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RESEARCH PAPER

Small-Scale Farmers' Perception of Climate Change Vulnerabilities to their Crops and Adaptation Behaviours in Punjab, Pakistan

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ABSTRACT

The rudimentary focus of this research is to explore the climate-change perception of small-scale farmers in the Punjab and to shed light on their adaptation behaviour. Historically, the past agri-climate actions construed farmers as a collective community, neglecting their distinct roles, obscuring their understanding of climate knowledge and restraining the government from introducing techno-economic solutions. Resultantly, the small-scale farmers continued to adhere to traditional farming, posing peril to climate change and food security. The data collected through eight semi-structured interviews conducted in Sialkot and Faisalabad districts suggests that small-scale farmers do not perceive climate change as an unusual threat. Further, due to their limited adaptive capacity and fatalist approach against climate change, the farmers consistently are at loss and have resorted to autonomous adaptation behaviour involving slight adjustments to conventional farming practices, compared to government's high-end artificial inputs and farm mechanisation. Ergo, this study recommends modernisation of the small-scale farmers to address these syndromes.

KEYWORDS Adaption Behaviours, Climate Change, Perception, Small Scale Farmers

Introduction

Agriculture in Pakistan's Punjab is extremely sensitive to extreme climate conditions like heat stress, drought, and heavy rains that jeopardise both food security and productivity (World Bank, 2022). The essential climate-smart practices are supported by international frameworks like the IPCC (2022), however, the small-scale farmers have adopted these measures in a very limited way. This syndrome is mainly looming because climate adaptation is not merely a technical process but it is profoundly shaped by political, social, and economic, contexts (Brink et al., 2023). Historically, the policies of the government have viewed the farmers uniformly, thereby neglecting the unique challenges of small-scale farmers who consist of 50% of Punjab's farm owners (PBS, 2010). These farmers, being marginalised and facing dearth of resources, are at peril and have adhered to ancestral methods, depicting resistance to externally propelled adaptation strategies (Burton et al., 2008; Schwartz & Meltzer, 2018). The Government policies that clubbed the landholders from three to seventy five *acres* together (Punjab Agriculture Policy, 2018); failed to address the constraints and specific needs of small-scale farmers. This has resulted in low engagement with modern climate-smart technologies and restrained uptake of government interventions, leaving traditional and less resilient farming practices dominant and impeding effective climate adaptation and food security in the Punjab (World Bank Group, 2019; FAO, 2022).

Literature Review

The study relies on thematic Literature Review. The following are the main themes focused in the Literature Review in order to understand the foundations of the topic and to find the research gap:

Who are Small Scale Farmers and what is their importance?

The definition of small-scale farmers is complicated because of its diversity in the characteristics of farms, resources, and agro-ecological environments. According to the FAO (2017), the small-scale farmer is a marginalised, resource-poor category, and this marginalised category is usually linked to poverty and low probability of success. Although land-size criterion (less than 2 hectares in size) is universally applicable to facilitate operations and ease in work, it is constrained. The farm distribution, organization of labour, differences in productivity among regions cannot be explained by the size of land alone (Gillman et al., 2019; Ricciardi et al., 2020). A good example is one hectare in Sub-Saharan Africa and compared to one hectare in the region of the Black Sea.

Nevertheless, the two-hectare limit remains unarguably popular: Two-thirds of world farms cover fewer than two hectares. In Pakistan, there are 67 percent of farms with less than two hectares, therefore having small-scale farmers being a major agricultural force in the country (PBS, 2010). By taking into account even farms smaller than 5 hectares, which is a concession to the fertile Punjab lands, it turns out to be true that more than 90 percent of farmers can be deemed as small scale (GoP, 2018). Some of the small-scale farmers, especially 90 percent of wheat farmers in Punjab, contribute to food security although they are still involved in the traditional farming that will continue to become less efficient against climate change (Gorst et al., 2018; Nadeem, et. al., 2023)). The inability of the subsidies and agri-tech investments to alter the behaviour of farming highlights the importance of the comprehension of the interaction between the governments' activity and the behaviour of the small-scale farmers, rather than just blaming the deficiency of resources.

Farmer behavioural factors

The past years have been marked by the increased attention to the behavioural aspects of farmer decision-making in terms of policies. Most studies however tend to assume farmers as a unified group never investigating into the personality of the individual small scale farmers. There is the negligence of the mechanisms of individual behaviour, biases, and the construction of perception (Dessart et al., 2019). The majority of the interventions target top-down controls and utility maximisation policies with little knowledge regarding the intrinsic behavioural motivation of small-scale farmers.

The Theory of Planned Behaviour (TPB) holds the view that attitude, social norm and sense of control influence behaviour (Ajzen, 1991). There is a potent influence of background factors, education, media exposure, financial capacity, and on beliefs and behaviour (Sok et al., 2020). Still, rationality is a kind of a social concept, not necessarily suitable to environmental policy, as there is imperfect information and externality (Shogren, 2012; Ashraf, 2021). However, behavioural economics in turn proposes such concepts as *status quo* bias, endowment effects, and loss aversion because decision-making do not follow the rational approach (OECD, 2012; Thaler, 2016).

The use of behavioural economics is controversial: Its opponents (Halpern, 2015; Rose, 2018) contend that it makes people an instrument of manipulation and that most of its outcomes have a temporary nature as they cease as soon as the incentive is turned off. However, other countries such as the UK have managed to enact policy instruments of the behavioural nature like cash payments to engage in sustainable agriculture (DEFRA, 2013).

The literature on adaptation behaviour of farmers is still divided whether such behaviour of the farmer is rational or not and there is little cross-disciplinary studies, especially in Punjab. To address this gap, the present paper uses the distal-proximal spectrum (Dessart et al., 2019), that contains in itself disposition factors (personality, values, goals), social factors (pressure of the community, norms), and cognitive factors (control, prejudice, perception of risks). This economic, sociological and psychological approach allows one to take a whole perspective of the behaviour of adaptation by the small-scale farmers.

Farm level vulnerability:

The vulnerabilities on the farm level include social measures and ecological measures (IPCC, 2022). Social indicators are gender, income and governance whereas the ecological indicators concern climate hazards on crops. Research in Punjab (Khan et al., 2020; Haque et al., 2022; Ali & Erenstein, 2017; Ashraf & Adnan, 2022; Ahmed, et. al., 2021) indicate that economically deprived farmers are more vulnerable than others are to the effects of climate change because they have fewer funds and resources. As an example, lack of money to purchase quality seed or fertilizer would result in underperformance whereas dependence on traditional knowledge would influence the perceptions of climate risk.

The notion of vulnerability has currently become attached to the sense of sensitivity and adaptive potentiality (Khan et al., 2020). Resource-based research uncovers significant elements of physical and demographic resources, but fails to identify the role of these limitations in forming values and perceptions. Institutional gaps might end up causing fatalism, causing the farmers to believe that it is fate and they should not adapt to the climate events (Mahmood et al., 2020; Eriksen et al., 2021). Therefore, dispositional, social and cognitive factors are important in the fully understanding vulnerability at the farm level.

On-farm adaption preferences:

Practices of adaptation vary along a continuum running among autonomous (local knowledge, low level changes) and planned (national plans, government schemes) and maladaptation (deleterious change, unwanted effects). According to the IPCC (2022), adaptation is referred to as the measure of enhancing adaptive capacity. The choice of adaptation greatly depends on the context, as many aspects of an individual, such as behaviour, financial abilities, education, and support of the institution influence adaptation (Vincent & Cundill, 2021; Gorst et al., 2018). Nevertheless, the responses suggested by the governments do not fall in local context but implement blanket approaches to the problem, which might have opposition or lead to partial cooperation (Laborde et al., 2016; Brink et al., 2023).

It is also true that most adaptations are autonomous, shortsighted, and unsustainable (FAO, 2022; IPCC, 2022). The successful aspect of planned adaptation is its

targeted nature, serving the better-resourced farmer, whereas the maladaptive scenario, including excessive input utilization or depreciation of the environment, may negate long-term resiliency and initiate adverse patterns, such as migration (Neset et al., 2019; Datta et al., 2022).

The studies in Punjab concern the aspects of production primarily; the research on behavioural factors is scarce, especially on small-scale farm level analysis (Ali & Erenstein, 2017). Since it is clear that motives are different i.e. small-scale farmers are afraid of losses whereas large-scale farmers seek profits, behavioural perspective is likely to make a significant difference (Brink et al., 2023),

To conclude, the thinking processes and adaptation patterns of small-scale farmers are contextual (FAO, 2022). Literature in the Punjab has focused techno-economic solutions collectively, but ignored individual thinking that is based on cultural and socio-economic realities. The way that this research fills the gap is by viewing small-scale farmers as unique actors whose perceptions and adaptation choices are complex, internally motivated processes that are influenced by the dispositional, social, and cogitative aspects.

Research Paradigm

Post Positivist Approach

This study relies on post-positivist approach as it recognizes that reality can be studied objectively, meanwhile acknowledging all observations as fallible and influenced by various factors. It therefore emphasises empirical evidence, critical examination, and a possible element of researcher's bias.

Research Ontology: Constructivism

In this work, the qualitative research method is used, the ontological orientation of which is constructionism, instead of objectivism (Bryman, 2016). Constructionism permits the comprehension of the meanings relating to social phenomena, which small-scale farmers themselves assign to it as agents, which is based on their ancestral knowledge.

Research Epistemology: Interpretivism

The research aim cannot be applied to objectivism, which perceives social realities as subject to objects. An interpretative-qualitative approach is thus effective in facilitating an in-depth examination of the participants points of view, employing flexible data generation procedures that respond to the societal context (Flick, 2022; Ritchie & Lewis, 2014). To study the climate adaptation behaviours, the lived experiences of the farmers were imperative, which became possible through the flexible semi-structured interviews.

Qualitative Research Approach

A case study was applied to revolve around the small-scale farmers as a unique unit since they are marginalised and lack access to the modern farming as opposed to the large-scale farmers. This comparative study helped to have an analysis on economic, social and psychological perspective and the result of this analysis has given a contextualised knowledge that can be applied to the case of Punjab (De Vaus, 2001).

Research Framework: Distal-Proximal Spectrum

The analytic framework used in this study is the Integrated Taxonomy of Behavioural Factors (Distal-Proximal Spectrum) since it categorises and explains adaptation behaviours of small-scale farmers through the dispositional, social, and cognitive perspectives (Dessart et al., 2019). This model is behavioral in particular, unlike institutional or social-ecological models (IAD or SES) that use institutional or social-ecological frameworks.

Research Methodology

Sampling

As seen in the Diagram 1, the Purposive Sampling Method was used.

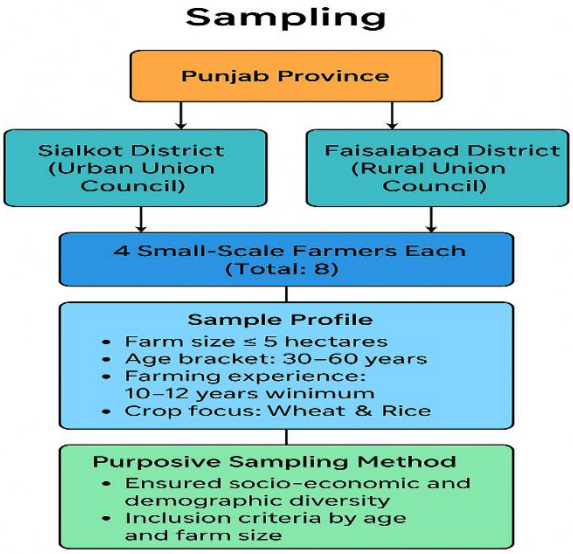

Figure 1: Sampling Area and Features

The context of study contingents on Punjab which allocates 53 percent of the agricultural GDP nationally and 74 percent of the cereal output (Imran, Shrestha & Datta, 2018). The crops of concern are wheat and rice which are important in food security. The researcher, for data collection, chose Sialkot (urban union council) and Faisalabad (rural union council) districts, being home to wheat and rice cultivation (Government of the Punjab, 2018). This research aims to reflect varied views, and that is why different urban and rural locations were involved in the mix.

Purposive sampling method, a non-probability method, was used to find eight small-scale farmers (4 in each area) up to 5 hectares land (Government of the Punjab, 2018). This method helped to select the participants with particular characteristics and in a socio-economic context, not wasting much time (Bryman, 2016; Mason, 2017). Inclusion criteria was diversified in terms of age and farm size to eliminate bias and expand the scope of views (Lewis, 2015). An age bracket (30-60 years) accompanied with a minimum experience of 10-12 years in farming life made all the respondents relevant in terms of experience due to exposure to prolonged climatic changes, and hence the results were more accurate.

Data collection

The WhatsApp application helped conduct semi-structured interviews because of the travel and resource limitation. An interview process took 6090 minutes, with communication done in indigenous languages like Punjabi and language.

The use of the tape in all the interviews was done by verbal consent that beat resource and the low tech-literacy of the participants. The recordings helped in administrating secondary analysis and accuracy. Transcriptions of the interviews were conducted in English by means of naturalisation method with retaining the original material and lessening the likelihood of misunderstanding (Oliver et al., 2005).

A topic guide was drafted to cover all desirable frames and at the same time to be flexible and open-ended (Marshall & Rossman, 2011; Ritchie & Lewis, 2014).

Triangulation

Triangulation was employed to cross-validate findings by comparing information gathered through different data sources and analytical perspectives, thereby strengthening the trustworthiness and robustness of the research outcomes.

Data analysis

The thematic analysis was inductive because themes were defined based on the participant accounts instead of reference to readymade categories (Bryman, 2016; Caulfield, 2022). This took place through a six-phase model by Braun and Clarke (2006); familiarisation, coding, initial theme search, theme review, definition/naming themes and writing up. A deviant case was used with the aim to elevate plausibility. Coding quality and analytical rigour were achieved using a 15-point checklist.

Research ethics

The University Research Ethics Committee granted the ethical approval. It was all voluntary and verbal consent was counted as most people are illiterate and do not have access to technology. Prior to participating in the interviews, research objectives, rights of participants and use of data were discussed through briefing sessions and written guide in the local language. They made sure that they maintained confidentiality; sensitive information was coded and will be destroyed after the degree has been obtained; high-level data was buried deep in the server of the University. The anonymity of the participants was ensured, and the university procedure adopted in case of risks.

Results and Discussion

The research findings or results aim to address two fundamental research questions. The critical findings from the participant interviews are as follows:

Perception of Small-Scale farmers about the climate change vulnerabilities to their crops

All the participants agreed that, in some way or another, climate change affects their crop productivity. However, their perception of conceiving climate change as a

threat is an entirely different story. Most of the participants considered climate change as a natural process and had an indifferent approach to the associated vulnerabilities. The *prime facie* reason for this perception is that climate change effects are contextual and bounded by small-scale farmers' socio-economic dynamics. Cognitive factors like risk aversion and risk tolerance and dispositional factors like farming objectives and Lifestyle play a decisive role in farmers assessing the vulnerability of climate change. Resultingly, the research found that small-scale farmer climate change's perception is not based on rational decision-making and science-backed logic. Instead, it is driven by bounded rationality rooted in cultural heuristics and behavioural repertoire. The key findings are as under:

Climate change is nothing more than weather variation

Despite the consistent effort by the government to highlight the climate change issues and spread its awareness, only one participant, Farmer 4, had the idea of climate change and associated vulnerabilities to the farms. According to him, climate change is a serious threat to farmers, and there is a need for better resource management and government support to make farms climate-resilient, like water management through laser levelling. The remaining participants were aloof from the climate change phenomenon and considered it a natural weather fluctuation since immemorial. They see crop damage from the climate as part and parcel of farming. Farmer 2 said that:

"*I believe it is a natural process, and we do not have control over it… Sometimes it is good, sometimes bad.*"

Similarly, the Farmer 3 point of view was that: -

"*These are all stories. How can we interfere with the weather?*"

The answers depict that small-scale farmers strongly believe that fighting back against the weather is beyond human capability. The research found that the root of this perception is based on ancestorial beliefs, who, due to technological limitations, had fewer options than to compromise over climate change losses to the crops. The same compromise is dominant in the next generation of small-scale farmers compared to large-scale farmers due to adaptative capacity issues. The wealthier farmers successfully cope with weather troubles and maintain a certain productivity threshold through better knowledge access, government extension services, farm resources and markets. Whereas small-scale farmers are helpless to cope with weather troubles due to meagre resources and socio-economic deprivation. They regularly witness low crop production and, at times, crop losses due to weather. Over time, the deprivation has made the farmers more tolerant towards climate change, where they remain indifferent to crop damages and accept weather troubles as business-as-usual. The casual attitude of accepting losses precludes small-scale farmers from seeing the difference between normal weather fluctuations and climate change effects. The climate-tolerant attitude makes them believe that any change in weather is a natural phenomenon and nothing more than fabricated stories.

Judging climate from one crop season to the next crop season

The research found that small-scale farmers' short-time-discounting behaviour is another critical factor in understanding climate change. Due to socio-economic constraints, the farmer only plans and calculates the risk from one crop season to the next. It restricts the farmer's time discounting, where they disproportionally weigh costs

and benefits from immediate crops more than the ones in the future. As climate change, events are relatively uncertain and happen over an extended period; therefore, they naturally get far away from small-scale farmers discounting attention span to be merit as a potential threat. Resultingly, most of the participants in the research were found calculating climate change damages to their crops as isolated incidents from one crop season to another, diluting the picture to see the whole scheme of things as a long-term phenomenon. Farmer 7, sharing his thoughts, said:

"*In the last cropping season, my farm soil remains wet till late December due to the rains. Resultingly, my wheat sowing got late…That was a bad season.*"

But, when Farmer 7 was further inquired about the impact of this incident in conceiving climate change, he said: -

"*I do not think that weather is changing. My every cropping season is not affected by rain. So, my habits are the same.*"

Similarly, Farmer 2 talked about his experience by recalling a three-year-old incident where, due to heat stress, the moisture from his standing crop evaporated quickly against the average time. That year, his wheat grain lost considerable weight, and net yield dropped to 10 to 15 tons per acre. However, his cost appraisal of climate change as a risk was quite interesting. He said:

"*Good and bad seasons are part of farming, and farmers should not panic. Apart from little variations, I think no significant change is needed.*"

The finding tells that the small-scale farmer time discounting is only focused on the immediate cropping season, as they do not have the information and resources to plan and project long-term farming goals. The limitations keep small-scale farmers focused on the immediate gains and neglect the overall losses in the expanded time from climate change. It affects the farmers' perception, where instead of becoming loss averse; the risk of losing is more significant than the probability of equal gain; they become more tolerant towards climate troubles and develop an indifferent approach. The approach keeps them engaged in day-to-day cost appraisal. It weakens their cognitive ability to forecast long-term profit and loss from climate change, making them unique from the rest of the farmer community.

Satisfaction paradox – impoverish lifestyle

The indifferent approach towards climate change and accepting losses have deep roots in the small-scale farmers' farming objectives and Lifestyle. The perpetual low-end societal status has made small-scale farmers less ambitious and demotivated to seek fortune from farming. The research found that most participants were just farming due to a lack of other options or under societal pressure to manage inherited ancestral land for family survival. Farmer 1 shared his views by saying that: -

"*The small-scale farmers with 7 to 8 acres of land can neither leave nor make a profit out of the land. He is only continuing farming due to a lack of options.*"

Not surprisingly, Farmer 6 also shares the same views:

"*I want to tell you that for small farmers like me, farming is just sustaining.*"

Seven of eight participants felt satisfied to continue farming in the present state and were not interested in bringing significant changes to the farms. Damages to the crop's productivity up to a certain level were a new normal for them. Due to overtime socio-economic deprivation, they have developed a satisfaction paradox of false consciousness of happiness, where they accept living in the present conditions with hopelessness to improve. Such a state of mind seeks refuge in religion and societal pressure. No wonder the research found a strong sense of fatalism directly influencing farmers' perception of climate change. Farmer 3 shared: -

"*God always thinks good for humanity. I believe we must accept the weather as God's decision.*"

According to Farmer 5:

"*Yes, this is right that pollution by humans, like brick kilns, contributes to climate change… But the final decision is with God.*"

The research found that fatalism is dominant over science and government policies in small-scale farmers. It seriously hampers how the farmers interact with the government and are influenced by incentivisation schemes to change traditional agriculture practices. The fatalism keeps the farmer in the satisfaction paradox, where he accepts farm losses as God's act and remains in disbelief that any effort by him or the government can strengthen them against the climate. The perception widens their knowledge gap and acts as resistance to any agri-climate solution involving expenditures. As a result, small-scale farmers are stuck in the perpetual low-end farming goals. Their demotivated behaviour promotes little eagerness to learn new knowledge and brings significant changes in their conventional farming methods.

Autonomous adaptation practices by the small-scale farmers

The farmer's choice of adaptation depends on how he perceives the climate change risk and control over the adaptation method. The findings about the small-scale farmer in Punjab seeing climate change as a natural process and less of a threat has made autonomous adaptation a preferred method. The key findings are as follows: -

Autonomous adaptation comes naturally and hard to standardise

Farmers have an inherited tendency to move with the weather and make autonomous adaptations to keep their farms in day-to-day working conditions. These adaptations are usually minor adjustments from the pre-existing practices and come as a natural behavioural change influenced by the farmer's personality, community guidelines and how the weather affects the farmer. The highly contextual variables make the farmers independent in deciding on autonomous adaptation options according to their socio-economic varies. However, the most common autonomous adaptations found in the participants were change of seed, mixing of the seed, timing of sowing and soil tilting. For example, Farmer 4 relied on deep tilting through the tractor to protect the seed from heat stress. He said:

"*I have a tractor, so I am doing 6-to-8-inch deeper tilting... It keeps the plant roots safe from heat.*"

Whereas Farmer 1, instead of deep tilting, was changing the sowing timing of the seed to avoid heat stress. He said:

"*Previously, I used to sow wheat seeds in December. But now, I start the seed sowing in early November to avoid heat stress in March and April.*"

The research found these adaptations are strongly influenced by descriptive norms, where the farmers rely more on the surrounding farming practices, especially neighbours, instead of taking advice from any unfamiliar formal channel. The main reason is that in typical village life, the farmers know each other, and without hesitation, they form a like-minded consultation group. These groups decide which autonomous adaptation to adopt or otherwise. Farmer 2 said:

"*I am part of a small farmer circle... We decide mutually on the type of seed, fertiliser, and sowing timing.*"

Likewise, Farmer 5 view was:

"*We decided mutually on these aspects. I believe the experience of different farmers results in wise decisions.*"

These consultation groups fill in the vacuum of information deficiency due to missing government extension services. As all the group members belong to the same community, the active consultation creates a social learning environment that naturally appeals to the farmer.

However, these community's practices vary from place to place and are difficult to standardise. Instead, deep tilting and seed breaking before sowing were dominant practices for coping with the same climate variation. Besides variations, the yield per acre from these adaptations was erratic. Most participants said they do not get a uniform yield per acre and, depending on the weather and technique; the yield varies yearly from 35 to 45 tons per acre. The drawback of this non-uniformity is that autonomous adaptation cannot be followed as a standardised process to plan essential aspects of food security. The uncertain yield per acre keeps the farmer financially constrained and overall agriculture sector productivity at risk.

Autonomous adaptation as catalyst for change

The research found that autonomous adaptation develops a moral pressure on the reluctant or financially constrained farmers to start an effort for adaptation and reach at least their neighbour farmer's threshold level, i.e., copying the behaviour of the other farmer. For example, Farmer 1, while talking about his change of seed, said:

"*Normally, I am shy about changing the seed. But I have started using new market seed after seeing it on my friend's farm.*"

Similarly, Farmer 6 changed his wheat crop cycle because his fellow farmers were doing it: -

"*I was not in favour of sowing the wheat crop a month earlier in November. The weather changes every year…However, I had to change the sowing timing because all the other farmers were doing it.*"

Similarly, it was found that small-scale farmers who could not afford climate-resistant seeds and fertilisers due to financial constraints were improvising to keep pace with their community. For example, Farmer 7 was mixing cow dung with fertilisers to

manage the fertiliser cost. Farmer 2 was mixing homegrown seeds with government hybrid seeds to increase his farm productivity like his neighbour farmer.

These improvisations show that small-scale farmers tend to adapt to prevailing community behaviour. The collectivist culture keeps them under moral pressure to remain open to descriptive norms and abide by the community farming protocols. It encourages the shy farmers to bring at least a few changes to survive the harsh climate and overcome their old farming habits.

Autonomous adaptation work against *status-quo*

On-farm adjustments and improvisations tell that small-scale farmers are open to ideas and not status-quo biased, an impression that is usually associated with the community. They are ready to bring changes in conventional farming practices. However, socio-economic impediments prevent them from bringing a substantial shift in farming. The prolonged impoverishment nurtures insecurities and influences small-scale farmer behaviour resistant to change. The research found that small-scale farmers are more inclined to incremental processes rather than radical change, a behaviour often misconceived as status-quo bias. For example, most participants said that whenever they use new seeds, fertiliser, or change crop timing, it is done on a small portion rather than on a complete field. After seeing the result in one or two crop cycles, they decide whether to adopt it. Farmer 3, sharing his experience, said:

"*Initially, I changed the wheat crop cycle on only 3 acres of land…It is after seeing the result in one to two seasons that I change the timing of the complete crop.*"

The incremental change is, at times, so slow that it gives the impression that farmers are not ready to adapt. Whereas, within the socio-economic constraints and limited understanding of the climate, farmers are changing pre-existed farming methods, which are less risky, controllable and approved within their community. The only challenge is that autonomous adaptation has erratic outcomes as it depends on the community's prevalent level of knowledge instead of scientific discourse and government policy action. Making them uncertain amid the climate change scenario.

Missing government support is a big hurdle in planned adaptation

The research found that the only impediment to planned adaptation by small-scale farmers is their financial constraints and information deficit of climate change. Both factors affect the farmer's adaptive capacity for planned adaptation. It keeps them demotivated to set ambitious farming objectives, directly influencing their behaviour towards climate change.

Government missing footprints

The starting point for planned adaptation is to motivate the small-scale farmer to pursue farming as a career goal and bring him out of the satisfaction paradox. Therefore, government support through the social safety net is imperative in strengthening farmers financially for planned adaptation. The research participant's response to government support was not very optimistic, especially when asked about government loans, crop insurance and subsidies as reflected in Punjab Agricultural Policy- GoP (2018). A sense of dissatisfaction and mistrust prevailed among the farmers about the government. Farmer 2 response to government loans and insurance policies was:

"*I have heard about it, but no such facility has been provided to us... So, I never bothered to know the detail.*"

Farmer 3 was disappointed by the red tape and cumbersome procedures involved in availing government social safety net schemes. He expresses his grievance:

"*A few years back, when I had a bad season, a government official came to me for crop insurance at Rs 5000 per acre. But he asked for bribery before registering me in the program, which I refused.*"

The farmer added: -

"*Secondly, they ask for many documents which I do not understand... So, it is better not to try for the loan and waste time.*"

Likewise, Farmers 1,8 and 5 never heard about any government social safety net scheme, which shows inadequate government outreach.

Another critical aspect requiring attention was fatalism's impact on government initiatives. Due to the loan interest, many farmers hesitated to use the facility for being against their religious beliefs. Islamic jurisprudence, the main religion in Punjab, Pakistan, forbids taking loans with interest (Hossain, 2009). Farmer 6 said:

"*These schemes have an interest which is forbidden in Islam. I do not like such schemes. Therefore, I have never thought about it.*"

The research found that small-scale farmers were not only distant from the government's social safety net but also felt hopelessness in the government. When asked how government subsidies on wheat and fertilisers are helping them, many had no idea about it. The few aware of the programs had strong reservations about the program outreach. Farmer 3 said:

"*Subsidies are designed for large-scale farmers. They get the benefit, not us.*"

The sense of disconnection and outreach issues with the government has distanced small-scale farmers from the government's climate adaptation policies. The lack of knowledge to apply, lengthy procedures, and corrupt practices have created a vacuum of mistrust between the farmers and the government. The vacuum has been filled in by the farmers' indigenous knowledge instead of government-planned adaptation measures. In the absence of a targeted social safety net like direct subsidies and interest-free loans designed according to the small-scale farmer's needs, the trust gap between the farmer and the government cannot be bridged.

The private lender has taken over the government's role

The research found that due to the inadequate social safety net, the private lender, known as "ARTI" in the local language, has assumed a critical role in small-scale farmer life. They act as a bloodline for small-scale farmers through guaranteed loans at the start of the farming season. These loans provide farmers with the financial stability to start their farming season, which otherwise they could not do due to poor financial backgrounds. Farmer 8 said:

"*At the start of the season, we sell all our crops to the ARTI as collateral, and he gives us advance money. With this money, we buy seeds and fertilisers and pay electricity bills.*"

Farmer 6 highlighted the importance of ARTI and said:

"*At the start of the season, I get advance money from him by keeping my crops as collaterals. Without this money, I cannot cultivate my crops.*"

However, the research found that where these ARTIs are playing a significant role in addressing the liquidity crunch of the farmers at the start of the cropping season; conversely, they are also the reason for the debt trap due to high interest rates of as much as 40%. Interestingly, these interest rates are commonly known as commissions in the private market to dough religious barriers of forbidden interest. Under the high commission debt burden, the small-scale farmer has limited options to buy new assets like tractors and other mechanised inventory and adopt expensive planned adaptation models. The debt leads to a vicious cycle of the poverty trap, ultimately affecting small-scale farmers' farming objectives. For example, Farmer 5 said that at the start of the season, he became handicapped with a high-commission ARTI loan. The only worry he has in mind is to make crops profitable enough to pay back the money. Because if he fails, then no one in the market will give him advance money to start the next cropping season. Therefore, for him, farming is only about survival and living a low-end life.

Clueless farmer on planned adaptation

Another challenge for the small-scale farmer is the lack of knowledge on planned adaptation. It would be unfair to say that the participants did not have the idea of high-end solutions like laser levelling of fields for water conservation, soil testing for rightly enriching the soil, resizing the farms, adopting expensive climate resilient seeds and agri-tech investment. However, all the participants consider these planned adaptations as a specialised job done by the government and commercial farmers rather than ordinary farmers. The prime reason for the information deficiency is the lack of government extension services to train farmers and enhance their knowledge and confidence in the planned adaptation. Farmer 7 expressed his concerns about the difficulty involved in planned adaptation techniques:

"*We do not know what exactly to change... Even I do not know what benefit I will get from buying machines apart from saving time.*"

Farmer 6 was dependent on the government training and support to start planned adaptation: -

"*No one in our village knows soil testing and how to do laser levelling… so no one will do it without proper training and government support.*"

The inadequate government extension services, i.e., advisory services, workshops, and training programs down to the bottom level, have created a knowledge gap and discouraged small-scale farmers from attempting planned adaptations. The situation negatively influences the farmers' perceived self-efficacy, creating doubts about their skills and capacity to undertake an action.

The situation also negatively affects society's injective norms, where the farmer's community expects the farmer to do just good enough to repay the loan and avoid costly experiments under debt burden. The injective norms act as a cognitive barrier because

the choice of adaptation also has a social acceptability component, where expensive adaptation methods in the absence of training may get lower approval from the farmer community. Any farmer attempting these adaptations will be considered reckless and, in a few cases, an outcast. As an outcome, the planned adaptation is conceived as a high-end solution only for large-scale farmers and an alien concept to the small-scale farmers' local context.

A rising tendency of maladaptation

Various adaptation practices to make crops climate resilient and have high yields also have another side. The constant pressure of using artificial inputs like fertilisers, hybrid seeds, pesticides and expensive agri-tech machines for better yield has transformed farming from a modest to a highly complex, technical, and costly profession. The added burden has disproportionately affected the small-scale farmers compared to the wealthier farmers. Farmer 1 sees this transformation like this:

"*Farming has transformed. We used to cultivate only a small portion of the farm... Now, complete land needs to be cultivated to manage the expenditure on seeds, fertilisers, and fuel. The added burden has made farming stressful.*"

Likewise, Farmer 4 said:

"*Our ancestors used to do farming without getting worried about the weather and high yield. But now, we have the pressure of getting a high yield to manage the expenditure on the crop*"

The research found that the constant pressure of transformation leads to maladaptation in two significant ways: Rebounding vulnerabilities and leaving the profession. The detail is as follows:

Transformation in Farming Leading to Rebounding Vulnerabilities

The heavy dependence on pesticides, fertilisers, and hybrid seed to make crops less vulnerable to climate stress has created a rebounding effect, where, over the years, the consistent use of artificial means has created a risk of new pests and weeds with stronger immunity. It has trapped small-scale farmers to buy new and more pesticides with ever-increasing costs. The vicious cycle has placed the farmer at a relevant disadvantage against the large-scale farmer due to the difference in socio-economic background.

The research found that small-scale farmers find it hard to cope with the expenditure of buying artificial inputs. As a result, they are using less quantity or compromising by using cheaper products with bad quality. The practice makes their crops more prone to pests and weeds attacks than a wealthier farmer using good quality with the right input. The dilemma of the unaffordability of artificial inputs has resulted in low yields per acre for small-scale farmers. Farmer 6 talks about this issue: -

"*I have no money to give four pest control sprays to my crops.*"

Likewise, other participants had the same views and talked about their fear of losses by attempting to grow crops without artificial means. Farmer 2 said:

"*Without fertiliser, the soil remains degraded. It has become dependent on nitrogen, sulphur...*"

The rebounding vulnerability has created an impasse for the small-scale farmer. The constant use of artificial inputs is becoming a reason for a new variety of pests and weeds. Further, without their usage, a high yield cannot be obtained. Therefore, the farmer can either accept the low yield due to constant pest attacks and degraded soil or get under the debt burden to afford the artificial inputs. Unfortunately, most participants adopted the maladaptation of accepting the low yield. The situation negatively affects the socio-economic well-being of the small-scale farmer and, overall, the country's agricultural productivity.

The last farmer

The transformation has demoralised small-scale farmers. The rising farming cost, lack of government support, and low-ambition farming have forced small-scale farmers to look for new opportunities by changing professions and migrating to cities. Unfortunately, all the participants indicated they would be the last farmer in their families, and their children would do other jobs. Farmer 2 said:

"*I think I will be the last farmer in the family. I do not want my children to become farmers. Therefore, I will maintain the present status and not improve it.*"

Farmer 4 was selling his farming assets and wanted to send his children abroad: -

"*I am already selling my cows whenever I need money. Probably, in the next 10 years, I shall also sell my land and send my children abroad.*"

The pessimism and rising migration tendency have made small-scale farmers non-interested in climate change adaptation measures. The lack of interest in pursuing farming as a future, especially for children, has gradually transformed farmers' behaviour into the bottleneck to understanding and implementing climate change adaptations. The farmers seem more interested in saving money and helping their children to join another profession rather than improving their farm's adaptive capacity against climate change. The prevalent trend has a negative effect on the country's agriculture sector. The current circumstances may leave more than 50% of the province's farms unprepared for climate challenges. Further, it can create more severe policy problems of skill human resource deficiency in farming tantamount to food security risk.

Discussion

The discussion is based on the knowledge, literature review and research questions. It would be aiming at the most significant contribution to the current literature, the disagreement of opinions, limitations and determining the research gaps that could be discussed further. As seen in the diagram 2, discussion will be around four points:

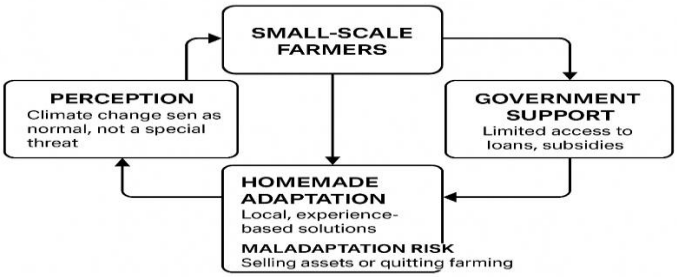

Figure 2: Discussion

Why climate change is not a threat to the small-scale farmer

The farmers of the Punjab region are considering the climate change in a normal way, as a recurring phenomenon, not as a separate threat (FAO, 2022; Brink et al., 2023). Such syndrome can be explained by two key aspects. Firstly, short-term discounting behaviour, due to which farmers are under urgent socio-economic barriers and secondly the lack of knowledge (Gattig & Hendrickx, 2007; Kahneman & Tversky, 1979; Heikkinen, 2015). This results into confusing climatic change and normal weather variation. Moreover, farming goals are low due to the ongoing economic deprivation, thus developing the attitude of acceptance to losses as the will of god or climate-fitting mentality (Noll, 2013; Greiner, 2015). Such deep-rooted dispositional agents of climate tolerance and low goals cannot be altered by just economic policy; this is why such an approach should be focused on the wider socio-economic reforms (Dessart et al., 2019).

Homemade adaptation is prevalent among the small-scale farmers

The existing approach towards the adaptation of small-scale farmers is autonomous, which implies voluntary and experience-driven responses to weather events (Ali & Erenstein, 2017). The motive behind these actions is adherence to community norms, feeling of control and easy to take care of using the available means (Schmidtner et al., 2011; Lapple & Kelley, 2014; Wauters et al., 2010). Nevertheless, they are not homogeneous, standardised, and not enough in conditions of ongoing food security with the high risk of climatic conditions (FAO, 2022). Interestingly, this paper concludes that small-scale farmers are not *status-quo* bound sternly; their practices are modernized when subjected to new knowledge and markets in accordance to the changing standards in their community.

Adaptation planned cannot take place without government help

The deliberated adaptation, in which the government has been on the forefront with development of loans, subsidies and extension services, is far beyond the reach of the small-scale farmers. Lack of extension coverage, cumbersome procedures of loans and poor safety net compel them to take credit at exorbitant rates, leaving them to debt traps (Ricciardi et al., 2020; Khan et al., 2020; Barbier et al., 2015). Such support acts as a reinforcement of pessimistic injective norms and a determiner of self-efficacy (Defrancesco et al., 2007; van Dijk et al., 2016).

Maladaptation - A threat developing

Maladaptation is becoming a primary hazard, and the increasing farming expenses are forcing small-scale farmers to sell possessions or quit farming, thereby hampering the livelihoods, cultural identity, and food security (Neset et al., 2019; Khan

et al., 2022). The study illustrates the necessity of such policy intervention that will deal with the material resources available and shed light on the behavioural and social processes that determine adaptation.

Conclusion

Small-scale farmers have a critical role in the agri-climate environment as they hold half of the farms in Punjab, Pakistan (PBS, 2010). However, in the past, the research impetus has remained towards demographic and ecological conditions with little insight to recognise the small-scale farmer's peculiar socio-economic dynamics affecting their climate adaptation behaviour. Therefore, this study aimed to explore various socio-economic factors shaping farmers' perception of climate change and guiding their adaptation behaviour. For the said purpose, the research used qualitative methodology with semi-structured interviews to interpret different dispositional, social and cognitive factors originating from the farmer's normative world, shaping their attitude and biases towards climate change.

The results show that the small-scale farmers in Punjab do not consider climate change a threat to their crops. Their short-time discounting behaviour and low farming objectives only keep them worried about immediate crops and impair them from judging the difference between regular weather fluctuation and prolonged climate change effects. These factors promote climate-tolerant behaviour in the farmers and keep them disinterested in climate change knowledge. The knowledge gap and impoverished lifestyle keep them satisfied with climate hardships as part of their faith and stimulate the perception that climate change is a natural phenomenon that will settle with time.

Without threat, the research found that the small-scale farmer feels more comfortable in the traditional farming practices and does only autonomous adaptation involving minor adjustments in the pre-existing farming methods. These adaptations are part of community descriptive norms and help the farmers bring incremental changes in day-to-day farming as part of natural behaviour change. However, being highly localised, autonomous adaptation methods depend on the farmer's personality and community knowledge level, making it unreliable for uniform agriculture productivity.

On the contrary, the small-scale farmers of Punjab are far away from government-planned adaptation measures due to weak social safety net and extension services. The inadequate outreach has worsened the farmer's socio-economic situation and demotivated them to attempt planned adaptation. It has also put a cognitive barrier where the farmer thinks that planned adaptation is a unique and expensive project only designed for large-scale farmers. The situation has widened the knowledge gap and developed a mistrust between the farmers and the government-sponsored agri-climate actions, creating challenges to inspire the farmers' typical mindset for adopting advanced farming imperative for the country's food security.

The outcome of the present situation is the rising trend of maladaptation. The small-scale farmers feel demotivated to continue farming and bear the rising cost of artificial inputs to make the farm climate resilient. Their plans include selling the farming assets and seeking other career opportunities instead of improving the farms. The behaviour warrants separate deliberation as the research was limited to knowing only the factors behind current behaviour attributes. It will help to develop a long-term agri-climate policy by incorporating small-scale farmer socio-economic limitations. The approach will be beneficial in recognising the small-scale farmers as a separate entity

with unique characteristics, without which their perception and adaptation preferences will be challenging to change.

Policy recommendations

Only progressive small-scale farmers can be mindful of climate change's adverse effects on their farms. Therefore, it is necessary to uplift their socio-economic indicators, leading to positive behaviour towards agri-climate practices. The government can achieve it by initiating short and long-term policy programs tailored to small-scale farmers' needs. The policy recommendations are as under: -

The Government extension services should be strengthened at the grassroots level to fill the communication gap between the small-scale farmer and the government. It will upgrade community descriptive norms and educate farmers on the modern agri-climate lines. Through training workshops, seminars and advisory services, the farmers will be better posited to extend their climate change time discounting and understand government action. It will also enable them to get full benefits from the governmental services and act as a feedback loop to help the government design bottom-up policies to address the community challenges.

A special quota needs to be identified within the government social safety net program to accommodate small-scale farmers' needs. The program should provide interest-free loans, subsidies for agri-tech machines, and fair-price pesticides and fertilisers to make small-scale farmers economically viable. It will incentivise the farmer's risk-seeking behaviour, setting higher farming objectives and motivation to participate in the planned adaptation without fiscal constraints.

A long-term rural development program should be initiated to stop maladaptation, especially migration. It should include providing better education, health, infrastructure development, market access and representation of socio-political voices in policymaking. It will improve the socio-economic well-being of the farmers to match the pace of the changes happening in the climate change scenario and build their confidence to see a better future for their families in farming.

References

Abid, M., Schilling, J., Scheffran, J. and Zulfiqar, F. (2016). Climate Change Vulnerability, Adaptation and Risk Perceptions at Farm Level in Punjab, Pakistan. *Science of The Total Environment*, *547, 447–460*. https://doi.org/10.1016/j.scitotenv.2015.11.125.

Ahmed, S., Farid, A., & Ashraf, S. (2021). Climate Change: Implications and Policy Recommendations. *Pakistan Languages and Humanities Review*, *5*(2), 170-180

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50(2), 179–211*

Ali, A. and Erenstein, O. (2017). Assessing Farmer Use of Climate Change Adaptation Practices and Impacts on Food Security and Poverty in Pakistan. *Climate Risk Management*, *16, 183–194*. https://doi.org/10.1016/j.crm.2016.12.001.

Ashraf, S. (2021). Geopolitics of Climate Change: US and China are Reciprocal Contenders. *Journal of Development and Social Sciences,* 2(3),543-550

Ashraf, S., & Adnan, M. (2022). An Economic Confrontation Between Us & China: Implications On Global Climate Change. *The Journal of Political Science (JPS)*, *40*(1), 1-14

Barbier, E.B., López, R.E. and Hochard, J.P. (2015). Debt, Poverty and Resource Management in a Rural Smallholder Economy. *Environmental and Resource Economics*, 63(2), *411–427*. https://doi.org/10.1007/s10640-015-9890-4.

Boyd, E. (2017). Holistic Thinking Beyond Technology. *Nature Climate Change*, 7(2), *97–98*. https://doi.org/10.1038/nclimate3211.

Braun, V. and Clarke, V. (2006). Using Thematic Analysis in Psychology. *QuZtative Research in Psychology*, 3(2), *77–101*. https://doi.org/10.1191/1478088706qp063oa.

Brink, E. and Wamsler, C. (2017). Collaborative Governance for Climate Change Adaptation: Mapping Citizen-Municipality Interactions. *Environmental Policy and Governance*, *28(2), 82–97*. https://doi.org/10.1002/eet.1795.

Brink, E., Falla, A.M.V. and Boyd, E. (2023). Weapons of the Vulnerable? a Review of Popular Resistance to Climate Adaptation. *Global Environmental Change*, *80, p.102656*. https://doi.org/10.1016/j.gloenvcha.2023.102656.

Bryman, A. (2016). *Social Research Methods*. 5th ed. Oxford: Oxford University Press.

Caulfield, J. (2022). *How to Do Thematic Analysis | Guide & Examples*. Scribbr.

Datta, P., Behera, B. and Rahut, D. (2022). *Fixing the Agriculture–Climate Change Maladaptation Information Gap*. Asia Pathways.

De Vaus, D.A. (2001). *Research Design in Social Research*. London: Sage.

DEFRA (2013). *Department for Environment, Food and Rural Affairs Behavioural Economics in Defra: Applying Theory to Policy*.

Defrancesco, E., Gatto, P., Runge, F. and Trestini, S. (2007). Factors Affecting Farmers? Participation in Agri-environmental Measures: A Northern Italian Perspective. *Journal of Agricultural Economics*, 0(0), p.071003055534001-??? https://doi.org/10.1111/j.1477-9552.2007.00134.x.

Dessart, F.J., Barreiro-Hurlé, J. and van Bavel, R. (2019). Behavioural Factors Affecting the Adoption of Sustainable Farming practices: a Policy-oriented Review. *European Review of Agricultural Economics*, 46(3), *417–471*. https://doi.org/10.1093/erae/jbz019.

Dow, K., Haywood, B.K., Kettle, N.P. and Lackstrom, K. (2013). The Role of Ad Hoc Networks in Supporting Climate Change Adaptation: a Case Study from the Southeastern United States. *Regional Environmental Change*, *13(6), 1235–1244*. https://doi.org/10.1007/s10113-013-0440-8.

Eriksen, S., Schipper, E.L.F., Scoville-Simonds, M., Vincent, K., Adam, H.N., Brooks, N., Harding, B., Khatri, D., Lenaerts, L., Liverman, D., Mills-Novoa, M., Mosberg, M., Movik, S., Muok, B., Nightingale, A., Ojha, H., Sygna, L., Taylor, M., Vogel, C. and West, J.J. (2021). Adaptation Interventions and Their Effect on Vulnerability in Developing Countries: Help, Hindrance or Irrelevance? *World Development*, *141, 105383*

FAO (2012). *FAO INVESTMENT CENTRE Pakistan Priority Areas for Investment in the Agricultural Sector*.

FAO (2014). *The State of Food and Agriculture Innovation in Family Farming*.

FAO (2017). *Defining Small Scale Food Producers to Monitor Target 2.3. of the 2030 Agenda for Sustainable Development*.

FAO (2022). *Climate Change Impacts and Adaptation Options in the Agrifood System*. Food & Agriculture Org.

Ferdi, L., Une, E. and Reconnue D'utilité, F. (2016). *Fondation Pour Les Études Et Recherches Sur Le Développement International*.

Finance Division - GOP (2023). *Pakistan Economic Survey 2022-23*.

Flick, U. (2022). *An Introduction to Qualitative Research*. *Google Books*. SAGE Publications.

Gattig, A. and Hendrickx, L. (2007). Judgmental Discounting and Environmental Risk Perception: Dimensional Similarities, Domain Differences, and Implications for Sustainability. *Journal of Social Issues*, *63(1), 21–39*. https://doi.org/10.1111/j.1540-4560.2007.00494.x.

Gillman, S., Magazine, F.H., Research, H.T.E. and Magazine, I. (2019). *Small Farms Produce More Food than Statistics Show*. phys.org. Available at: https://phys.org/news/2019-06-small-farms-food-statistics.html [Accessed 8 Aug. 2023].

Gorst, A., Dehlavi, A. and Groom, B. (2018). Crop Productivity and Adaptation to Climate Change in Pakistan. *Environment and Development Economics, 23(6), 679–701*. https://doi.org/10.1017/s1355770x18000232.

Government of the Punjab (2018). *Punjab Agriculture Policy -2018*.

Greiner, R. (2015). Motivations and Attitudes Influence farmers' Willingness to Participate in Biodiversity Conservation Contracts. *Agricultural Systems*, *137, 154–165*. https://doi.org/10.1016/j.agsy.2015.04.005.

Haque, A.K.E., Mukhopadhyay, P., Nepal, M. and Shammin, M.R. (2022). *Climate Change and Community Resilience; Insight from South Asia*. Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-16-0680-9.

Heikkinen, N. (2015). *What Do Farmers Think about Climate Change?* Scientific American

Hollander, J.A. and Einwohner, R.L. (2004). Conceptualizing Resistance. *Sociological Forum*, *19(4), 533–554*. https://doi.org/10.1007/s11206-004-0694-5.

Imran, M., Shrestha, R.P. and Datta, A. (2018). Comparing Farmers' Perceptions of Climate Change with Meteorological Data in Three Irrigated Cropping Zones of Punjab, Pakistan. *Environment, Development and Sustainability*, *22(3), 2121–2140*. https://doi.org/10.1007/s10668-018-0280-2.

IPCC (2007). *AR4 Climate Change 2007: Synthesis Report – IPCC*. Ipcc.ch. Available at: https://www.ipcc.ch/report/ar4/syr/ [Accessed 17 Apr. 2023].

IPCC (2019). *Fifth Assessment Report – IPCC*. Ipcc.ch. Available at: https://www.ipcc.ch/assessment-report/ar5/ [Accessed 18 Apr. 2023].

IPCC (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability*.

Kahneman, D. and Tversky, A. (1979). Prospect Theory: an Analysis of Decision under Risk. *Econometrica*, *47(2), 263–292*. https://doi.org/10.2307/1914185.

Khan, I., Akram, A., Fatima, S., Ahmad, B., Rehman, Z., Arshad, N., Sattar, A. and Ahmad, Z. (2022). Problems of Agriculture in Pakistan: An Insight into Their Solutions. *Pakistan Journal of Biotechnology*, *19(02), 73–83*. https://doi.org/10.34016/pjbt.2022.19.2.73.

Khan, N., Fahad, S., Naushad, M. and Faisal, S. (2020). *Credit Impact on Agriculture Production in Pakistan*. papers.ssrn.com. Available at: https://ssrn.com/abstract=3618660 [Accessed 23 Jul. 2023].

Khan, N.A., Gao, Q., Abid, M. and Shah, A.A. (2020). Mapping Farmers' Vulnerability to Climate Change and Its Induced hazards: Evidence from the Rice-Growing Zones of Punjab, Pakistan. *Environmental Science and Pollution Research*, 28(4), *4229–4244*. https://doi.org/10.1007/s11356-020-10758-4.

Laborde, S., Alfonso Diestro Fernández, Sui Chian Phang, Hamilton, I., Henry, N.J., Hahn Chul Jung, Aboukar Mahamat, Mouadjamou Ahmadou, Labara, B.K., Kari, S., Durand, M., Mark, B.G., Scholte, P., Xiao, N., Ziebe, R. and Moritz, M. (2016). Social-ecological Feedbacks Lead to Unsustainable lock-in in an Inland Fishery. *Global Environmental Change-human and Policy Dimensions*, *41, 13–25*. https://doi.org/10.1016/j.gloenvcha.2016.08.004.

Lapple, D. and Kelley, H. (2014). Spatial Dependence in the Adoption of Organic Drystock Farming in Ireland. *European Review of Agricultural Economics*, 42(2), *315–337.* https://doi.org/10.1093/erae/jbu024.

Lewis, S. (2015). Qualitative Inquiry and Research Design: Choosing Among Five Approaches. *Health Promotion Practice*, *16(4), 473–475*. https://doi.org/10.1177/1524839915580941.

Mahmood, N., Arshad, M., Kaechele, H., Shahzad, M.F., Ullah, A. and Mueller, K. (2020). Fatalism, Climate Resiliency Training and Farmers' Adaptation Responses: Implications for Sustainable Rainfed-Wheat Production in Pakistan. *Sustainability*, *12(4), p.1650*. https://doi.org/10.3390/su12041650.

Marshall, C. and Rossman, G.B. (2011). *Designing Qualitative Research*. *Google Books*. SAGE.

Mason, J. (2017). *Qualitative Researching*. *Google Books*. SAGE.

Nadeem, K., Yaseen, Z., & Muzaffar, M. (2023). Climate Change and Global Boiling: An Understanding. *Annals of Human and Social Sciences*, *4*(3), 857–873. https://doi.org/10.35484/ahss.2023(4-III)79

Neset, T.-S., Wiréhn, L., Klein, N., Käyhkö, J. and Juhola, S. (2019). Maladaptation in Nordic agriculture. *Climate Risk Management*, *23, 78–87*. https://doi.org/10.1016/j.crm.2018.12.003.

Noll, H.-H. (2013). Subjective Social Indicators: Benefits and Limitations for Policy Making—An Introduction to this Special Issue. *Social Indicators Research*, *114(1), 1–11.* https://doi.org/10.1007/s11205-013-0379-7.

OECD (2012). *Farmer Behaviour, Agricultural Management and Climate Change | READ online*. oecd-ilibrary.org.

Oliver, D.G., Serovich, J.M. and Mason, T.L. (2005). Constraints and Opportunities with Interview Transcription: Towards Reflection in Qualitative Research. *Social Forces*, *84(2), 1273–1289.* https://doi.org/10.1353/sof.2006.0023.

PBS (2010). *Agricultural Census 2010 - Pakistan Report, Pakistan Bureau of Statistics*. www.pbs.gov.pk.

Ricciardi, V., Wane, A., Sidhu, B.S., Godde, C., Solomon, D., McCullough, E., Diekmann, F., Porciello, J., Jain, M., Randall, N. and Mehrabi, Z. (2020). A Scoping Review of Research Funding for small-scale Farmers in Water Scarce Regions. *Nature Sustainability*, *3(10), 836–844.* https://doi.org/10.1038/s41893-020-00623-0.

Ritchie, J. and Lewis, J. (2014). *Qualitative Research Practice : a Guide for Social Science Students and Researchers*. 2nd ed. Los Angeles: Sage.

Rose, D.C. (2018). *Understand How to influence farmers' Decision-making behaviour a Social Science literature review Contents*.

Schmidtner, E., Lippert, C., Engler, B., Häring, A.M., Aurbacher, J. and Dabbert, S. (2011). Spatial distribution of organic farming in Germany: does neighbourhood matter?

European Review of Agricultural Economics, *39(4), 661–683*. https://doi.org/10.1093/erae/jbr047.

Shogren, J. (2012). *Behavioural Economics and Environmental Incentives*. *OECD Environment Working Papers*. https://doi.org/10.1787/5k8zwbhqs1xn-en.

Sok, J., Borges, J.R., Schmidt, P. and Ajzen, I. (2020). Farmer Behaviour as Reasoned Action: a Critical Review of Research with the Theory of Planned Behaviour. *Journal of Agricultural Economics*, 72(2). https://doi.org/10.1111/1477-9552.12408.

Thaler, R.H. (2016). *Misbehaving the Making of Behavioral Economics*. New York, N.Y. W.W. Norton & Company.

UNEP (2021). *Adaptation Gap Report 2020*. UNEP - UN Environment Programme.

van Dijk, W.F.A., Lokhorst, A.M., Berendse, F. and de Snoo, G.R. (2016). Factors Underlying Farmers' Intentions to Perform Unsubsidised agri-environmental Measures. *Land Use Policy*, *59, 207–216*.

Vincent, K. and Cundill, G. (2021). The Evolution of Empirical Adaptation Research in the Global South from 2010 to 2020. *Climate and Development*, *14(1), 1–14.* https://doi.org/10.1080/17565529.2021.1877104.

Wauters, E., Bielders, C., Poesen, J., Govers, G. and Mathijs, E. (2010). Adoption of Soil Conservation Practices in Belgium: an Examination of the Theory of Planned Behaviour in the agri-environmental Domain. *Land Use Policy*, *27(1), 86–94.* https://doi.org/10.1016/j.landusepol.2009.02.009.

World Bank (2022). *Climate Explainer: Food Security and Climate Change*. World Bank.

Woroniecki, S. (2019). Enabling Environments? Examining Social Co-Benefits of Ecosystem-Based Adaptation to Climate Change in Sri Lanka. *Sustainability*, *11(3), p.772*. https://doi.org/10.3390/su11030772.

Zakir Hossain, M. (2009). Why Is Interest Prohibited in Islam? a Statistical Justification. *Humanomics*, *25(4), 241–253*. https://doi.org/10.1108/08288660910997610.