Complexity, Governance & Networks – Vol. 5, No 1 (2019) Special Issue: Adaptive Governance of Coupled Social-Ecological Systems, p. 81-100
DOI: http://dx.doi.org/10.20377/cgn-68

Adaptive Governance and Sub-national Climate Change Policy: A Comparative Analysis of Khyber Pukhtunkhawa and Punjab Provinces in Pakistan

Authors: Muhammad Mumtaz[1] and Saleem H. Ali[2]

[1] PhD Research Fellow, São Paulo School of Management, Fundação Getulio Vargas, Brazil

[2] Professor, Energy and the Environment, University of Delaware, USA

E-mail: mumtaz86@hotmail.com

This study explores the adaptive governance and effective implementation of climate policies at the subnational level in a developing country context. We focused on Pakistan as our central case as it is considered one of the most vulnerable countries to climate change and has also gone through a recent governance devolution process. This study is conducted to investigate climate governance at subnational level in Pakistan by looking at the province of Punjab and Khyber Pukhtunkhawah (KPK). We employ the Ostrom's Institutional Analysis and Development (IAD) Framework for this study. The framework as methodology is important to uncover the complexity of adaptive governance at subnational level after devolution and transformation of environmental institutions in Pakistan. Different aspects of governance such as engagement of local actors, activism of political leadership, awareness campaigns, and capacity building are the notable initiatives in the provinces. The study identifies the differences of initiatives in these provinces are manifest in subnational climate change policy differentiation, research capacity and institutional maturity. The study finds that the provincial government of the KPK follows more participatory and decentralized approach while Punjab is more centralized. The IAD framework provided an effective means of understanding these complex differences in outcome and scale.

Keywords: Framework, climate change, institutions, governance, Pakistan

Introduction

Climate change poses serious existential threats to Pakistan's wellbeing and is considered one of the most serious national crises in Pakistan (Salik et al. 2015). Pakistan's vulnerability to climate change stems from its diverse geographical and climatic conditions (Rasul et al. 2012) . Climate change has caused various disasters in the form of floods, droughts, and other natural calamities in the country over the past two decades (Banuri et al. 2012)

Climate change is particularly a real challenge for the agrarian economy of Pakistan which comprises the most significant economic and livelihood sector (Rasul et al. 2012). Food security of millions of Pakistanis is dependent on climate, which is highly sensitive to changes, keeping in view the important role of the agriculture sector which provides 45% of total employment in the country (Muhammad Abid et al. 2011; Pervin et al. 2013)

To manage the potentially fatal consequences of climate change, Pakistani national government responded with various national policy initiatives. These major initiatives are in the form of National Climate Change Policy (NCCP) of Pakistan and Framework for Implementation of Climate Change Policy. Both these documents mainly focused on adaptation measures.

The NCCP clearly states that "Adaptation effort is the focus of this document" (NCCP 2012: P6) Pakistan is ranked in the list of the countries that have the least adaptive capacity due to extreme poverty and lack of physical and financial resources (Muhammad Abid et al. 2011; Adger et al. 2007;

Weber and Khademian 2008). The subnational governments in Pakistan are principally responsible for implementation of climate change adaptation strategies. Subnational governments are key and more effective in curbing climate change due to their proximity to the consequences of climate change (Puppim de Oliveira 2019)

Pakistan recognizes the important role of subnational governments/provinces for effective response to climate change. After the 18th constitutional amendment in 2010, the responsibility of implementing climate change policies rests with respective provinces/subnational governments in the country. The objective of this study is to investigate adaptive governance by studying the case of Punjab and Khyber Pakhtunkhawa in the agricultural sector. This study focuses to identify the key adaptive governance initiatives in agriculture sector in both provinces. The following sections present, background of climate adaptive governance, Institutional Analysis and Development (IAD) Framework, research methodology, analysis of our study cases, and conclusion.

Background of Climate Adaptation Governance

Historical evidence from a wide variety of sources informs us that there is a strong linkage between the social and ecological systems (SESs) in the context of climate change; sustainable outcomes require an integrative approach to understanding ecosystem governance (Folke et al. 2005). Global warming and increased rates of biodiversity loss tell us that the SESs do not and cannot exist in isolation; they are highly interconnected (Berkes 2002). This complexity of the system is further complicated by human decisions for not taking proactive scientific decisions. These complications emerged as results of not properly managing the SESs while promoting free market capitalism and dealing with the global economic, ecological and social capitals (Zia 2013).

The field of Environmental Governance (EG) emerged as a means of understanding sustainable natural resource use patterns and managing the complexity of the SESs. The EG literature is considered as a link between the social and the ecological, and a mechanism to influence the trajectory of the SESs (Folke et al. 2005). The EG is a "set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes" (Folke et al. 2005). Other scholars define EG differently. For instance, Kay et al. (2001) define it as the process of resolving trade-offs and to provide a vision and direction toward sustainability (Chaffin et al. 2014) consider that "…EG is the system of institutions, including rules, laws, regulations, policies, and social norms, and organizations involved in governing environmental resource use and/or protection, and there are a variety of different approaches".

Adaptive governance (AG) emerged an important approach to deal with uncertainty and complexity of SESs. The AG literature emerged from the EG research. The AG deals with different form of resource management and confronts the complexity and uncertainty associated with rapid environmental change (Chaffin et al. 2014). The AG is a form of governance which emerged from the theoretical search for modes of managing uncertainty and complexity in SESs (Folke et al. 2005). The concept of AG gained prominent attention in the scientific community as an alternative form of governance during the last decade (Rijke et al. 2012). Dietz (2007) first formally coined the term "adaptive governance." Folke et al. (2005).described the AG as a strategy to resolve the social conflicts of complex ecosystems while (Chaffin et al. 2014) defines "adaptive governance as a range of interactions between actors, networks, organizations, and institutions emerging in pursuit of a desired state for the SESs".

Governance systems, especially the top-down or centralized systems, rarely match ecological complexity, especially in the face of rapid environmental change (Chaffin et al. 2014). Centralized

governance via top-down directives and centralized policies often fails to generate concrete solutions for highly contextualized situations (Lemos and Agrawal 2006). More succinctly, (Lemos and Agrawal 2006) argued that the centralized decisions are often falls short in efforts due to large-scale ecosystems that cross multiple jurisdictional boundaries.

Due to the governance challenges of a top-down approach, a number of bottom-up governance approaches emerged. These bottom-up approaches are framed by different groups of local actors, social networks, and as a result of collaboration among community leaders (Lemos and Agrawal 2006). The bottom-up approaches seem quite effective but these approaches also suffer in coordination due to complex geographies (Cosens et al. 2014). There are other challenges for bottom-up approaches of governance.

Local governance is not always evidently representative of all stakeholders' especially marginalized communities, like indigenous communities, who are deprived of rightful access to resources (Cosens et al. 2014). To fix these challenges, there is a need to bring new approaches of governance which are capable to handle the governance hurdles and the complexity between the SESs components. The AG is increasingly recognized as a right form of governance to address these challenges and uncertainties (T. Dietz et al. 2003; Folke et al. 2002; Lebel et al. 2006). The AG addresses uncertainty through continuous learning, involving multiple stakeholders in decision making process and self-organization of governance systems (Rijke et al. 2012).

The learning process is an important component to understand and deal with the complex dynamics and uncertainty associated with such systems (Folke et al. 2005). This learning process happens due to the interaction among individuals, organizations, institutions and agencies at multiple levels (Olsson et al. 2006). Such learning facilitates the replication of successful practices from each other and coordination of effective resource utilization. Various international efforts are taking place to utilize different knowledge system and learning environments for enhancing the capacity building which is dealing with the complex adaptive system (Armitage 2005).

The AG is essentially involved in devolution of management rights and power sharing to ensure the participation of relevant stakeholders in decision making (Folke et al. 2005). This devolution of rights, delegation of power and responsibilities, and access to heterogeneous local bodies can essentially contribute to the AG (E Ostrom 2005). The presence of multiple communities contributes to accumulate diverse knowledge by interaction which ultimately enhances the adaptive capacity of the community (E Ostrom 2005). Decentralized networks have been proven to be effective to confront local problems at local levels (Bodin et al. 2006). Leadership plays an important role in organizational effectiveness and for the effective governance at local scales.

Leadership is instrumental for collaboration and interaction among different actors at different levels of governance structure. Such leadership is important to frame change and reorganize to incorporate innovation and keep flexibility to deal with the complex dynamics of the system (Folke et al. 2005). Further, leaders are important for performing the key functions for the AG like trust building, linking actors, compiling and generating knowledge, establishing links among the networks. The lack of leadership can lead to inertia in the SESs, while visionary leadership gives directions for positive change and transforming governance. Along with proactive leadership, transformability is a key aspect of the AG.

Transformability is the capacity to produce a new system when the existing system of social, political, and economic impact remains untenable. Transformability produces novel components and ways of life from various existing sub-systems to define a new system (Walker et al. 2004). This transformation has four phases: (1) to prepare the system for change (2) to open an opportunity, (3)

to navigate and transition and (4) to chart/establish new direction for management to build resilient of the new governance regime.

To evaluate the innovative governance or AG, multiple frameworks and theories can be utilized. For instance, Zia et al. (2014) suggest that the generalized autocatalytic set theory can be applied to understand the SESs. In the developing world where the AG is in nascent stages and not fully evolved, to apply generalized autocatalytic set theory appears too early. Therefore, in this study we employ the Institutional Analysis and Development (IAD) framework (E Ostrom 2005) to understand and analyze the AG in two provinces of Pakistan.

Institutional Analysis and Development (IAD) Framework

The IAD framework was originally established in the 1980s by Elinor Ostrom (Cole 2014). The framework was refined by Ostrom and other scholars in the following decades. The IAD framework is one of the most distinguished and tested frameworks in the field of policy sciences (Gibson et al. 2005). The IAD framework is widely used as research methodology to study local management practices (Benson et al. 2013)

The IAD framework is presented in figure 1. It consists of exogenous variables, an action arena, composed of actors located within action situations and affected by a set of external variables. Actors' interaction within action situations leads to outcomes, which feedback into the external variables and the action arena.

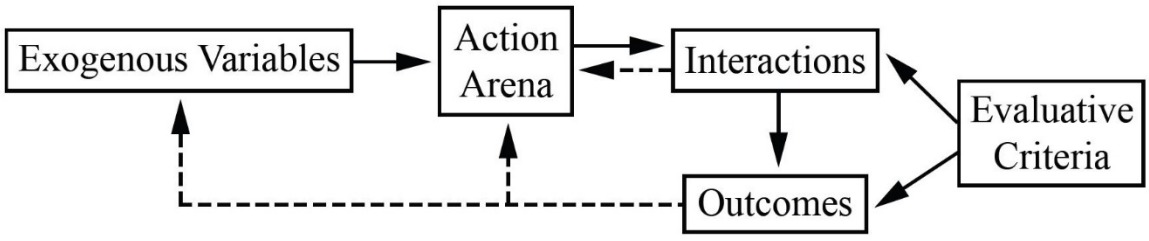

Figure 1: The IAD framework

Source (E Ostrom 2005)

Some researchers selected parts of the framework to focus on the action situations leading to interactions and outcomes (McGinnis 2011). It is a tested and most distinguished framework in the field of policy sciences (Gibson et al. 2005). The IAD framework is applied in many research disciplines. For instance, (Abel et al. 2014) applied the IAD framework to study polycentric governance and climate change. Figure 2 shows how Abel and his colleagues operatized the framework.

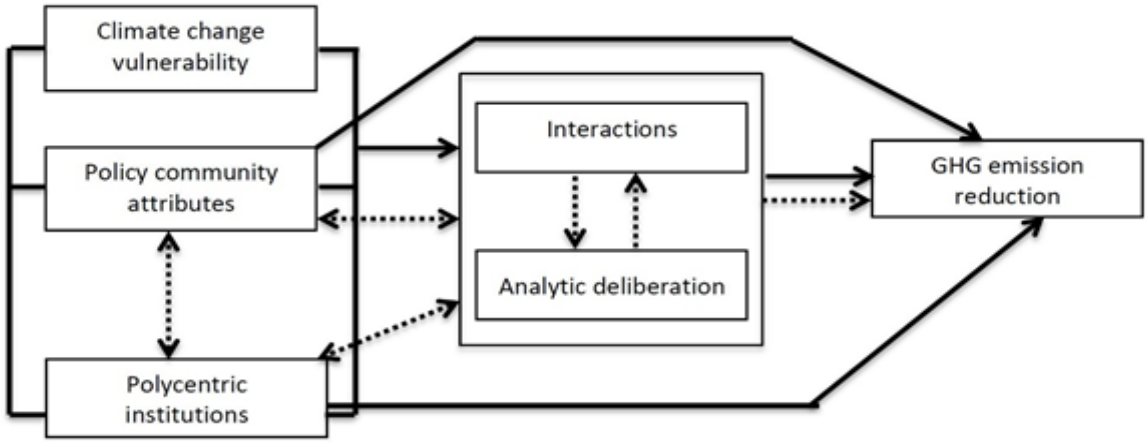

Figure 2: State climate policy action situations.

Source (Abel et al. 2014)

The core aspect of this framework is the "action arena," which is composed of action situations and actors. "Action situation" means social space where actors act, resolve the problems, and exchange the good and services (Elinor Ostrom 2007). Actors are those who interact in the action situation to address a common problem.

In our study, the action situation is to promote adaptive governance at subnational level to address the issue of climate change. In the action arena the interests of various stakeholders are discussed and produced or (re)shaped initiatives are presented to tackle the common challenge. Therefore, in our case, we are examining the actions of two provinces to address adaptive challenges to climate change; the drivers behind these initiatives; and how these initiatives have produced differential outcomes between the provinces.

Methodology

A comparative case study approach is employed for this study which is effective in providing a nuanced analysis of differentiated outcomes in organizational studies (De Vaus 2002). In the initial phase of this study, we collected information from reports, policy documents, internet news archives, physical newspapers, and scientific & academic articles. A field study is conducted from November 2016 to April 2017. During this phase, 30 in-depth semi-structured interviews including six initial exploratory interviews were conducted with relevant stakeholders in both provinces. The respondents included policy experts, government officials, think tanks working in the area, non-governmental organizations, academics, ministry of climate change, and environmental protection agencies in the respective provinces, farmer community, civil society, and climate change activists. These respondents were chosen because they are directly linked with climate governance in Pakistan. The list of our respondents is attached in Appendix A.

The provinces of Khyber Pakhtunkhwa (KPK) and Punjab were chosen as the sites of the case studies due to three major reasons. Firstly, both the provinces are highly dependent on the agriculture sector. Secondly, the provinces shared some common agro-ecological zone. Therefore, it is expected that both the provincial governments might have taken same kind of initiatives and it

is easy to compare these two provinces. Thirdly, it was easy to collect data for from these provinces and they have comparatively better climate governance structure in Pakistan.

The Case Study Areas

KPK is the 3rd largest province in the country. KPK accounts for 11.9% of Pakistan's total population and it contributes to 10% of Pakistan's gross domestic product (GDP). It has approximately 27.5 million inhabitants (70% rural) and a GDP per capita of USD 1,037. Agriculture is the major livelihood of the people in the province. The agriculture sector contributes to 48 percent of the total labor force and 40 percent to the GDP of the province (Khan 2012; Nomman and Schmitz 2011). Climate change threatens to have adverse impacts on agricultural productivity throughout KPK. The province is one of the most affected regions due to mega floods back in 2010 in Pakistan. To deal with the issue of climate change, KPK is set to establish multiple initiatives in compliance with federal policies and plans.

Punjab is the most populous and second largest province of Pakistan. Punjab is a fertile agricultural region which holds an extensive irrigation network and plays a leading role in the development of the economy (Muhammad Abid et al. 2015). The province accounts for 56.2% of the total cultivated area, 53% of the total agricultural gross domestic product and 74% of the total cereal production in the country (Badar et al. 2007; PBS n.d.). Punjab mainly contributes for agricultural sector in the percentage of land (57.2%) in agricultural sector and the percentage share (53% percent) of Pakistan's agricultural gross domestic product (Hanif et. al, 2010). Agriculture sector in Punjab is facing the impacts of climate change (Ahmed et al. 2018). Adaptation strategies are an important response to climate change. It has been pointed out that agriculture adaptation measures can reduce losses (Fleischhauer and Bornefeld 2006; Hansen and Jones 2000; Nawaz Khan 2010). The subnational government of Punjab is taking adaptation steps to tackle climate change.

Findings of the Study

In this section the findings of the study will be discussed in the context of the IAD framework in each province.

Action arena

In the "action arena" of the IAD, the involvement of relevant stakeholders is vital in our study. The major stakeholders are provincial governments, farmers' communities, civil society organizations working in area of climate change, academics, and the federal government.

Provincial Governments

Both provinces took steps to tackle the impacts of climate change, especially towards agriculture adaptation. Climate change policies play an important role in handling the impacts of climate change. KPK province has established and operationalized its provincial climate change policy whereas Punjab is still in the process of framing its policy. The main driver behind why KPK has established a provincial climate change policy, but not in Punjab, is identified in this study as the political-will prioritization and sequencing of development tasks. The political leadership of

KPK is actively involved to addresses climate change in the province because it sees this as a means of differentiating itself through self-reliance on its agrarian economy, whereas Punjab sees external economic investment as its key differentiator.

The sharing of knowledge is equally important for climate adaptation. It is noted that in both the provinces, autonomous adaptation is transferred from one place to another place or from one farmer's community of one area to another farmer's community of another area. There is a need to channel this transformation and the subnational governments have to play their role in order to fully incorporate such autonomous measures in actually government action plans.

Capacity building is important to adapt to climate change. The United Nations Framework Convention on Climate Change (UNFCCC) recognizes and highlights the significance of capacity building for effective adaptation and mitigation to climate change. In the climate change adaptation process, capacity building plays a key role. This study identified that the importance of capacity building is well recognized in both the provinces, although Punjab is ahead of the KPK in this arena due to its economic development ascendancy. Both provinces especially the KPK need to enhance capacity building for effective adaptation policies. Some international governmental organizations like the United Nations Development Programme, the International Union for Conservation of Nature and others are involved in both provinces for *climate change adaptation* training, policy advocacy, and *capacity building*. In parallel with governmental initiatives, the farmers' community is also taking steps for climate change adaptation in agriculture sector in both the subnational governments.

Farmers' Community

It is important to point out that local farmers are actively involved in autonomous adaptation in both provinces. The subnational governments encourage the engagement of farmers in climate adaptation policies. This research study noted that in both the provinces the farmers have changed their planting dates because their crops were badly affected due to heat/rise in temperature or unpredictable rainfall patterns. Some others have changed their variety of crops as the farmers opt for the crops which are heat *tolerant* and have fewer damages in case of floods, droughts or heat waves. Changing fertilizers and planting shade trees are other strategies that have been adopted by the farmers' community. The overall textures of the autonomous initiatives in both provinces are fairly similar. Four important autonomous adaptation initiatives have been identified in this regard: changing planting dates, changing crops types, changing fertilizers, and planting shade trees. All of these initiatives complemented organizational efforts from the provincial authorities.

Agriculture Extension Departments

Agriculture extension departments which work closely with the farmers at local levels collect data from the fields and gives training to the farmers at local levels. Based on these initiatives, the farmers are able to execute what they learned in their farming practices. For instance, they are advised that they should plant seeds which have been tested in scientific labs and shown to have the capabilities to survive severe weather conditions. It is noted that many trained farmers approached the agriculture extension departments to obtain suitable seeds with respect to weather conditions. We were told by the agriculture extension department in Faisalabad that after attending the training, the farmers' community is encouraged to approach the department for more information about climate change, suitable seeds, and solutions for damages due to pests etc.

Coordination among relevant line departments is important for the implementation of any policy. The subnational government of Punjab has established a link among the 26 agriculture institutes throughout the province in order to set up comprehension strategies for climate change and the agriculture sector. They regularly arrange meetings among these institutes to discuss the new challenges and the existing strategies to manage the negative impacts of climate change. For instance, *Ayub* Agricultural *Research Institute* (AARI), which manages climate change related activities, is well familiar with what is happening in the agriculture extension departments at various levels and vice versa. By being aware of the activities of agriculture extension departments and others, AARI can disseminate the positive activities among other institutions and set new targets accordingly.

This study identified that agriculture extension departments in Punjab province are active and more established as compared to the province of KPK. The KPK is behind due to lack of human resources, weak intuitional arrangements, and scarcity of financial resources.

Civil Society Organizations

Civil society organizations are playing an important role in both the provinces. Some international and local non-government organizations are also working in the area of climate change adaptation. For instance, the climate change research center at Agriculture University Peshawar is a notable research institution in the KPK province. It is coordinating research activities for climate change, creating linkages with national and international research institutions and to actually train local farmers. One of the important works of this center is to develop district-wise climate scenarios which are very important for establishment of local adaptation action plans. Some other international organizations are also providing assistance for policy research and advocacy for climate change adaptations for agriculture sector in the provinces. These organizations are one of the major pressure groups who push the provincial governments to take concreate action for managing climate change.

Academics

Academics are also major stakeholders in both provinces. People from academia were involved in establishing provincial climate change policies in Punjab and KPK. Academics play a vital role in handling climate change by producing scientific and academic studies. These scientific and empirical studies help the respective governments to establish action plans that are adaptive to empirical findings. Furthermore, these academic institutions are a mean of promoting awareness about climate change through teaching courses on climate change. For instance, a professor at department of environmental sciences at the University of Peshawar told us that many students have started working on climate change and agriculture sector in recent years due to the course offerings provided. The professor further highlighted that we are devising curriculum with provincial government so that new courses related to climate change can be offered in academic institutions throughout the province in alignment with skill sets needed by policy makers. Likewise, in Punjab, the Agricultural University Faisalabad is a leading academic institution that produced many studies on climate change, agriculture and related areas. These studies contribute to understand the impact of climate change and tell us the future projection of climate change and its likely impacts. These findings are quite helpful to proactively act against the negative consequences of climate change.

Federal Government-Ministry of Climate Change

The Ministry of Climate Change (MoCC) at the federal level is also a stakeholder with provinces to deal with climate change. The ministry is responsible for dealing with all the climate related material at the international level. The ministry arranged quarterly meetings with all the provinces and federal units so as to assess the overall progress of Pakistan to address climate change. The ministry is not directly involved in implementation of climate change policies and action plans. However, it can give guidance and support to the provinces for effective governance. After 18th constitutional amendment, provinces are responsible for implementation of climate change and other related policies.

Bureaucratic Interaction

A detailed organizational analysis of the bureaucracy for addressing climate change in both provinces allows us to understand the interactions, patterns, and outcomes in the form of governance. The AG in both provinces is still in a new phase of absorbing and understanding the responsibilities and functions of decentralization. The provinces got more autonomy in 2010 when the 18th constitutional amendment was promulgated in Pakistan. To some extent participation from different actors are seen in decision making, establishing a policy, or framing an action plan as a result of the constitutional amendment. We have seen in this study that local institutions are emerging and are in line to perform more effectively and better interaction is observed among different departments. Figure 3, presents climate change related institutions in KPK.

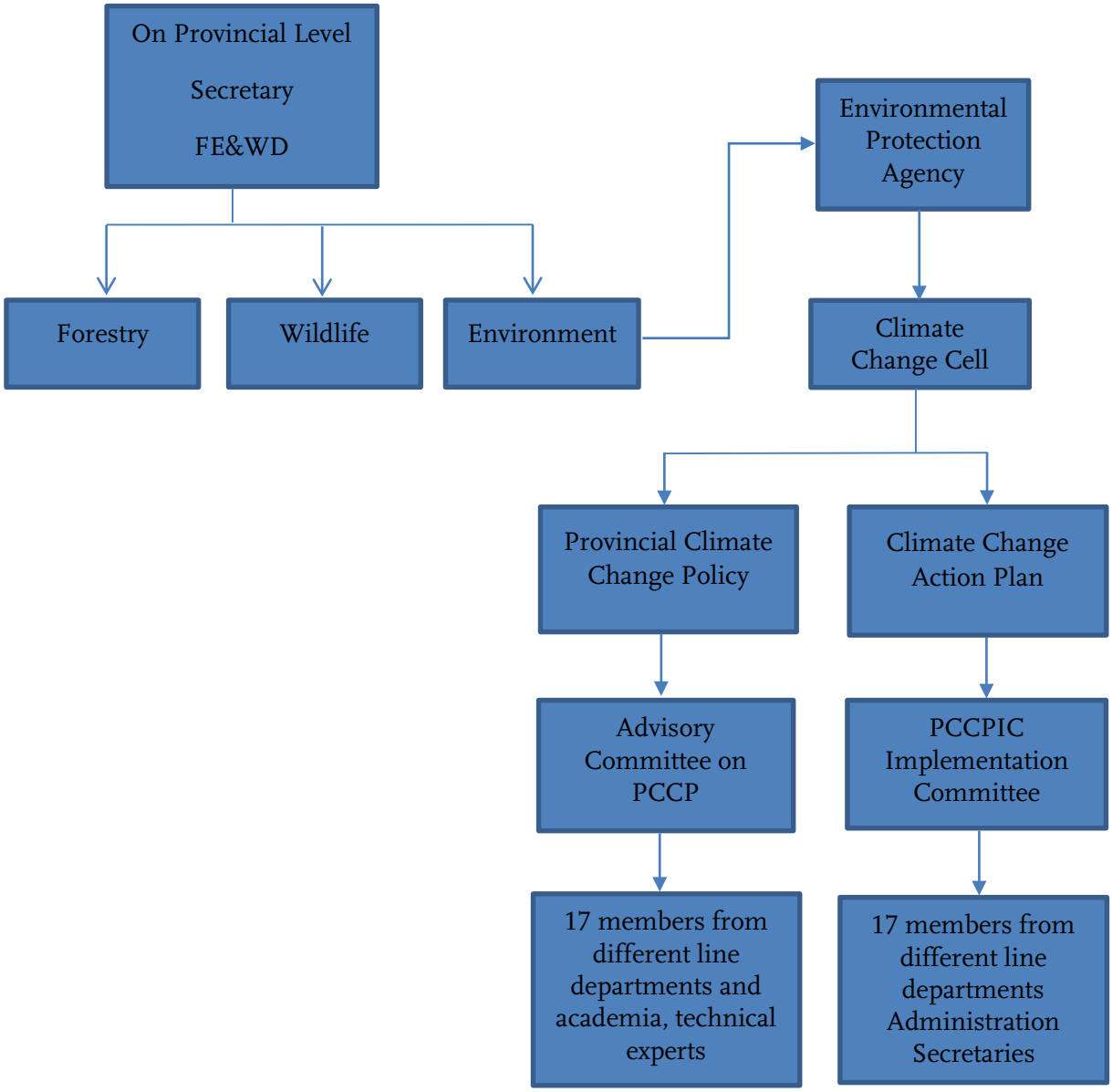

Figure 3: Organizational Chart of KPK Climate Change Bureaucracy

Note: The lists of members of Advisory Committee and implementation committee are given in Appendix B and Appendix C

The figure shows the interactions among various organizational units in KPK while devising provincial climate change policy and dealing with other climate change related matters. An official at the climate change cell responded that the concerns of all the related departments and stakeholders were fully addressed before sending the policy to cabinet – a point which has been validated by stakeholders as well. The involvement of related stakeholders clearly shows that the local institutions are getting space in decision making, policy formulation and policy action that allows for more effective adaptive governance in case of climate change shocks

Another salient aspect of the KPK's approach is to involve and incorporate local knowledge and practices in action plans to deal with climate change. The government is exploring the adaptation strategies of farmers at local level so that their traditional knowledge and effective local practices can be well utilized for upcoming action plans.

Likewise, in Punjab, an official at *AARI* informed us that they arrange regular meetings of 26 agriculture related research institutions and other relevant stakeholders to discuss and establish common agenda. To him, each and every department has opportunity to explain its point of view and every view point of every stakeholder is discussed before taking any decision. For instance, agriculture extension departments bring the challenges and best practices of local farmers, these things are discussed and evaluated within the meeting so that implementable and sustainable strategies can be established. Figure 4 presents climate change related institutions in Punjab province.

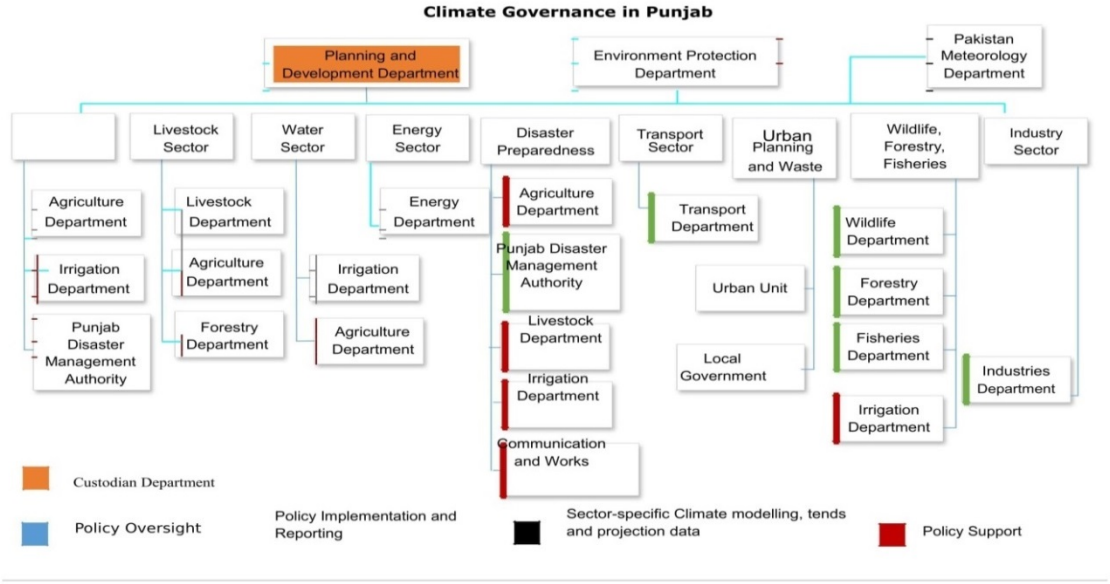

Figure 4: Structure of climate governance in Punjab province. Source: Punjab Climate Change Policy Draft.

The MoCC at the federal level is also partially involved in the interaction process. Although, it is not the responsibility of the federal government to formulate and implement aspects of climate change policies and action plans but it oversees the international obligation and legally binding elements of provisions in national laws. A committee composed of all provinces and federal units' representation arranges a quarterly meeting at the ministry to discuss the overall achievements to curb climate change in the country. So far 15 meetings have been arranged at the ministry since its establishment.

Evaluation

The IAD framework does not give us a detailed criterion for the evaluation of policies; instead it provides some metrics such as efficiency, equity, finance, accountability, confirmation to the value and sustainability (Nigussie et al. 2018). To establish the evaluation criteria for this study, the following key dependent variables associated with AG are focused: learning and knowledge sharing mechanism; stakeholder involvement; role of leadership; capacity building, inter-governmental relations; and monitoring evaluation efficacy.

Learning and Knowledge Sharing

In our case study, both provincial governments are responsible for formulation and implementation of climate change strategies. Therefore, both the governments have to promote and share information about climate change in their respective provinces. Public awareness about climate change is an important factor for climate adaptation. Public awareness aims to ensure that all relevant regional and sub-regional bodies understand the impacts of, and take action to respond to, certain climate impacts (Awareness Campaigns for Behavioral Change, 2015).

It has been observed that both the subnational governments have launched public awareness campaigns about climate change in their respective spheres. Both provinces have achieved success of public awareness up to a certain level. However, there is still a need to extend the public awareness campaign even further, perhaps even to the union council levels. The major drivers for promotion of awareness among the masses are to promote knowledge of climate change, to educate farmers and to tackle climate change more effectively.

The sharing of knowledge is important for effective governance. It is noted that in both the provinces, autonomous adaptation is transferred from one place to another place or from one farmer's community of one area to another farmer's community of another area. However, there is a need to channel this transformation and the subnational governments have to play their role in order to fully incorporate such autonomous measures in actually government action plans.

Stakeholder Involvement

The involvement of relevant stakeholders is key for the implementation of effective adaptation strategies. In this study, the involvement of farmers in establishing actions and plans is highly important. Adaptation to climate change requires the joint efforts of individuals, businesses, industries, governments and other actors who are confronted by the impacts of climate change (Corfee-Morlot et al. 2009). Both subnational governments have shown that they are keen to involve the farmers' community for the establishment of adaptation action plans for the agriculture sector. The governments are monitoring autonomous adaptation initiatives so that effective initiatives can be incorporated in upcoming action plans.

Role of Leadership

Leadership plays a key role in success of climate governance, particularly in hierarchical societies such as Pakistan. One of the most important factors which influenced the success of climate change governance is the involvement and active interest of the top political leadership (Meadowcroft 2009). When the political leadership takes a keen interest then things can move forward smoothly.

Imran Khan- current Prime Minister of Pakistan, with a following among the youth due to his erstwhile role as a famous sportsman, is very concerned about the impacts of climate change and has galvanized major interest to address climate change. The KPK province is governed by his party and it is considered the most vulnerable to climate change province in Pakistan. In 2010, KPK was the major victim of the flooding in the country. It was historical the worst flood in Pakistan. He has discussed climate change and its impacts on many occasions in Pakistani society. Based on his personal interest in this matter the KPK established a climate change policy and launched a reforestation project (Billion Tree Tsunami Project) in 2015. They successfully achieved the targets in 2017 by planting 1 billion saplings in the province.

Capacity Building

Capacity building is important to adapt to climate change and the UNFCCC recognizes and highlights the significance of capacity building for effective adaptation and mitigation to climate change.

In our study, the importance of capacity building is well-recognized in both the provinces, although Punjab is ahead of KPK in this respect as shown in the above section. Both provinces, especially KPK, need to enhance capacity building for effective adaptation policies. Some international governmental organizations like the United Nations Development Programme, the International Union for Conservation of Nature and others are involved in both provinces for *climate change adaptation* training, policy advocacy, and *capacity building*.

Inter-Governmental Relations

In the case of Pakistan which has nascent democratic institutions, intergovernmental relations between the federal and provincial levels are very important to deal with climate change. Before the 18th constitutional amendment in 2010, the federal government was responsible for all climate related matters including establishing climate policies and action plans. Presently, it is the responsibility of provinces but it is important to get due help and information about climate change. Moreover, the federal is responsible to present Pakistan at international level. The study finds that there is weak coordination among the provinces and at the federal level. Although, there is an evaluation committee at federal level but it's role is very limited and it could not bring any substantial results. Likewise, the coordination among the provinces is very weak. There is a need to establish a strong links among the provinces so that successful actions can be learnt and transferred to another place in other provinces. The coordination with ministry of climate change is equally important so the actual success/failure can be shared and presented at international level.

Monitoring and Evaluation

Monitoring and evaluation are by definition vital for the AG, as only through such mechanisms adaptation can be operationalized. Monitoring and evaluation helps to improve management decision-making, increase transparency and accountability, and effective implementation plans (Bellamy et al., 2001; Stem et al., 2005). In both provinces there is a nascent setup for monitoring and evaluation of climate change policy. For instance, in Punjab at the ARC, they arrange meetings of all 26 agriculture institutions to know the progress and outcome so that further plans can be established. However, in KPK, there is no such proper system. Both the governments need to establish a comprehensive and dedicated evaluation and monitoring mechanism so that weaknesses and strengths of the actions can be monitored properly.

Conclusions

To uncover the AG in Pakistan remained complex in nature due to confusion in powers and scope of the institutions between the provincial and federal governments. The establishment of novel institutions at provincial levels after 18th constitutional amendment in Pakistan and political structure in the country are also creating confusion while uncovering the AG. Provincial governments are responsible for dealing climate change but there are certain institutional complexities to fully understand the AG in Pakistan. The IAD framework is important; it can help us to explore those complexities and explain the AG at the subnational level in Pakistan.

The concept of AG is in early stages of implementation in Pakistan. Effective AG emerges smoothly in politically stable and institutionally balanced societies. However, there is a case for AG as an enabling mechanism is also fostering such stability and thus proactive investment to foster such mechanisms is important in developing countries like Pakistan as well. To shape the AG in

countries like Pakistan requires a highly deliberative process, keeping in view Pakistan's heterogeneous society and the unstable political atmosphere in the country. However, the evolution/emergence of the AG in the context of climate change has come about with relative success in both KPK and Punjab provinces – which are ruled by different political parties and have divergent economic development priorities.

On the heels of 18th constitutional amendment, at multiple fronts the political and institutional powers have delegated to the provinces at subnational level. This devolution of power and decentralization provided a foundation for emergence of the AG in the Pakistan. By utilizing the IAD framework, the study finds local actors are involved in establishing policies and action plans for addressing climate change challenges. Multiple stakeholders are being involved in climate change governance at subnational levels. Political leadership is active especially in KPK to promote sound and sustainable mechanisms to address climate change. The institutions are newly established and lack the specialty but they are considering their responsibilities in both the provinces for effective governance. The role of academics and voices of civil society are being properly considered to address the challenge of climate change in both provinces.

The differences of initiatives in these provinces are manifest in subnational climate change policy differentiation, research capacity and institutional maturity. KPK government has developed and officially launched provincial climate change policy, whereas Punjab government is in the process of formulating its policy. Punjab, however, is ahead in terms of carrying out research work and developing institutional capacity. The most important initiative of the Punjab government, inter alia, is launching an awareness campaign about climate change by publishing related literature in local languages, establishing a radio station, arranging farmer day, and writing articles for newspapers. Moreover, the study finds that the provincial government of KPK follows more participatory and decentralized approach while Punjab is more centralized.

There is a room for improvements in order to overcome the weak aspects of the governance in the provinces. The reforms especially in the legal system, further delegation of power at community level and ensure proper evaluation and monitoring can enhance the AG and transformation of the AG in Pakistan.

References

Abel, T. D., Stephan, M., & Daley, D. (2014). Climate risk polycentricity and the IAD framework.

Abid, M. et al, Scheffran, J., Schneider, U. A., & Ashfaq, M. (2015). Farmers' perceptions of and adaptation strategies to climate change and their determinants: the case of Punjab province, Pakistan. Earth System Dynamics, 6(1), 225–243.

Abid, M., Ashfaq, M., Hassan, S., & Fatima, N. (2011). A resource use efficiency analysis of small Bt cotton farmers in Punjab, Pakistan. Pak. J. Agric. Sci, 48(1), 65–71.

Adger, W. N., Agrawala, S., Mirza, M. M. Q., Conde, C., o'Brien, K., Pulhin, J., et al. (2007). Assessment of adaptation practices, options, constraints and capacity. Climate change, 717–743.

Ahmed, I., ur Rahman, M. H., Ahmed, S., Hussain, J., Ullah, A., & Judge, J. (2018). Assessing the impact of climate variability on maize using simulation modeling under semi-arid environment of Punjab, Pakistan. Environmental Science and Pollution Research, 25(28), 28413–28430.

Armitage, D. (2005). Adaptive capacity and community-based natural resource management. Environmental management, 35(6), 703–715.

Badar, H., Ghafoor, A., & Adil, S. A. (2007). Factors affecting agricultural production of Punjab (Pakistan). Pak. J. Agri. Sci, 44(3).

Banuri, H., Alam, M., Khan, S., Manzoor, J., Ali, B., Khan, Y., et al. (2012). An Android runtime security policy enforcement framework. Personal and Ubiquitous Computing, 16(6), 631–641.

Benson, D., Jordan, A., & Smith, L. (2013). Is environmental management really more collaborative? A comparative analysis of putative 'paradigm shifts' in Europe, Australia, and the United States. Environment and Planning A, 45(7), 1695–1712.

Berkes, F. (2002). Back to the future: ecosystem dynamics and local knowledge. Understanding Transformation in Human and Natural Systems.

Bodin, Ö., Crona, B., & Ernstson, H. (2006). Social networks in natural resource management: what is there to learn from a structural perspective? Ecology and Society, 11(2).
Chaffin, B. C., Gosnell, H., & Cosens, B. A. (2014). A decade of adaptive governance scholarship: synthesis and future directions. Ecology and Society, 19(3).
Cole, D. H. (2014). Formal Institutions and the IAD Framework: Bringing the Law Back In. Available at SSRN 2471040.
Corfee-Morlot, J., Kamal-Chaoui, L., Donovan, M. G., Cochran, I., Robert, A., & Teasdale, P.-J. (2009). Cities, climate change and multilevel governance.
Cosens, B., Gunderson, L., Allen, C., & Benson, M. (2014). Identifying legal, ecological and governance obstacles, and opportunities for adapting to climate change. Sustainability, 6(4), 2338–2356.
De Vaus. (2002). Surveys in Social Research (5th ed.). Routledge.
Dietz, K. (2007). Vulnerabilität und Anpassung gegenüber Klimawandel Ansatzpunkte für eine Multi-Level-Governance-Analyse aus der Perspektive der Problemkonstitution. In Multi-Level-Governance (pp. 161–188). Nomos Verlagsgesellschaft mbH & Co. KG.
Dietz, T., Ostrom, E., & Stern, P. C. (2003). The struggle to govern the commons. science, 302(5652), 1907–1912.
Fleischhauer, M., & Bornefeld, B. (2006). Klimawandel und Raumplanung. Raumforschung und Raumordnung, 64(3), 161–171.
Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S., & Walker, B. (2002). Resilience and sustainable development: building adaptive capacity in a world of transformations. AMBIO: A journal of the human environment, 31(5), 437–440.
Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. Annu. Rev. Environ. Resour., 30, 441–473.
Gibson, C. C., Andersson, K., Ostrom, E., & Shivakumar, S. (2005). The Samaritan's dilemma: the political economy of development aid. Oxford University Press on Demand.
Hansen, J. W., & Jones, J. W. (2000). Scaling-up crop models for climate variability applications. Agricultural Systems, 65(1), 43–72. doi:Doi 10.1016/S0308-521x(00)00025-1
Khan, S. A. (2012). Binding constraints: the role of the army in Pakistan's economic under-development.
Lebel, L., Anderies, J. M., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes, T. P., & Wilson, J. (2006). Governance and the capacity to manage resilience in regional social-ecological systems. Ecology and Society, 11(1).
Lemos, M. C., & Agrawal, A. (2006). Environmental governance, governance annual reviews environment resources. Annual Reviews, School of Natural resources and Environment, University of Michigan, 298–303.
McGinnis, M. D. (2011). An introduction to IAD and the language of the Ostrom workshop: a simple guide to a complex framework. Policy Studies Journal, 39(1), 169–183.
Meadowcroft, J. (2009). Climate change governance. The World Bank.
Mustafa, Z. (2011). Climate change and its impact with special focus in Pakistan. In Pakistan Engineering Congress, Symposium (Vol. 33, p. 290). Lahore.
National Climate Change Policy (2012). National climate change policy. Policy document, Ministry of Climate Change, Government of Pakistan.
Nawaz Khan, A. (2010). Chapter 10 Climate change adaptation and disaster risk reduction in Pakistan. In Climate change adaptation and disaster risk reduction: An Asian perspective (pp. 197–215). Emerald Group Publishing Limited.
Nigussie, Z., Tsunekawa, A., Haregeweyn, N., Adgo, E., Cochrane, L., Floquet, A., & Abele, S. (2018). Applying Ostrom's institutional analysis and development framework to soil and water conservation activities in north-western Ethiopia. Land use policy, 71, 1–10.
Nomman, A. M., & Schmitz, M. (2011). Economic assessment of the impact of climate change on the agriculture of Pakistan. Business and Economic Horizons, 4(1), 1–12.
Olsson, P., Gunderson, L. H., Carpenter, S. R., Ryan, P., Lebel, L., Folke, C., & Holling, C. S. (2006). Shooting the rapids: navigating transitions to adaptive governance of social-ecological systems. Ecology and society, 11(1).
Ostrom, E. (2005). Understanding institutional diversity: Princeton Univ Pr.
Ostrom, E. (2007). A diagnostic approach for going beyond panaceas. Proceedings of the national Academy of sciences, 104(39), 15181–15187.
PBS. (n.d.). Pakistan Bureau of Statistics: Agricultural statistics of Pakistan. Government of Pakistan, statistics division, Pakistan bureau of statistics, available at: http://www.pbs.gov.pk/content/ agricultural-statistics-pakistan. last access: 1 August 2014), 2011.

Pervin, M., Sultana, S., Phirum, A., Camara, I. F., Nzau, V. M., Phonnasane, V., et al. (2013). A framework for mainstreaming climate resilience into development planning. International Institute for Environment and Development: London, UK.
Puppim de Oliveira, Jose A. (2019). Intergovernmental relations for environmental governance: Cases of solid waste management and climate change in two Malaysian States. Journal of Environmental Management, 233, 481–488.

Rasul, G., Mahmood, A., Sadiq, A., & Khan, S. I. (2012). Vulnerability of the Indus delta to climate change in Pakistan. Pakistan journal of meteorology, 8(16).
Rijke, J., Brown, R., Zevenbergen, C., Ashley, R., Farrelly, M., Morison, P., & van Herk, S. (2012). Fit-for-purpose governance: a framework to make adaptive governance operational. Environmental Science & Policy, 22, 73–84.

Salik, K. M., Ishfaq, S., Saeed, F., Noel, E., & Syed, Q. (2015). Pakistan: country situation assessment. Sustainable Development Policy Institute.

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social–ecological systems. Ecology and society, 9(2).

Weber, E. P., & Khademian, A. M. (2008). Wicked problems, knowledge challenges, and collaborative capacity builders in network settings. Public administration review, 68(2), 334–349.

Zia, A. (2013). Post-Kyoto climate governance: Confronting the politics of scale, ideology and knowledge. Routledge.

Zia, A., Kauffman, S., Koliba, C., Beckage, B., Vattay, G., Bomblies, A. (2014) From the Habit of Control to Institutional Enablement: Re-envisioning the Governance of Social-Ecological Systems from the Perspective of Complexity Sciences. Complexity, Governance and Networks. 1(1): 79-88. DOI: 10.7564/14-CGN4

Appendix A

Respondents' Profiles

Respondent ID	Respondents' responsibilities/ roles	Respondents' Organization
1	Inspector General Forests	Ministry of Climate Change
2	Director General Environment	Ministry of Climate Change
3	Charmain and member of board of governance	Sustainable Development Policy Institute
4	Professor of Policy Study and Sustainable Development	Center for Policy Study, COMSATS University, Islamabad
5	Head of Department	Center for Climate Research and development
6	Senior Researcher for agriculture and climate change	Global Chang Impact Studies Center
7	Director Agronomic and an active member for climate negotiation and policies in Punjab	Ayub Agriculture Research Institute, Faisalabad
8	PhD research student working on climate adaptation and agriculture sector	University of Agriculture, Faisalabad
9	Regional Director for agriculture extension department	Agriculture Extension Department in Faisalabad
10	Farmer's community(8interviews)	Farmers in Punjab
11	Director working on climate adaptation strategies	Helvetas Swiss Intercooperation organization, Peshawar, Pakistan
12	Professor of Environmental Sciences	University of Peshawar
13	Deputy Director and involve in framing climate policy in the KPK	Center for Climate Change, Peshawar
14	Professor of agriculture and climate change	Agriculture University Peshawar
15	Climate change policy researcher	Pakistan Forest Institute, Peshawar
16	Director dealing with floods and rescues	Provincial *Disaster Management* Authority, KPK
17	Farmer's community(7 interviews)	Farmers in the KPK

Appendix B

Members for Advisory Committee

S. No	Departments/Academic Institute	Focal Person	Designation	Address
1	Directorate of Science & Technology, Govt. of Khyber Pakhtunkhwa, Peshawar	Mr. Abid Suhail	Deputy Director (S&T)	Directorate of Science & Technology, 250 3rd Floor Deans Trade Center Peshawar Cantt,
2	Industries & Commerce Department, Govt. of Khyber Pakhtunkhwa, Peshawar.	Mr. Akhunzada Anwar Saeed	Additional Director	Directorate of Industries and Commerce, Khyber Pakhtunkhwa, Peshawar
3	Wildlife Department, Govt. of Khyber Pakhtunkhwa, Peshawar	Dr.Mohsin Farooq/M.Ali	Conservator Wildlife, Peshawar	Office of the Chief Conservator Wildlife, Khyber Pakhtunkhwa Peshawar
4	Meteorological Department Govt. of Khyber Pakhtunkhwa, Peshawar.	Mr.Alam Zeb	Deputy Director	Regional Meteorological Centre, Meteorological Department Govt. of Khyber Pakhtunkhwa, Khyber Road Peshawar
5	Agriculture Extension, Govt. of Khyber Pakhtunkhwa, Peshawar.	Mr. Khisro Nawaz Ahmad/Hafiz Farhad Ali	Deputy Director Horticulture HQ, Peshawar	Opposite Islamia College, Peshawar.
6	Department of Geography University of Peshawar.	Dr. Iffat Tabassum	Assistant Professor	Department of Geography University of Peshawar
7	Chief Conservator of Forests, Central Southern Region, Region-I Peshawar	Dr. Faizul Bari/Ali Haider	Conservator of Forests, FP&M Circle Peshawar	Shami Road Peshawar
8	Irrigation Department, Peshawar	Abdul Rauf Khan/Farooq Ahmad	Deputy Director (P)	Office of the Chief Engineer (South) wing Irrigation Department Khyber Pakhtunkhwa Peshawar
9	The Environmental Sciences Department University of Peshawar	Dr. Asif Khan	Assistant Professor	Department of Environmental Sciences, University of Peshawar
10	Agriculture University of Peshawar	Dr.Jawad Ali	Director Climatic Change Center	Climatic Change Center, Agriculture University of Peshawar
11	Department of Geology	Mr Gohar Rehamn	Faculty	University of Peshawar
12	Department of Botany	Prof Dr. Siraj ud din	Professor /Chairman	University of Peshawar
13	Department of Zoology	Dr Farah Zaidi	Lecturer	University of Peshawar
14	Pakistan Forest Institute Peshawar	DG PFI/Gulam Ali Bajwa		PFI, Peshawar
15	Energy and Power Department, Peshawar		Managing Director	
16	Economics Department, University of Peshawar		Chairman	University of Peshawar
17	Chemistry Department, University of Peshawar.		Chairman	University of Peshawar

Source: Climate Change Cell, KPK

Appendix C

Members for Implementation Committee

S.	Designation	Rank
1)	Secretary to Government of Khyber Pakhtunkhwa, Forestry, Environment & Wildlife Department.	Chairperson
2)	Secretaries to Government of Khyber Pakhtunkhwa: i) Agriculture, ii)Irrigation, iii) Local Government, iv) Transport & Mass Transit, v), Planning & Development, vi) Law vii) Finance, viii)Industries, ix) Public Health Enqineering.	Members
3)	Director General, Provincial Disaster Management Authority.	Member
4)	Director General Environmental Protection Agency, Khyber Pakhtunkhwa	Member/Secretary
5)	One representative from Corporate Sector	Member
6)	One representative from Chamber of Commerce &Industries	Member
7)	Chief Executive Sarhad Rural Support Proqramme (SRSP) NGO	Member
8)	Director Reqional Meteorological Center Khyber Pakhtunkhwa	Member

Source: Climate Change Cell, KPK