have the tools to adapt. Small-scale farmers, most of whom have very little financial support, are hit the hardest. Their ability to adapt is limited by a lack of information, poor infrastructure, and little access to loans or insurance. Institutions are also not yet fully prepared to help farmers handle climate change. Because of this, global efforts are now focusing not just on growing more food but on making agriculture more resilient and sustainable while reducing risks.

In this wider context, Pakistan is considered one of the most climate-sensitive farming economies in the world. The country faces high levels of climate risk because of its geography, a mix of farming environments, and heavy reliance on natural resources. In recent decades, Pakistan has seen a rise in climate-related disasters – massive floods, long droughts, irregular monsoon rains, heatwaves, unusual glacier melting, rising temperatures, and shifting pest and disease patterns. These have repeatedly disrupted farming, damaged infrastructure, and put rural incomes at risk. Major events such as the 2010 mega-flood, the 2022 monsoon disaster, the 2025 floods in Punjab, recurring heatwaves in Punjab and Sindh, and ongoing droughts in Balochistan and KPK show that these extreme weather patterns are becoming more frequent and severe. As a result, farmers are producing less, earning less, facing higher risks, and dealing with growing uncertainty.

Farming is central to Pakistan's economy. It adds a large share to the national GDP, provides jobs to nearly 40% of the workforce, and supports over 60% of the population. Major crops like wheat, rice, cotton, sugarcane, and maize are essential for food security and for industries that depend on agriculture. But this vital sector is under increasing threat from climate-related problems like water shortages, salty soils, erosion, and the breakdown of rangelands and groundwater resources. Pakistan's farming system, which depends on irrigation from the Indus River, is especially sensitive to changes in climate. Less water in rivers, wasteful irrigation methods, too much groundwater use, and poor drainage systems have led to waterlogging and salty soils, particularly in the south. On top of that, rising temperatures are shortening the time crops can grow, lowering harvests, and increasing the amount of fertilizers and water needed – putting both natural and financial strain on farmers.

The risks facing Pakistan's farmers are made worse by weaknesses in the systems meant to support them. Many don't have access to timely weather updates, better seed types, modern machinery, or testing services for their soil and water. They also lack tools and practices that could help them adapt to the changing climate. The country's agriculture extension system – which is supposed to help farmers deal with these changes – is stretched thin. It suffers from limited funds, not enough staff, poor transportation, and outdated ways of delivering support. Although research organizations are coming up with useful innovations, the gap between research and what's actually used on farms is still large, so new technologies spread slowly. Social issues, gender inequality, and unfair access to credit and insurance make it even harder for communities to adapt. Together, these problems limit Pakistan's ability to respond effectively to climate change and prevent farmers from making the long-term changes they need.

Given these realities, this study was launched. It brings together a review of existing research, in-depth discussions with researchers and extension workers, and a structured survey of farmers in three climate-sensitive districts – Rajanpur, DI Khan, and Ghotki. The study offers a detailed look at climate threats, current ways farmers are coping, challenges in the system, and what farmers themselves see as priorities. The goal is to provide solid, evidence-based recommendations for climate-smart farming policies that fit Pakistan's diverse farming and social environments. In the end, the study aims to support national goals of protecting food supplies, safeguarding rural incomes, and building a farming sector that's strong enough to withstand the growing threats of climate change.

3. Objectives

Overall aim of this project was to assess climate risks, adaptation practices, institutional challenges, and strategic opportunities for promoting innovative and climate-resilient agriculture in Pakistan.

Specific objectives of this study are:

- To identify major climate risks affecting agriculture and their spatial variability across districts.
- To determine vulnerable crops, farming systems, and production contexts under changing climatic conditions.
- To analyse existing farmer coping strategies, adaptation practices, and indigenous resilience methods.
- To evaluate institutional, extension, financial, and socio-cultural barriers influencing climate adaptation.
- To propose actionable recommendations for strengthening climate-resilient agriculture through evidence-based interventions/Policy reforms.

4. Methodology

4.1. Overall Research Approach

This project employed a mixed-methods research design that integrated a desk-literature review, Focus Group Discussions (FGDs), and a structured farmer survey across the climate-vulnerable districts of Rajanpur, Ghotki, and Dera Ismail Khan. The purpose of combining qualitative and quantitative methods was to generate a comprehensive and triangulated understanding of climate risks, adaptation behaviours, and institutional challenges in Pakistan's agricultural sector. This approach allowed scientific insights, field-level experiences, and farmer realities to be merged into a unified evidence base that informs policy and practice.

4.2. Desk-literature review

The study began with an extensive review of national and international literature on climate change impacts, climate-smart agricultural technologies, policy frameworks, and adaptive responses relevant to Pakistan. This review helped identify thematic gaps, informed the structure of FGD guides, and ensured that primary data collection was aligned with both scientific knowledge and national climate adaptation priorities. It also served as a baseline for understanding observed field-level patterns.

4.3. Focus group discussions with experts and practitioners

To gather in-depth qualitative insights, FGDs were conducted with key stakeholder groups, including researchers, academics, and agriculture extension officers. The FGD guides used during these sessions were based on the annexured proformas (Annex II) for researchers and extension officers (Annex III). Discussions with researchers explored scientific evidence, innovation potential, indigenous knowledge validation, research gaps, and policy relevance. FGDs with extension officers focused on specific climate risks, communication channels, farmer response behaviour, barriers to adoption, institutional limitations, gender constraints, and capacity-building needs. Each session followed a semi-structured format to ensure both guided discussion and flexibility. All participants provided informed consent, discussions lasted 60–90 minutes, and detailed notes were recorded.

4.4. Farmers' survey

To quantify climate impacts and adaptation patterns, a structured survey was conducted with farmers, including progressive and lead farmers. The survey instrument was developed in urdu language (Annexure IV) and administered through face-to-face interviews of 45 farmers (15 farmers from each above-mentioned district). A purposive sampling approach was used to ensure representation across diverse agro-ecological zones, farm sizes, and irrigation sources. The survey collected detailed information on landholding, soil conditions, irrigation, fertilizer use, crop residue management, agroforestry trends, climate impacts, coping strategies, institutional support, financial constraints, and future priorities.

4.5. Data Analysis

Qualitative data from the FGDs were analysed through thematic analysis, in which transcripts and notes were reviewed to identify recurring patterns related to climate risks, vulnerable crops, adaptation practices, barriers, communication challenges, and institutional gaps. These themes helped contextualize and deepen the understanding of farmers' experiences and contributed to the synthesis of cross-cutting insights. Quantitative data from the farmer survey were analysed using descriptive statistics, including frequencies, percentages, and district-level comparisons. This analysis allowed identification of major trends, such as the prevalence of soil salinity, adoption rates of climate-smart practices, common climate impacts, and financial stresses reported by farmers.

Findings from the literature review, FGDs, and survey analysis were triangulated to enhance validity and ensure consistency across data sources. For example, irregular rainfall, heatwaves, and pest outbreaks reported by extension officers were compared with farmer-reported frequencies in the survey, and both were cross-checked against scientific literature. Similarly, resistance to drip irrigation, challenges in obtaining quality seed, and institutional constraints were examined across all data sources. This triangulation strengthened the credibility and coherence of the final conclusions.

4.6. Ethical considerations and study limitations

The study adhered to ethical research standards. All participants provided informed consent as described in the respective proformas, and respondent anonymity was protected. Participation was voluntary, and individuals could withdraw at any time without consequence. Despite the methodological strengths, certain limitations existed, including purposive sampling, which limits generalizability, and the reliance on seasonal perceptions of climate impacts. Additionally, some FGDs were conducted online due to geographic constraints, which may affect engagement depth. Nevertheless, the breadth of methods and triangulation of findings ensured the reliability of the study’s insights.

5. Findings & Insights

5.1. FGDs - Researchers and Agriculture Extension Officers

The focus group discussions engaged agriculture extension officers and researchers from universities and research institutes, both of whom contributed essential yet distinct perspectives on climate-resilient agriculture. Extension officers provided grounded, field-level insights based on their daily interaction with farming communities in diverse agro-ecological settings. Researchers, on the other hand, contributed conceptual, methodological, and evidence-based analyses rooted in scientific experimentation, national datasets, and thematic research on climate impacts and climate-smart agriculture. The combination of practice-oriented and research-informed voices offered a holistic understanding of climate risks, adaptation gaps, and institutional constraints.

5.1.1. Perceived climate risks

Both groups unanimously recognized that Pakistan's agriculture is increasingly threatened by irregular rainfall patterns, prolonged dry spells, heatwaves, rising temperatures, and spatially uneven monsoon behaviour. Extension officers repeatedly observed unexpected heavy rains, undesired rainfall timing during sowing and harvesting, and increasing unpredictability in seasonal weather, consistent with global and national research trends. Researchers linked these observations to broader drivers of climate variability, including changing monsoon cycles, glacial melt dynamics, and extreme weather events.

Additionally, localized issues such as waterlogging, salinity, soil degradation, and declining groundwater quality were emphasized. Researchers contextualized these challenges through empirical evidence showing soil nutrient depletion, declining water-use efficiency, and increased evapotranspiration rates-issues. Together, these findings demonstrate a shared understanding that climate risk manifests as a combination of hydro-climatic variability, ecological degradation, and thermal stress, with notable differences in severity across districts and ecological zones.

5.1.2. Vulnerable crops and farming systems

Extension officers identified wheat (71%) and cotton (57%) as the most climate-vulnerable crops, followed by rice (29%), sesame (29%), fruit orchards including citrus (29%), and vegetables (14%). One extension officer (14%) specifically highlighted early-sown cotton as highly exposed to sudden heatwaves, illustrating the misalignment between traditional cropping calendars and new climatic realities.

Researchers confirmed these vulnerabilities using available research evidence showing that wheat yields decline sharply with temperature rise and that cotton is extremely sensitive to heat and pest outbreaks under climate change. They further highlighted that monocropping systems, flood irrigation, and poorly managed soils weaken resilience-an observation consistent with national technical reviews. The overlap between high-value horticulture and staple cereals underscores that climate change threatens both farmer incomes and food security.

5.1.3. Existing Coping Strategies

Both researchers and officers acknowledged that farmers are not passive recipients of climate impacts; rather, they are experimenting with incremental adjustments. These include changing sowing dates or timing (reported by 43%), adopting ridge and bed planting (29%), adjusting irrigation schedules and intervals (29%), switching to improved stress-tolerant varieties (71%), and in some cases shifting towards less water-demanding crops as a form of diversification (14%).

Extension officers discussed how bed and ridge sowing is increasingly used to combat both water scarcity and waterlogging, with 43% of extension officers explicitly mentioning ridge or bed sowing as a coping strategy. However, they also noted limitations – highlighting salinity and waterlogging (14%) as persistent problems with no effective local solution yet available at scale – reflecting structural land and water management challenges.

Researchers expanded on this by explaining that while these incremental measures provide short-term relief, they remain insufficient without system-level interventions such as improved drainage, canal modernization, soil-health restoration, and water-efficient irrigation-approaches.

5.1.4. Communication channels and advisory uptake

Extension officers described a rapidly digitalizing extension landscape: WhatsApp groups (71% of officers), in-person visits or farmer meetings (71%), SMS alerts (43%), and social media or status updates (43%) were reported as primary advisory channels; one officer also referenced using electronic media. One officer specifically described maintaining a dedicated WhatsApp group where weather and technical messages are shared daily. Coordination with meteorological departments is growing but remains limited, as only 14% of officers explicitly referenced advisories originating from the Meteorological Department. While some officers (14%) noted that digital advisories improve farmer response, particularly for irrigation scheduling, others highlighted persistent constraints, including unequal mobile access (29%; one officer estimated only about 40% farmers have Android phones) and the fact that limited canal water availability can restrict farmers' ability to act on advisories.

Researchers supported these insights, stressing that Pakistan lacks a unified, reliable, farmer-friendly climate information system and that research outputs often fail to reach farmers in usable formats. Digital channels are expanding reach, but structural and technological barriers continue to restrict equitable adaptation.

5.1.5. Climate-smart practices: Opportunities and resistance

Both groups emphasized that certain climate-smart practices are easier for farmers to adopt. Extension officers highlighted sowing-time adjustments, improved sowing methods, disease-resistant varieties, and bed/ridge planting as practices that farmers readily accept. Conversely, practices such as drip and sprinkler irrigation, green manuring, conservation agriculture, tree plantation, and micro-irrigation systems face strong resistance. Key reasons include the high initial cost, fear of yield loss, skepticism toward new technologies, and deeply embedded traditional norms.

Researchers corroborated these barriers and added that limited technology transfer, insufficient field demonstrations, financing gaps, and lack of proven local success models further slow adoption. Misconceptions-such as "trees reduce yields"-and poor access to heat-tolerant varieties compound these challenges. This indicates a need for a dual approach: scale up low-cost, low-risk practices while tackling cost, knowledge, and behavioural constraints associated with advanced technologies.

5.1.6. Extension system constraints and support needs

Both groups pointed out serious structural challenges within the agricultural extension system. Extension officers reported ongoing issues like not having enough staff, a shortage of transportation, limited fuel and operational budgets, few chances for training, and being pulled into administrative tasks unrelated to their core duties. These problems mean they can’t visit farms often, struggle to reach remote villages, have trouble maintaining consistent follow-up after giving advice, and can’t regularly run demo plots or farmer training sessions.

They also mentioned that because they lack mobility and fuel, they can’t respond quickly to emergencies like floods, heatwaves, or pest outbreaks. On top of that, tight budgets make it hard to distribute printed advice, diagnose problems directly on farms, or bring communities together for discussions. Without enough refresher courses and access to up-to-date materials, officers find it difficult to offer advice tailored to local climate challenges – like dealing with heat stress, soil salinity, or pest control – and can’t easily turn new research into practical recommendations for farmers.

Researchers echoed these concerns, saying such barriers keep scientific breakthroughs from being used in the field. They also weaken the critical feedback loop needed to refine research based on real-world conditions. Poor coordination between research institutions and extension services, along with weak tracking of whether new practices are being adopted, means it's hard to learn what actually works. This slows down the improvement of both technologies and advice. Researchers stressed that without a strong extension system, even the most promising climate-resilient solutions won’t gain traction

5.1.7. Gender and youth in Climate-resilient agriculture

Both FGDs pointed to persistent gender and youth barriers. Extension officers noted some progress, such as recruitment and inclusion of female extension staff (71% of officers) and references to engaging women through existing roles such as cotton picking (14%). However, cultural and social norms (57%), mobility and access constraints (14%), limited female staffing (71%), and male-dominated technical roles (29%) still prevent many women from accessing timely climate information and extension services.

Researchers underscored that gender-responsive climate adaptation remains weak nationally. They highlighted that CRA frameworks call for women-inclusive technologies, gender-sensitive training modules, and community-level engagement models, which are not yet adequately implemented. Youth engagement was also described as limited, though some officers noted increasing interest among digitally connected young farmers.

5.1.8. Priority interventions and policy messages

When asked to identify priorities, extension officers highlighted early sowing of cotton (14%), climate-resilient or improved seed varieties (43%), resource-conserving technologies such as ridge and bed sowing (29%), tree plantation (14%), green manuring (14%), and farmer training or awareness programmes (29%). Researchers prioritized climate-resilient seed development, water-efficient irrigation technologies, data-driven advisory systems, improved soil health management, and multidisciplinary research (e.g., economics, social sciences, hydrology). Both groups emphasized the importance of demonstration plots, stronger research-extension collaboration, and consistent availability of quality inputs.

Their policy messages included:

- **Ensure timely supply of climate-resilient seeds and inputs:** This involves strengthening the supply chains for seeds and other essential farm inputs so that stress-tolerant varieties, fertilizers, and crop protection products reach farmers before sowing time and ahead of expected climate events. It also means improving quality control and last-mile delivery, so farmers can follow recommended practices without facing delays or uncertainty.
- **Reduce administrative burdens on extension staff:** Extension officers shared that being overloaded with non-extension duties and paperwork limits their ability to spend time in the field, conduct demonstrations, and provide guidance to

farmers. Simplifying reporting, digitizing routine tasks, and clearly distinguishing between administrative and advisory responsibilities would allow them to better focus on supporting farmers – especially during extreme weather events.

- **Increase investment in staff development and field facilities:** This includes regular training updates for staff on climate-smart practices and new challenges like heat stress, salinity, and pest outbreaks. It also requires providing practical support – such as transport, fuel allowances, and operational funds – for running demonstrations and farmer training sessions. These are the basic conditions needed to help more farmers adopt these practices effectively.
- **Institutionalize technical expert involvement in climate policy design:** They suggested creating formal ways for researchers and technical experts to be directly involved in shaping climate policies. This would help ensure strategies are grounded in evidence, tested in local conditions, and updated based on field-level feedback. It would also strengthen collaboration between research and extension, making policies more practical and effective on the ground.

5.1.9. Overall Implication

The combined focus group discussions reveal that both researchers and extension officers have a strong understanding of climate challenges and practical ways to adapt. They frequently mentioned increasing heat stress, more unpredictable rainfall, and more frequent flooding, along with specific local issues like salinity, waterlogging, soil degradation, and declining groundwater quality. They also talked about several practical, short-term farm adjustments already being tested – such as switching crop varieties, using ridge and bed planting techniques, changing irrigation schedules, and adjusting planting times.

However, despite this knowledge, their ability to scale up climate-resilient farming is limited by a range of interconnected challenges. These include weak operational capacity in the extension system – such as staff shortages, limited mobility, and inadequate training. Financial constraints also hinder farmers from adopting new practices and inputs. Moreover, climate information systems and feedback channels are underdeveloped, and the transfer of technology and field demonstrations are inconsistent. Coordination between research institutions and extension services is still too weak to support continuous, two-way learning. Additionally, gender-based barriers limit women's access to information, services, and decision-making, reducing the potential for households to adapt effectively.

A successful strategy for building climate resilience must bring together efforts across four key areas:

Farmer-level interventions: This includes expanding the use of stress-tolerant crop varieties and improving seed quality and availability. It also involves better soil health practices, such as increasing organic matter, using balanced fertilizers, and managing salinity where needed. Water-saving strategies – like improved irrigation scheduling and conservation-focused field methods – are also essential. These measures are critical because farmers are already facing multiple climate-related risks, but adoption is uneven due to cost and limited awareness.

Stronger extension systems: To improve extension services, it's not just about having more staff—it's also about ensuring they can move around easily and receive regular training. This enables them to provide practical advice during heatwaves, floods, and pest outbreaks. Digital tools like WhatsApp and SMS can help reach more farmers quickly, but they need to be better coordinated, inclusive of farmers with limited phone access, and tailored to local realities, such as water availability.

Research-extension-community integration: Stronger collaboration is needed to shift from general advice to location-specific solutions. This means co-designing field demonstrations, building structured feedback systems between farmers and researchers, and quickly testing and refining practices based on local needs – for example, tackling salinity and drainage in Rajanpur, managing water scarcity in DI Khan, or promoting technology-based demos in Ghotki.

Gender- and youth-inclusive approaches: For climate-smart agriculture to work, it must be inclusive. This involves increasing female-focused extension services, addressing cultural and mobility constraints, and creating learning opportunities tailored for women and young people. These steps help expand access to climate information, farm inputs, and training, leading to higher adoption rates and stronger household resilience.

Ultimately, it will take a coordinated, multi-pronged approach to truly build climate resilience in Pakistan's agriculture. The risks are complex and overlapping, and the barriers exist at every level—from individual farms to service delivery systems and national policies.

5.2. Farm survey on climate-resilient agriculture

This part presents an integrated analysis of the farmer survey on climate-resilient agricultural practices in three districts of Pakistan – Rajanpur, DI Khan, and Ghotki. The survey covers farm characteristics, perceived climate change impacts, adaptation strategies, constraints, financial and risk management, future priorities, and farmers' own suggestions. The findings are discussed in light of national and international literature on climate change and agriculture.

5.2.1. Farm characteristics and production context

The sample comprises 45 farmers, 15 from each district. Average farm sizes differ substantially (Table 1). Ghotki has the largest mean landholding (147.7 acres), followed by Rajanpur (136.6 acres), whereas DI Khan has smaller farms (66.3 acres). Land tenure patterns show that Ghotki farms are predominantly owner-operated; in contrast, Rajanpur farmers cultivate a high proportion of rented land (75.1 acres on average), while DI Khan is almost entirely owner-operated (Table 1).

This structure has important implications for climate adaptation. Owner-operated farms generally have stronger incentives for long-term investments such as soil conservation, tree planting, or irrigation upgrades, whereas tenants face uncertainty and may prefer short-term, low-investment strategies. Similar links between tenure security and adaptation have been reported for Pakistan and other Asian countries.

Soil conditions vary markedly between districts (Table 2-4). Based on farmer ratings, most farmers report "average" soil health and fertility, with only a minority describing their soils as "good". However, salinity emerges as a serious concern. Rajanpur is thus the most salinity-affected district in the sample. This is consistent with broader evidence that large parts of southern Punjab suffer from waterlogging and salinity due to canal irrigation, poor drainage, and climate-related hydrological stress.

Across districts, farmers predominantly rely on canal irrigation, with tube-wells as a supplementary source (Table 6). Around one-sixth of respondents report inadequate water supply, most frequently in Rajanpur.

The cropping pattern confirms reliance on Pakistan's major food and cash crops (Table 8). Wheat dominates Rabi, while rice, sugarcane and cotton dominate Kharif, with fodder and minor crops grown on smaller areas. This crop mix is highly sensitive to climate extremes – heatwaves, floods, and erratic rainfall – especially for wheat and cotton.

Mineral fertiliser use is relatively intensive, averaging around 3.5 bags of nitrogen and 2 bags of phosphorous per acre per crop, with lower use of potassium (Table 9-11). Residue management practices differ: approximately one-third of farmers incorporate crop residues, another third burn residues, and the remainder mainly use residues as livestock feed (Table 13). Residue incorporation improves soil organic matter and water-holding capacity, which enhances resilience to both drought and heavy rainfall, while residue burning contributes to nutrient losses and air pollution. Similar trade-offs between soil health and labour constraints are widely documented in South Asian farming systems.

5.2.2. Perceived impacts of climate change on agriculture

5.2.2.1. Weather-Related Hazards

The survey confirms that farmers in Rajanpur, DI Khan and Ghotki are already experiencing climate change impacts: erratic rainfall, floods, heatwaves, altered pest and disease regimes, and soil and water degradation. Their perceptions match recent scientific assessments that highlight Pakistan as one of the most climate-vulnerable countries, particularly in terms of agriculture and rural livelihoods. Farmers across all three districts clearly recognise climate change (Table 16-17). The most commonly reported manifestations include:

- **Erratic and excessive rainfall** (reported by 73% of farmers)

Farmers shared that rain now comes at unexpected times and usually in short, heavy downpours rather than steady showers. This unpredictability disrupts both sowing and harvesting, causes seeds to wash away, and increases crop lodging. It also leads to more frequent disease outbreaks, especially in crops like cotton, rice, and vegetables. These sudden rains often wash away fertilizers and make it harder for farmers to get into the fields when needed.

- **Floods** (62%)

Many farmers described floods as a major cause of crop loss and reduced income, as floodwaters submerge standing crops, damage field boundaries, and ruin stored seeds and fertilizers. They also said floods delay replanting, create a surge in pests once waters recede, and make recovery slow because they damage soil structure, irrigation channels, and farm roads.

- **Heatwaves and extreme heat** (38%)

Farmers observed that extreme heat events are happening more often and tend to strike during critical crop stages. This leads to flowers falling off, poor grain development, and lower overall yields. The heat also increases the need for irrigation, worsens pest problems – particularly sucking pests in cotton – and speeds up crop cycles, which can reduce yields even when other conditions are favorable.

- **Waterlogging and standing water** (18%)

Waterlogging, often caused by poor drainage, intense rainfall, or excessive irrigation, was linked to root damage, slower plant growth, and a higher risk of fungal diseases. Farmers noted that waterlogged fields are difficult to work in, making it hard to weed, spray, or apply fertilizer – leading to lower yields and more wasted inputs.

- **Drought or prolonged dry spells** (11% of farmers, mostly in DI Khan)

In DI Khan, farmers highlighted that dry spells are becoming longer and water availability less reliable. This lack of moisture during key crop stages puts stress on plants, increases reliance on groundwater, raises costs, and often forces farmers to adjust their planting dates, crop choices, or reduce the area they can cultivate.

These perceptions mirror scientific evidence that Pakistan is already experiencing increased frequency of heatwaves, heavy precipitation events and compound flooding, with serious implications for agriculture. Floods and intense monsoon events have recently caused extensive crop damage and infrastructure losses across the country, and farmers in this survey directly reference these hazards.

5.2.2.2. Crop-Level impacts, pests, and diseases

Farmers most frequently pointed to wheat (58%), sugarcane (49%), cotton (around 44%), and rice (18%) as the crops most affected by climate change (Table 18). They reported several key impacts: more frequent and severe pest attacks (69%), the emergence or worsening of crop diseases (40%), physical damage to crops from storms or lodging (27%), and noticeable reductions in yields (22%).

These losses go beyond just reduced production – they also increase input costs and risks for farming families. Pest outbreaks and disease pressures often lead to heavier pesticide use and more fieldwork, while damage from storms and crop lodging can lower the quality of grain and fiber and make harvesting more difficult.

What farmers described aligns closely with research showing that rising temperatures, increased humidity, and shifting rainfall patterns are changing pest and disease behavior and reducing yields – especially for major crops like wheat and cotton in Pakistan. Statistical analysis supports this view, showing a strong link between excessive rainfall and a rise in pest attacks ($r = 0.58$) and disease outbreaks ($r = 0.61$).

These findings echo broader regional studies that show climate extremes are already affecting farm productivity across Asia. They also highlight the urgent need to pair climate forecasts – especially rainfall predictions – with timely advice on crop protection and integrated pest and disease management to help farmers avoid preventable losses.

5.2.3. Adaptation strategies and indigenous coping practices

5.2.3.1. Adoption of climate-resilient practices

Farmers are not passive victims. They adjust sowing dates, diversify crops, change varieties, and adopt a mix of structural and behavioural practices. Yet adoption is highly uneven across districts, positively associated with landholding but heavily constrained by costs, knowledge gaps and institutional weaknesses. This aligns with national-level findings that adaptive capacity remains low despite high exposure to climate extremes.

The survey considered five core climate-resilient practices: (1) Crop diversity, (2) Water-saving technologies, (3) Agroforestry, (4) Land conservation measures, and (5) Drought- and heat-resilient crops (Table 19). A composite adaptation index was created by counting how many of the five practices each farmer used. District-level averages for this index are:

- DI Khan – 0.8 practices (low adoption)
- Rajanpur – 2.6 practices (medium adoption)
- Ghotki – 3.27 practices (highest adoption)

A simple regression of the number of practices adopted on total landholding indicates that larger farms tend to adopt more practices (correlation r = 0.36), with approximately 0.8 additional practices per 100 extra acres. This relationship is similar to other empirical work showing that wealthier or better-resourced farmers are more likely to adopt climate adaptation measures.

Nonetheless, farm size explains only part of the variation, underlining the importance of non-economic factors such as knowledge, social norms, and institutional support.

5.2.3.2. Tactical and behavioural adaptation responses

Beyond structural practices, farmers implement a range of tactical responses:

- Shifting sowing dates (56%)
- Crop diversification (40%)
- Switching to more tolerant varieties (33%)
- Adjusting irrigation scheduling (20%)
- Increasing pesticide use as a defensive response (29%)

Statistical analysis reveals impact-specific links such as flood exposure is associated with shifting sowing time (r = 0.52) and variety change (r = 0.46). Similarly, heatwaves are associated with crop diversification (r = 0.49) and higher pesticide use (r = 0.44) and drought stress correlates with adjustments in irrigation scheduling (r = 0.42).

These results indicate that adaptation is largely reactive and event-driven, reflecting short-term risk management rather than systematic, planned transformation – a pattern also highlighted in broader adaptation literature for South Asia.

5.2.3.3. Indigenous resilience practices

Indigenous practices – especially crop–livestock integration, residue management, and experiential climate knowledge – provide a critical foundation for resilience. When supported with modern science (e.g. soil testing, climate information services), these practices can evolve into robust climate-smart farming systems, as emphasised in studies on indigenous ecological knowledge (IEK) in Pakistan and other developing countries. Several indigenous or traditional practices continue to support resilience:

- **Crop–livestock integration**

Linking crops and livestock continues to be a practical way for farmers to build resilience, as it helps manage household risks. Many farmers feed crop residues to their animals and return manure to the fields, which boosts soil fertility and reduces the need to buy external inputs. Livestock also act as a financial safety net during climate shocks, which fits with the broader finding that climate-related events often lead to income uncertainty and loan repayment pressure. In response, households use strategies like keeping livestock to spread and manage risk alongside other coping measures.

- **Residue incorporation**

Incorporating crop residues into the soil helps build organic matter and improves the soil's ability to retain moisture. This is especially important in light of the report's focus on soil degradation, salinity threats, and the demand for affordable soil health solutions. By improving water-holding capacity, this practice helps reduce the effects of drought between irrigation cycles or during dry spells, making it a solid, low-cost approach to climate-smart soil management. The report also points out that burning residues harms long-term soil health, so incorporating them into the soil is a better option when possible.

- **Timing-based decisions**

Farmers are already using their local climate knowledge to adjust sowing and irrigation times based on rainfall patterns and seasonal cues. This behavior reflects their experience in dealing with changing weather and matches survey findings that show many are shifting sowing dates to cope with climate variability. Timing decisions are one of the most accessible ways for farmers to adapt when resources are limited. Strengthening advisory services with better forecasting can support and enhance these existing strategies by helping farmers make more accurate and timely decisions, rather than replacing their traditional practices.

However, problematic practices such as residue burning (Table 13) and a decline in agroforestry (Table 14) reduce long-term adaptive capacity by degrading soil quality and removing micro-climatic buffers.

5.3. Barriers, motivations, and financial risk

Frequent climate shocks, income volatility, rising input costs, and weak insurance and credit systems create a climate–debt trap for many households. Without targeted financial instruments – climate-smart credit, index-based insurance, and targeted subsidies – farmers will struggle to move from short-term coping to long-term adaptation and resilience.

5.3.1. Barriers to Adoption

The biggest obstacles farmers face when trying to adopt climate-resilient practices revolve around cost and access, with limited knowledge making these problems worse (Table 20). In total, 89% of farmers pointed to high upfront costs, 87% said they lacked access to necessary inputs or information, 71% cited a lack of training and technical know-how, and 27% mentioned social or community-related barriers.

These challenges reflect a wider trend highlighted in the report: climate change is already making incomes less stable and input costs higher. As a result, even when farmers understand the benefits of new practices, they often can’t afford to try them. This also matches broader findings from Pakistan and the region showing that financial limitations, gaps in information, and weak institutional support are the main roadblocks to climate adaptation.

- **High initial cost of technologies (89%)**

Cost stands out as the most common barrier, because many climate-smart options require money upfront – like better seeds, water-saving tools, land preparation changes, or extra crop protection. But many farmers are already struggling financially due to climate impacts. The report notes that 67% of farmers are experiencing income instability, and 60% are facing rising costs for fertilizer and pesticides. These factors make it hard to invest in new technologies without some form of financial support. Cost concerns are particularly high in DI Khan and Ghotki (93.3% each), showing that even in areas with relatively more resources, upfront cash needs remain a major issue.

- **Lack of access to materials or inputs (87%)**

This challenge is about both availability and reliability. Even when farmers are open to trying new methods, they often can't get quality seeds, fertilizer, equipment, or trusted technical advice when they need it. In the report, farmers emphasize the need for institutional and market support – for example, requesting input subsidies and better service delivery. Rajanpur had the highest percentage of farmers facing access issues (93.3%), which fits with the report's point that this district faces more complex land and water management problems and has weaker support systems in place.

- **Lack of training and technical knowledge (71%)**

The knowledge gap isn't just about not knowing what climate-resilient practices are – it's also about not feeling confident enough to try them or manage the risks during the initial stages. Many farmers highlighted their need for training in areas like climate-smart techniques (60%), managing pests and diseases under stress conditions (56%), and using modern irrigation tools (44%). Ghotki had the highest percentage of farmers struggling with this (80%), showing that even in better-off districts, hands-on experience, repeated support, and demonstration-based learning are still essential.

- **Community and social barriers (27%)**

Social issues include hesitation to try unfamiliar practices, strong reliance on traditional norms, and unequal access to information or decision-making power. Rajanpur again stood out, with over half of the farmers (53%) citing these issues, compared to 20% in Ghotki and just 7% in DI Khan. This suggests that in some places, technical support alone isn't enough – there's also a need to mobilize communities, build trust through local leaders, and set up demonstration plots to reduce fear and encourage learning from peers.

Taken together, these district-level differences point to a key lesson for program design: support for climate adaptation must combine financial tools (like subsidies, affordable loans, and insurance) with dependable access to inputs and practical, hands-on training. It also needs to be tailored to local conditions, especially where social barriers are more deeply rooted.

5.3.2. Motivations and drivers of adaptation

Farmers mentioned several reasons for adopting climate-resilient practices: reducing climate-related risks (56%), improving profits and income (42%), guidance from extension workers or professionals (42%), and access to subsidies or financial help (27%).

Notably, the fact that extension services are just as influential as the desire for profit shows that these services are doing more than just raising awareness – they're actively helping farmers make decisions, especially in areas where climate shocks happen often and uncertainty is high.

This fits with broader evidence showing that a farmer's willingness to adapt depends a lot on having access to reliable information, trusting the advice they receive, and feeling confident that the recommended practices are doable – not just on how risky they think the situation is.

The report also shows how these motivations vary by district, depending on local conditions. In Rajanpur, where farmers face serious challenges like salinity, waterlogging, and frequent climate changes – and where social constraints are more visible – many farmers are driven by climate concerns and are more responsive to extension advice as a way to reduce their losses. In Ghotki, where farms tend to be larger and adoption rates are higher, the motivation is more profit-oriented. This makes sense – farmers who are better resourced are more likely to invest in new methods when the financial benefits are clear. In DI Khan, there's a mix of motivations, but lower levels of adoption. This matches a context where issues like water scarcity and affordability hold back farmers from turning interest into real action.

These findings point to two key adaptation pathways that should be developed side by side:

First, a climate-focused pathway, where farmers adopt practices to reduce risk and maintain yields. This path can be strengthened with trustworthy advisory services, local field demonstrations, and practical training that gives farmers clarity on what works in their specific area. This approach builds on the strong demand for training seen in the report and reflects research showing that knowledge, confidence, and institutional support are crucial for long-term behavior change.

Second, a profit-focused pathway, where farmers adopt practices because they expect clear financial gains. For this to work, farmers need financial support and incentives, as high costs and lack of access to inputs are major barriers. Even though only 27% of farmers said subsidies were their main motivation, the overall findings make it clear that affordability is a key issue. Well-designed subsidies, input packages, and climate-smart credit options can help turn interest into actual adoption – especially for higher-cost solutions and better-quality seeds.

5.3.3. Financial stress, credit, and risk Management

Only about 40% of farmers have ever accessed formal or informal agricultural credit; Rajanpur has the lowest credit access (27%). Awareness of crop insurance stands at one-third of farmers, but actual uptake is extremely low (Table 21). Climate events translate directly into financial vulnerability:

- Income instability is reported by about 67% of farmers.
- Increased fertiliser and pesticide expenses are reported by 60%.
- Loan repayment difficulties after climate-related crop loss are reported by 47%.

Excessive rainfall and flooding show a strong positive correlation with income instability ($r = 0.58$), confirming that climate extremes are undermining farm-level financial resilience. Farmers employ several risk-spreading strategies – sowing-date adjustment, diversification, livestock keeping, savings, limited use of weather information and, in some cases, forward selling (Table 22). Farmers with credit access adopt more diversified risk management strategies ($r = 0.48$), underlining that financial inclusion supports adaptive capacity, as emphasised in recent adaptation studies.

5.4. Future Priorities, training needs, and institutional support

5.4.1. Future Priorities

Looking ahead, farmers have identified four key areas where they want to invest for the future: climate-resilient, high-yielding seeds (64%), improved irrigation and water management technologies (53%), better soil fertility management and testing (49%), and modern machinery and mechanisation (40%).

These choices matter because they go beyond short-term coping strategies. Instead, farmers are clearly aiming for deeper, more lasting changes to how farming is done. They're looking to upgrade the core technologies they rely on – like seeds, water systems, soil analysis tools, and machinery – rather than simply adjusting planting times or making small tweaks to current practices.

These forward-looking preferences also reflect the real, on-the-ground limitations farmers are facing today. For instance, nearly half of them want better soil testing and fertility management, yet only 16% have actually tested their soil. This highlights both a gap in available services and a growing demand for support in this area.

Similarly, the strong focus on irrigation improvements is tied to farmers' heavy reliance on canal irrigation, often supplemented with tubewells. With rainfall becoming more unpredictable and dry spells more common, there's a clear need for better water management and reliability. The push for more mechanisation shows that farmers are also looking for ways to save time and labour – especially since they're now dealing with tighter, climate-sensitive windows for land preparation, planting, and harvesting.

What farmers are prioritising lines up closely with what scientists recommend for climate-resilient food systems. The IPCC, for example, highlights adaptation measures like switching crop varieties, adjusting planting times, and improving fertilizer and irrigation use – all of which are reflected in farmers' emphasis on seeds and water systems.

From a program design perspective, the report suggests that these future priorities will be most effective if backed by practical training and strong extension services. That's because farmers are also asking for more support in learning climate-resilient techniques, managing pests and diseases, and using water-saving methods.

5.4.2. Training and information needs

Farmers show a strong interest in training, with their top priorities closely reflecting the main risks and challenges identified throughout the study. The most requested training topic is climate-resilient farming techniques (60%), highlighting farmers' need for practical, proven advice on how to adapt as rainfall becomes less reliable and heat stress more intense. A similarly large number (56%) want support with managing pests and diseases in changing climate conditions, which makes sense given their experience with increasing pest problems and crop diseases.

Training in water-saving irrigation methods (44%) is also a key area of interest, showing how important it has become to use limited water resources more efficiently – especially with longer dry periods and uneven rainfall. Interest in soil testing and nutrient management (40%) signals a shift toward more precise and informed soil health practices, which are essential where soil degradation is already hurting productivity. Lastly, about a third of farmers (31%) say they want help with financial literacy and credit management, recognising that adapting to climate change isn't just about farming practices – it also requires better financial planning, especially when it comes to input costs, loans, and repayments under uncertain conditions.

The data also shows that this demand for training is closely tied to knowledge gaps. The correlation between wanting climate-related training and feeling uninformed is quite strong ($r = 0.73$). In other words, the less confident farmers feel about their knowledge, the more eager they are to learn. This suggests that slow adoption of new practices often comes down to limited skills or confidence – not unwillingness to change.

In practical terms, this means training efforts should be hands-on, repeated over time, and tailored to local conditions. Approaches like demonstration plots, farmer field schools, and local advisory sessions – combined with follow-up support – can help farmers adopt new practices more confidently and with less risk.

5.4.3. Desired institutional and financial support

After speaking with farmers through the survey, a clear set of support priorities emerged – focused on making climate-resilient farming more affordable, practical, and scalable (Table 26):

- **Subsidies for climate-resilient inputs and technologies (73%)**

The most common request from farmers was for subsidies, reflecting how much high costs are holding them back. When farmers mention subsidies, they're usually referring to financial support that helps reduce the price of essential inputs like high-quality seeds, fertilizers, and crop protection products. They also want help covering the initial costs of adopting technologies that save water and conserve resources. This response shows that many farmers are interested in climate-smart practices, but simply can't afford them without support.

- **Investments in water infrastructure and drainage (60%)**

Water-related challenges – too much or too little – are a major concern. Farmers called for better water infrastructure to deal with floods, waterlogging, and droughts. This includes more reliable canal systems, well-maintained watercourses, better on-farm water use, and improved drainage in areas where standing water and salinity are common. The strong focus on drainage highlights a key point: farmers know that changing how they farm isn't enough if the broader water and land systems aren't also improved.

- **Access to low-interest credit (51%)**

Affordable credit was another major need. Farmers explained that access to low-interest loans would help them invest in adaptation – like buying improved seeds, irrigation equipment, or machinery – while also managing cash flow during uncertain weather. They also noted that climate shocks often lower yields and income, making it harder to repay traditional loans. So, they want financial products that reflect the real risks they face.

- **Stronger, more responsive extension services (40%)**

Farmers expressed the need for more useful and timely advice, especially during crises like floods, heatwaves, or pest outbreaks. They want extension officers to visit more often, offer specific local guidance (not one-size-fits-all advice), demonstrate what works on nearby farms, and respond quickly to changing conditions. This shows that farmers don't just need materials – they also need confidence and clarity about how to use them.

- **Practical and accessible crop insurance schemes (38%)**

Many farmers are interested in crop insurance to manage the growing risks from climate-related losses. But they're clear that the insurance needs to be simple, affordable, easy to understand, and quick to pay out. They want systems that actually help reduce risk – not ones that add extra hassle with unclear rules and delays in compensation.

In open-ended responses, farmers added even more detail. They talked about the need for reliable soil and water testing services, more local field trials of climate-resilient seeds, better access to modern tools and irrigation technologies, and policies that are straightforward, inclusive, and delivered on time.

Overall, the message from farmers is consistent: they don't just want new technologies – they need a supportive system around them. That means strong extension services, better infrastructure, financial tools, and farmer-friendly institutions that reduce risk and make it easier to adopt new practices. These findings are well-aligned with national and global recommendations, which stress the need for an enabling environment – alongside better farm-level practices – to help agriculture adapt to climate change effectively.

The findings point to several key policy priorities that can help unlock climate-resilient farming in the surveyed districts:

I. Strengthen climate-smart extension with locally tailored packages

Farmers need practical advice that reflects their specific local conditions. This means designing and delivering climate-smart “practice bundles” tailored to each district’s unique challenges – like salinity and drainage-focused support in Rajanpur, drought and pest management in DI Khan, and technology demonstrations and mechanisation in Ghotki. These packages should include clear, field-tested recommendations, seasonal farming calendars, and step-by-step guidance on when and how to apply these practices effectively.

II. Invest in soil and water rehabilitation as critical infrastructure

Long-term resilience requires more than just changes at the farm level. There’s a strong need for accessible soil and water testing services, better drainage systems, and well-maintained irrigation infrastructure. In areas facing chronic waterlogging and salinity, community-level interventions may be necessary, especially where individual farmers can’t fix these issues alone. Promoting agroforestry and improving soil organic matter are also important long-term solutions.

III. Expand access to climate finance to break adoption barriers

Affordability remains one of the biggest obstacles for farmers. Policymakers should scale up access to low-interest credit, targeted subsidies for quality seeds and climate-smart inputs, and user-friendly crop insurance. These financial tools should be linked to the adoption of proven climate-resilient practices – like certified seeds or efficient irrigation systems – to ensure they lead to real, measurable improvements on the ground.

IV. Align advisory services and incentives with farmer motivations

Farmers tend to adopt new practices for one of two main reasons: to reduce climate risks or to improve profits. Policies should therefore offer both timely advice (on risks, best practices, early warnings) and tangible incentives (like input subsidies, bundled packages, or market access). By doing so, both climate-conscious and profit-motivated farmers have a clear path to take action.

V. Build farmer capacity through training and local organisations

Regular, hands-on training – through farmer field schools, demo plots, and peer learning – is essential to close knowledge gaps and increase confidence. Supporting farmer organisations can also help with negotiating access to inputs, services, and information. These collective approaches build trust and reduce resistance by showing results and empowering local champions.

VI. Fix capacity gaps in the extension system

Farmers rely heavily on extension services, but many systems are overstretched. Addressing staff shortages, ensuring transport and fuel budgets, and providing regular training to extension officers – especially on climate-smart agriculture, pest management, and water use – are all essential. Also, reducing the administrative burden on technical staff would allow them to spend more time directly helping farmers in the field.

Overall, these recommendations echo both national and global guidance on climate adaptation in agriculture. The survey clearly shows that farmers in all three districts are aware of climate change and are already trying to adapt. But their efforts are held back by environmental constraints like salinity and water stress, financial and knowledge gaps, and weak institutional support. With coordinated action that strengthens systems, improves infrastructure, and makes finance and information more accessible, these farmers can play a leading role in transforming Pakistan's agriculture for a climate-resilient future.

6. Final recommendations

These recommendations stem directly from a comprehensive body of evidence gathered during the study. This includes insights from focus group discussions with researchers and agricultural extension officers, along with a structured survey of farmers in Rajanpur, Dera Ismail Khan, and Ghotki. The study clearly shows that climate change is already having a real impact on farming. Farmers are facing unpredictable and intense rainfall, floods, heat stress, and region-specific challenges like salinity, waterlogging, soil degradation, and declining water quality. Although farmers are making efforts to adapt – such as shifting planting schedules, using different crop varieties, and changing how they irrigate – these efforts tend to be reactive, inconsistent, and held back by high initial costs, limited access to good-quality resources and timely advice, and a lack of hands-on training and demonstration opportunities.

To tackle these issues, the recommendations have been grouped by stakeholder to reflect their unique yet interconnected roles in developing climate-resilient agriculture. Altogether, the recommendations propose a mix of immediate, low-risk steps and more long-term policy and institutional changes – laying out a clear and actionable path to shift Pakistan's agriculture from reactive measures to a more strategic, inclusive, and sustainable approach to climate adaptation.

6.1. Farmer-Level recommendations

(Primary adopters of climate-resilient practices)

- **Climate-Resilient crop and production practices**

Farmers need support to start using seed varieties that can handle heat, drought, flooding, and salinity – especially for key crops like wheat, cotton, rice, and sugarcane, which are particularly sensitive to climate changes. Ensuring that certified, climate-resilient seeds are available on time through local markets and extension services is key to helping farmers make this shift. To reduce both climate-related and market-related risks, farmers should be encouraged to grow a variety of crops instead of relying on a single crop – especially in areas that are highly exposed to climate stress.

- **Soil health and land management**

Soil testing services should be made more widely available and should come with clear, easy-to-follow guidance on how to manage nutrients, deal with salinity, and improve soil quality. Farmers should be supported in practices like leaving crop residues on fields, using green manure, and applying organic materials to boost soil health and water retention. Integrating crops with livestock can further improve soil fertility and provide more stable income. In areas affected by salinity, promoting salt-tolerant crops and suitable agroforestry practices should be a priority.

- **Water management and irrigation efficiency**

With water becoming scarcer and irrigation often being inefficient, it’s important to promote affordable and scalable water-saving techniques like ridge and bed sowing, laser land leveling, and better field channel designs. Farmers should plan irrigation based on crop growth stages and local weather forecasts. Where it's affordable, slowly introducing micro-irrigation systems – especially for high-value crops – can be beneficial. In places that suffer from waterlogging and heavy rains, improving drainage and managing water collectively at the community level is essential.

- **Farm-Level risk management and resilience**

To manage risks better, farmers should diversify their crops and mix different farming systems to spread out their climate and income risks. Making better use of weather forecasts and early warning systems can help them decide when to sow and irrigate. Other useful strategies include keeping some livestock, saving small amounts of money, and planting in staggered intervals to better handle unexpected weather events.

- **Capacity building and learning at farm level**

Farmers need hands-on, practical training that is repeated over time – not just one-time awareness sessions. Expanding farmer field schools and setting up local demonstration plots can show what climate-resilient practices look like in action. Encouraging peer learning – where experienced farmers share their knowledge – can help build trust and confidence in trying new methods.

6.2. Recommendations for Extension officers and advisory services

(Key delivery mechanism for adaptation)

- **Boosting the capacity of extension services**

To effectively support farmers with climate adaptation, extension services need stronger operational capacity. This means tackling staff shortages, improving their ability to travel to farming communities, and ensuring officers can spend enough time in the field. Administrative tasks that aren't directly related to technical support should be reduced so officers can focus on advising farmers. Reliable funding for things like transport, fuel, and daily operations is essential – especially during climate-related emergencies like floods, heatwaves, or pest outbreaks.

- **Tailored, Climate-Smart advice for farmers**

Extension teams should create and share climate-smart advice that is specific to each district and crop type. These messages should match local farming systems and clearly align with crop growth stages and expected climate conditions so farmers can act early and protect their crops. Since pest and disease outbreaks are closely tied to changing weather, pest management tips should be included with climate updates.

- **Using both digital and traditional communication channels**

A blended communication approach should be used – combining digital tools like WhatsApp and SMS with traditional methods like radio and local TV. This helps reach more farmers, including those without smartphones or internet access. Extension services should also build two-way communication systems, allowing farmers to ask questions, report issues, and get timely advice.

- **Demonstration, building trust, and supporting adoption**

Each district should have on-farm demonstration plots where climate-smart practices can be shown under real local conditions. Encouraging farmer-to-farmer learning, organizing exposure visits, and involving lead farmers can help build confidence and reduce the fear of trying new methods. Sharing real success stories from within communities can strengthen trust and help more farmers adopt these practices.

6.3. Recommendations for researchers and academia

(Innovation, validation, and evidence generation)

- **Focused, localized research based on actual needs**

Research efforts should zero in on the biggest climate challenges identified in the study – such as salinity and waterlogging in flood-prone areas, drought and water shortages in dry zones, and rising heat stress affecting crops across regions. The goal should be to create affordable, low-risk, and easy-to-use technologies that fit within the practical limits of what farmers can afford and implement. Research findings should directly address the specific needs of each district to make sure they are both useful and more likely to be adopted on the ground.

- **Strengthening links between Researchers, Extension Officers, and Farmers**

Researchers should collaborate closely with extension workers to design field trials and demonstrations that reflect real-life farming conditions. Systems should be set up to gather feedback from farmers and track how well things work in practice, so the research can be improved based on actual results. Research findings must then be simplified into clear, practical materials that explain what's being recommended, what benefits to expect, and any possible risks involved.

- **Integration of indigenous and local knowledge**

Indigenous climate indicators, coping techniques, and locally developed farming methods should be properly recorded as part of climate research. When these practices are proven effective through scientific testing, they should be refined and formally included in climate solutions. Once validated, they can be added to extension advice to make recommendations more locally relevant, widely accepted, and culturally appropriate.

- **Encouraging multidisciplinary climate research**

Climate adaptation research needs to go beyond just technical fixes. It should bring together experts from fields like farming, water management, economics, and social sciences. It's also important to include perspectives on gender and youth so that solutions are inclusive and fair. More support should be given to research that's practical, grounded in fieldwork, and directly informs the work of extension officers and policymakers working to make agriculture more climate-resilient.

6.4. Recommendations for financial institutions and private sector

(Reducing financial barriers to adoption)

- **Climate-Smart credit and financing**

Banks and other financial institutions should design special low-interest loan products to help farmers invest in climate-resilient technologies like improved seed, water-saving irrigation systems, soil amendments, and farm machinery. Loan repayment plans need to be flexible and take into account climate-related risks – such as offering grace periods after events like floods or heatwaves. Pairing credit with technical training and support from extension services can help reduce the risk for farmers and ensure that the financed technologies are used effectively.

- **Input supply and service markets**

The private sector should take a more active role in ensuring farmers have timely access to high-quality climate-resilient seeds and other essential inputs at local markets. Models like machinery rental and service provision should be encouraged so that small and medium-sized farmers can use tools such as laser levellers, planters, and irrigation equipment without having to make large upfront purchases. Businesses can also help scale up soil and water testing services, working alongside extension officers to ensure that test results lead to clear, practical guidance for farmers.

- **Climate risk insurance and safety nets**

Insurance products that help manage climate risk – especially index-based crop and weather insurance – should be tested in districts most vulnerable to climate impacts. These insurance options can help protect farmers against losses from floods, heat stress, and unpredictable rainfall. To build trust, insurance schemes should be straightforward, easy to understand, and quick in processing claims. In the early stages, farmers may need support through subsidized premiums or joint public–private risk-sharing approaches to encourage participation and show how valuable insurance can be as a tool for managing climate risk.

6.5. Government and Policy-Level recommendations

(Creating an enabling environment)

- **Strengthening extension as public infrastructure**

Governments should treat agricultural extension as a vital public service for climate adaptation and significantly boost long-term investment in staffing, field mobility, and operational resources. This includes filling technical vacancies, providing regular in-service training, and ensuring extension staff can prioritize fieldwork. Modernizing extension systems with digital tools for delivering advice, gathering data, and monitoring progress is essential. Continuous training on climate-smart agriculture, pest and disease dynamics, and water management should be institutionalized so that extension services stay responsive to changing climate challenges.

- **Integrated climate information systems**

A national integrated climate information system should be developed by connecting data from meteorology, irrigation, research, and extension sectors. This system should produce localized short-term forecasts and seasonal climate outlooks, delivered as clear, actionable guidance in local languages. Sharing this information at key stages – like sowing, flowering, and harvesting – can help farmers make preventive decisions. Technical literature highlights that such services are most effective when tailored to local needs, trusted by farmers, and supported by strong feedback loops through public institutions.

- **Targeted subsidies and incentive mechanisms**

Policies should focus on time-bound, targeted subsidies that lower upfront costs for adopting climate-resilient seeds, soil amendments, and water-saving technologies.

Public support for soil and water testing is especially important to guide evidence-based decisions on nutrient and salinity management. Incentives should be directly tied to the uptake of proven climate-resilient practices rather than offering general input subsidies, making sure public funds contribute to real resilience gains and efficient use of resources – as recommended by climate adaptation best practices.

- **Gender- and Youth-Responsive climate policies**

Climate policies must close persistent gaps in gender and youth inclusion. This involves hiring and retaining more female extension staff and community resource persons, and creating training formats that are accessible for women – through appropriate locations, timings, and content. Youth should be actively engaged by supporting agri-innovation, digital advisory services, and climate-smart service enterprises. Young people can be key drivers of change, given their openness to new technologies and their role in transforming rural economies.

- **District-Specific policy priorities**

Policies should be tailored to the unique climate risks and farming systems of each district. For example, Rajanpur should focus on managing salinity, improving drainage, and supporting flood recovery. In D.I. Khan, efforts should target drought response, water efficiency, and pest control under heat stress. Ghotki's larger farms offer a chance to pilot advanced technologies, mechanisation, and set up demonstration hubs for broader regional scaling. Technical literature supports such location-specific strategies as essential for making climate adaptation more effective.

6.6. Cross-Cutting implementation, coordination and monitoring

- **Multi-Stakeholder coordination platforms**

To implement climate-resilient agriculture efforts in a well-coordinated and effective manner, district-level coordination platforms should be set up. These platforms should bring together key players – such as extension services, research institutions, irrigation and water authorities, meteorological departments, NGOs, private sector representatives, and farmer groups. Regular coordination among these stakeholders can help better align advisory services, infrastructure development, and delivery of climate information. It also helps avoid duplication of efforts and strengthens the collective ability to respond to climate risks.

- **Monitoring, learning and adaptive management**

Every climate-resilient agriculture program should include a strong monitoring and learning system. This means tracking important indicators like how many farmers are adopting recommended practices, how stable crop yields remain during climate stress, and whether farm incomes are becoming more resilient. It’s also important to measure the involvement of women and youth to make sure the impact is inclusive. Ongoing feedback from both farmers and extension staff should be used to adjust advisory materials, financial tools, and program strategies over time – allowing for adaptive management as climate conditions continue to change.

- **Scaling and sustainability pathways**

Programs that prove successful in helping farmers adapt to climate change should follow a clear process – from initial piloting to evaluation and then expansion. Lessons from pilot efforts should guide scale-up into similar agro-ecological areas. Public–private partnerships should be encouraged to bring in innovation, financing, and efficient service delivery. For long-term impact, climate resilience needs to be built into everyday agricultural planning, budgeting, and development processes – not treated as separate or short-term projects.

6.7. Concluding remarks

This study shows that farmers across Pakistan’s varied agro-ecological zones are already aware of the climate challenges they face and are actively looking for practical solutions to adapt. Many are ready and willing to adopt climate-resilient practices, but their progress is often held back by gaps in institutional support, limited access to financing, and poor coordination among different systems.

To move forward effectively, it's crucial that government bodies, extension services, researchers, financial institutions, and the private sector work together in a more coordinated way. This collaboration is key to reducing risks, making climate solutions more affordable, and providing farmers with timely, locally relevant support.

There’s an urgent need to shift from small, one-off pilot projects to larger, integrated efforts that can make a real difference at scale. The recommendations in this report offer a clear, evidence-based roadmap to help strengthen climate-resilient agriculture in Pakistan – supporting long-term productivity, better rural livelihoods, and food security in the face of a changing climate.

Annexures / Appendices

Annexure-I: Farmers' survey data

Table 1. Landholding (Mean, Median, Min, Max)

District	Total Land (Mean)	Median	Min–Max	Own Land (Mean)	Median	Min–Max	Rented (Mean)	Median	Min–Max
Rajanpur	136.6	140	76–200	60.2	50	25–150	75.1	80	0–160
DI Khan	66.3	60	35–100	65.2	60	34–100	1.1	0	0–16
Ghotki	147.7	126	34–300	133.3	120	10–300	14.3	0	0–46
Overall	116.8	100	34–300	86.2	70	10–300	30.2	0	0–160

Table 2. Soil health

Soil Health Category	Overall %	Rajanpur	DI Khan	Ghotki
Below average	2.2%	6.7%	0%	0%
Average	64.4%	93.3%	66.7%	33.3%
Good	33.3%	0%	33.3%	66.7%

Table 3. Soil fertility status

Fertility Level	Overall %	Rajanpur	DI Khan	Ghotki
Below average	2.2%	0%	6.7%	0%
Average	64.4%	100%	40%	53.3%
Good	33.3%	0%	53.3%	46.7%

Table 4. Soil salinity

Soil Salinity	Overall %	Rajanpur	DI Khan	Ghotki
No salinity	46.7%	6.7%	93.3%	40%
Some salinity	53.3%	93.3%	6.7%	60%

Table 5. Soil testing

Response	Overall %	Rajanpur	DI Khan	Ghotki
Yes	15.6%	6.7%	13.3%	26.7%
No	84.4%	93.3%	86.7%	73.3%

Table 6. Main Irrigation Source

Irrigation Source	Overall %	Rajanpur	DI Khan	Ghotki
Canal	53.3%	60%	53.3%	46.7%
Tube-well	26.7%	20%	26.7%	33.3%
Rain-fed	4.4%	6.7%	0%	6.7%
Mixed	15.6%	13.3%	20%	13.3%

Table 7. Organic vs Traditional

Farming Type	Overall %	Rajanpur	DI Khan	Ghotki
Traditional	91.1%	100%	93.3%	80%
Organic	8.9%	0%	6.7%	20%

Table 8. Most Common Rabi and Kharif Crops (Frequency)

Crop	Rabi Mentions	Kharif Mentions
Wheat	41	–
Sugarcane	–	24
Rice	–	28
Cotton	–	20
Fodder	6	9
Mustard	4	–

Table 9. Average mineral fertilizer use (bags per acre)

District	N	P	K
Rajanpur	3.07	2.29	0.38
DI Khan	3.73	2.00	0.86
Ghotki	3.70	1.75	1.14
Overall	3.50	2.01	0.78

Table 10. Use of micro-nutrient fertilizers by district

District	Yes (n)	No (n)	Yes %	No %
Rajanpur	14	1	93.3	6.7
DI Khan	0	15	0.0	100.0
Ghotki	8	6	53.3	40.0
Overall	22	22	50.0	50.0

Table 11. Percent of farmers using each basis

District	Soil analysis %	Crop calendar %	Extension advice %	Own decision %
Rajanpur	0.0	6.7	20.0	80.0
DI Khan	0.0	20.0	13.3	80.0
Ghotki	6.7	0.0	53.3	66.7
Overall	2.2	8.9	28.9	75.6

Table 12. Percent of farmers using each type of organic input

Organic input type	Rajanpur %	DI Khan %	Ghotki %	Overall %
Animal manure	40.0	33.3	66.7	46.7
Compost	0.0	6.7	13.3	6.7
Biofertilizer	0.0	13.3	0.0	4.4
Green manuring	0.0	0.0	20.0	6.7
Poultry manure	0.0	0.0	13.3	4.4

Table 13. Crop residue management

District	Burning %	Animal feed %	Field incorporation %
Rajanpur	28.6	35.7	35.7
DI Khan	66.7	22.2	11.1
Ghotki	16.7	16.7	66.7
Overall	37.9	27.6	34.5

Table 14. Adoption trend of agro-forestry / shelter belts

District	Increased %	Decreased %	Maintained %
Rajanpur	0.0	53.3	46.7
DI Khan	20.0	20.0	60.0
Ghotki	7.1	85.7	7.1
Overall	9.1	52.3	38.6

Table 15. Reasons for decrease in trees/plants

Reason category	n	% of "Yes" farmers
Waterlogging / flood	6	27.3
Diseases (e.g. dieback)	4	18.2
Climate change / temperature stress	3	13.6
Cutting / fuel / selling	3	13.6
Chemical misuse (pesticides/fertilizer)	1	4.5
Other / not specified	5	22.7

Table 16. Overall Frequency of climate change impacts on agriculture

Impact Type	Frequency	% Farmers
Severe insect-pest attacks	31	**69%**
New diseases in crops	18	**40%**
Crop lodging / physical damage	12	**27%**
Yield reduction	10	**22%**
Delayed crop maturity	6	**13%**

Table 17. Quantitative frequency of climate change Impact types

Climate Impact Category	Frequency	% of Farmers
Excessive rainfall / uneven rainfall	33	**73%**
Floods	28	**62%**
Heatwaves / extreme heat	17	**38%**
Unexpected rainfall / off-season rain	11	**24%**
Waterlogging	8	**18%**
Drought / moisture stress	5	**11%**

Table 18. Crops Most Affected by Climate Change

Crop	Frequency Mentioned	% Farmers
Wheat	26	**58%**
Sugarcane	22	**49%**
Cotton	20	**44%**
Rice	14	**31%**
Fodder	8	**18%**
Vegetables	6	**13%**

Table 19. Adoption rates of climate-resilient practices (% of farmers)

District	Crop diversity	Water-saving technologies	Agroforestry	Land conservation measures	Drought-resilient crops
DI Khan	26.7	20.0	26.7	6.7	0.0
Ghotki	66.7	80.0	53.3	93.3	33.3
Rajanpur	46.7	80.0	6.7	86.7	60.0
Overall	46.7	60.0	28.9	62.2	31.1

Table 20. Barriers to adoption (% of farmers selecting each)

District	Lack of knowledge / training	High initial costs	Lack of access to inputs/info	Community barriers	Other barriers
DI Khan	73.3	93.3	86.7	6.7	0.0
Ghotki	80.0	93.3	80.0	20.0	0.0
Rajanpur	60.0	80.0	93.3	53.3	0.0
Overall	71.1	88.9	86.7	26.7	0.0

Table 21. Motivations for adopting climate-resilient practices (% of farmers)

District	Profit	Climate change mitigation	Extension services	Subsidy / financial assistance	Other motivations
DI Khan	46.7	26.7	20.0	26.7	0.0
Ghotki	80.0	40.0	26.7	20.0	0.0
Rajanpur	0.0	100.0	80.0	33.3	0.0
Overall	42.2	55.6	42.2	26.7	0.0

Table 22. Financial Constraints from Climate Change

Constraint Type	Frequency	% of Farmers
Crop loss leads to inability to repay loans	21	47%
Increased cost of fertilizers & pesticides	27	60%
High cost of irrigation due to water shortages	18	40%
Income instability	30	**67%**

Table 23. Climate risk management strategies used by farmers

Strategy	Frequency	% Farmers
Crop diversification	22	**49%**
Saving cash / emergency funds	12	27%
Keeping livestock as backup asset	19	42%
Contract farming / forward selling	5	11%
Using climate information (weather updates)	8	18%
Shifting sowing dates	25	**56%**

Table 24. Farmers' future priorities for farm improvement

Priority	Frequency	% Farmers
High-yield / climate-resilient seeds	29	64%
Better irrigation / water management	24	53%
Improved soil management (testing, fertility)	22	49%
Access to modern machinery	18	40%
Switching to profitable crops	16	36%
Expanding farm area	9	20%
Training in new technologies	15	33%

Table 25. Training and information needs of farmers under changing climate

Training Need	**Frequency**	**% Farmers**
Climate-resilient farming techniques	27	**60%**
Pest/disease management under climate stress	25	**56%**
Advanced irrigation & water-saving technologies	20	44%
Soil testing & nutrient management	18	40%
Financial literacy / credit management	14	31%

Table 26. Institutional and financial support needed by farmers under changing climate

Institutional Need	**Frequency**	**% Farmers**
Subsidies for inputs (fertilizer, seed, machinery)	33	**73%**
Water infrastructure improvements	27	**60%**
Access to low-interest credit	23	**51%**
Strong extension services	18	40%
Crop insurance schemes	17	38%
Market support / fair pricing	13	29%

Annexure-II
Questionnaire – Focus Group Discussion

Theme: Innovative Climate Adaptation & Resilient Strategies in Agriculture (Pakistan)

Target Group: Researchers & Academics (Universities and Research Institutes)

Consent Form

We are conducting a focus group discussion (FGD) to gather insights on climate adaptation and resilience in Pakistan's agriculture sector. You have been invited because of your expertise in research.

Participation is voluntary. Your responses will remain confidential and will be used only for research and policy purposes. You may refuse to answer any question or leave the discussion at any time. With your permission, notes or recordings may be taken to ensure accuracy.

By signing below, you consent to participate in this FGD.

Signature: ____________________ Date: ____________

Name: _____________________________

Section 1: Shared Core Questions

1. What major climate challenges are currently impacting agriculture in Pakistan?
2. Which crops, regions, or communities are most vulnerable?
3. What role do climate change-induced extreme weather events (e.g., floods, droughts, and heatwaves) play in shaping farming strategies?
4. What coping strategies are already in practice, and how effective are they?

Section 2: Research-Specific Questions

A. Innovations & Evidence

1. What recent research has shown promising results in developing climate-resilient seeds, soil practices, irrigation systems, or pest control?
2. Which indigenous practices have scientific validation for resilience, and how can they be scaled?
3. What lessons can we learn from other countries' adaptation research that apply to Pakistan?
4. How can climate-resilient agricultural innovations be adapted to different scales, from smallholder farmers to large commercial farms?

B. Research Gaps & Challenges

1. Where are the biggest knowledge gaps in climate adaptation for agriculture (e.g., salinity management, heat stress, crop diversification)?
2. What limitations do researchers face in data availability (climate, soil, crop yield, hydrology)?
3. How is research on livestock and mixed farming systems integrated into adaptation strategies?
4. How can multi-disciplinary approaches (e.g., integrating social sciences, economics, and agriculture) improve climate adaptation strategies in agriculture?

C. Technology Transfer & Outreach

1. How effectively are research outputs reaching farmers?
2. What barriers exist in moving from lab/field trials to farmer adoption (awareness, affordability, policy support)?

3. How can universities and institutes collaborate better with extension services, NGOs, and private sector?

4. What role do mobile technology and digital platforms play in disseminating climate-resilient agricultural knowledge?

D. Policy & Institutional Linkages

1. To what extent does government policy (e.g., National Adaptation Plan, provincial agriculture policies) align with research evidence?

2. How can research institutes influence policymaking more effectively?

3. What partnerships (international, local) are most useful for advancing adaptation innovation?

4. What role can local communities play in fostering climate adaptation and resilience, and how can researchers engage them effectively?

E. Future Research Directions

1. If given resources, what 3 top research priorities would you pursue in the next 5 years for agriculture resilience?

2. Which cross-cutting themes (gender, digital tools, finance, social equity etc.) need more academic attention?

3. Please rank which areas need urgent research investment.

Theme	Rank	Notes
Seeds		
Water		
Soil		
Livestock		
Data		
Finance		
Technology Transfer		

Any other___________

Section 3: Closing Reflection

1. Any other comments, if any:

Annexure-III

Questionnaire – Focus Group Discussion

Theme: Innovative Climate Adaptation & Resilient Strategies in Agriculture (Pakistan)

Target Group: Extension Workers / Agriculture Officers

Consent Form

We are conducting a focus group discussion (FGD) to gather insights on climate adaptation and resilience in Pakistan's agriculture sector. You have been invited because of your role as an extension worker/agriculture officer.

Participation is voluntary. Your responses will remain confidential and will be used only for research and policy purposes. You may refuse to answer any question or leave the discussion at any time. With your permission, notes or recordings may be taken to ensure accuracy.

By signing below, you consent to participate in this FGD.

Signature: ____________________ Date: ____________

Name: _____________________________

Section 1: Shared Core Questions

1. What major climate challenges are currently impacting agriculture in your district/area?

2. Which crops, regions, or farmer groups are most vulnerable?

3. What coping strategies are already in practice, and how effective are they?

4. How do climate change impacts vary by region (e.g., coastal, desert, mountainous), and how do these differences affect adaptation strategies?

Section 2: Extension-Specific Questions

A. Communication & Advisory

1. How do you currently communicate weather forecasts or advisories to farmers?

2. Are farmers able to act on these advisories in time? Why or why not?

3. What tools (SMS, apps, radio, in-person visits) are most effective for outreach?

B. Adoption & Barriers

1. Which climate-smart practices are easiest for farmers to adopt?

2. Which practices face the most resistance and why?

3. What common misconceptions or challenges do farmers report to you?

C. Institutional Challenges

1. What challenges do you face in promoting adaptation practices (resources, training, transport, trust)?

2. How well are extension services coordinated with universities, NGOs, and private sector?

3. What additional support would make your role more effective?

D. Gender & Inclusivity

1. How do you involve women and youth farmers in extension work?

2. What barriers prevent women farmers from fully accessing extension services?

E. Future Priorities

1. If you had to prioritize 3 climate-smart interventions for farmers in your area, what would they be?

2. What capacity-building (training, resources, data) do you need to support adaptation better?

3. Please rank which are most practical and impactful for farmers.

Practice/Innovation	Rank	Notes
Climate-resilient seeds		
Drip irrigation		
Crop diversification		
Organic methods		
Early warning alerts		
Flood-tolerant varieties		

Any other____________

Section 4: Closing Reflection

1. If you had one message for policymakers or funding agencies about how to improve agricultural extension for climate adaptation, what would it be?
2. Any other comments, if any:

Annexure- IV

سروے کا سوالنامہ

موضوع: پاکستان کے زرعی شعبے میں موسمیاتی تبدیلیوں کے مطابق طریقے اور مضبوط حکمت عملی

ہدف گروپ: ترقی پسند کسان

رضامندی کا فارم
ہم پاکستان کے زرعی شعبے میں موسمیاتی تبدیلیوں کے مطابق طریقوں اور حکمت عملیوں پر بصیرت حاصل کرنے کے لیے ایک سروے کر رہے ہیں۔ آپ کو ترقی پسند کسان رہنما کے طور پر مدعو کیا گیا ہے۔

یہ شرکت رضاکارانہ ہے۔ آپ کے جوابات راز رہیں گے اور صرف تحقیق اور پالیسی کے مقاصد کے لیے استعمال کیے جائیں گے۔ آپ کسی بھی سوال کا جواب دینے سے انکار کر سکتے ہیں یا کسی بھی وقت ڈسکشن چھوڑ سکتے ہیں۔ آپ کی اجازت سے نوٹس یا ریکارڈنگ کی جا سکتی ہے تاکہ درستگی کو یقینی بنایا جا سکے۔

نیچے دستخط کر کے آپ اس سروے میں شرکت کی رضامندی دیتے ہیں۔

دستخط:________________________ تاریخ:______________________

نام :____________________________________

سیکشن 1: زرعی فارم کی عمومی خصوصیات

۱۔ آپ کے فارم کا کل رقبہ کتنے ایکڑ ہے؟	
۱۔۱ کل رقبہ ملکیت (ایکڑ)	
۱۔۲ کل رقبہ ٹھیکہ (ایکڑ)	

۲۔ آپ کی زمین کی صحت کیسی ہے؟ (مٹی کا تناسب، زرخیزی، نمکیات کا مسئلہ وغیرہ)

زمین کی صحت	اوسط سے کم	اوسط	اچھی
مٹی کی نوعیت	ریتلی	میرا	چکنی
زمین کی زرخیزی	اوسط سے کم	اوسط	اچھی
کلراٹھاپن	کوئی نہیں	ہلکی کلراٹھی	زیادہ کلراٹھی

۳۔ کیا آپ اپنی مٹی کا تجزیہ کرواتے ہیں؟ ہاں / نہیں اگر ہاں، تو کتنی بار؟ ۱۔موسمی ۲۔سالانہ ۳۔ہر دو سال بعد ۴۔دو سال سے زیادہ	
۴۔ کیا آپ پانی کا تجزیہ کرواتے ہیں؟ ہاں / نہیں اگر ہاں، تو کتنی بار؟ ۱۔موسمی ۲۔سالانہ ۳۔ہر دو سال بعد ۴۔دو سال سے زیادہ	
۵۔ آپ کے فارم پر اگائی جانے والی فصلیں اور ان کا رقبہ (ایکڑ میں)	

ربیعی	i.	ii.	iii.	iv.
خریف	i.	ii.	iii.	iv.
کوئی اور	i.	ii.	iii.	iv.

۶۔ آپ کس قسم کی کھیتی باڑی کرتے ہے؟ ۱۔نامیاتی ۲۔روایتی	
۷۔ آپ کا کھیتی باڑی کا تجربہ کتنا ہے؟ (سال)	

آپ نے سال میں کتنی کھادیں (مثلاً 1 ایکڑ میں) استعمال کیں؟ اور کس قسم کی کھاد استعمال کی؟

نائٹروجن	i.	ii.	iii.	iv.
فاسفورس	i.	ii.	iii.	iv.
پوٹاشیم	i.	ii.	iii.	iv.
دیگر	i.	ii.	iii.	iv.

کیا آپ نے کبھی مائیکرو نیوٹرنٹ کھاد استعمال کی؟ ہاں / نہیں اگر ہاں تو آپ نے کون سی استعمال کی؟ (نام اور مقدار بتائیں)	

i.	ii.	iii.	iv.	v.

آپ کس طرح فیصلہ کرتے ہیں کہ کونسی کھاد کب ڈالنی ہے؟	

	مٹی کے تجزیے پر مبنی ۲۔کیلنڈر کے مطابق۔ ۳۔توسیعی عملے کی ہدایات کے مطابق ۱۔ ۴۔فیصلے پر مبنی
	آپ نے سال میں کتنی نامیاتی کھاد ڈالی؟ (ٹن فی ایکڑ)
	جانوروں کا فظلہ
	کمپوسٹ
	بائیو فرٹیلائیزر
	سبز کھاد
	پولٹری کا فظلہ
	دیگر
	فصلوں کے باقیات کو نمٹانے کے لیے کونسا طریقہ استعمال کرتے ہیں؟ ۱۔جلا دینا۔ ۲۔جانوروں کو کھلا دینا ۳۔کھیت میں دبا دینا ۴۔دیگر
	آپ کس قسم کی مشینری استعمال کرتے ہیں؟ ۱۔ہارویسٹر ۲۔کمبائن ہرویسٹر ۳۔moor ۴۔ریپر۔ ۵۔سپرنکلر۔ ۶۔ڈرپ ایریگیشن ۷۔ سیڈ ڈرل۔ ۸۔ دیگر
	پچھلے دس سالوں میں ایگرو فاریسٹری کا کیا حال رہا؟ ۱۔بڑھی ۲۔کم ہوئی ۳۔برقرار رہی
کیا کوئی درخت/پودا آپ کے فارم سے ختم ہوگیا ہے؟ اس کی وجہ کیا ہے؟	

سیکشن 2: مخصوص سوالات

۱۔پچھلے 2-3 سالوں میں آپ کی کھیتی باڑی پر کون سے بڑے موسمی چیلنجز اثرانداز ہوئے ہیں؟

۲۔ان موسمیاتی تبدیلیوں میں آپ کے فارم پر کون سی فصلیں یا مویشی سب سے زیادہ متاثر ہوئے ہیں؟

۳۔کیا آپ نے موسمیاتی تغیرات کی وجہ سے فصلی کیڑوں اور بیماریوں میں کوئی تبدیلی دیکھی ہے ؟

۴۔آپ کے کھیتوں میں موسمیاتی تبدیلیوں سے نمٹنے کیلیے جو حکمت عملیاں استعمال ہو رہی ہیں، وہ کتنی موثر ثابت ہوئیں ہیں؟

سیکشن 3: کسان سے مخصوص سوالات

موسمیاتی تبدیلیوں کے موافق اقدامات

۱۔آپ نے ان میں سے کون سے اقدامات موسمیاتی تبدیلیوں کے موافق کئے ہیں؟ (جو لاگو ہوں، وہ تمام منتخب کریں)

۱۔فصلوں کی تنوع

۲۔پانی کی بچت کی تکنیکیں

۳۔ایگرو فاریسٹری

۴۔زمین کے تحفظ کے طریقے

۵۔خشکی سے بچاؤ والی فصلیں

۶۔دیگر (براہ کرم وضاحت کریں) ____________________

۲۔ان میں سے کون سی پریکٹسز کامیاب ہوئیں اور کون سی نہیں؟

۳۔آپ کو ان پریکٹسز کو اپنانے میں کون سے چیلنجز کا سامنا ہے؟

۱۔علم یا تربیت کی کمی

۲۔ابتدائی لاگت زیادہ

۳۔وسائل یا مواد تک محدود رسائی

۴۔کمیونٹی کے افراد کی مزاحمت

۵۔دیگر (براہ کرم وضاحت کریں) ____________________

۴۔آپ کو یہ پریکٹسز اپنانے کے لیے کیا محرکات ہیں؟

۱۔منافع

۲۔موسمیاتی تبدیلیوں کے خطرات میں کمی

۳۔توسیعی محکمہ سے مشورہ

۴۔ سبسڈی یا مالی معاونت کی دستیابی

۵۔ دیگر (براہ کرم وضاحت کریں)________________________________

رکاوٹیں اور چیلنجز

۱۔ آپ کے علاقے کے دیگر کسانوں کو ان پریکٹسز کو اپنانے سے کیا چیز روکتی ہے؟

۲۔ آپ کو معیار کی بیج، پانی یا قرض جیسے وسائل تک رسائی میں کیا چیلنجز ہیں؟

۳۔ آپ کے فیصلوں میں معلومات (مشورہ، ایپس، محکمہ توسیع) کا کیا کردار ہے؟

علم اور ٹیکنالوجی

۱۔ آپ کو موسم کے پیش گوئی یا مشورے کی معلومات کہاں سے ملتی ہیں؟ (توسیعی کارکن، موبائل، ریڈیو)

۲۔ کیا آپ ان مشوروں پر اعتماد کرتے ہیں اور ان پر عمل کرتے ہیں؟ کیوں یا کیوں نہیں؟

۳۔ آپ کو بہتر زرعی فیصلے کرنے کے لیے کون سے نئے اوزار یا ٹیکنالوجی مددگار ثابت ہو سکتے ہیں؟

فنانس اور خطرے کا انتظام

۱۔ کیا آپ فصلوں کی انشورنس، مائیکرو کریڈٹ یا دیگر خطرے کے انتظامات کرتے ہیں؟

۲۔ آپ ان کا زیادہ استعمال کرنے میں کس چیز کی کمی محسوس کرتے ہیں؟

۳۔ آپ کو نئی موسمیاتی تبدیلیوں کے مطابق طریقوں کو اپنانے کے لیے کس مالی معاونت کی ضرورت ہے؟

۱۔ زرعی خام مال کے لیے سبسڈیز

۲۔ کم سود والے قرضے

۳۔ انفراسٹرکچر کی ترقی کے لیے گرانٹس

۴۔ دیگر (براہ کرم وضاحت کریں)________________________________

مستقبل کی ترجیحات

۱۔ اگر آپ کو مالی مدد ملے تو آپ اگلے 2 سالوں میں اپنے فارم پر کون سی 3 تبدیلیاں کرنا چاہیں گے؟

۲۔ آپ اپنے گھرانے یا کمیونٹی فارم کے فیصلوں میں نوجوانوں اور خواتین کا کیا کردار دیکھتے ہیں؟

۳۔ براہ کرم یہ درجہ بندی کریں کہ آپ کے فارم کے لیے کون سی پریکٹسز سب سے زیادہ موثر اور عملی ہیں۔

پریکٹس	**درجہ بندی**	**نوٹس**
کوالٹی بیج		
بوائی کی تاریخوں میں تبدیلی		
ڈرپ ایریگیشن		

مخلوط کاشت

مویشیوں کی تنوع

نامیاتی کھادیں

دیگر ____________________________

سیکشن 4: اختتامی عکاسی

۱۔اگر آپ کو پالیسی سازوں کو ایک پیغام دینا ہو تو آپ زرعی شعبے کو موسمیاتی تبدیلیوں کے مطابق کونسے اقدامات کرنے کا مشورہ دیں گے؟

۲۔اگر کوئی اور تبصرے ہیں تو برائے مہربانی یہاں شامل کریں