



ORCID of JAR: <https://orcid.org/0009-0000-0723-9485>

CrossRef DOI Number: [10.67244/jar.bwo-researches.v6i3.a627](https://doi.org/10.67244/jar.bwo-researches.v6i3.a627)

Link to the Paper: <https://jar.bwo-researches.com/index.php/jarh/article/view/627>

Edition Link: [Journal of Academic Research for Humanities JARH, 6\(3\), Jul-Sep 2026](#)

HJRS Link: [Journal of Academic Research for Humanities JARH \(HEC-Recognised for 2026-2027\)](#)

YouTube Link for the Paper Video Overview: <https://youtube.com/shorts/8Ug1ZnkQAWQ>

Climate-Smart Agriculture in Pakistan: Farmers' Perceptions, Gender Inequality, and Institutional Constraints

Author 1:	Zainab Habib , Scholar, International Relations, Department of Humanities and Social Sciences, Bahria University, Karachi, Pakistan, zainihabibbu@gmail.com , https://orcid.org/0009-0004-1220-4999
Author 2:	Neha Muskan , Scholar, International Relations, Department of Humanities and Social Sciences, Bahria University, Karachi, Pakistan, nehamuskan024@gmail.com , https://orcid.org/0009-0005-5850-0010
Corresponding & Author 3:	Dr. Muhammad Habib , Assistant Professor, Department of Humanities and Social Sciences, Bahria University, Karachi, Pakistan, muhammadhabib.bukc@bahria.edu.pk , https://orcid.org/0000-0001-5990-5283

Paper Information

Citation of the paper:

(JARH)Habib, Z., Muskan, N., Habib, D. M., (2026). Climate-Smart Agriculture in Pakistan: Farmers' Perceptions, Gender Inequality, and Institutional Constraints. In *Journal of Academic Research for Humanities*, 6(3), 162–172.

Subject Areas for JARH:

- 1 Farmers' Perceptions
- 2 Gender Inequality
- 3 Social Sciences & Humanities

Timeline of the Paper at JARH:

Received on: 05-08-2026.
Reviews Completed on: 29-08-2026.
Accepted on: 28-09-2026.
Online on: 29-09-2026.

License:



[Creative Commons Attribution-Share Alike 4.0 International License](#)

Recognised for BWO-R:



HEC Journal
Recognition System

Jointly Published by BWO Research INTL:



CrossRef DOI Image of the paper:



Abstract

QR Code for the Paper:



Climate change severely affects the agricultural sector through floods, droughts, intensified heatwaves, erratic rainfall, and reduced productivity. It threatens food security and the livelihoods of farmers, particularly for women and marginalised groups. This study adopts a qualitative explanatory approach to examine farmers' perceptions of climate change and Climate-Smart Agriculture (CSA), CSA adoption practices, and the role of social, institutional, financial, and gender-related factors in shaping adoption decisions. The study draws on primary data from six semi-structured interviews with farmers in Punjab, Sindh, and Khyber Pakhtunkhwa, supplemented by secondary sources including academic journals, NGO reports, government documents, and development publications. The interview and documentary evidence were analysed thematically. The findings reveal robust experiential knowledge of climate change among farmers, which is influencing partial adaptation to resilient agricultural practices such as hybrid seeds, improved irrigation, agroforestry, and soil conservation. However, several obstacles, including ineffective extension services, lack of financial resources, insecure land tenure, poor policy implementation of the policy and gender disparities, drastically restrict adaptation, especially limiting the role of women in decision-making. The reviewed evidence and participant accounts indicate that NGO-led trainings can contribute to improved agricultural resilience and productivity among women farmers. The study frames Climate Smart Agriculture CSA not only as a technological innovation but as a socio-institutional imperative. It advocates for robust extension networks, gender-responsive policies, equitable access to credit and land rights, and inclusive governance to empower marginalised groups. By outlining these facilitators and barriers, the study provides policy implications for developing climate-resilient agriculture, protecting food systems, and enhancing sustainable rural development in Pakistan.

Key Words: Marginalised groups, Climate-Smart Agriculture (CSA), Extension Services, Sustainable rural development, Socio-institutional imperative, Gender-responsive policies

1-Introduction:

Climate change is a strategic threat to agriculture, food security, and rural livelihoods in Pakistan. Pakistan is highly dependent on agriculture, making the country particularly vulnerable to climate-related risks such as floods, droughts, heatwaves, and unpredictable rainfall. These effects farmers crops, incomes and particularly on women and marginalized groups. Most studies on climate change in Pakistan have focused quantitatively on crop losses, rainfall variability, and economic impacts, while comparatively less qualitative attention has been given to the social, institutional, and behavioural factors influencing farmers' decisions to adopt CSA practices. Decision are depended on their personal preferences, and male and female farmers tend to have varied interests and priorities in farming. The crops that are grown by male farmers are normally those that are in high demand and higher yield profits as compared to the crops that are grown by female farmers. Gender as an aspect of innovation has been an issue, and women's role in innovation has been increasing over the past several years. However, the gap between male and female innovators remains considerable. (Sikod, 2007)

This study has taken Pakistan as a representative of the developing world. The sixth most populous developing country is Pakistan, and approximately two-thirds of Pakistani women are involved in agriculture. Historically, Pakistan has a very low position on the global gender equality indexes, and the rights of women have been restricted. To overcome these problems, Pakistan has signed international agreements to reduce the gap between men and women. Conventionally, Pakistani women have not been included in decision-making on farms. However, the events are shifting in Pakistan, and women farmers are leaving their unpaid family labor and becoming key decision-makers on farms. The number of women in agriculture is also on the rise since more men are shifting to towns to get non-agricultural employment. (Luqman, Malik, & Khan, 2006)

(In this study, the term 'women farmers'

refers to women who participate directly in agricultural activities and decision-making within farming households or farm operations; it does not necessarily imply that all participants are women-headed farm households).

This study aims to explore how smallholder farmers, especially women and marginalized groups, perceive and adopt climate-smart agriculture practices. It also examines the role of extension services, local governance, and policy intervention in promoting climate-resilient agriculture.

1.1 Background

Pakistan is widely regarded as one of the countries most vulnerable to the adverse impacts of climate change because of its diverse agro-ecological zones, sensitive geographic location, and heavy reliance on agriculture for rural livelihoods. Pakistan is an agrarian economy; therefore, agriculture plays a central role in national employment generation and food security. In the context of Pakistan, farmers, especially women, often face several challenges related to limited access to resources as well as cultural, societal, and personal barriers that restrict their adaptive capacity. These limitations highlight the need to strengthen their creative problem-solving behaviour and decision-making power to respond effectively to climate change. Therefore, this research aims to assess the decisional empowerment and innovativeness of women farmers and examine their role in adopting various climate-smart agriculture (CSA) practices at the farm level. In this context, a qualitative approach is useful for examining how women and marginalized farmers experience these constraints, understand climate-related risks, and make decisions regarding the adoption of CSA practices within their social and institutional environments.

The world can benefit greatly from giving more power to women in agriculture in terms of increased adoption of CSA practices, consequently improving food security and mitigating climate change. Results reveal that most of the women farmers lacked decisional power related to productive resources such as

sale and purchase, renting of farmland, using farm machinery, and availing credit. (Aziz, Nisar, Koondhar, Meo, & Rong, 2020)

Women farmers are disadvantaged relative to male farmers. Women farmers in developing countries lack financial capital and access to productive resources. Guaranteeing rights equivalent to males concerning water, land, income, and other resources could generate prolific results in sustainable agricultural productivity. In developing countries like Pakistan, women play an influential role in agricultural growth. Regardless of all this, women's share of food production is more than 50% worldwide, and the role of women in agriculture cannot be denied because 36.7% and 43.6% of the agricultural labor force of developed and underdeveloped countries, respectively, consisted of women in agriculture. (Shahbaz P. U., 2022)

Although existing research provides valuable evidence on CSA adoption, crop productivity, and economic outcomes, less attention has been given to how farmers themselves understand climate change and CSA within their social and institutional contexts. In particular, limited qualitative evidence explains how gender relations, access to resources, land tenure, extension services, and institutional support shape farmers' ability and willingness to adopt CSA practices. This gap is particularly important for women and marginalized farmers, whose access to productive resources and participation in agricultural decision-making may be constrained by social and institutional factors. This study aims to explore how smallholder farmers, particularly women and marginalized farmers, perceive climate change and CSA practices and how these perceptions shape their adoption experiences. By using qualitative evidence from farmers alongside relevant secondary sources, the study seeks to identify the barriers and enabling conditions that shape climate-resilient agricultural practices in Pakistan.

1.2 Statement of the Problem

Due to its geographic location, Pakistan is

recognized as one of the countries most susceptible to the adverse impacts of Climate Change. Pakistan is facing growing challenges of rising temperatures, irregular rainfall patterns, recurrent floods, extended droughts, heatwaves, and other extreme weather conditions that disturb the natural balance and agricultural productivity. These climatic shocks pose severe threats to food security and rural livelihoods. Those impact further affect smallholder farmers, communities that rely on livestock, and particularly women and marginalized groups who are more socially and economically vulnerable. Social and gender inequalities escalate vulnerability and restrict women's participation in the process of decision-making and access to resources, which undermines their ability to adopt adaptive farming practices. The growing population, especially urbanization, causes land degradation, water scarcity, and financial limitations that make the country more Vulnerable to climate change. Additionally, different factors like heavy reliance on Rain-dependent agriculture and traditional farming practices are increasing food insecurity, malnutrition, and livelihood struggles in rural areas. Analyzing the complex relationships between environmental, social, and institutional obstacles is vital for drafting effective climate resilience strategies. A Comprehensive analysis of these factors can guide policies that boost agricultural productivity and sustainable rural development, ensuring equitable resource distribution and long-term Climate resilience in Pakistan.

Despite the growing emphasis on CSA as a pathway to climate-resilient agriculture, insufficient qualitative attention has been given to how women and marginalized farmers experience and negotiate these constraints in their everyday agricultural practices. The problem is therefore not limited to farmers' awareness of climate change or CSA technologies; it also concerns whether farmers possess the resources, decision-making power, institutional support, and enabling conditions required to translate awareness into actual

adoption. This study addresses this problem by examining farmers' perceptions, adoption experiences, and the social, gender, financial, and institutional factors that shape CSA adoption in selected regions of Pakistan.

1.3 Research Objectives

1. To examine how farmers, particularly women and marginalized farmers, perceive climate change and climate-smart agricultural practices.
2. To explore the forms of CSA practices currently adopted by farmers in the selected regions.
3. To examine how gender relations, financial constraints, land tenure, extension services, and institutional support influence CSA adoption.
4. To develop evidence-based recommendations for gender-responsive and institutionally inclusive climate-resilient agriculture in Pakistan.

1.4 Research Questions

1. How do women and marginalized farmers perceive climate change and CSA practices?
2. What CSA practices are currently being adopted, and through which sources of knowledge?
3. How do gender relations, financial resources, land tenure, extension services, and governance affect CSA adoption?
4. What institutional and policy interventions could improve equitable CSA adoption among women and marginalized farmers?

1.5 Significance of the Study

This research is significant for several reasons:

1. This study highlights the social, institutional, and behavioral aspects of climate adaptation which are often overlooked in quantitative studies.
2. This study provides policy-relevant insights for strengthening climate-smart agriculture, extension services, and inclusive governance.
3. This study highlights the role of gender and marginalized groups in climate resilience to ensure equitable adaptation strategies.
4. The findings can guide government agencies, NGOs, and development organizations in

designing specific strategic actions to improve food security and rural livelihoods.

5. The study plays a role in the academic literature by unifying qualitative perspectives into the discourse on climate change and food security in Pakistan.

1.5 Rationale of Research/ Justification of the Study

Climate change poses a growing threat to Pakistan's agricultural sector, food security, and rural livelihoods. Although existing studies provide substantial quantitative evidence on climate impacts and agricultural outcomes, there remains limited qualitative understanding of how social, institutional, gender, and behavioural factors shape farmers' climate adaptation decisions. The rationale for this study therefore lies in examining the experiences and perceptions of women and marginalized farmers and understanding how access to resources, decision-making power, extension services, land tenure, and institutional support influence CSA adoption. A qualitative approach enables the study to capture contextual experiences that may not be adequately reflected through quantitative measures of adoption or productivity.

1.6 Scope

This study focuses on understanding how farmers in Pakistan, particularly women and marginalized groups, perceive and adopt climate-smart agricultural practices. It also examines the Role of Extension Services, including local governance and policy interventions, in promoting climate-resilient agriculture. The study explores social, institutional, and gender-based barriers to effective adaptation. Geographically, this study targets the climate-vulnerable regions where agriculture is the primary livelihood, including areas vulnerable to floods, droughts, and heatwaves. Methodologically, the study adopts a qualitative explanatory approach based on primary data from six semi-structured interviews with farmers in Punjab, Sindh, and Khyber Pakhtunkhwa, supplemented by secondary sources including academic literature, NGO

reports, government documents, and development publications. The primary data provide participants' experiential perspectives, while secondary sources are used to contextualize and triangulate the interview findings.

1.7 Limitations

The study is based on six semi-structured interviews and therefore provides contextual and experiential insights rather than statistically representative evidence of CSA adoption across Pakistan. The purposive nature and limited size of the interview sample may also restrict the diversity of perspectives captured in the study.

1. The findings depend on the accuracy, scope, and methodological validity of previously published studies. Any gaps, biases, or Irregularities in the sources may affect the validity of this research. The findings are geographically limited to participants from selected areas of Punjab, Sindh, and Khyber Pakhtunkhwa. Consequently, the experiences reported by participants should not be generalized to all women and marginalized farmers across Pakistan."
2. Due to limited resources, only materials published within the past 5–7 years were used.
3. The study also relies on selected secondary sources, whose methodological quality, scope, and potential biases may affect the interpretation and synthesis of documentary evidence.
4. Due to resource and scope limitations, the review primarily focuses on literature and reports published within the past five to seven years. This may exclude some earlier studies that could provide additional historical context.

2-Literature Review:

This research considered Pakistan as a case study to represent the developing world. Pakistan is the 6th most populous developing nation in the world, and almost two-thirds of Pakistani women are employed in the agriculture sector. More importantly, women farmers in Pakistan also confront similar hindrances as

faced by women farmers in other developing countries. Traditionally, Pakistani women have been kept away from the agricultural decision-making process. But now, the situation is changing in Pakistan, and the role of women farmers is also shifting from unpaid family labor to main decision-makers at the farm level. Moreover, feminization in farming is also growing due to the movement of males to cities for off-farm work. ([Shahbaz P. u., 2022](#))

Climate change poses a profound threat to agricultural productivity and food security in Pakistan; it is highly vulnerable due to its arid climate, mountainous terrain, and reliance on agriculture for livelihoods. Warming temperatures, irregular rainfall, floods, droughts, and other extreme weather events have negatively impacted crop and livestock production, as well as rural livelihoods, thereby increasing vulnerability in rural Pakistan ([Forster, 2022](#)). Various studies suggest that traditional farming practices, resource scarcity, and rapid population growth further exacerbate the vulnerability of Pakistan's agricultural sector. ([Abbas, 2025](#)) In developing countries, although they confront tenacious social hindrances and economic restraints, women play an influential role in agricultural growth. (Women own less than 20% of the world's land. It's time to give them equal property rights 2017)

CSA is essential for economic development, food security, environmental sustainability, and conservation of ecosystems in developing countries. CSA has three main attributes: (1) enhanced agricultural productivity and income; (2) improved farm resilience against climate change; and (3) decreased GHG emissions from agriculture. CSA refers to several practices and technologies intended to enhance this "triple win" ([Mohiuddin et al., 2020](#))

Women contribute more than 50% of the agricultural labor force in developing countries, but women farmers are comparatively disadvantaged compared to male farmers in controlling productive resources (land, animals, credit, and farm machinery). Women farmers' limited access to and control over physical and

human capital affects their livelihood and capacity to adopt different CSA practices at the farm level. Irrespective of the context under consideration, CSA adoption signifies the role of adaptive capacity, which depends on the decision-making power related to the usage of productive resources and the innovativeness of the women farmers. Moreover, Decision-making is one of the most important components of a farm manager's responsibilities, becoming more important under a changing climate. Women's access to farm resources positively contributes to the implementation of CSA. (Khoza, Van Niekerk, & NemaKonde, 2019).

Water availability is the fundamental requirement for good crop yield, and water conservation is key to sustainable food production in developing countries. Adoption of different combinations of CSA strategies maximizes the synergies at the farm level and enables farmers to overcome overlapping challenges of social, economic, and environmental sustainability (Haq, Boz, & Shahbaz, 2021)

Agricultural extension services are also playing a pivotal role in building adaptive capacity. Agroforestry is considered a significant land management strategy that utilizes natural resources efficiently. Agroforestry is the integration of woody vegetation (trees and shrubs) into the farming system. These trees and shrubs can be within or around the crops. Farming systems with agroforestry practices provide more ecosystem services (soil erosion reduction, enhanced carbon sequestration, and improved landscape biodiversity) than agroforestry-less farming systems. (Santiago-Freijanes et al., 2018). Additionally, socio-cultural factors such as gender inequality influence adaptation outcomes. Another researcher (Habib, 2025) reveals that women, particularly in rural and low-income households, are disproportionately affected by climate-induced shocks and further face higher risks of malnutrition, dietary deficiencies, and food insecurity.

There are targeted policies addressing

women's nutrition and inclusion in climate-smart agricultural initiatives are crucial for building equitable resilience. Agroforestry adoption represents another technique for overcoming climate risks and improving food security. Another study, Safeer et al 2025 highlight that climate variability, such as extreme weather and rainfall, decreases agricultural production and forest cover, which constrains adoption. The study uses the Theory of Planned Behaviour TPB and stresses that farmer belief of behavioral, normative, and control affects the acceptance of adopting agroforestry practices. Further, socioeconomic and global factors also interact with climate change to affect food security. Another study by (Abbas, 2025) that shows negative impacts of population and climate vulnerability on Pakistan's food security. However, globalization can help to reduce risks through adaptation.

There is a substantial body of literature on the adoption of Climate-Smart Agriculture CSA at the farm level. However, studies examining CSA adoption in relation to the decisional empowerment and innovativeness of women farmers remain limited. While research on CSA is growing, most studies in Pakistan and other developing countries have primarily focused on quantitative aspects, e.g., crop yield, economic returns, and adoption rates, often overlooking the social, institutional, and behavioural factors that shape farmers' decision-making processes. In particular, the roles of gender, decisional empowerment and the innovativeness of women farmers in influencing CSA adoption remain underexplored. Existing literature frequently assumes that households are homogeneous units, thereby neglecting intra-household inequalities and the marginalised status of women in terms of access to resources and participation in decision-making within farming households. Furthermore, there is a lack of qualitative insight into how women and marginalised farmers perceive climate change, adapt within their socio-cultural context, and interact with extension services, governance structures, and institutional support systems.

This research addresses these gaps by adopting a qualitative, gender-sensitive approach to explore the experiences, perceptions, and challenges faced by women and marginalised farmers in Pakistan.

3-Research Methodology:

This study adopts a qualitative explanatory research design based on both primary and secondary data to examine the factors influencing farmers' adoption of Climate-Smart Agriculture (CSA) practices in Pakistan. The study seeks to understand how farmers perceive climate change, how they understand and experience CSA practices, and how their attitudes and perceptions influence adoption behaviour. It also examines the contextual factors that shape CSA adoption, including extension services, governance, gender relations, financial constraints, land tenure, and institutional support. The qualitative design is appropriate because it enables the study to explore farmers' experiences and perceptions within their social, economic, and institutional contexts rather than focusing only on measurable adoption rates.

The study draws on two types of qualitative evidence. First, primary data were collected through six semi-structured interviews with farmers from selected areas of Punjab, Sindh, and Khyber Pakhtunkhwa. Second, secondary data were obtained from peer-reviewed journal articles, government reports, policy documents, NGO publications, international development agency reports, and relevant field-based studies on climate-smart agriculture in Pakistan. The primary interviews provide participants' direct experiences and perceptions, while the secondary sources provide contextual and supporting evidence for interpreting the findings.

Secondary sources were selected purposively according to their relevance to climate-smart agriculture, farmers' experiences, gender-related constraints, institutional support, extension services, governance, and agricultural adaptation in Pakistan. Priority was given to credible and methodologically transparent

sources that directly addressed the research objectives. The review primarily focused on literature and reports published within the past five to seven years, while relevant earlier sources were retained where necessary for theoretical or conceptual foundations.

The study directly addresses farmer behaviour responses to climate change, CSA Adoption patterns, gender-based barriers, and the role of extension services and governance. The selection focused on participants with direct involvement in farming activities and experiences relevant to the study's emphasis on women and marginalized farmers.

Ethical considerations were observed in conducting the semi-structured interviews. Participants were informed about the purpose of the study, and their participation was treated confidentially. Participants were identified through codes rather than personal names in the presentation of findings. Interview information was used solely for academic research purposes. The study also acknowledges and properly cites all secondary sources to maintain academic integrity and accurately represent the contributions of previous researchers and organizations.

4-Findings and Analysis

This Chapter highlights the findings, which are derived from six semi-structured interviews conducted in different cities, including Punjab, Khyber Pakhtunkhwa, and Sindh, along with analysis of selected NGO reports, including publications by (Aurat Foundation report, 2018), (GIZ, 2025), and (Community World Service Asia, 2025). Using thematic analysis, the findings are organized into key themes related to perceptions of climate change, awareness of climate-smart agriculture (CSA), and financial and institutional constraints. The analysis brings together primary and secondary data and explains how structural and social factors influence CSA adoption among women and marginalized farmers in Pakistan.

Most of the respondents reported observed changes in weather patterns over recent years. Farmers from Punjab and KPK highlighted irregular rainfall, extreme heat, and occasional

floods. On the other hand, respondents from Sindh highlighted that water stagnation and flood damage are frequent problems. These climatic disruptions were consistently linked to reduced crop yields, livestock stress, and unstable household income.

One of the respondents from Sindh observed unseasonal rainfall over the past two to four years, which directly reduced crop productivity. One of the female farmers from Sajawal described that the rising temperatures and water shortages as serious threats to both crop cultivation and livestock health. Likewise, a respondent from KPK observed irregular rainfall and heat stress with declining agricultural income.

A key finding from the interviews is the distinction between conceptual awareness of CSA and practical implementation of adaptive techniques. Many of the respondents had not heard of the term “climate-smart agriculture.” However, they were already applying practices consistent with CSA principles, including hybrid seeds, improved irrigation systems, solar tube-wells, agroforestry, and soil conservation.

For example, a respondent from Punjab used advanced irrigation and hybrid seeds due to government guidance, while a respondent from Swabi, KPK practiced agroforestry and soil conservation despite limited policy awareness. A respondent from Buner, KPK adopted Chinese hybrid seeds based on company marketing rather than extension training.

On the other hand, NGO driven initiatives reflect a more institutionalised understanding of CSA. For example, Community World Service Asia conducted training for 900 women farmers in flood-affected areas of Sindh and provided financial and technical support, which resulted in increased wheat yields. Similarly, GIZ Pakistan provided climate adaptation training to rural women in planting and water conservation. This comparison shows that CSA adoption is stronger where structured institutional support exists.

Financial barriers emerged as the most Central theme across interviews. Smallholder farmers repeatedly identified cost as the primary

obstacle to adopting improved irrigation systems, machinery, and modern inputs. Respondents cultivating rented land expressed particular hesitation in making long-term investments due to land insecurity.

Respondents from KPK emphasized that, as small farmers, the main problem is the financial limitations that prevent them from investing in advanced irrigation systems. Respondents from KPK reported that a lack of modern tools and limited access to training restricted further adaptation. Even those using CSA-related practices indicated that expansion depended heavily on financial capacity.

According to a 2023 Aurat Foundation report, shows that women’s vulnerability is due to social exclusion from land, extension, and policymaking rather than a deficit of ability. The 2018 reports also revealed unpaid work, wage discrimination, and lack of social protection for women farmers. However, NGO programs show that when supported by institutions, women’s productivity and capacity to adapt increase. Community World Service Asia reported higher yields of wheat and greater food security for women farmers who accessed CSA training and financial support. The case studies reveal that women have capacity to adapt, but are constrained from participating fully in the transition towards CSA. Gender inequality emerged as a critical determinant of CSA adoption. A respondent from Punjab noted that his father made all key farming decisions, while women participated primarily as labourers. Respondents from Swabi, KPK, and Buner, KPK, similarly reported minimal involvement of women in farming decisions.

Only the respondent (female farmer from Sajawal) described joint decision-making within her household. Despite this relative empowerment, she reported limited access to training, financial support, and technological resources. These observations are supported by the 2018 Participatory Assessment conducted by Aurat Foundation, which found that many agrarian women lacked access to credit, formal lease agreements, and financial services. Women

and marginalised farmers were unequally affected by limited financial inclusion and insecure land ownership. Thus, CSA is hindered not just by lack of knowledge but also by lack of access to resources through structural economic exclusion.

A consistent concern across interviews was the weakness of agricultural extension services. Several respondents reported minimal interaction with government programs and limited access to training workshops or policy guidance.

A respondent from Buner-KPK expressed dissatisfaction with policy implementation, while a respondent from Swabi-KPK reported receiving no formal support from extension officers or NGOs. A respondent from Umarmkot-Sindh suggested that stronger government policies and fair land distribution were necessary to support small farmers. By comparison, NGO-supported initiatives utilized formal training models and provided cash payments, which led to improved productivity and enhanced food security. The contrast between government outreach and NGO implementation suggests a gap in governance between policy development and implementation. While national climate policies recognise vulnerability, implementation strategies seem disjointed and inconsistent across regions.

Farmers working on leased lands expressed a lack of security to invest in long-term practices such as irrigation and soil amelioration. Land insecurity undermines incentives for sustainable adaptation. A lack of lease agreements was identified in the 2018 Aurat Foundation report. Overall, the findings indicate that CSA adoption among the participants is shaped by interconnected financial, gender-related, institutional, and structural factors. Participants demonstrated awareness of climate-related risks, but their ability to adopt or expand CSA-related practices was constrained by financial limitations, weak extension support, insecure land tenure, and restricted participation in agricultural decision-making. The evidence from NGO-supported initiatives further suggests that

International "Journal of Academic Research for Humanities (JARH) 6(3)" training, financial assistance, and institutional support can facilitate adaptation among women and marginalized farmers.

5-Discussion/Analysis

The research findings signify that the main barriers and facilitators to Climate-Smart Agriculture (CSA) adoption by women and marginalized farmers in Pakistan are aligned with the research aims. This discussion interprets these results in relation to existing literature, highlighting how experiential knowledge, institutional gaps, gender relations, and structural vulnerabilities influence the uptake of CSA in Punjab, Khyber Pakhtunkhwa (KPK), and Sindh provinces. The farmers in these areas are very aware of climate change because they have first-hand experience of the disturbed climatic conditions such as irregular rainfall patterns, catastrophic floods, and increasing heat waves. These climatic disruptions have been associated with reductions in agricultural productivity and household income. This awareness, to some extent, promotes the adoption of Climate-Smart Agriculture practices such as hybrid seeds and agroforestry, which improve soil stability and biodiversity (Icek Ajzen, 1991). Notably, farmers often adopt these practices through trial and error, without formal knowledge of CSA terminology. This is aligned with the Theory of Planned Behavior (TPB), where normative beliefs shaped by observing peers' successes influence adaptive intentions and behaviors. However, significant conceptual gaps remain. Most knowledge is acquired through informal sources, such as private seed companies or word of mouth, rather than formal extension services. This fragmented learning limits bigger behavioural change towards long-term resilience, as farmers are hesitant to invest in unfamiliar or complex practices without reliable guidance.

The government extension services are a significant challenge, with interviewees in all provinces reporting that the services are inconsistent and underfunded. Remote smallholders are rarely reached, leaving a gap that is often filled by NGOs such as GIZ and

Community World Service Asia. These results resonate with those who criticize the lack of relationship between knowledge transfer and productivity increase, and attribute it to fragmented governance frameworks that favor large-scale mechanized farms at the expense of smallholders. Gender inequalities further constrain CSA adoption. Although women contribute over 43 per cent of agricultural labour in Pakistan, they control 10-20 per cent of farmland globally and have limited decision-making power over resource allocation, such as access to credit or the distribution of machinery. This marginalization restricts their ability to innovate, confining them to low-input activities. In the case study from Sujawal district, women were empowered to make joint decisions that enabled them to trial CSA practices such as intercropping and organic composting, which brought greater resilience. This is supported by literature: multivariate probit models indicate that decisional autonomy is positively correlated with the adoption rates. A report by the Aurat Foundation (2018) further highlights structural barriers, including limited access to credit due to the requirement of male guarantors and cultural norms that deny women remuneration for farm work. However, NGO-led interventions reveal the untapped potential of women, suggesting that empowering them could reduce global poverty by 12-17% (Food and Agriculture Organization of the United Nations, 2020). Thus, women's empowerment acts as a multiplier for CSA adoption and supports a gender-inclusive policy framework.

The findings can be interpreted through the Theory of Planned Behavior by demonstrating how attitudes, social influences, and perceived control interact with structural conditions such as gender norms, financial constraints, land tenure, and institutional support. This interpretation extends the discussion of CSA adoption beyond individual attitudes by highlighting the contextual conditions that can enable or constrain farmers' perceived ability to adopt adaptive practices.

However, the study has several limitations.

First, the primary qualitative evidence is based on six semi-structured interviews, which limits the diversity of perspectives and prevents statistical generalization. Second, the selected secondary sources vary in geographical coverage, research design, and methodological approach, which may affect comparability. Future research could build on these findings through larger and more geographically diverse qualitative samples and, where appropriate, mixed-method research.

Conclusion and Recommendations

This study examined how women and marginalized farmers perceive climate change and Climate-Smart Agriculture (CSA) practices and how financial, gender-related, institutional, and structural factors influence their adoption experiences. The findings from six semi-structured interviews, supported by selected secondary sources, indicate that participants possess considerable experiential knowledge of changing weather conditions, including irregular rainfall, extreme heat, flooding, and water-related challenges. Although several participants were unfamiliar with the term "Climate-Smart Agriculture," they reported using practices such as improved irrigation, hybrid seeds, agroforestry, solar tube-wells, and soil conservation. This indicates that climate-adaptive practices may exist even where formal awareness of CSA terminology is limited.

The evidence from NGO-supported initiatives suggests that training, technical assistance, and financial support can facilitate access to CSA-related knowledge and resources. However, the findings also indicate the importance of strengthening institutional and government-level mechanisms so that support for climate-resilient agriculture is not limited to specific projects or locations.

Overall, the study suggests that CSA adoption should be understood not only as a technological process but also as a socio-institutional process. Because the study is based on six interviews and selected secondary sources, its findings provide contextual qualitative insights rather than nationally representative evidence. Future

research can build on these findings through larger and more geographically diverse samples and by combining qualitative evidence with quantitative assessment where appropriate.

Based on the findings of the study, the following recommendations are proposed to strengthen the adoption of Climate-Smart Agriculture (CSA) among women and marginalized farmers in Pakistan:

Government agricultural extension departments should strengthen outreach services for women and marginalized farmers. Financial constraints emerged as one of the major barriers to the adoption and expansion of CSA practices. Policies should therefore promote greater security and transparency in land-tenure arrangements, particularly for smallholder and tenant farmers. Women should be provided greater opportunities to participate in decisions concerning agricultural production, resource allocation, farm inputs, credit, machinery, and household agricultural investments. Agricultural programs should recognize women not only as agricultural labourers but also as active decision-makers and participants in climate adaptation.

Future research should examine CSA adoption through larger and more geographically diverse samples. Further qualitative research can explore the experiences of women, tenant farmers, and other marginalized groups in greater depth, while mixed-method studies can complement these findings with quantitative evidence on the extent and determinants of CSA adoption across different regions of Pakistan.

Bibliography

Abbas Haider, A., Kousar, S., Lu, H., Lu, S., Liu, F., Li, H., Miao, C., Feng, W., Ahamad, M. I., Mehmood, M. S., & Zulqarnain, R. M. S. (2025). Climate variability, population growth, and globalization impacting food security in Pakistan. *Scientific reports*, 15(1), 4225.

Aurat Foundation report. (2018 Oct 30). Launching Ceremony of Participatory Policy.

AzizN., NisarQ.A., KoondharM.A, MeoM.S., & Rong, K. (2020). Analyzing the women's empowerment and food security nexus in rural areas of Azad Jammu & Kashmir, Pakistan: By giving consideration to sense of land entitlement and infrastructural facilities. *Land*

International "Journal of Academic Research for Humanities (JARH) 6(3)"

Use Policy, 94, 104529.

Community World Service Asia. (2025 Jan 17). Empowering communities through climate-smart agriculture.

(2020). Food and Agriculture Organization of the United Nations. The state of food and agriculture 2020: Overcoming water challenges in agriculture.

Forster, M., Smith, C. J., Walsh, T., Lamb, W. F., Lamboll, R., Hauser, M., Ribes, A., Rosen, D., Gillett, N., Palmer, M. D., Rogelj, J., von Schuckmann, K., Seneviratne, S. I., Trewin, B., Zhang, X., Allen, M., Andrew, R., Birt, A., Borger, A., Boyer, P. (2022). Indicators of Global Climate Change 2022: annual update of large-scale indicators of the state of the climate system and human influence. *Earth Syst. Sci. data*, 15, 2295–2327.

GIZ Deutsche Gesellschaft für Internationale Zusammenarbeit. (2025 May 01). Strengthening climate adaptation and climate resilience, Pakistan. pakistan: GIZ.

HabibKarim, H., & Lehri, Z. A.S. (2025). The impact of climate change on women's nutrition and food security in Pakistan. *Policy Journal of Social Science Review*, 3(10).

Haq S. U., Boz, I., & Shahbaz, P. (2021). Adoption of climate-smart agriculture practices and differentiated nutritional outcome among rural households: A case of Punjab province, Pakistan. *Food Security*, 13, 913–931.

Icek Ajzen. (1991). The theory of planned behavior. *Human Decision Processes*, pages 179– 211.

KhozaS., Van NiekerkD., & NemaKondeL.D. (2019). Understanding gender dimensions of climate-smart agriculture adoption in disaster-prone smallholder farming communities in Malawi and Zambia. *Disaster Prev. Manag. Int. J.*, 28, 530–54.

LiR., WeiC., AfrozM.D., LyuJ., & ChenG. (2021). A GIS-based framework for local agricultural decision-making and regional crop yield simulation. *Agric. Syst*, 193, 103213.

LuqmanM., MalikN.H., & KhanA.S. (2006). Extent of rural women's participation in agricultural and household activities. *J. Agric. Soc. Sci.*, 2, 5–9.

MohiuddinI., KamranM.A., JalilovS. -M., Ahmad M. -U.-D., AdilS.A., UllahR., & Khaliq. (2020). T. Scale and Drivers of Female Agricultural Labor: Evidence from Pakistan. *Sustainability*, 12, 6633.

Panhyar, A., Magsi, D. I., & Chandio, N.M. (2025). Climate Change and its socioeconomic impacts on Pakistan's agriculture sector. *Journal of Climate and Community Development*, 4(2), 37-43.

Santiago-Freijanes J.J., Pisanelli A., Rois-Díaz M., Aldrey-Vázquez J.A., Rigueiro-Rodríguez A., . . . M.R. (2018). Agroforestry development in Europe: Policy issues. *Land Use Policy*, 76, 144–156.

Shahbazul Haq, S., Abbas, A., Batool, Z., Alotaibi, B. A., & Nayak, R. K.P. (2022). Adoption of Climate-Smart Agricultural Practices through Women Involvement in Decision-Making Process: Exploring the Role of Empowerment and Innovativeness. *Agriculture*, 12(8), 1161.

Shahbazul Haq, S., Abbas, A., Batool, Z., Alotaibi, B. A., & Nayak, R. K.P. P. (2022). Adoption of climate-smart agricultural practices through women's involvement in decision-making process: exploring the role of empowerment and innovativeness. *agriculture*, 12(8), 1161.

Sikod, F. (2007). Gender division of labour and women's decision-making power in rural households in Cameroon. *Afr. Dev.*, 32, 58–71.

Women own less than 20% of the world's land. It's time to give them equal property rights. *monique villa: world economic forum*.