Climate Change Adaptation (CCA) in Turkey's Agriculture: Farmers' Social Capital and Agricultural Institutions

by

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Koç University

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To shed light for future generations who will passionately search for ways to address the climate crisis.

ABSTRACT

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Agrarian populations bear the brunt of the multifaceted impacts of the climate crisis, including slow-onset events such as drought, rising sea levels, land salinization, and water scarcity, as well as rapid-onset events such as storms, heatwaves, floods, and hail. They increasingly experience losses in yields, income, and livelihoods because they are highly dependent on environmental and climatic conditions. They adjust their on-farm and off-farm activities to such climatic challenges. Likewise, their capacity to adapt to climate change tend to differ based on existing socio-economic, political conditions, underlying vulnerabilities, and inequalities in as much as on the severity and frequency of climate change impacts. However, existing studies on climate change adaptation (CCA) in agriculture tend to have a skewed emphasis on the economic or proximate social dimensions of adaptation, while more profound social, and sociological aspects remain to be less examined. In light of these tendencies, this dissertation, from an interdisciplinary perspective, has three primary purposes. *First,* it probes farmers' climate change perceptions, main adaptation strategies and the adaptive and maladaptive consequences of such adaptation measures. *Second*, building upon the former, it focuses on the role of farmers' social capital (*bonding social capital* vs. *bridging-linking social capital*) in increasing their adaptive capacity. *Third*, it seeks an answer to the adaptive capacity of intermediate agricultural institutions with which farmers are in direct contact. In doing so, it expands the widely used demographic-socio-economic determinants of adaptation strategies by adding *farmers scale* (small-scale, medium-scale and large-scale farmers), *vulnerability index* (less vulnerable-vulnerable and highly vulnerable ones) alongside *agricultural sources and methods*. Apart from certain adaptation strategies and institutional endeavours that increase farmers' adaptive capacity, this study overall reveals that the majority of the farmers analysed tends to be closer to the maladaptive end of the continuum between successful adaptation and maladaptation. Among the main reasons are exacerbating climate change effects, insufficient adaptive capacities, path dependencies, partially effective social capital and formal institutions, and a lack of innovative, inclusive, and sustainable climate policies. This study relies on an extensive fieldwork from 2021 to 2023 in three research areas from Turkey (Afyonkarahisar-Şuhut, Mersin-Erdemli and Şanlıurfa-Eyyübiye), each being reliant on agriculture and under various impacts of climate change. Primary data collected by the author consist of survey interviews with 111 farmers, semi-structured in-depth interviews with 53 farmers and 48 survey questionnaires and 29 semi-structured in-depth interviews with experts/officials from intermediate agricultural institutions. The latter comprise chambers of agriculture, district and provincial directorates of agriculture, agricultural cooperatives, irrigation associations, and seed-fertilizer-pesticide companies. Feeding on mixed method approach, it primarily utilizes descriptive statistics, column proportion tests, logistic regression, critical-comparative approach, and qualitative analysis. Likewise, apart from filling significant gaps in existing research on (mal)adaptive, relational, and institutional dynamics of research on climate change adaptation in agriculture at the micro-, meso-, and macro-levels, this study also represents the first endeavour in this direction within the context of Turkey.

Keywords: Climate change, (mal)adaptation, agriculture, adaptation strategies, bonding social capital, bridging-linking social capital, vulnerability, climate change governance, formal institutions, institutional adaptive capacity, sustainability.

ÖZETÇE

Türkiye Tarımında İklim Değişikliğine Uyum (İDU): Üreticilerin Sosyal Sermayelerinin ve Tarımsal Kurumların Rolü

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Tarımla uğraşan nüfus grupları; gerek kuraklık, yükselen deniz suları, toprak tuzlanması, su kıtlığı gibi yavaş seyreden gerekse fırtına, sıcak hava dalgası, sel ve dolu gibi aniden baş gösteren iklim krizinin çok yönlü ve karmaşık etkileri karşısında olumsuz etkilenen grupların başında gelmektedir. Yaşam koşulları büyük ölçüde çevresel ve iklimsel faktörlere bağlı olduğu için ürünlerinde ve geçim kaynaklarında gittikçe artan kayıplar yaşamaktadırlar. İklim krizinin bu etkilerine uyum sağlayabilmek için tarımsal ve tarımsal olmayan faaliyetlerinde değişikliğe gitmekte, geçim ve yaşam koşullarını bu etkiler karşısında yeniden düzenlemektedirler. Üreticilerin iklim değişikliğine uyum sağlama kapasiteleri ise, iklim değişikliği etkilerinin şiddeti ve sıklığı kadar mevcut sosyo-ekonomik, politik koşullara, altta yatan kırılganlık ve eşitsizliklere sıkı sıkıya bağlılık göstermektedir. Tarımda iklim değişikliğine uyum (İDU) üzerine mevcut çalışmalar, uyumun/adaptasyonun ekonomik veya yakın toplumsal boyutlarına yoğun bir şekilde odaklanırken daha derin toplumsal ilişki ve yapıya ilişkin yönleri çoğunlukla göz ardı edilmektedir. Bu eğilimler ışığında, disiplinlerarası bir perspektife dayanan bu tezin üç temel amacı bulunmaktadır. Öncelikle, çiftçilerin iklim değişikliği algıları ve temel uyum stratejilerine odaklanarak bu stratejilerin, üreticilerin uyum kapasitelerini ne ölçüde artırıp azalttığına ve üreticilerin iklim değişikliğine uyum-uyumsuzluk eğilimlerine cevap aramaktadır. İkinci olarak, bu ilk sorudan hareketle, çiftçilerin sosyal sermayesinin (*bağlayan sosyal sermaye* ve *köprü kuran-birleştiren sosyal sermaye*) uyum sağlama kapasitelerini ne ölçüde etkilediğine odaklanmaktadır. Üçüncü olarak, üreticilerin doğrudan temas halinde olduğu tarım kuruluşlarının iklim değişikliği karşısında uyum sağlama kapasitesini merkezine almaktadır. Çoğunlukla demografik-sosyo-ekonomik özelliklere dayanarak üreticilerin iklim değişikliğine uyum stratejilerini analiz eden ilgili literatürün kapsamını genişleterek, üreticilerin uyum-uyumsuzluk eğilimlerini, hem tarımsal kaynak ve yöntemlere dayanarak hem de üretici *büyüklük indeksi* (küçük-orta büyüklükte-büyük üretici) ve *kırılganlık indeksi* (az kırılgan-kırılgan-çok kırılgan) temelinde incelemektedir. Üreticilerin uyum kapasitesini artıran belli başlı uyum strateji ve kurumsal teşebbüsler dışında, bu çalışma; üreticilerin büyük çoğunluğunun, maladaptasyon ve başarılı adaptasyon döngüsünde, daha çok maladaptasyona yakın olduğunu ortaya çıkarmaktadır. Bunun temel nedenleri arasında ise, iklim değişikliğin şiddetlenen etkileri, yetersiz kalan uyum kapasiteleri, tarihsel bağımlılıklar, kısmen etkili olan sosyal sermaye ve tarımsal kuruluşlar, inovatif, kapsayıcı ve sürdürülebilir iklim politikalarının eksikliği gelmektedir. Bu çalışma; iklim krizinin çeşitli etkileri altında olan ve temelde geçimi tarıma dayanan, Türkiye'den üç bölgede (Afyonkarahisar-Şuhut, Mersin-Erdemli ve Şanlıurfa-Eyyübiye) ve 2021-2023 yılları arasında yürütülen saha çalışmasından beslenmektedir. Bu doğrultuda, 111 üretici ile anket görüşmesi; 53 üretici ile yarı yapılandırılmış derinlemesine görüşme; tarımsal kuruluşlardan (ziraat odaları, il/ilçe tarım müdürlükleri, kooperatif, sulama birlikleri ve tohum-gübre-zirai ilaç bayii)

48 uzmanla anket ve 29 uzmanla yarı yapılandırılmış derinlemesine görüşme gerçekleştirilmiştir. Yöntemsel olarak, başlıca betimsel istatistikler, sütun oran testleri, lojistik regresyon, eleştirel-kıyaslamalı yaklaşım ve nitel analizleri kapsayan karma yöntemlere dayanmaktadır. Bu çalışma, kırsalda iklim değişikliğine uyum-adaptasyon doğrultusunda bireysel-ilişkisel-kurumsal dinamikler üzerine mikro, meso ve makro seviyede yürütülen çalışmalardaki önemli boşlukları gidermenin yanı sıra, Türkiye bağlamında da bir ilk olma özelliği taşımaktadır.

Anahtar Kelimeler: İklim değişikliği, (mal) adaptasyon, tarım, uyum stratejileri, bağlayan sosyal sermaye, köprü kuran-birleştiren sosyal sermaye, kırılganlık, iklim değişikliği yönetimi, kurumsal uyum kapasitesi, sürdürülebilirlik.

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ABBREVIATIONS

ARIP	Agricultural Reform Implementation Project
CCA	Climate Change Adaptation
CAP	Common Agricultural Policy
COP	Conference of Parties
ÇATAK	Environmentally- Based Agricultural Land Protection
DIS	Direct Income Support
DSİ	State Hydraulic Works
EU	European Union
FAO	Food and Agriculture Organization
FRS	Farmer Registration System (‘ÇKS’ in Turkish)
GAP	Southeastern Anatolia Project
GEF	Global Environment Facility
GHG	Greenhouse Gas Emissions
GNP	Gross National Product
GSSSH	Graduate School of Social Sciences and Humanities
ID	Identity
IDKK	Climate Change Coordinating Committee
IDHYKK	Climate Change and Weather Management Coordination Board (formerly IDKK)
IDUK	Climate Change and Adaptation Coordination Board
IAs	Irrigation Associations
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IMF	International Monetary Fund
LDCs	The Least Developed Countries
MAF	Ministry of Agriculture and Forestry
MFA	Ministry of Foreign Affairs
NDCs	Nationally Determined Contributions
NAP	National Adaptation Plan

NRDC	The Natural Resources Defence Council
OECD	Organization for Economic Cooperation and Development
R&D	Research and Development
RASFF	Rapid Alert System for Food and Feed
Region A	Afyonkarahisar Şuhut
Region B	Mersin-Erdemli
Region C	Şanlıurfa-Eyyübiye
SC	Social Capital
TAGEM	General Directorate of Agricultural Research and Policy
TARBİL	Agricultural Monitoring and Information System
TARSİM	Agricultural Insurance Pool
TBMM	Grand National Assembly of Turkey
TMO	Agricultural Products Office
TURKSAT	Turkish Statistical Institute
UNEP	United Nations Environment Programme
UNFCCC	The United Nations Framework Convention on Climate Change
WB	World Bank

Chapter 1

INTRODUCTION

1.1 Background

The climate crisis has wide-ranging irreparable effects on different geographies, sectors, and groups of human and non-human actors. Among the most vulnerable groups are farmers and rural communities who heavily rely on climatic and environmental conditions for their livelihoods.[1] They experience increasing losses in yields, incomes, and livelihoods alongside risk and uncertainty in the face of disasters such as flooding, hail, frost, heatwaves, landslides, storms, and slow onset impacts of climate change, including drought, rising sea levels, land salinization, and water scarcity. Accordingly, they adapt their farming and non-farming activities to the drastic impacts of climate change. Adaptation in this respect could be broadly defined as an adjustment process to current or anticipated climate conditions and their impact (Intergovernmental Panel on Climate Change-IPCC, 2014).

Since climate change effects are irreversible and mitigation (reducing greenhouse gas emissions) *per se* is inadequate, there has been a growing reorientation to adaptation to climate change, a trend also reflected in research on climate change in the last decade (IPCC, 2022; Lancu et al., 2022). More precisely, the fact that mitigation and adaptation cannot be dissociated from one another, and triple benefits of mitigation-adaptation-sustainability should lie at the core of global climate action has manifested itself better in the last decade (IPCC, 2014; 2022). Likewise, although global interest in climate change adaptation became more evident in the early 2000s, it has been the Cancun Adaptation Framework in 2010 and the subsequent Paris Agreement that have further systematized attention to it within the global climate action (United Nations Framework Convention

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[1] Agriculture, while prone to climate change, is also a significant emitter of greenhouse gases, primarily through land use changes and methane emissions. The latter is not within the direct foci of this research, yet, where relevant, it indirectly pays attention to it, e.g., in the third chapter on farmers' maladaptive tendencies.

on Climate Change-UNFCCCa, n.d.; UNFCCCb, n.d.).

Despite such an increasing interest in adaptation, systematized, and planned adaptation measures in developing and the least developed countries tend to remain unsatisfactory, where farmers face multiple challenges in handling both climatic and non-climatic challenges. Accordingly, existing research suggests that farmers' adaptation strategies, particularly small-scale ones in the least developed and developing countries like Turkey, tend to be mainly autonomous, reactive, and privately managed (e.g., Dhungana, 2018; Callo-Concha, 2018; Asrat & Simane, 2018; Zhai et al., 2018; Abera & Tesema, 2019; Karapınar & Özertan, 2020; Tessema & Simane, 2020). Likewise, albeit context-dependent, the most recurring barriers relate to the lack of planned interventions (Khan et al., 2018; Callo-Concha, 2018; Asrat & Simane, 2018; Abera & Tesema, 2019; Tessema & Simane, 2020); which is accompanied by a lack of financial and material capacity (e.g., Dany et al., 2015; Asrat & Simane, 2018; Khan et al., 2020; Sibiya et al., 2023; Adom et al., 2023; Ghorbani et al., 2024).

Thus, farmers' main adaptation strategies specifically in the Global South tend to primarily comprise autonomous measures, which refer to those that take place in reactive response to climatic stimuli without a direct intervention by a governmental organization (Smit & Pilifosova, 2003). These include livelihood and income diversifications, crop rotation, storage, intercropping, date cultivar change, migration and so on. Although autonomous adaptation strategies may appear to be typical and instinctive responses to historical climatic and environmental changes -and are indeed crucial for local adaptation- the increased severity and frequency of unprecedented climate change effects surpass the effectiveness of these autonomous reactions.

Moreover, it is widely acknowledged in public policy and academic discourse that climate change disproportionately affects the least responsible ones. Equally important, if not more, are the different capacities of differently situated agrarian populations, such as marginalized and disadvantaged ones (e.g., small-scale, subsistence or female ones), to adapt to such changes. It is mainly because they vastly differ not only in their contributions to climate change but also capacities to adjust to the negative impacts of it.

Likewise, the consequences of adaptation behaviour might not enhance the adaptive capacity of related actors. In other words, having adaptation measures does not equate to possessing adaptive capacity (Robinson & Berkes, 2011). Accordingly, as opposed to expected outcomes from adaptation, consequences might even be maladaptation, which could be defined as an unintended result of an adaptation action that increases the vulnerability of people, sectors, and systems due to manifold reasons (Barnett & O'Neill, 2010; Schipper, 2020; IPCC, 2022). The unforeseen outcomes resulting from efforts to adapt can create lasting conditions of vulnerability, exposure, and risk, which are difficult and expensive to address, ultimately exacerbating existing inequalities (IPCC, 2022). However, attention to such consequences and the varied capacities of differently situated rural communities to adjust to climate change still have not garnered the appropriate level of attention.

This is mainly linked to the dominant tendency to depoliticize ‘adaptation’, as natural sciences play a larger role in adaptation studies compared to critical adaptation studies. The latter, which emphasize social vulnerability, began to emerge in the 1970s within the frameworks of political ecology and political economy studies (Klepp & Chavez-Rodriguez, 2018). In other words, climate change adaptation discourse, originating in evolutionary biology, inherently tends to reinforce the divide between humanity and nature, viewing environmental and climate factors as external to underlying social and political contexts. Such dominating apolitical, technocratic, and apolitical reading of climate change adaptation does not refute an increasing interest in the inclusion of more social science and interdisciplinary perspectives into adaptation, which has become manifest with the latest IPCC Assessment Reports (ARs), particularly the 6th one. As such, it is the AR6 itself that, by highlighting the indivisibility of underlying vulnerabilities and equity concerns in relation to mitigation, adaptation, and sustainable development, calls for more research from interdisciplinary, specifically political economy studies (IPCC, 2022).

Nevertheless, although critical adaptation studies that challenge the uniform, technocratic and top-down adaptation *vis â vis* an adaptation that is varied, situated, and political have made significant progress in the last decades (e.g., Klepp & Chavez-Rodriguez, 2018; Bettini et al, 2017; Sultana, 2022), research on CCA in agriculture has been rather bereft of such foci.

As such, the predominant line of existing research in climate change adaptation (CCA) in agriculture dwells on farmers' climate change perceptions, adaptation measures, and some demographic and socio-economic determinants of such adaptation behaviours. In contrast, existing vulnerabilities, underlying inequalities, and the larger socioeconomic, institutional, and relational contexts remain underexamined. Therefore, it would be right to suggest that most attention has been paid to the more immediate social dimensions of CCA, where more profound and sociological aspects of it are being investigated less. As a case study, this study focalizes on three regions from Turkey, which, as a developing Global South country, is under various effects of climate change. It is worthwhile to briefly discuss climate change impacts in Turkey in general and its agriculture in specific. In the eastern Mediterranean, Turkey is among the countries most prone to climate change effects. One can observe the wide-ranging implications of climate change in the country, including both sudden-onset events and gradual effects. Lately, Turkey has experienced a significant increase in drought occurrences (Şenol, 2021) and sudden weather events (General Directorate of Meteorology, 2022), surpassing those seen in Northern and Western Europe (Kelebek et al., 2021). IPCC also considers Turkey prone to drought, intensified and prolonged heatwaves, and coastal flooding (IPCC, 2022). The fragility of the country's agriculture to climate change effects has become more evident given that agriculture uses nearly 77% of the consumed water in Turkey (Ministry of Agriculture and Environment- MAF, 2023).

Irrespective of such climatic challenges, agriculture in Turkey is also grappling with other structural and long-lasting problems, which constitute a significant barrier to successful CCA. These include the climbing agricultural input price index (Agricultural-IPI), which has risen by 105.70% in 2022 (Turkish Statistical Institute-TURKSAT, 2022). The latter directly leads to escalating costs and debts for farmers, worsened by a lack of agricultural reform, aging rural populations, and overemphasizing capital-intensive agriculture for long years (Pitel, 2022). That is why tracing how rural populations adapt to climate change effects would also necessitate a look at how they adapt to such structural challenges.

Moreover, one can observe the reflections of above-mentioned similar research trends for Turkey as well. The dominant line of research tends to comprise studies that primarily focus on predicting (economic) repercussions of climate change on agriculture and food production (e.g., Çakmak et al., 2009; Dudu & Çakmak, 2018; Dellal & Unuvar, 2019; Karahasan & Pınar, 2023). Concerning research on climate change adaptation in agriculture, existing few studies predominantly dwell upon either risk perceptions (e.g., Aydoğdu & Yenigün, 2016), economic gains of adaptation strategies (e.g., Karapınar & Özertan, 2020), or perceptions, adaptation strategies and some of their determinants (e.g., Karapınar et al., 2018; Sevim & Somuncu, 2018; Çaltı & Somuncu, 2018; Karapınar & Özertan, 2020). A limited number of studies, albeit not directly related to farmers' adaptation behaviour, delve into underlying inequalities, or the impact of state/institutional policies on various agrarian populations in reaction to climate change effects (e.g., Turhan et al., 2015; Lelandais, 2015).

Nevertheless, one cannot assume that the diverse and extensive climate change effects -accompanied by non-climatic challenges- are confined to the technical, economic, and agronomical scope. Instead, it indicates a process where climate change, thus adaptation to it, is deeply entwined with existing social, political-economic, institutional, and relational dynamics. In other words, climate change adaptation is a powerful concept indicating a social process where actors at various levels negotiate power, knowledge, and likely futures (Klepp & Chavez-Rodriguez, 2018).

In light of these tendencies, situated at the intersection of sociology of climate change, geography, political economy and political ecology, this research overall aspires to contribute to *critical adaptation studies* by resocializing climate adaptation as a variegated and situated phenomenon within the context of CCA in agriculture. To this end, challenging most studies which focalize on adaptation actions and their main determinants in agriculture, it delves into the adaptive and maladaptive consequences of, and the underlying reasons behind, farmers' adaptation behaviours, with an emphasis on the situatedness of adaptation within social, political, cultural, economic, and historical contexts.

This research also represents the first endeavour in this direction within the context of Turkey,[2] alongside filling other significant gaps in existing worldwide literature *as per* each specific research question (detailed below and throughout other chapters).

1.2 Broader Scope of Contributions

In the absence of the above-mentioned more structured measures and interventions, rural communities' immediate context, -ranging from individual and household adaptation strategies, networks of relations with other people, and agricultural institutions within their reach- can provide a likely answer to the question *how farmers in the least developed and developing countries adapt to climate change effects*? In other words, it might neither be international, national (state or NGO-based) interventions nor National Adaptation Plans (NAPs) - (which mostly envisage adaptation as proceeding in a linear, homogenous, and technocratic manner)- that could shed light on the above-mentioned question. Instead, it might be more mid-level mechanisms such as farmers' ties with other farmers, relatives,

[2]The originality of each specific research focus has been checked through the database of YÖK (The Council of Higher Education), Web of Science, Proquest, and Google Scholar.

neighbours, agricultural engineers, and meso-level agricultural institutions within farmers' reach [3] that could provide a better grasp of real, on-ground adaptation to climate change. All such inclinations have led to the formulation of the general theoretical background of this dissertation which is discussed in the rest of this section.

Against the predominant tendency to confine agricultural adaptation to climate change within the scope of agronomy or economy where farmers tend to be equated to *Homo Economicus*, the broader goal of this dissertation is to search adaptation's (seemingly a mere economic phenomenon) embeddedness in the social at *two* levels. While both levels refer to the embeddedness of the economic in the social, they have distinct views of the relationship between the economic and the social. The *first* level corresponds to the *embeddedness* conception of Granovetter (1985), which basically states that any human action whether economic or not, cannot be stripped of social relations and networks, but rather is embedded in the immediate social context, in concrete and ongoing systems of relations (Granovetter, 1985, p. 504).[4] What Granovetter proposes with his *embeddedness* is a meso-level approach where relations and networks act as constitutive elements that sustain, rupture, and transform social and economic institutions (Powell & Smith-Doerr, 1994, p. 396). However, Granovetter's account of *embeddedness* does not have much to say about macro-scale questions, related to political culture, structural factors and so on.

The *second* level corresponds to the Polanyian account of *embeddedness,* which sees human economy as embedded in broader social structures, including state action, culture, and institutions (Polanyi, 1992, p. 34). Distilling from this perspective, Polanyi's account of *embeddedness* alludes to *always embedded economy* (Block, 1994; 2003), which concerns the involvement of state or politics (e.g., state protection) in any economic activity, agricultural adaptation to climate change being no exception.

In comparison, Polanyi's concept of embeddedness concerns the integration of economy into broader social systems whereas Granovetter's concept deals with identifying relational bases of social action in economic contexts (Kripner &Alvarez, 2006). In brief, Polanyi's understanding of the *embeddedness of the economy in the social* is a holistic one at a macro level, comprising state action (redistribution and regulations),

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[3] Such meso-level agricultural institutions include district/provincial directorates of agriculture, chambers of agriculture, farmers' cooperatives, seed-fertilizer-pesticide sellers.

[4] Granovetter's concept of embeddedness contrasts two extremes: the *undersocialized* view from classical and neo-classical economics, which sees actors as rational and self-interested, detached from social relations, and the *oversocialized* view, which sees individuals as entirely shaped by social norms, classes, and roles. Both perspectives, Granovetter argues, ultimately isolate actors from their social context (Granovetter, 1985, pp. 483-6).

reciprocity and exchange. In contrast, Granovetter's account of the *embeddedness of the economy in the social* relates more to relational, social ties at micro- and meso-levels.

At this point, despite tensions and drastic differences of scope between two conceptions of *embeddedness* (Krippner& Alvarez, 2007), they could be viewed complementary at the level of unit of analysis and for a comprehensive, if not a unified, understanding of the relationship between the social and the economic. At this point, with a complementary view and informing the broader scope of this dissertation, my conception of *embedded embeddedness* comes into play which is inspired by the coalescence of Polanyi's and Granovetter's distinct conceptions of *embeddedness*, respectively. *Embedded embeddedness* suggests that to the extent agricultural adaptation to climate change (a seemingly mere economic action) is not stripped of social relations and networks as elaborated by Granovetter at a more micro- and meso-level, it does not exist or operate in a political, legal, or institutional vacuum at a more macro-level. Rather, it is well-embedded and enmeshed in the political, legal, and institutional contexts and spheres, namely, in state action, as argued by Polanyi.

In this context, farmers' adjustment to climate change is contingent not solely on their personal and familial endeavours and social networks, but also on state subsidies, policies, market fluctuations, and the impacts of neoliberal changes, among other factors. In other words, from a comprehensive perspective, this conception aspires to shed light on how farmers adapt to climate change as *embedded* in their social ties and networks (Granovetter's embeddedness), which are themselves *embedded* in given institutions and state policies (Polanyi's embeddedness)?

In light of these, the findings of this dissertation could have essential implications in three broad respects, alongside more specific ones. *First*, it attempts to expand budding sociological perspectives on adaptation to climate change in agriculture. It will unravel how adaptation (based on social ties and formal institutions) proceeds for differently situated farmers (smallholders, large-scale farmers, highly vulnerable ones etc.) as embedded in specific structural contexts. Thus, this research aims to weave proximate means of adaptation with more fundamental ones, including underlying relational and institutional dynamics. In that respect, it also intends to contribute to a critical understanding of adaptation, diverging from a general tendency to confine it to the scope of economics, natural sciences, or more proximate social dimensions.

Second, utilizing a mixed method approach, this research also attempts to provide a fine-grained understanding of CCA in agriculture since such an encompassing and complex issue necessitates a much deeper look, where benefits of qualitative methods feed quantitative ones and vice versa. For instance, the quantitative results have provided general trends for each specific research question in this study, showing significant convergences and divergences across multiple variables, while the qualitative results have offered in-depth, first-hand accounts from farmers and agricultural institutions. *Third*, it endeavours to yield important implications for policymaking, for it reveals the (mal)adaptive capacity, strengths, and weaknesses of different farmers and formal agricultural institutions and the main barriers to the overall adaptive capacity in three of the most susceptible regions of Turkey to climate change. Likewise, it endeavours to inform about how ties at horizontal and vertical levels operate, which ties are loose, and which group of farmers have access to and use such support mechanisms and which have not. Based on such findings, improvements or interventions could be made at institutional, local, regional, and even national levels. Thus, the findings of this dissertation are likely to contribute to the formation of proactive, sustainable, inclusive, and socio-ecologically just and viable adaptation and agricultural policies and new institutions in the long term.

1.3 Specific Research Questions and Hypotheses

In light of the above-mentioned context, this dissertation seeks an answer to the following three main questions: 1) What is the role of social capital in increasing adaptive capacity of farmers? 2) What is adaptive capacity of existing formal agricultural institutions and their effectiveness in changing adaptive capacity of farmers? 3) Are farmers in Turkey closer to successful adaptation or maladaptation and tend to adapt autonomously or collectively?

Revolving around these three questions and the findings of the upcoming chapters, this dissertation argues that, apart from some early institutional efforts and autonomous and planned adaptation strategies, which tend to increase farmers' adaptive capacity, the majority of farmers in the analyzed regions tend to be closer to the maladaptive end of the spectrum between successful adaptation and maladaptation. This tendency is due to a variety of factors, including worsening climate change impacts, insufficient adaptive capacities, historical path dependencies, only partially effective social capital and agricultural institutions, and the absence of effective, inclusive, and transformative climate policies.

Initial Hypotheses as outlined in in line with desk research and pilot studies were as follows:

Table 2.1: Main research questions and hypotheses.

Based on lit. review and preliminary interviews with farmers and agricultural institutions, my research questions and hypotheses were as follows:[5]
Central Research Question: How Does Adaptation to Climate Change Proceed within the Context of Social Capital and Agriculture-related Intermediate Formal Institutions among Farmers in Turkey? A Comparative Study of Three Regions
Sub-questions: **Q1-** What is social capital's role in increasing farmers' adaptive capacity in Turkey? **H1-** Social capital has a positive impact in general, yet considerable variance exists among its sub-types (*bonding/bridging/linking*) as an adaptation strategy to climate change (**H1**). While *bonding* social capital (proximate ties with relatives, friends, neighbours) provides significant short-term and reactive responses to sudden onset events such as floods and storms, it is *bridging* and *linking* social capital (links with more distant contacts such as extension workers, agriculture engineers, weather insurance experts, state officials) that provide more proactive and long-term responses to climatic changes. Hence, social capital is likely to provide only short-term or unsustainable means of adaptation, especially for smallholders and the poor due to their limited access to bridging and linking ties (**H1a**). Implications of these in Turkey need to be studied.
Q2: What is the effectiveness of existing state policies/formal institutions in increasing the adaptive capacity of farmers? **H2-** There might not exist a well-concerted, innovative state policy which pays enough attention to social dimensions of agricultural adaptation to climate change in Turkey. The existing ones mainly consist of technocratic efforts, with the partial exception of training and awareness-building activities. **H2a**.Due to reasons mentioned in H2, it is more intermediate/meso-level mechanisms such as agriculture-related formal institutions (farmers' unions, cooperatives, chambers of agriculture etc.) and farmers' ties with other farmers, relatives, neighbours, agricultural engineers, or extension workers that could provide an accurate understanding of 'real, on-ground agricultural adaptation to climate change.'
Q3- Are farmers in Turkey likely to adapt or maladapt and adapt autonomously or collectively? **H3**- Apart from some emergent and promising planned and collective efforts like using drought-resistant local wheat seeds ('sorgül buğdayı') in Mardin and Konya, farmers in Turkey mostly tend to adapt autonomously, privately, and reactively. Existing adaptation measures of farmers, especially in drought-prone areas of Turkey, might lead to maladaptation, e.g., the formation of sinkholes due to overexploitation of groundwater in the Konya plains.

1.4 Main Approach, Data, and Methodology

This dissertation employed multiple stages to conduct this multi-site and comparative research. *First*, I conducted extensive desk research reviewing relevant literature on

[5] As highlighted in the thesis's proposal which is dated 27.05.2021.

agricultural adaptation to climate change, including related policy documents. This enabled me to identity key themes and gaps in existing research. *Second*, I designed a fieldwork plan to collect primary data through survey interviews, survey questionnaires, semi-structured in-depth interviews with farmers and experts/officials from related agricultural institutions. As part of this plan, I performed pilot studies between late 2020 and early 2021 to see general tendencies regarding my research questions with multiple stakeholders, including farmers and key informant interviews with experts/officials from related agricultural institutions. All have provided valuable insights into the practical implications of adaptation practices and the likely social dynamics at play in the agricultural sector.

Third, in line with research objectives, which were refined following pilot studies, I employed a multi-stage sampling approach comprising purposive and snowball sampling techniques. To this end, two broader criteria were utilized in selecting regions: 1) Areas that mainly depend on agriculture for sustenance and provide a rich comparison between farmers producing different agricultural products, mainly being cereal producers, cash crop producers, and fresh fruit and vegetable producers; 2) Areas where varying impacts of climate change are highly observable, ranging from rapid-onset and slow-onset effects of climate change. Hence, the primary comparison level involves comparing different groups of farmers based on various climate change impacts (slow-onset vs. rapid-onset), regional differences, and multiple variables (socio-economic factors, agricultural sources, farmers' scale, and vulnerabilities), as addressed by each research question in this study.

In line with these criteria and primary research questions, the following research zones were purposively chosen: Afyonkarahisar-Şuhut (Region A henceforth), Mersin-Erdemli (Region B), and Şanlıurfa-Eyyübiye (Region C). The participant pool expanded through snowball sampling. A combination of snowball and purposive sampling allowed for the incorporation of farmers from various backgrounds to the greatest extent possible.[6]

Additionally, I utilize a mixed-method approach, which proves helpful in the overall scrutiny of climate change adaptation (Landaverde et al., 2022). The data for this thesis mainly feeds on primary sources collected from 2021-2023, alongside secondary sources. Primary data consist of survey interviews with 111 farmers, semi-structured in-depth interviews with 53 farmers, 48 survey questionnaires, and 29 semi-structured in-depth interviews with experts/officials from meso-level agricultural institutions in selected

[6] More detailed information on the methods and how they are applied is provided in each analytical chapter (Chapters 3, 4, 5).

three research sites. Secondary sources comprise an analysis of key reports, plans, and programs by related authorities alongside a thorough analysis of existing literature.

Primary data analysis methods range from descriptive statistics, column proportion tests, logistic regression to a critical-comparative approach and qualitative analysis, with the distribution of these methods outlined in Figure 1.1. Since analytical chapters (Chapters 3, 4, 5) are written in the structure of scholarly journal articles, *the specifics of data analysis and methods used are elaborated within each analytical chapter.* As highlighted in Figure 1.1, each analytical chapter differs in terms of both the methods and sources used, except for Chapters 3 and 4, which rely on the same primary sources.

CHAPTERS	PRIMARY DATA SOURCES	MIXED METHODS
1. Introduction	Secondary sources (scholarly and policy)	Qualitative-critical
2. Background	Secondary sources (scholarly and policy)	Qualitative-critical
3. First Analytical Chapter	Survey interviews with 111 farmers + Semi- semi-structured in-depth interviews with 53 farmers +29 semi-structured in-depth interviews with experts from agricultural institutions	Quantitative + Qualitative (Column proportion tests, descriptive statistics, thematic analysis)
4. Second Analytical Chapter	Survey interviews with 111 farmers + Semi- semi-structured in-depth interviews with 53 farmers +Expert interviews with agricultural institutions	Quantitative + Qualitative (Column proportion tests, logistic regression, descriptive statistics, thematic analysis)
5. Third Analytical Chapter	Survey questionnaires with 48 experts form agricultural institutions + 29 semi-structured in-depth interviews with experts from agricultural institutions	Quantitative + Qualitative (Descriptive statistics+ thematic analysis)
6. Conclusion	Synthesis	Qualitative-critical

Figure 1.1: Distribution of primary sources and methods by chapters.

Concerning the units of analysis, it weaves micro-, meso-, and macro-level analysis throughout Chapters 2-3-4-5 (Figure 1.2). Since Chapter 2 dwells upon the possible effects of key developments, such as neoliberal transformation and formal institutions (state policies, programs, and plans), on adaptation, it provides a macro-level analysis. Chapters 3, by focusing on farmers' adaptive and maladaptive behaviours at an individual and household levels, ibasically provides a micro-level analysis. Chapter 4, analysing farmers adaptation action based on their proximate and distant ties, is built upon the combination of micro- and meso-level analysis while Chapter 5, with a focus on the adaptive capacity of intermediate level agricultural institutions, such as chambers of agriculture, agricultural cooperatives, and district/provincial directorates of agriculture, primarily feeds on meso- and macro-level approach.

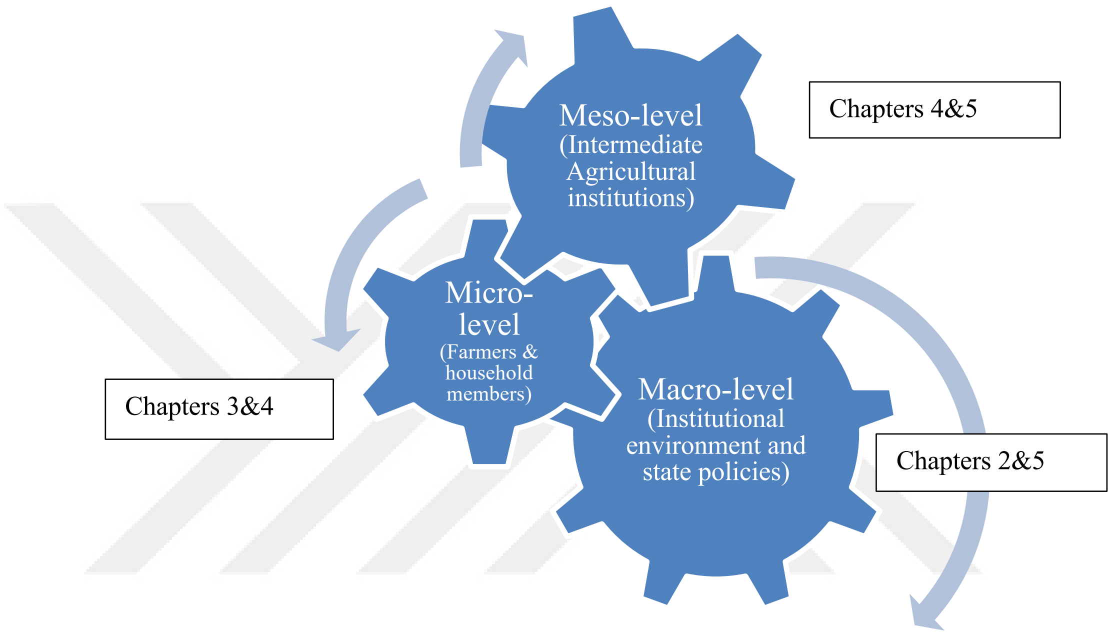

Figure 1.2: Visualization of units of analysis by chapters.

This research was conducted following the endorsement of the Ethics Committee of Koç University, with Decree No. 2021.350.IRB3.152, dated 23.09. 2021. Congruently, all participants provided verbal consent; written consent was provided where necessary.

All in all, by combining insights from recent literature review and multi-site fieldwork, I aimed to develop a comprehensive understanding of the social embeddedness of agricultural adaptation to climate change, going beyond the traditional economic and proximate social perspectives.

1.5 Specific Contributions and Thesis Outline

Against the wider scope of theoretical, practical, and methodological contributions discussed above, each chapter has substantial contributions by filling specific gaps in the existing literature that this dissertation contributes. These will be summarized in the rest of this section; interlinkages of which being highlighted in Figure 1.1 below.[7]

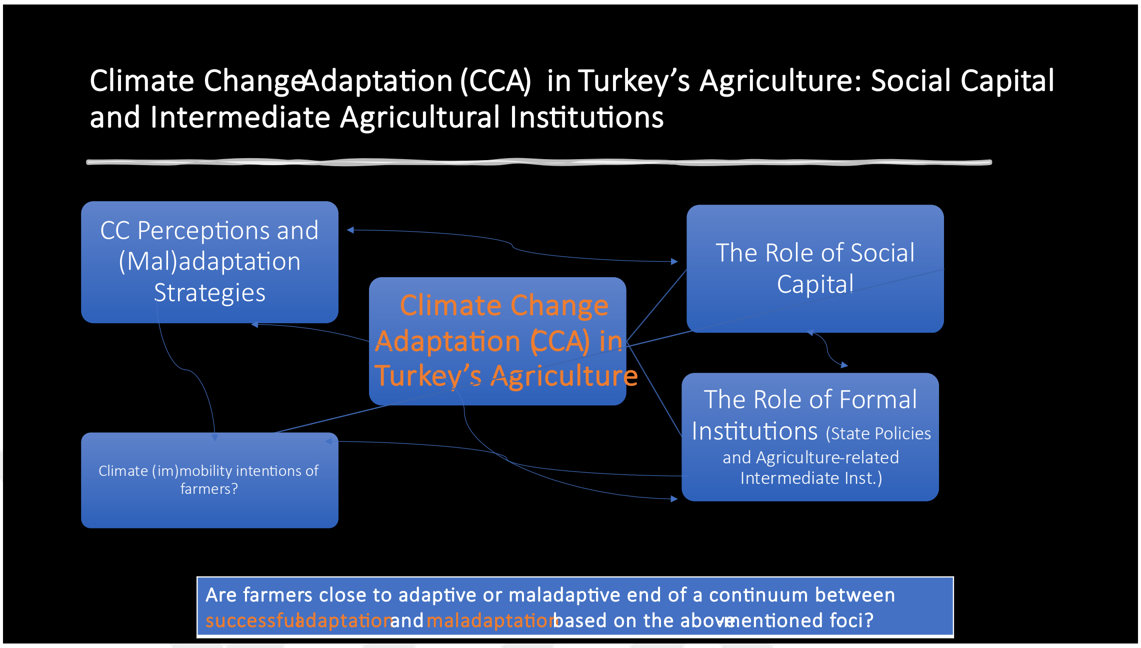

Figure 9.3: Visualization of research design.

This dissertation consists of six chapters: Introduction, Background Chapter, three Analytical Chapters, and Conclusion Chapter.

The Second Chapter (Background Chapter), titled *Turkey's Path in Climate Change Adaptation (CCA) in Agriculture: Neoliberal Transformation, Climate Negotiations, and Formal Institutions*, has three main foci laying the ground for upcoming chapters. *First*, it summarizes neoliberal transformation (which started in the 1980s of Turkey as a wave of the liberalization of commodity trade and the flexibilization of its labor markets) in Turkey's agriculture since neoliberal policies have been one of the most crucial factors behind existing vulnerabilities of the agricultural sector and farmers, thus making them more susceptible to the worsening effects of climate change. *Second*, revolving around Turkey's stance in global climate negotiations and climate action, it leaves some room for Turkey's route in terms of developments within the context of UNFCCC, with a particular focus on climate change adaptation. *Third*, it offers a brief overview of

[7] Climate (im)mobility intentions of differently situated farmers, which complement this dissertation's findings as a likely off-farm adaptation strategy, are not given within the scope of this study. I intend to work on andpublish it as a separate paper afterward during my post-doc studies. However, one can see its short version as a policy brief published by Rice University's Baker Institute, co-authored by me and my supervisor (Gören &İçduygu, 2024).

government programs and plans that might relate to CCA in agriculture and presents a timeline for critical formations and plans which reflect Turkey's climate change adaptation in agriculture. Doing so, it becomes the first endeavour to present such periodization.

The Third Chapter (the first analytical chapter), titled *Maladaptive Tendencies of Farmers' Adaptation Strategies to Climate Change: Comparison of Three Regions from Turkey,* mainly centres around (mal)adaptive tendencies of farmers' predominant adaptation tactics in the analysed research sites. To this end, *first*, it explores the varying experiences of agrarian communities faced with climate change. *Second*, it probes main adaptation behaviours of farmers to climate change, including both adaptive and maladaptive ones. *Third*, it delves into underlying immediate and structural factors, which contribute to (mal)adaptive consequences. Significant regional similarities and differences in climate change effects and (mal)adaptive tendencies are highlighted throughout the chapter. Thus, against the prevailing studies that solely concentrate on adaptation strategies and their determinants, it endeavours to contribute to budding research on the unintended consequences of adaptation behaviours that are maladaptive. Likewise, as mentioned earlier, it broadens the scope of the most widely analysed determinants of (mal)adaptative measures by adding *farmers' scale* – (small-scale, medium-scale, and large-scale ones) and *vulnerability index* (less vulnerable, vulnerable, and highly vulnerable ones), alongside *agricultural sources and methods*.

The Fourth Chapter (the second analytical chapter), *Bonding & Bridging-Linking Social Capital in Farmers' Adaptation to Climate Change: The Case of Turkey,* primarily attempts to shed light on the role of *social capital* in climate change adaptation practices and processes of farmers in related research zones. It defines *social capital* as the aggregate of ties that an individual farmer or a small group of farmers have based on trust, recurring relations, reciprocity, and norms or values that could affect their adaptation behaviour. It endeavours to achieve two specific purposes. *First*, it focuses on which sub-type of social capital (*bonding social capital,* which basically refers to farmers' horizontal ties vs. *bridging-linking social capital*, which broadly indicates farmers' vertical ties) operates among different groups of farmers in the face of both sudden-onset and slow-onset events. *Second*, it seeks an answer to the extent of each social capital type's effectiveness among farmers of various backgrounds, emphasizing the pitfalls and constraints of both social capital types. Where relevant, regional similarities and differences are highlighted. From a critical and comprehensive perspective, it expands the dominant line of research that either focuses on the positive effects of social capital on rural communities' adaptation or that mostly pays attention to the role of social capital following sudden-onset events.

The Fifth Chapter (the third analytical chapter), titled *Adaptive Capacity of Agricultural Institutions to Climate Change and Barriers: A Comparative Study,* has two main objectives. *First*, it assesses the adaptive capacity of intermediate agricultural institutions at two levels; the first level refers to the adaptive capacity of such formal institutions in themselves, while the second level refers to their adaptive capacity in increasing farmers' resilience. It bases the analysis of institutions on formal intermediate agricultural institutions, such as chambers of agriculture, district/provincial directorates of agriculture, agricultural cooperatives, and seed-fertilizer-pesticide companies. *Second*, it examines critical barriers to the institutional adaptive capacity at both levels. Regional similarities and differences are pivotal to each research objective. Consequently, it bridges the gap between studies that merely dwell upon farm-level adaptation processes and studies that solely assess the internal adaptive capacity of formal institutions.

The sixth chapter (the conclusion chapter), converge main research findings, their significance, and contributions, highlighting implications for further research and policymaking. It also briefly discusses the limitations of this dissertation alongside a reflection of the challenges faced all the while. To this end, it presents 4 affirmations and 3 refinements in Hypotheses provided in Table 1.1., alongside offering 4 broad and 4 specific contributions to existing research. Additionally, it presents nearly 20 practical/policy recommendations and 10 suggestions for further research alongside offering 3 refreshed or novel concepts derived from this study.

Each chapter feeds one another and has significant interlinkages, as depicted by Figure 1.3, and will be highlighted throughout this dissertation. For instance, the second chapter (Background Chapter) presents a general framework on how certain developments at a more macro level such as neoliberal transformation in agriculture, have rendered adaptation to climate change a daunting process. Likewise, it provides a general framework for how Turkey's position in climate negotiations and state plans and programs regarding CCA in agriculture, could have ramifications for meso-level relational and institutional basis of adaptation. Together with Chapter 5, which examines the adaptive capacity of agricultural institutions, Chapter 2 highlight the extent to which the state in Turkey is involved in climate adaptation, (Planyi's notion of *embeddedness*), although state-specific analysis is not the primary focus of this research. Specifically, they

(Chapters 2 and 5) jointly trace the state's role at two levels: first, by examining existing state policies, programs and plans concerning climate adaptation and the state's decreasing role due to neoliberal transformation (Chapter 2); second, by analysing the extent to which these policies and programs are implemented in practice through agricultural institutions, such as district/provincial directorates of agriculture, chambers of agriculture and similar (Chapter 5).

Similarly, the chapter on farmers' adaptation strategies and maladaptive tendencies (Chapter 3), by presenting *what farmers do to adapt to climate change*, provides a basis for the upcoming chapters, which primarily focus on the relational and institutional basis of CCA and seek an answer to the question of *how do farmers adapt to this change?* Similarly, the chapter on the role of social capital (Chapter 4) has notable connections with the upcoming one on the role of formal institutions (Chapter 5). For instance, *bridging-linking social capital* primarily refers to farmers' vertical ties with agricultural institutions, which have direct and indirect connections with the adaptive capacity of formal agricultural institutions. Likewise, each chapter's notable findings shed light on farmers' and agricultural institutions' overall (mal)adaptive capacity in the analysed regions and the agricultural sector in Turkey.

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Chapter 2

TURKEY'S PATH IN CLIMATE CHANGE ADAPTATION (CCA) IN AGRICULTURE: NEOLIBERAL TRANSFORMATION, CLIMATE NEGOTIATIONS, AND FORMAL INSTITUTIONS

2.1 Introduction

Since this dissertation considers and analyses climate change effects as inseparable from non-climatic factors, it finds it highly crucial to present key macro-level developments, thereby paving the way for the following analytical chapters. To this end, *first,* it presents a recap of the neoliberal transformation in Turkey's agriculture, which has made both the agricultural sector and farmers more fragile to the intensifying impacts of climate change. *Second*, it presents a general overview of Turkey's general stance in global climate negotiations by tracing its position in United Nations Framework Convention on Climate Change (UNFCCC). *Third*, it offers a brief descriptive overview of formal institutions, including state policies, programs, laws, and regulations associated with climate change adaptation (CCA) in agriculture. It mainly feeds on secondary sources, consisting of existing studies, critical reports, plans, regulations, and programs that might relate to CCA in agriculture. All combined, this chapter intends to shed light on the embeddedness of climate adaptation within the larger economic, political and institutional environment (reminiscent of Polanyi's concept of embeddedness, as highlighted in Chapter 1).

2.2 Neoliberal Transformation in Turkey's Agriculture

This section provides a summary of neoliberal transformation in Turkey's agriculture as one of the underlying forces that has made climate change adaptation rather a challenging process for multiple stakeholders including farmers. Before this, it finds its worthwhile to briefly discuss the emergence of neoliberal transformation in Turkey in general.

Emerging against the background and upon the failure of Keynesian policies across the world, mainly the USA and England, neoliberalism has become a highly debated term that is widely used without discrimination, inconsistently defined, and lacking empirical precision (Brenner, 2009, p. 183). While there is not agreement on the exact definition and scope of neoliberalism or neoliberal transformation, one can view it as a project driven by class interests, disguised with neoliberal terminology emphasizing individual freedom, liberty, personal responsibility, privatization, and the free market (Harvey, 2009).

Turkey began its neoliberal reforms in 1980 with the liberalization of commodity trade and the flexibilization of its labor markets (Cizre & Yeldan, 2005, p. 388). The 1980s, under Prime Minister Turgut Özal, are known for structural market reforms and are referred to as the first generation of economic liberalization. In contrast, the current phase of neoliberal economic reforms, which started in 2001, can be termed the 'second-generation' marketization reforms. While both sets of reforms aimed at establishing free market capitalism, the second-generation reforms have been more focused on the transnational movement of capital and global networks (Cizre & Yeldan, 2005, p. 388). Additionally, the neoliberal transformation of Turkey was implemented through the structural adjustment programs of the IMF and the World Bank whereby the previous focus on nationwide welfare distribution being shifted to prioritizing global private interest groups (Gönen &Yonucu, 2011, p. 75). This shift towards neoliberalism in Turkey has been primarily associated with the withdrawal of the state and a wave of privatization across various sectors, including health, energy, finance, the economy, and environmental issues, with agriculture also being profoundly affected.

The neoliberalization of renewable energy in Turkey is one of the most striking examples of the broader neoliberalization of climate policy and action. For instance, the increasing number of urgent expropriation decisions for the exploitation of renewable resources for electricity production, particularly water through hydroelectric power plants (e.g., 14 decisions between 1978 and 2000, rising to 830 from 2000 to 2014), which result in land dispossession, resource depletion, and public opposition, could indicate the scale of such sweeping transformation (Kaya, 2016).

The rest of this section touches on the evolving dynamics between the state and the market, especially since the 1980s, and their effects on specific agricultural policies and initiatives, which predominantly favour agribusiness while disadvantaging (small-scale) farmers.

In this direction, the period from 1930 to 1980 could be broadly defined as the one where the state played either a direct or indirect key role in policy design and implementation in agricultural policies and plans, ranging from the allocation of inputs and credits to extension services and supporting modern farming technologies (Aydın, 2010). From the 1980s onward, the involvement of the state in Turkey's agriculture gradually declined and shifted towards transnational agribusiness because of a wave of liberalization, de-regularization, and re-structuring economic programs initiated by the World Bank and International Monetary Fund (IMF) and embraced by Turkey alongside many other developing countries (Aydın, 2010). The capitalization of agriculture, which accelerated with the Green Revolution -broadly covering the nationalist-developmentalist post-war period- has thus gained another impetus since 1980. With this, transnational corporations have increasingly prioritized high-value cash crops that require artificial fertilizers and improved seeds and chemicals instead of traditional crops.

Such a transformative process peaked in the early 2000s with a reform package that almost wholly removed support prices, initiated Direct Income Support (DIS), dissolved parastatal procurement agencies, privatized many state enterprises, and so forth (Aydın, 2010). To name but a few, initiatives like the Agricultural Reform Implementation Project (ARIP), to adapt to the Common Agricultural Policy (CAP) of the European Union (EU), have brought about substantial shifts, making farmers and the agricultural sector more vulnerable to global commodity prices and demands of global agrifood companies. This transformation has involved a transition from a production-oriented support system to a one centred on land ownership with DIS, neglecting production-based planning and promoting market-friendly alternative crops like corn, sunflower, and soybean instead of traditional crops like cereals (Aydın, 2010; Adaman et al., 2020). Likewise, in the absence of the state's previous key role, contract farming has increased farmers' dependence on agrifood firms for purchase guarantees, shifting the whole responsibility and related risks to farmers during the whole cycle of agricultural production (Aydın, 2010; Keyder &Yenal, 2011; Adaman et al., 2020).

Such a sweeping process over the last two decades has resulted in de-agrarianization, decline in agricultural employment, contraction of arable lands, and a decrease in the supply of agricultural products as well as exacerbating vulnerabilities of farmers -particularly small-scale ones- due to their dependence on market relations with unequal access to political and economic power (Adaman et al., 2020). Through commodification, dispossession, and proletarianization, such radical transformations have ended traditional understandings of agriculture, peasant life, and practices (Keyder & Yenal, 2013).

Similarly, one of the gravest impacts of such drastic impacts of neoliberal policies has been the dissolution of small farmers, putting the latter at the merch of agri-food companies (Aydın, 2010; Keyder & Yenal, 2011). Contrary to what had been expected, which was an increase in agriculture's share, the latter has increasingly declined. For instance, the share of agriculture, with 40% of the Gross National Product (GNP) in 1923, had remained stable up until the 1970s and has undergone a sharp decline since then, becoming 25% in 1980, 17% in 1990, and %6,5 in 2022 (Ministry of Agriculture and Forestry -MAF, 2023; Doğan, 2018).

However, Turkey's agricultural policies have never operated at the absolute discretion of the market logic (Gürel, 2013; Keyder & Yenal, 2013; Adaman et al., 2020). Instead, they have acted like two sides of a pendulum between neoliberal and protective state policies (Keyder & Yenal, 2013). To offset the escalating tension and dissatisfaction among rural populations, particularly before elections, the governments often have had recourse to state subsidies as an instrument for their populist purposes (Aydın, 2010; Gürel, 2013). It could remind the Polanyian double movements of marketization and social (state) protection, which see market society as being shaped continuously by this double movement between state action and markets (Block, 1994).

Nevertheless, this is not to deny that the direction of this double movement has largely and eventually skewed towards the market due to such transformative policies and plans aimed at integration with the global agricultural regime. All these factors combined have made the agricultural sector and farmers, particularly small-scale, landless ones, more susceptible to increasing production costs, unstable commodity prices, climbing indebtedness, and restricted access to crop markets. Only by comprehending this intricate nature of Turkey's agricultural reality can one truly understand how farmers endeavour to adjust to the consequences of climate change. This is because if neoliberalism is a programme that aims at establishing the limitless dominance of capital on all societies and the world system (Boratav, 2016), including the web of life, the consequences of climate change are just a reminder of these very limits.

2.3 Glance at Turkey's Position in International Climate Negotiations

To provide a basis for Turkey's position in climate negotiations and thus climate action and policymaking, this section traces Turkey's path in the UNFCCC, the first international convention addressing climate change as a global phenomenon. In doing so, it also touches upon brief developments regarding adaptation within this framework.

In 2004, Turkey joined the UNFCCC, which was negotiated in 1992 and came into effect in 1994. Additionally, in 2009, Turkey also became a participant in the Kyoto Protocol of the UNFCCC, initially approved in 1997 and activated in 2005 as a key protocol (Ministry of Foreign Affairs-MFA, n.d.).[8] The principle of shared but varied responsibilities constitutes the backbone of the UNFCCC, categorizing countries as Annex I, Annex II, and non-Annex in line with their levels of development and historical accountability for greenhouse gas emissions.[9] It is mainly from this classification that Turkey's evolving stance originates and could be viewed as somewhat hesitant (Turhan et al., 2016; Şahin, 2016a) and contentious (Şahin, 2016a).

Turkey, due to its membership with the Organization for Economic Cooperation and Development (OECD), was first included in both Annex I and Annex II countries, initially giving the country full responsibility for tackling climate change and its effects (MFA, n.d.). Its first plea to be excluded from both annexes was not initially endorsed, considering Turkey's increasing share of fossil fuels and energy intensity. Following Turkey's proposition of an amendment emphasizing its "special circumstances" based on its early stage of industrialization and the maxim of *common but differentiated responsibilities*, however, it was excluded from the list in Annex II in the 7th Conference of Parties (COP7) in 2001, its "special circumstances" placing Turkey still at a different position from Annex I countries (Türkeş, 2017). Turkey's "special circumstances" were recognized in COP decisions in 2010, 2011, 2012, and 2014, highlighting the significance of assisting parties with special circumstances by providing financial, technological, and capacity support for effective climate action.

However, its argument based on "special circumstances" has mainly become invalid with the landmark Paris Agreement adopted in 2015 during COP21, which has somewhat blurred the distinction between developing and developed countries (Mazlum, 2017; Türkeş, 2017). It is mainly because compared to the more rigid obligations of the Kyoto

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[8] Turkey is also a signatory of a good number of other international conventions that can relate to global climate action, including the Montreal Protocol on Substances that Deplete the Ozon Layer, United Nations Convention to Combat Deforestation, the Vienna Convention for the Protection of Ozone Layer, and Convention on Biological Diversity and so on (Talu & Kocaman, 2019).

[9]Annex I nations encompass industrialized states that belonged to the OECD in 1992, alongside economies in transition (EIT) countries. Annex II nations comprise OECD members of Annex I, excluding EIT Parties, obligated to provide financial aid for emissions reduction efforts in developing nations. Non-Annex I parties, mainly developing countries, bear no responsibility for emission cuts under the Convention. See also "Parties and Observers" in *the United Nations Framework Convention on Climate Change*. 2019. Accessed September 28, 2019. https://unfccc.int/parties-observers

Protocol, the Paris Agreement, which has no reference to UNFCCC annex lists, has allowed parties to the UNFCCC to determine their mitigation targets voluntarily (Mazlum, 2017).

Primarily because of this, the agreement has been so far signed by 195 parties out of 198 parties to the Convention, (UNFCCCa, n.d.), committing them to ensure that the rise in the global average temperatures remains significantly beneath a 2°C rise from pre-industrial levels and to actively work towards restricting it to 1.5°C above pre-industrial levels (UNFCCC, n.d.). While Turkey signed the agreement in 2016, it did not ratify it until 2021. In that respect, Turkey joined the late ratifying country groups, Eritrea becoming the latest one in 2023, while the non-ratifiers comprise Iran, Libya, and Yemen (UNFCCCa, n.d.).

As to Turkey's share of receiving climate funds, this again brings into light Turkey's contentious position within the UNFCCC. Partly because of this positionality, it is not eligible for funds from the Green Climate Fund, the most significant climate fund under the UNFCCC and the Paris Agreement. However, it has been a long-standing recipient of Global Environment Facility (GEF) support (UNFCCC, 2023). Additionally, in its updated Nationally Determined Contributions (NDCs) dated 2023, Turkey reiterated the need for new and additional international financial resources to achieve its NDC and the green growth process (UNFCCC, 2023, p. 27). Such a call for need also resonated during the COP28 meeting, where Turkey, for the first time, demanded to be included as a receiver of the loss and damage fund, which was established at COP19 in 2013. This demand tends to contradict the country's earlier stance because of Turkey's involvement in Annex I and continuing demands to access the Green Climate Fund primarily for mitigation and technology purposes (Mazlum, 2023).

At this point, it is vital to consider the current nature of global climate action, particularly adaptation, so that Turkey’s positionality can be better grasped. Before all, the current interest in global action and related funds is not comparable to the scale of vulnerable countries’ need to adapt to climate change. Additionally, the issue of allocation concerning adaptation emerges as problematic since such allocation is considered between countries instead of between sub-national groups, which might eventually disregard vulnerability as a locally contextualized phenomenon (Remling & Persson, 2015). The latter is further reinforced by developments within the context of UNFCCC over a three decade-period, which have been primarily incremental, being confined to diplomatic success rather than concrete environmental action (Green, 2024, p. 41).

Among the core reasons behind such incremental progress lies, among others, the clash of interests among different interest groups, primarily oil, gas, and coal companies, as well as developed and the least developed and developing countries. That is why an assessment of Turkey's trajectory within the UNFCCC in light of such tendencies could provide a better grasp of Turkey's positionality in the global climate regime and governance.

2.4 Turkey’s Formal Institutions Relating to CCA in Agriculture

This section presents a brief overview of formal institutions, including state policies, programs, laws, and regulations associated with CCA in agriculture. Based on such formal institutions, it comes up with a periodization of CCA in agriculture, highlighting key dates where Turkey has concentrated on adaptation in agriculture in specific and climate action in general. Not alleging to be encompassing considering the complexity of climate change adaptation in agriculture, this periodization, providing a glimpse of the general distribution of formal institutions, is the first endeavour in this sense. Additionally, it briefly describes Turkey's National Climate Change Adaptation Strategy and Action Plan (2011-2023) and its NDCs, which provide a basis for adaptation in general and specific to agriculture.

Even though attention to adaptation largely emerged following the initial assessment report of the Intergovernmental Panel on Climate Change (IPCC) in 1990 and the Rio Summit in 1992, emphasis has become more evident since the early 2000s (Klepp & Chavez-Rodriguez, 2018). With the Cancun Adaptation Framework (COP 16) dated 2010, the focus on adaptation has become more manifest within the context of climate action (UNFCCCd, n.d.). Paris Agreement (COP21) has entrenched such growing interest, paying more systemic global attention to states' resilience in coping with climate change effects (UNFCCCb, n.d.). Likewise, comprehension of adaptation as inseparable from mitigation has been more evident, with attention going toward the co-benefits of adaptation and mitigation (IPCC, 2014). These implications become much starker with one of the latest publications of the IPCC, where adaptation is mainstreamed into climate action (IPCC, 2022). Such increasing interest in adaptation, only to some extent, reflects in the evolution of the adaptation fund, which primarily aims at supporting communities at risk in developing countries in adjusting and building resilience to adverse impacts of climate change, though (Adaptation Fund, n.d.).

Concerning climate change adaptation within the Turkish context, it would not be wrong to state that Turkey's response has been reactive rather than proactive in this regard, which could be traced back to its National Strategy for Climate Change (2010-23) dated 2010, and the National Climate Change Adaptation Strategy and Action Plan (2011-2023) dated 2011. However, as Table 2.2 glances at earlier key laws and regulations that might underlie upcoming climate policies and plans, very early foundations of CCA concerning agriculture could be dated to the years of 1980s and even 1970s, albeit with no explicit emphasis on the concepts of *climate change* or *adaptation*. In this direction, it is possible to see several laws laying the ground for upcoming climate change adaptation-related laws, regulations, and policies.

To name but a few, *Environmental Law* (no. 2872) dated 1983 could set an example since it aspires to "… make a better use of and preserve land and natural resources in rural and urban areas… preserving the country's livestock and vegetative assets…" (Environmental Law, 1983). The first emphasis on climate change comes with an amendment to this law (no. 5491) in 2006, where the theme of climate change is considered only from a broader perspective of "fight against climate change," "sustainable environment," and "sustainable development."

Similar inclination also holds for several other laws, including the *law on the Assistance to Farmers who have suffered losses due to Natural Disasters* (no. 2090) dated 1977, which, subsequently, transformed into *Agricultural Insurance Law* (no. 2005) dated 2005. While the former does not explicitly talk about climate change, focusing on compensation for wide-ranging losses deriving from floods, earthquakes, landslides, storms, frost, hail, drought, and diseases, the latter (Agricultural Insurance Law) explicitly lays the ground for more detailed policies and procedures in the compensation of losses deriving from climate change effects (Agricultural Insurance Law, 2005).

Alongside such underlying laws and mechanisms, which have either direct or indirect focus on climate change adaptation in Turkey, one can conceive the year 2004 as notably most significant because, as depicted by Figure 2.1 and Table 2.1[10], the number of laws, regulations, state policies and programs addressing CCA in general and specific to agriculture has undergone an increasing trend since 2004, when Turkey joined the

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[10] Both Figure 2.1 and Table 2.1 are based on the reviewed policy papers and plans, primarily comprising strategic plans of the Ministry of Agriculture and Forestry (from 2010-2023), annual report of the same ministry from 2006 to 2022, alongside key climate plans like Turkey's Climate Change Adaptation Strategy and Action Plan and Drought Management Plans.

UNFCCC. Hence, one can view 2004 as a kay date highlighting a steep increase in related climate policies, plans and programs. Likewise, more comprehensive, country-wide action plans follow Turkey's endorsement of the Kyoto Protocol in 2009. Thus, such tendencies could be interpreted as a reflection of international climate agreements, within the context of UNFCCC, on Turkey’s climate adaptation policies. These are the National Strategy for Climate Change (2010-2023) in 2010 and the National Climate Change Adaptation Strategy and Action Plan (2011-2023) in 2011. Another general glance at this figure reveals that laws and regulations steadily increase from the early 2000s to 2015, afterward giving place to increasing state policies and programs, specifically as of 2010 (Figure 2.1). Such tendencies might be interpreted as laws and regulations laying the ground for related plans and policies.

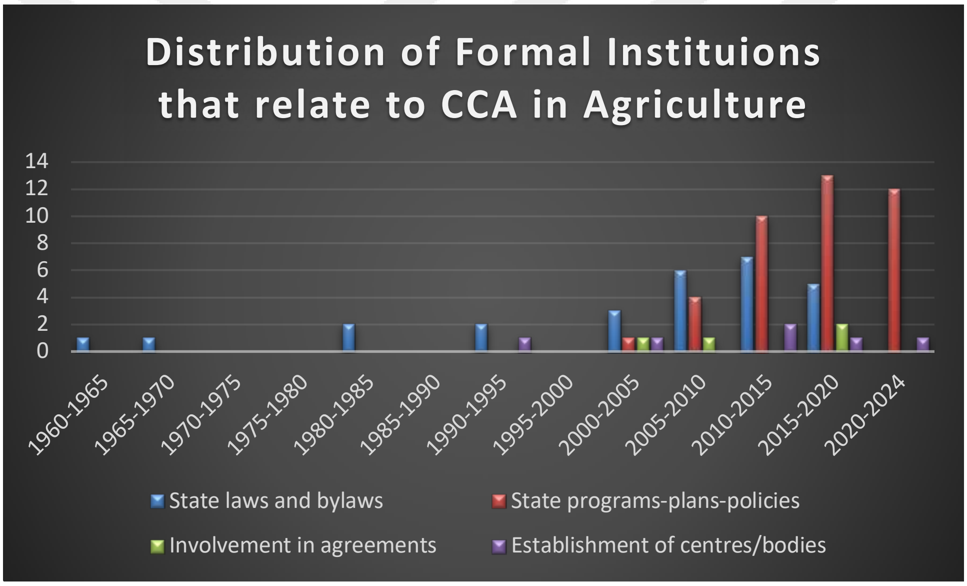

Figure 2.1: Distribution of formal institutions that relate to CCA in agriculture.

Table 2.1: Glimpse of distribution of formal institutions related to CCA in agriculture from 2004 to 2024.

2004	2005	2006	2007	2008	2009	2010	2011	2013	2014	2015	2016	2017	2018	2019	2020	**2021**	2022	2023
Law (no. 5262) on Organic Farming	Soil Conservation and Land Use Law(no.5403)	Agriculture law (no. 5488)	Submission of the 1st National Communications under UNFCCC	TARBİL (Agricultural Monitoring and Information System) not put into practice	Signing Kyoto Protocol	National Strategy for Climate Change (2010-23)	Turkey's National CC Adaptation Strategy and Action Plan (2011-23)	Submission of the 5th National Communications under UNFCCC (2-3-4) collected under one heading	The 10th (2014-18) National Development Plan	Submission of the NDC under UNFCCC	Signing the Paris Agreement	National Agricultural Project (Basin-based Support Model)	Law (no.7153) on Amending Environmental Law and other laws	Regulation on Land Consolidation and on-farm development	Law (no.7255) on making amendments on Food, Agriculture and Forest areas	Ratification of the Paris Agreement	Climate Council Final Declaration of Recommendations (2022) following th First Climate Council held in Konya	Submission of the the 8th National Communications under UNFCCC
Turkey joined the UNFCCC	Agricultural Insurance Law (no.2005)	Regulation of Agricultural Extension and Consultancy System (based on Agriculture law, no.5488)	The 9th Five-Year Development Plan (2007-13)	Regulation on Control and Monitoring of Food Security and Quality		Drought Test Centre within Bahri Dağdaş Research Institute	Agricultural Research Master Plan (2011-2015)	National Action Plan for Combatting Soil Erosion (2013-2017)	Law (no. 6537) on Amending the Law on Soil Conservation and Land Use (no. 5403)	National Strategy and Action Plan to Combat Desertification	Submission of the 6th National Communications under UNFCCC	Regulation on Trials concerning Plant Protection Products	Submission of the 7th National Communications under UNFCCC	Climate Change Action Plans with Regional Focus	TAGEM's increasing projects (i.e. early warning systems etc.)	Parliamentary Investigation Commission to Minimize Climate Change Impacts, Combat Drought and Make Efficient Usage of Water Resources	Türkiye's Strategy and Action Plan for Combatting Agricultural Drought (2023-2027)	Drought Management Plans for 23 river basins of all 26 rivers basins across TR
Regulation on Water Pollution Control	Environmentally Based Agricultural Land Protection (ÇATAK) Program	Law (no. 5491) on Amending the Environmental Law (within the context of sustainability)				Regulation on Good Farming practices		National Agricultural Drought Strategy and Action Plan (2013-2017)	Regulation on amending the Bylaw about Good Farming Practices		National Drought Management Strategy and Action Plan 2017-2023	Regulation on Land Consolidation and Implementation (based on Law on Soil Conservation and Land Use (no. 5403)		11th Development Plan (2019-23)		Change in the name of ministry: Ministry of Environment, Urbanization and Climate Change	Green Growth Technology Roadmap for Fertilizer Sector (2022)	Flood Management Plans for 24 river basins of all 25 rivers basins across TR
Law (no. 5179) on Adoption with amendments of the Decree Law regarding food production, consumption, and inspection						Regulation on the Principles and Implementation of Organic Farming		Climate Change and Weather Management Coordination Board (İDHYKK in Turkish) formerly IDKK	Regulation on Environmental Impact Assessment (based on Env. Law no.2875)		National Report on Land Degradation Neutrality for Turkey (2016-2029)	River Flood Control Action Plan (2017)		National Water Plan (2019-2023)		Strategic Plan of MAF (2019-2023) updated version		Water Efficiency Strategy Document and Action Plan in the Framework of Adaptation to the Changing Climate (2023-2033)
						Regulation on Agricultural Basins			Regulation on Protection of Wetlands		Agricultural Research Master Plan (2011-2015)			National Action Plan for Sustainable Soil Management in Turkey		Türkiye's Green Deal Action Plan (2021)		Submission of the Updated First NDCs
									National Agricultural Development Strategy (2014-2020)							National Agricultural Development Strategy (2021-2023)		
									National Basin Management and Strategy Action Plans (2014-2023)							National Steppes Protection Strategy and Action Plan (2021-2030)		
									Roadmap for Climate Change and Related Disasters (2014-2023)							Climate Change and Adaptation Coordination Board (IDUK in Turkish)		

Table 2.2: Glimpse of distribution of formal institutions that might lay the ground for CCA in agriculture until 2004.

1960	1977	1983	1984	1991	1994	1998	2001
Law (no. 1960) on Underground Waters	Law (no. 2090) on the assistance to farmers who have undergone losses due to natural disasters	Environmental Law (no.2872)	Law (No. 3083) on land arrangement in irrigated areas	Establishment of TAGEM (General Directorate of Agricultural Research and Policies)	Regulation on the Production of Plant and Animal Products via Ecological Methods	Pasture Law (no. 4342)	The 8th Five-Year Development Plan (2001-5)
							Climate Change Coordinating Committee (IDKK in Turkish)

The year 2021 (Table 2.1) emerges as another key date when Turkey officially ratified the Paris Agreement, and since then climate change (adaptation) has been more evidently mainstreamed into climate change action plans and policies. For instance, of symbolic importance, the name of the Ministry of Environment and Urbanization was officially changed into *the Ministry of Environment, Urbanization and Climate Change* (The Ministry of Environment, Urbanization and Climate Change). Likewise, it was again in 2021 that the first Parliamentary Investigation Commission, directly addressing climate change, was established to Minimize Climate Change Impacts, Combat Drought, and Make Efficient Usage of Water Resources (Grand National Assembly of Turkey-TBMM, n.d.). Nevertheless, the awaited climate law and the updated version of the National Climate Change Adaptation Strategy and Action Plan have yet to be prepared since 2021 (Tuğaç, 2022), which will guide future climate action for Turkey.

Concerning research and development (R&D) projects and activities that could be evaluated within the context of CCA in agriculture and primarily performed by the General Directorate of Agricultural Research and Policy (TAGEM), one can identify some promising early steps. Such activities and projects primarily consist of monitoring, mapping, and forecasting climate change impacts on different agricultural products under different climate change scenarios; development of new adaptive plants and animals such as drought-resistant crops and salinization-resistant crops; modern irrigation systems (e.g., drip irrigation for paddy farming) alongside other modern irrigation methods (The Ministry of Environment, Urbanization and Climate Change, 2011; Annual Reports by the Ministry of Agriculture and Forestry dated 2018-2019-2020-2021).

Overall, based on the above-mentioned key dates, one can argue that developments within the UNFCCC might have played a key role in urging Turkey to increase regulations, plans, and programs addressing climate change adaptation in general and CCA in agriculture. Last but not least, relying on the trajectory of such formal institutions relating to CCA in agriculture, it would be right to define such a path as *a change with significant continuities* rather than a complete, transformational change.

2.4.1 Turkey's National Climate Change Adaptation Strategy and Action Plan

Viewing Turkey's National Climate Change Adaptation Strategy and Action Plan dated 2011 as the first founding document for climate change adaptation, this section presents a short overview of this plan, which is yet to be updated by the Ministry of Environment, Urbanization, and Climate Change. It follows with a brief comparison of Turkey's first NDCs dated 2015 and its updated version in 2023 to see Turkey's trajectory of development on CCA within the UNFCCC.

At this point, it is worthwhile to touch upon the main decisions taken at COP16 in 2010 since COP16 has paved the way for a better global engagement with climate change adaptation. As mentioned earlier, the conference established Cancun Adaptation Framework and Adaptation Committee to enhance adaptation action in developing countries and provide technical support and guidance (UNFCCCd, n.d.). A plan outlining most effective approaches to tackle the repercussions of climate change, specifically focusing on loss and damage from climate change effects in developing countries, has been another significant development resulting from this conference (UNFCCCd). Besides, it has been a landmark conference in initiating a process for the Least Developed Countries (LDCs) and developing countries to map out NAPs. The latter has two primary purposes: 1) reducing vulnerability to climate change via enhancing adaptive capacity and resilience; 2) integrating adaptation into new and existing policies and programmes (United Nations Environment Programme -UNEP, n.d.).

Turkey's NAP, constituting the very early underpinnings of adaptation to climate change, prioritizes five (thematic) vulnerability areas/fields concerning adaptation to climate change. These include 1) Management of water resources, 2) Agricultural sector and food security, 3) Natural disaster risk management, 4) Ecosystem services, biodiversity, and forestry, 5) Public health (The Ministry of Environment, Urbanization and Climate Change, 2011, p. 30). In particular, the NAP tends to associate adaptation to climate change in agriculture with water resources management, food security, “natural” disaster management, and ecosystem services. Likewise, adaptation to climate change is by and large viewed as integrating it into existing programs and policies, rather than a start from scratch' process (ibid).

Regarding Turkey's NDCs, differences between its first version, dated 2015, and the updated one in 2023 could show the evolution of Turkey's path towards CCA in agriculture. For instance, the earlier version of the NDC primarily dwells upon mitigation, with emphasis on reduction in GHG emissions up to 21% from the business as usual (BAU) level for 2030, while adaptation, at a more descriptive level, is merely depicted as an element of National Climate Change Action Plan (UNFCCC, 2015). Concerning the agricultural sector, the report pays attention to land consolidation, rehabilitation of grazing lands, limits on the use of fertilizers, and the importance of modern agricultural practices, alongside reduced tillage methods, with no explicit reference to adaptation (UNFCCC, 2015).

Regarding its updated version in 2023, nearly half the report focuses on the country's adaptation plans, with more specific targets expressed. Within the context of adaptation goals, the agriculture and forestry sectors are jointly assessed, with most attention being paid to drought management, the protection of forests, and increasing institutional capacity towards this end (UNFCCC, 2023, pp. 20-21). Such topics as disaster risk management and the water sector emerge as other key areas, with a specific focus on fire management plans, agricultural insurance, protection of water resources, and flood management plans (UNFCCC, 2023, pp. 21-13). Throughout the report, one can also observe a proliferation of policies and programs towards such ends.

Despite such increasing plans, programs, policies, and future targets on adaptation, as for mitigation, the Climate Action Tracker [11] still evaluates its overall rating as "critically insufficient" regarding its net zero targets for 2053 (Climate Action Tracker, n.d.). It adds that such targets will not prompt real-world emission reduction, suggesting that the Turkish government should come up with a coal phase-out plan for the power sector since Turkey holds the world's third-largest coal pipeline (Climate Action Tracker, n.d). Such warning/suggestion resonates with other suggestions of climate policy scholars who

[11] It furnishes an impartial scientific assessment that monitors governmental efforts in addressing climate change and assesses them in accordance with the internationally agreed objective of the Paris Agreement, which aims to "limit warming to well below 2°C and strive for 1.5°C. The scale consists of such categories as "critically insufficient," "highly insufficient," "insufficient," "2°C compatible", "1.5°C Paris Agreement Compatible", and "Role Model," where there does not exist any country fitting "Role Model."

foresee a lock-in due to Turkey's heavy dependence on fossil fuels, specifically coal on the one hand, and its increasing interest in clean energy, resulting in policy inertia (Şahin, 2016b; 2018). Because Turkey's carbon emissions have escalated in the last decade, most of its total energy supply coming from coal, oil, and natural gas (Altaeb, 2021).

Overall, based on proliferation of above-mentioned policy documents, plans, programs, and regulations regarding CCA in agriculture, one can argue that Turkey has, to some extent, done well in preparing *institutional adaptation options* as classified by IPCC and *soft adaptation measures* at the heart of which lie addressing policy, strategy and organizational regulations and knowledge and capacity building (Turkey's National Climate Change Adaptation Strategy and Action Plan, 2011, p. 32). To what extent such institutional adaptation options or measures translate into adaptation action or, more precisely, into more structural-physical and social adaptation measures is a question to be answered in detail by this dissertation's upcoming chapters/articles. The rest will be the story of "adaptation in practice" *vis â vis* "adaptation in theory".

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Chapter 3

(MAL)ADAPTIVE TENDENCIES OF FARMERS' ADAPTATION STRATEGIES TO CLIMATE CHANGE: COMPARISON OF THREE REGIONS FROM TURKEY

Abstract

Despite increasing studies dwelling upon adaptation efforts that are likely to increase adaptive capacity of farmers, limited attention has been paid to thriving cases of maladaptation, which indicates adaptation action that aggravates the vulnerability of a system, population group or a sector in the face of climate change. Within this framework, focusing on farmers' main adaptation strategies, this Chapter seeks an answer to the (mal)adaptive consequences of such efforts for differently situated farmers in three selected regions of Turkey (Afyonkarahisar-Şuhut, Mersin-Erdemli and Şanlıurfa-Eyyübiye). It reveals that a) farmers' *maladaptive* behaviours tend to dominate almost consistently across various groups of farmers in selected zones; b) The primary reason for maladaptive tendencies lies in path dependency deriving from years-long dependence on industrial agriculture and the inadvertent consequences of the developmental project-Southeastern Anatolia Project (GAP), entrenched by farmers' short-term behavioural responses; c) It is particularly older farmers, farmers engaged in agriculture longer years and with lower education who tend to display more maladaptive behaviours; d) Autonomous adaptation measures and planned adaptation action remain rather inadequate in preventing maladaptation; e) Farmers of higher vulnerabilities and less advantages are likely to have limited access to smart agricultural methods or agricultural insurance mechanisms. f) Modern irrigation systems tend to emerge as the sole structured method enhancing adaptive capacity of various farmer groups. Overall, it underscores the need for more structured agroecological efforts to address the multifaceted climate change adaptation in agriculture. It relies on an extensive fieldwork (2021-2023), which consists of survey interviews with 111 farmers and semi-structured in-depth interviews with 53 farmers and 29 expert interviews with agricultural institutions in selected zones.

Keywords: Climate change/crisis, (mal)adaptation, farmers, adaptation strategies, vulnerability, sustainability.

3.1 Introduction

Agrarian populations face significant consequences of climate change both on global and regional scale, ranging from abrupt events like flooding, cyclones, and storms to gradual effects such as drought, seasonal shifts, rising sea levels, and land salinization. It is particularly middle-income and low-income countries that more bear the brunt of climate change. Moreover, certain groups—such as low-income farmers, women, individuals with disabilities, older people, and children—disproportionately experience the effects of these changes (Ngcamu, 2023). As the effects of climate change cannot be fully reversed through mitigation efforts, there is a growing emphasis on adapting to these changes, a shift that has gained prominence in the last decade (Intergovernmental Panel on Climate Change- IPCC, 2022). Consequently, research on adapting to climate change has seen a significant rise during this period (Lancu et al., 2022).

Adaptation broadly refers to the adjustment process to current or anticipated climate conditions and their impact, while *adaptive capacity* pertains to the ability of systems, institutions, humans, and other organisms to cope with potential harm, seize opportunities, or respond to outcomes (IPCC, 2014). Such a broad definition of adaptation brings about significant challenges regarding identification and assessment of spatial and temporal scales of adaptation practices (Magnan et al., 2016; Schipper, 2020; Reckien et al., 2023). Speaking the language of transformation, *adaptation* discourse might also mask underlying vulnerabilities, inequalities, and different responsibilities behind the climate change (Baldwin & Forale, 2017). Equally, it is likely to veil maladaptive outcomes, which unintendedly increase the vulnerability of people, sectors, places due to overemphasis on short-term responses or poor planning (Sovacool & Linnér, 2016; Schipper, 2020; IPCC, 2022). However, there has been a growing body of proof demonstrating maladaptive practices which span various sectors and regions over the last decade (IPCC, 2022).

One can broadly define *maladaptation* as the present or future adverse effects resulting from adaptation efforts that worsen or alter the susceptibility or exposure of a system, sector, or a population group (Barnett & O'Neill, 2010; Juhola et al., 2016; Magnan et al., 2016). These practices have thus the potential to establish enduring states of vulnerability, exposure, and risk that are challenging and costly to rectify, thus worsen pre-existing disparities. (IPCC, 2022).

Similarly, maladaptation disproportionately harms already marginalized and vulnerable communities, including indigenous peoples, ethnic minorities, low-income households, and those living in informal settlements, which might eventually serve to solidify existing inequalities (IPCC, 2022). Nevertheless, there remains a limited comprehension of the circumstances in which responses associated with adaptation either diminish risk or inadvertently result in unintended consequences that amplify risk. (Reckien et al., 2023). With budding literature on maladaptation in rural areas, though, how the unintended repercussions of maladaptive actions unfold within specific contexts are gradually becoming evident (e.g., Klein et al., 2007; Haggblade et al., 2010; Beilin et al., 2012; Andersson-Sköld et al., 2015; Antwi-Agyei et al., 2018; Guodaar et al., 2020; Nyantakyi-Frimpong et al., 2022).

Turkey, positioned in the eastern Mediterranean, faces significant susceptibility to climate change effects, particularly in terms of drought, intensified and prolonged heatwaves, and the looming threat of coastal flooding (IPCC, 2022). In recent times, Turkey has observed a notable surge in drought incidents (Şenol, 2021) and abrupt weather phenomena (General Directorate of Meteorology, 2022), surpassing occurrences in Northern and Western Europe (Kelebek et al., 2021). The latest IPCC report (2022) underscores the adverse impact of climate change on agricultural output, emphasizing droughts as the primary catalyst for food insecurity (IPCC, 2022). Projections for the future paint a dire picture as Turkey is forecasted to be among the regions facing "extremely high" water stress by 2040 (Armstrong, 2022). That is why adaptation to climate change in Turkey's agriculture necessitates more attention for the sustainability of agricultural production and climate action. Since climate change effects cannot be dissociated from other factors including economic, social, political, it is worthwhile to note that agriculture under Turkey is under double exposure because it is under pressure from the consequences of both global environmental/climate change and neoliberal globalization (Turhan et al., 2015).

Regarding climate change adaptation in agriculture in Turkey, budding few studies predominantly dwell upon either risk perceptions (e.g., Aydoğdu & Yenigün (2016), economic gains of adaptive strategies (e.g., Karapınar & Özertan, 2020), or perceptions, adaptation strategies and their determinants (e.g., Karapınar et al., 2018; Sevim & Somuncu, 2018; Çaltı & Somuncu, 2018; Karapınar & Özertan, 2020). A limited number of studies, albeit not directly related to farmers' adaptation behaviour, delve into underlying vulnerabilities, inequalities, or the impact of state/institutional policies on various agrarian populations in response to climate change effects (e.g., Turhan et al., 2015; Lelandais, 2015).

In light of these, this Chapter seeks an answer to (mal)adaptive tendencies of farmers in different towns from three regions of Turkey, which are Afyonkarahisar-Şuhut (also called Region A hereinafter), Mersin-Erdemli (Region B henceforth) and Şanlıurfa-Eyyübiye (Region C hereinafter). To this end, the purpose of this Chapter is *three-fold*. *First*, it asks how differently situated agrarian populations experience climate change and adapt to its effects. *Second*, it focuses on the dominating (mal)adaptive tendencies in farmers' adaptation practices and processes. *Third*, it discusses both immediate and deep causes of such maladaptive tendencies. It pays particular attention to significant regional differences throughout the Chapter. In doing so, it expands the scope of most-widely analysed characteristics or determinants of (mal)adaptative measures by adding *farmers' scale* – (small scale, medium scale, and large-scale ones), and *vulnerability index* (less vulnerable, vulnerable, and highly vulnerable ones). To this end, following Introduction, in line with the findings of this Chapter, the second section glances at budding developments concerning research on (mal)adaptation. The third section glances at selected three research zones while the fourth one dwells upon data and methods. The fifth section focuses on results and discussion while the sixth section comes up with suggestions based on overall findings.

3.2 Background: Literature Review

There has been growing interest in research dwelling upon adaptation strategies in agriculture, including diversification of agricultural practices, e.g., diversification of crops, livelihoods, and income sources (Deressa et al., 2009; Asare-Nuamah et al., 2022; Rijal et al., 2022; Zakari et al., 2022). Positive impacts of such adaptation tactics, including its effects on yields, food security and income, have become steadily evident (Berhe et al., 2017; Karapınar & Özertan, 2020; Zakari et al., 2022). Despite such skewed emphasis on strategies likely to increase adaptive capacity of rural communities, studies empirically focusing on measures which tend to be maladaptive have not received adequate attention (Beilin et al., 2012; Antwi-Agyei et al., 2018; Guodaar et al., 2020; Nyantakyi-Frimpong et al., 2022). The latter tendency might present only a partial glimpse of the outcomes of what agrarian populations do to adapt to such change. However, there has been an increasing amount of evidence showcasing maladaptive practices that cut across different sectors and regions (IPCC, 2022).

Outcomes of maladaptation include an increase in greenhouse gas emissions, elevated or shifted vulnerability to climate change, diminished welfare, and more inequitable consequences (IPCC, 2022). *Eroding sustainable development* as such stands out as one of the most highlighted elements of maladaptation (Juhola et al., 2016; Antwi-Agyei et al., 2018; Guodaar et al., 2020; Reckien et al., 2023). Likewise, poor planning, drivers of vulnerability (Schipper, 2020) and short-term adaptation measures tend to be primary factors behind it (Brooks et al., 2009; Sovacool & Linnér, 2016;). For instance, raising artificial levees as a means of protection against floods might be maladaptive by reinforcing farmers' existing vulnerabilities when they often fail to safeguard farmers from erosion and flooding and cause high-velocity floods when they breach (Nyantakyi-Frimpong et al., 2022).

Identification, and assessment of (mal)adaptation indicates a challenging process. For instance, a project or measure could yield diverse results, with varying degrees of success and failure among different social groups, regions, timeframes, and sectors (Mills-Novoa, 2023). Similarly, some attempt or measure that is considered maladaptive might later prove to be beneficial and vice versa (Juhola et al., 2016; Juhola & Käyhkö, 2023). Likewise, for instance, despite its benefits of income diversification, migration might lead to many risks of entrenching or shifting vulnerability since it leads to reduced labour in farming operations (Antwi-Agyei et al., 2018; Guodaar et al., 2020; Schipper, 2020).

Against the background of the ambiguity of the concept *(mal)adaptation*, there have been attempts to increase its analytical and operational power (Barnett &O'Neill, 2010; Juhola et al., 2016; Magnan et al., 2016; Reckien et al., 2023). To specify a few, providing one of the earliest efforts to systematically outline the concept of maladaptation, Barnett & O'Neill (2010) divide forms of maladaptation into five and exemplify them through the consequences of large-scale projects (e.g., repercussions of Wonthhaggi desalination plant as an adaptation measure to water scarcity in Melbourne in 2007). Such outcomes include 1) increasing greenhouse gas emissions, 2) disproportionate impacts on the most vulnerable, 3) incurring high opportunity costs, 4) diminishing incentives for adaptation, 5) developing path dependency (Barnett &O'Neill, 2010).

Another group of studies consider maladaptation of broader perspectives (e.g., Juhola et al., 2016; Schipper, 2020; Reckien et al., 2023). Juhola et al. (2016, p. 136) categorize maladaptive outcomes into three: rebounding vulnerability (adaptation action increasing current or future susceptibility for the implementing or the target groups), shifting vulnerability (adaptation measures increasing the vulnerability of external actors), and eroding sustainable development, which refers to adaptation action that increases GHG emissions and has adverse effects on the environment and/or social, economic values. Such categorization has later resonated well with several empirical studies (e.g., Antwi-Agyei et al., 2018; Guodaar et al., 2020; Nyantakyi-Frimpong et al., 2022). Similarly, Schipper (2020) analyses maladaptation based on broader categories of behavioural, infrastructural, and institutional maladaptation, which comply with adaptation options suggested by IPCC (2014; 2022).

Among the most recent and comprehensive critical frameworks, Reckien et al. (2023) develop six criteria to assess the impacts of adaptation outcomes in a continuum. The first three consist of *system-level criteria* which primarily asks whether adaptation outcomes increase or decrease climate impacts on ecosystems and ecosystem services; whether they cause substantial additional GHG emissions and lastly whether they can contribute to a broader change by going beyond tackling the source of a particular risk. The second three criteria comprise *equity-related ones*, which ask whether adaptation tactics increase or reduce social vulnerability and adaptive capacity of low-income groups, women/girls, and marginalized ethnic groups, or similarly cause any unintended harm to or create opportunities for such disadvantaged groups (Reckien et al., 2023).

Such increase in scholarly studies have made it more apparent that adaptation and maladaptation are more of opposing ends of a continuum rather than two distinct processes or outcomes (Magnan, 2016; Schipper, 2020; Reckien et al., 2023; Mills-Novoa, 2023). In other words, at one end of the spectrum lies maladaptation and the other effective or successful adaptation (Adger &O'Brien, 2009; Schipper, 2020; Barnet &O'Neill, 2010) where unsuccessful, ineffective, inadequate, or neutral adaptation measures sit in between (Schipper, 2020; Reckien et al., 2023; Mills-Novoa, 2023). Thus, unsuccessful adaptation refers to a failed adaptation initiative which does not necessarily lead to adverse effects while maladaptation specifically denotes an increase in the vulnerability of a system, group, or sector (Barnett & O'Neill, 2010).

3.3 Three Research Zones from Turkey

As Figure 1 demonstrates, the first research area (Şuhut-Region A) is a town in Afyonkarahisar, a city located in the inner Aegean region of Turkey. Agriculture in this area primarily relies on cereal cultivation, specifically wheat and barley, and cash crops like potato and opium poppy (Şuhut-District Directorate of Agriculture, 2022).

Additionally, cattle farming serves as a significant livelihood in this town, which has a population of 35.973 (Turkish Statistical Institute-TURKSAT, 2022). Irrespective of the changing climate, Region A exhibits a continental climate, which is somewhat moderate by streams coming from the Aegean and Mediterranean regions. It is predominantly characterized by hot and dry summers, cold and snowy winters with limited rainfall, and moderate, rainy springs (Afyonkarahisar Municipality website).

Figure 3.10: Map of Turkey, research zones highlighted.

The second area (Erdemli- Region B) is coastal town within the city of Mersin, positioned in the Mediterranean region of Turkey. Its current population is 151.928 (TURKSAT) and farmers primarily cultivate high-value export goods, notably lemon and various citrus fruits, alongside fresh fruits, and vegetables, primarily grown in greenhouses (Erdemli-District Directorate of Agriculture, 2022). Regardless of the changing climate, Region B typically experiences a mild Mediterranean climate characterized by average temperatures of 9°C in winter and 29°C in summer, and cool, rainy winters (Şensoy & Demircan, 2008).

The third area (Eyyübiye-Region C) is a town situated in Şanlıurfa city within the southeastern region of the country hosting a population of 391.795 (TURKSAT 2022). Agriculture in this region is heavily dependent on cash crops such as cotton, corn, red lentil alongside cereals like wheat and barley (Şanlıurfa-Provincial Directorate of Agriculture, 2022). The agricultural landscape in this city has undergone significant transformation due to the Southeastern Anatolia Project (GAP), which stands as one of Turkey’s largest regional development initiatives, aiming to improve water and land resources in southeastern Turkey.[12] As a result of this project, agriculture in most parts of Şanlıurfa has shifted from rainfed practices to irrigated farming, facilitated with the construction of dams and hydropower plants that generate electricity. Despite the changing climate, Region C is characterized by a continental climate with long and extremely cold winter, alongside dry and hot summers, with springs and autumns undergoing hot and cold spells (Şensoy & Demircan, 2008).

3.4 Data and Methods

This Chapter's original results are based on primary sources collected by the author and mixed method approach: survey interviews with 111 farmers, semi-structured in-depth interviews with 53 farmers, and 29 expert interviews with agricultural institutions in the abovementioned research sites (Table 3.1).

Table 3.1: The overall distribution of survey interviews and in-depth interviews.

City-Town	The number of survey interviews with farmers	The number of semi-structured in-depth interviews with farmers	Expert interviews with agricultural institutions	Time interval
Afyonkarahisar-Şuhut (Region A)	34	25	9	August 2021-June 2023
Mersin-Erdemli (Region-B)	38	18	9	October 2021-October 2022
Şanlıurfa-Eyyübiye (Region-C)	39	10	11	October 2021-September 2022
Total	111	53	29	

In line with research objectives, this study employed a multi-stage sampling approach

[12] Even though the initial purpose was to build 19 hydroelectric power plants and 22 dams, the project has undergone many transformations over time. These included a shift from technical aspects, led by the state, and centred on infrastructure and economic development to primarily prioritizing social factors, being largely supportive of market dynamics, and chiefly emphasizing sustainability and human development (Bilgen, 2020).

comprising both snowball and purposive sampling techniques. Pilot studies, -conducted between late 2020 and 2021 to see general tendencies regarding how farmers perceive, experience, and thus adapt to climate change impacts, - provided an early base of the sampling process. These studies involved on-site farm visits, telephone interviews with farmers alongside key informant interviews with experts from agriculture-related institutions including district/provincial directorates of agriculture and chambers of agriculture from several places, including Regions A-B-C.

Based on these pilot studies and comprehensive desk research, two broader criteria were utilized in selecting regions. These criteria aimed at selecting areas primarily reliant on agriculture, especially emphasizing their significance for food security or export potential (with specific attention given to comparing cash crop producers, cereal producers, and growers of fresh fruits and vegetables). Additionally, the selection focused on regions where farmers face different impacts of climate change, comparing sudden-onset events with gradual effects. In alignment with the primary research questions, the above-mentioned research areas were purposively chosen.

These selections were made primarily because farmers in the former region predominantly cultivate cereals, mainly wheat and secondarily cash crops; those in the second region specialize in citrus fruits (specifically lemons) and fresh fruits and vegetables, particularly in greenhouse cultivation; and those in the third region are primarily engaged in cultivating cash crops, mainly cotton, corn, and cereals. The participant pool expanded through snowball sampling. Since the aim was not to evaluate politically or ideologically sensitive preferences, the use of snowball sampling, combined with purposive sampling, facilitated the inclusion of farmers from diverse backgrounds as much as possible (Appendix 3.1).

Likewise, in alignment with the research inquiries and fieldwork dynamics, and to capture potential divergence regarding farmers' socioeconomic characteristics, agricultural sources and methods, and farmers' scale and vulnerability levels, the number of people interviewed reached 34, 38 and 39 for Regions A, B, C, respectively, -numbers that ensure stable and reliable estimates for the statistical tests mentioned below (Table 3.1).Survey interviews were complemented by detailed, semi-structured interviews that aimed to elicit comprehensive responses through open-ended and probing questions. Both of these interviews were performed by the author herself, approximately 85% of which conducted through face-to-face interactions and the remaining 15% via telephone or

Zoom interviews.[13]

Column proportions test was run through IBM SPSS Statistics (Version 24), a reliable statistical tool, to see significant differences regarding (mal)adaptation strategies of farmers based on multiple variables across three broad categories: a) farmers' socioeconomic characteristics, b) agricultural sources, and methods, c) farmers’ scale and vulnerability index (Appendix 3.1 and Table 3.2a-3.2b-3.2c). The test looked at the rows of the table independently and compared pairs of columns, testing whether the proportion of farmers in one column is significantly different from the other column’s proportion. SPPS reporter has automatically assigned a one-character ID (A, B, C) to each column. For each (statistically) significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion. Significance level for upper case letters (A, B, C) is 0.05 (at the rate of 5%).[14] The results of semi-structured in-depth interviews were transcribed and coded through Maxqda Plus 2020 version. The coding system assigned *F* followed by numerical identifiers to farmers (e.g., F1, F2, F3…); *E* followed by numbers to experts or officials from agricultural institutions (e.g., E1, E2, E3…); *R* to regions followed by A-B-C (e.g., RA-RB-RC). Furthermore, to ensure the anonymity of expert respondents, they are categorized as public, civic, or private.

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[13] To avoid the likely sampling bias, the following methods were employed. First, considering that most farmers in Turkey are of ageing population and low education level, an oversampling technic was used so that farmers of higher education and younger generations are not excluded from the sampling. Second, considering that the interviews at agricultural institutions such as the district directorate of agriculture and chambers of agriculture might exclude farmers who are not registered in Farmer Registration System (ÇKS in Turkish), random visits were paid to farms and subsistence or small farmers so that they are not excluded from the sampling. Similar oversampling technic was applied to the inclusion of large-scale farmers since majority of farmers consist of small-and medium-scale farmers in Turkey, and one of the main purposes of this dissertation is to compare small-, medium- and large-scale farmers. The only sampling bias might relate to the skewed emphasis on male farmers for the majority of participating farmers are male, e.g., cereal producers consisting of mostly male farmers. This likely sampling bias might be disregarded since gender-based evaluation does not constitute one core foci of this research. Nevertheless, the latter should not blind one to the likely invaluable findings that could emerge from such a gender-based approach since female farmers are more inclined to experience the burden of climate change compared with the male (e.g., Nelson & Stathers, 2009; Jost et al., 2016).

[14] To exemplify, IDs of A, B, C have been automatically assigned to the columns *Region A*, *Region B* and *Region C*, respectively under the broader column *District of Farming*, and these are displayed below the column headings. For instance, see C below the cell contents in *Region B* cell of the *increase irrigation* row, which indicates that the proportion of farmers in *Region B* increasing irrigation is higher than the proportion of farmers in Region C and this difference in proportions is statistically significant at the rate of 5% significance level. Similarly, for the *changes in sowing-planting-harvesting time* row, this indicates that the proportion of farmers shifting their sowing-planting-harvesting time in Region A is higher than the proportion of farmers applying same method in both Regions A and C, and this difference in proportions is statistically significant at the 5% significance level. (See Table 3.2a-3.2b-3.2c for detailed results).

3.4.1 Explanatory Guide for Three Broad Categories of Variables

A table was created to outline descriptive statistics of the collected data (Appendix 3.1). Variables were categorized broadly into three groups: *Demographic-socioeconomic characteristics*; *Agricultural sources and methods*; *Farmers' scale*, and *vulnerability*. Detailed explanations are provided in the subsequent subsection specifically for variables requiring further clarification regarding their composition and content.

3.4.2 Demographic and Socioeconomic Characteristics

Concerning the main sources of livelihood, the term *extra work* refers to individuals involved in semi-proletarian occupations or formal jobs such as being an agricultural engineer in urban centres. Regarding *engagement in animal husbandry*, farmers in Region A predominantly rear cattle, whereas those in Region B tend to focus more on smaller livestock. In contrast, farmers in Region C are the least involved in animal husbandry. Across regions, the population is predominantly male, regardless of geographical differences.[15]

Regarding *farmers production volume* category, it classifies annual production in tonnes into three groups: Low-tonnage producers indicating 1-50 tonnes; Medium-tonnage producers, encompassing 50-300 tonnes; and High-tonnage producers, reflecting 300 tonnes and beyond. Based on TURKSAT’s standards, the variable *decares of land* was formed as follows: Small-scale landowners (smallholders) with 1-100 decares; Medium-scale landowners with 101-300; Large-scale landowners with over 300 decares.

3.4.3 Agricultural Sources and Methods

Under the category of *main type of farming*, *conventional farming* within this dissertation signifies reliance on industrial or capital-intensive agricultural practices, including synthetic fertilizers, pesticides, and high tillage. Greenhouse cultivation is considered a sub-set of conventional farming in this research.

Concerning farmers' *sale channels*, the term *intermediary* mainly entails middlemen, traders, and the private sector entities, while *state agency* primarily denotes Agricultural Products Office (TMO). The expression *I sell myself* indicates those selling their produce

[15] Since the rate of female participants is only 5%, a proportion that does not provide significant comparison, the gender variable is dismissed from the analysis. Likely reasons for such lower rate of gender is detailed earlier in Footnote 14.

at local markets or through their own shops.

3.4.4 Farmers' Scale and Vulnerability Index

The categorization of *farmers' scale* was based on the average annual income. *small-scale farmers* refer to those earning annually 200.000,00 TLs. *Medium-scale farmers* indicate those earning between 201.000,00-800.000,00 TLs while *large-scale farmers* specify those getting more than 800.000,00 TLs for the years 2020-2021.[16]

Based on Likert Scale nine questions, *vulnerability index* sought an answer to the fragility of farmers faced with climatic and non-climatic challenges common to each research site. Answers to nine questions were converted into a scale where *100* represents the most vulnerable and *0* the least. Three groups of farmers were formed as follows: *Less vulnerable, vulnerable*, and *highly vulnerable* (Appendix 3.1 and 3.2).

3.5 Results and Discussion

Based on main research questions, this section dwells upon the main findings and their assessment. To this end, first, it examines the effects of climate change as experienced by farmers in the studied regions, along with their primary adaptation strategies, which predominantly lean towards maladaptive consequences. Second, it analyses the likely reasons behind such dominating maladaptive inclinations.

3.5.1 Most Widely Observed Impacts of Climate Change

Largely mirroring the grey literature and media coverage regarding Turkey which depict drought as a highly critical climate risk for food security (e.g., Türkeş, 2021), this Chapter uncovers that farmers observe more complicated effects of climate change in the analysed three regions. It highlights that farmers experience both gradual effects of climate change like drought, seasonal shifts, and changes in precipitation regime and sudden-onset events such as frost and hail that are on the rise (Figure 3. 2).

[16] The average exchange rate of the Turkish Lira against the US Dollar in 2020 varied from 6 to 8 USD, whereas it ranged from 7 to 11 USD in 2021.

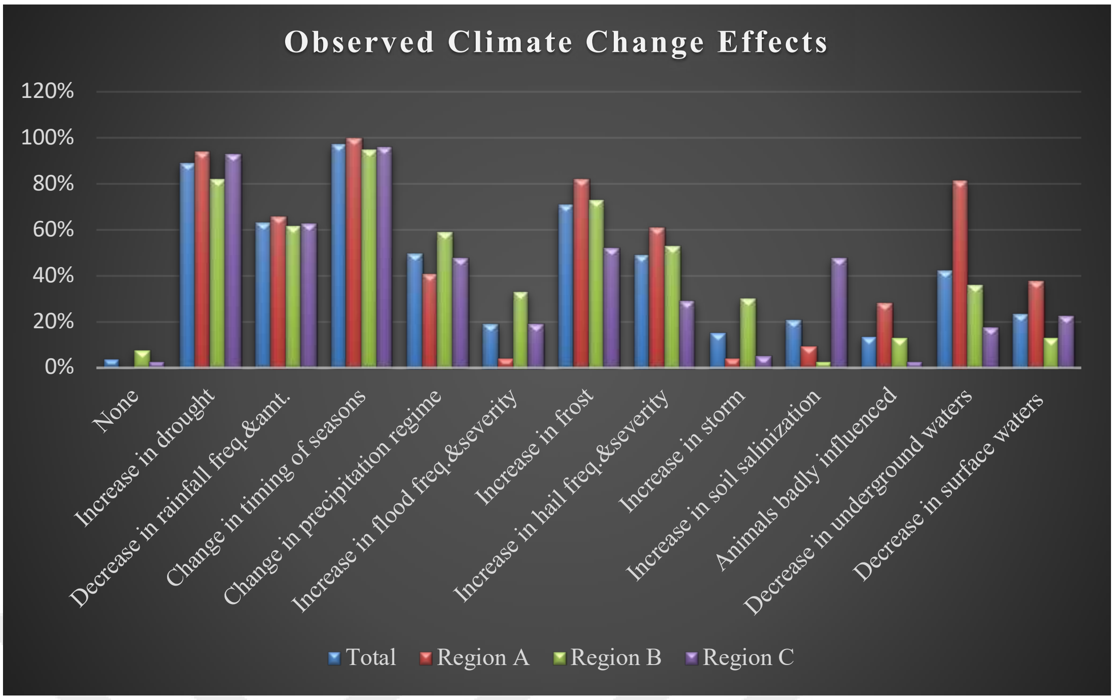

Figure 3.2: General and regional distribution of observed climate change impacts by farmers.

As depicted in Figure 3.2, without regional comparison, the general picture suggests that *change in timing of seasons*, with 97%, stands out as the most widely observed climate change impact among farmers, which is followed by *drought* (89%) and drought-associated implications, such as decrease in rainfall frequency and amount. The statements made by a farmer in Region C could demonstrate how shifts in seasons could potentially have extensive effects, which create a temporal dislocation that confronts modernity's singular temporality and its countertemporalities (Ginn, 2018).

> Winters starts late. Summers start late. That being the case, not only plants are under stress, but also we. We cannot manage pesticides' timing well because insects typically dormant under the snow cover remain active on the surface for too long!
>
> F1-RC

Similarly, the following quotation could also exemplify the grave impacts of drought not only for humans but also non-human actors:

> Last month, (meaning October 2021), two of our cows had to eat (yellow) hawthorn because they couldn't find any grass. What can they do if the cows can't find grass? There is no drop of rain! Because

> they weren't used to eating so much hawthorn, their intestines got blocked. We lost one cow, and the vet barely saved the other. -*emphasis added by the author*-
>
> F2-RA

Unlike common effects of climate change, its impacts also vary significantly across selected three regions, emphasizing the diverse implications of climate change as a localized phenomenon. For example, farmers in Region C perceive more *land salinization* effects while those in Region A contend with notably higher occurrences of *frost*, *reduced availability of both underground and surface water*, *adverse effects on animals*. Conversely, farmers in Region B predominantly face challenges related to *storms*, *flooding*, and *alterations in precipitation patterns*. Interestingly, farmers in Region C (Figure 3.2) demonstrate greater resilience to numerous effects of climate change, including decreased water sources, hail, and storms. This resilience could be partly attributed to the Southeastern Anatolia Project (GAP), a development initiative that augmented the region's irrigation capabilities. However, this has led to downsides and maladaptive inclinations, as discussed in upcoming sections.

3.5.2 Overarching Maladaptive Tendencies of Farmers' Adaptation Strategies

As Figure 3.3 and Table 3.2a depict, mostly consistent across all three research sites, the top two adaptation strategies to climate change are the *increase in irrigation* (by 47% of farmers) and the *increase in pesticide usage* (by 43% of farmers, including insecticides, herbicides, and fungicides).[17] The option of *increase in synthetic fertilizer use*, stated by 33% of respondents, is another highly favoured approach. Such actions, despite their short-term benefits for the farmers engaged in them by securing their agricultural income, tend to be maladaptive in terms of their consequences for farmers, other groups of people, and for the sustainability concerns, as discussed in the upcoming sections of this chapter.

[17] When directly asked as a follow-up question, "What do you do against increasing pests?" the same rate rises to 65%. It might be because farmers tend to avoid associating their measures against increasing pests with precautions taken against climate change effects, which is understandable since climate change mostly indirectly (via rising temperatures accompanied by farmers' maladaptive practices like industrial agriculture) contributes to the increase in pests.

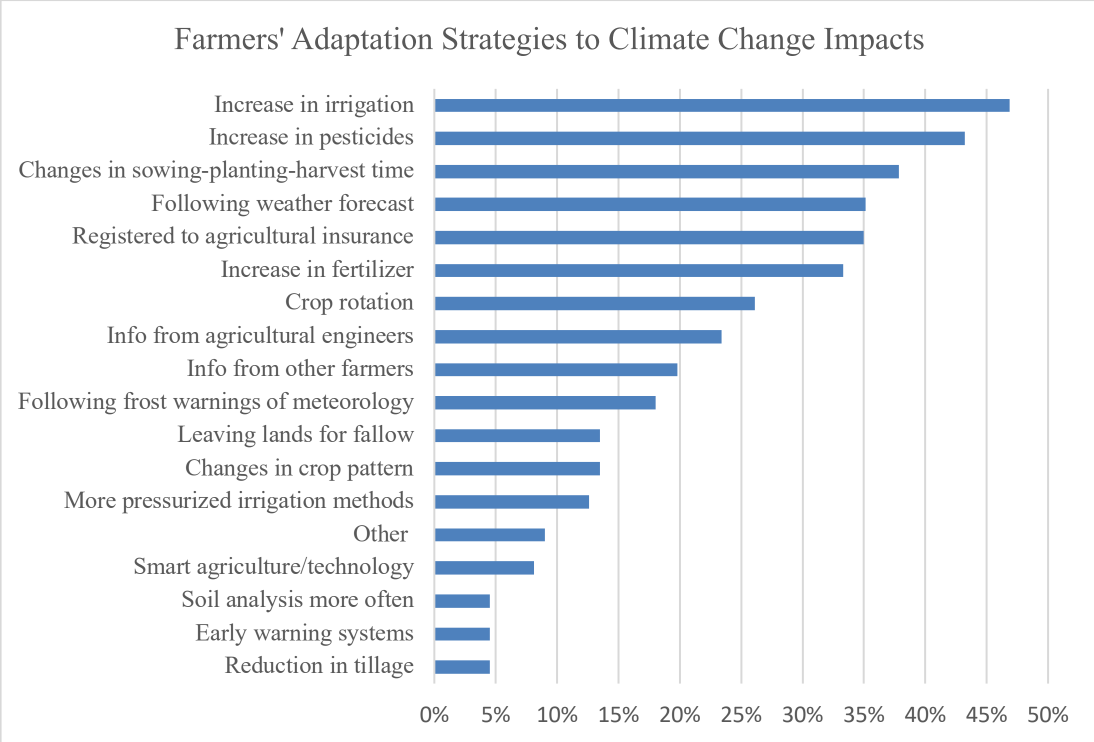

Figure 3.3: Farmers' adaptation strategies to climate change impacts.

When such maladaptive inclinations are analysed based on three key sets of variables, specific outcomes emerge (Table 3.2a-3.2b-3.2c). Factors such as age, years of farming, educational attainment, and regional attributes emerge as pivotal in influencing farmers' maladaptive behaviours. To elaborate, older farmers aged 50 and above notably increase irrigation and synthetic fertilizer usage compared to younger counterparts. Similarly, more seasoned farmers (engaged in agriculture for 20 years or more) exhibit a pronounced inclination to increase synthetic fertilizer application in contrast to those with lesser experience (15 years or below). Moreover, farmers with lower educational attainment (primary education level) tend to rely more on pesticides and synthetic fertilizers than their highly educated counterparts (holding a university degree). Concerning regional characteristics, the only notable difference relates to farmers in Region C, who do not show a parallel surge in irrigation usage (Table 3.2a). This trend might be attributed to the pre-existing access of farmers to water resources due to dams and hydroelectric power plants established through the GAP project, which will be further discussed.

Table 3.2a: Adaptation Strategies based on demographic and socio-economic features.

Adaptation Strategies based on Demographic and Socio-economic Features		District of farming			Age			Education			Main source of livelihood			Animal husbandry		Years of farming			Farmers Production Volume			Decares of land owned			Landholding or tenancy	
	Total (A) Column N %	Region A (A) Column N %	Region B (B) Column N %	Region C (C) Column N %	35 years old&below (A) Column N %	36-50 years old (B) Column N %	50 years old&above (C) Column N %	Low Education (A) Column N %	Intermediate Education (B) Column N %	High Education (C) Column N %	Agriculture+Retired (A) Column N %	Agriculture+Extra work (B) Column N %	Agriculture (C) Column N %	0 (A) Column N %	Animal husbandry (B) Column N %	15 years old and below (A) Column N %	15-25 years old (B) Column N %	25 years old and above (C) Column N %	Low tonnage producers (A) Column N %	Medium tonnage producers (B) Column N %	High tonnage producers (C) Column N %	Small holders (A) Column N %	Medium-scale landowners (B) Column N %	Large-scale landowners (C) Column N %	Only tenant (incl. sharecroppers) (A) Column N %	Both landholder&tenant (B) Column N %
Increase in irrigation	47%	53%	62% C	28%	42%	37%	66% B	53%	48%	40%	58%	48%	45%	47%	46%	31%	57%	54%	35%	61% A	44%	51%	50%	45%	33%	49%
Increase in pesticides	43%	44%	54%	33%	33%	39%	59%	60% C	36%	30%	58%	33%	48%	47%	29%	31%	43%	57%	41%	49%	39%	46%	54%	27%	33%	45%
Changes in sowing-planting-harvest time	38%	69% B C	15%	35%	36%	41%	34%	44%	44%	28%	42%	38%	38%	32%	58% A	33%	43%	38%	24%	49% A	28%	32%	46%	45%	40%	38%
Registration to agricultural insurance	35%	54%	31%	25%	37%	28%	43%	38%	43%	27%	55%	24%	38%	29%	54%A	21%	34%	49%	33%	36%	43%	30%	57%	40%	9%	38%
Following weather forecasts via smart phone	35%	50% C	36%	23%	18%	39%	47% A	47%	32%	26%	50%	40%	29%	33%	42%	28%	43%	35%	37%	34%	28%	37%	31%	27%	40%	34%
Increase in fertilizer	33%	31%	41%	28%	18%	33%	50% A	49% C	28%	21%	50%	24%	38%	37%	21%	18%	40%	43% A	33%	39%	22%	40%	38%	9%	20%	35%
Crop rotation	26%	47% B	8%	28%	21%	33%	22%	26%	36%	21%	33%	29%	23%	24%	33%	21%	37%	22%	22%	29%	22%	25%	31%	9%	33%	25%
Info from agricultural engineers	23%	22%	18%	30%	30%	20%	22%	23%	24%	23%	33%	24%	21%	24%	21%	26%	26%	19%	17%	32%	17%	26%	23%	9%	27%	23%
Info from other farmers	20%	25%	21%	15%	15%	20%	25%	33%	12%	12%	25%	17%	21%	20%	21%	15%	17%	27%	22%	20%	17%	19%	31%	9%	13%	21%
Following frost warnings of meteorology	18%	19%	21%	15%	21%	15%	19%	16%	28%	14%	17%	26%	13%	18%	17%	15%	20%	19%	17%	22%	11%	19%	23%	0%[2]	13%	19%
Changes in crop pattern	14%	9%	8%	23%	12%	22%	3%	12%	12%	16%	0%[2]	17%	14%	16%	4%	13%	20%	8%	7%	20%	11%	14%	19%	0%[2]	13%	14%
Leaving lands for fallow	14%	38% C	0%[2]	8%	9%	20%	9%	21%	8%	9%	17%	12%	14%	8%	33% A	10%	9%	22%	15%	10%	17%	16%	8%	18%	13%	14%
More using pressurized irrigation methods	13%	22% C	15%	3%	6%	13%	19%	14%	16%	9%	25%	12%	11%	13%	13%	10%	14%	14%	15%	17%	0%[2]	14%	8%	9%	20%	11%
Other	9%	0%[2]	21% C	5%	6%	9%	13%	14%	8%	5%	17%	10%	7%	10%	4%	5%	14%	8%	9%	12%	0%[2]	14%	4%	9%	0%[2]	10%
Using smart agriculture/tech	8%	9%	5%	10%	9%	9%	6%	5%	12%	9%	8%	10%	7%	10%	0%[2]	5%	9%	11%	2%	5%	28% A B	5%	15%	9%	7%	8%
Reduction in tillage	5%	9%	0%[2]	5%	9%	4%	0%[2]	2%	8%	5%	8%	5%	4%	3%	8%	10%	0%[2]	3%	4%	5%	6%	4%	8%	9%	0%[2]	5%
Using early warning systems	5%	3%	0%[2]	10%	12%	2%	0%[2]	7%	0%[2]	5%	0%[2]	5%	5%	5%	4%	3%	9%	3%	2%	7%	0%[2]	5%	0%[2]	9%	7%	4%
Soil analysis more often	5%	6%	0%[2]	8%	6%	7%	%[2]	5%	4%	5%	8%	0%[2]	7%	6%	0%[2]	3%	9%	3%	4%	2%	11%	4%	12%	0%[2]	0%[2]	5%
Grow crops twice/three times a year	3%	6%	0%[2]	3%	0%[2]	7%	0%[2]	2%	4%	2%	0%[2]	2%	4%	2%	4%	0%[2]	6%	3%	2%	2%	6%	4%	4%	0%[2]	0%[2]	3%
Planting trees	3%	0%[2]	5%	3%	6%	0%[2]	3%	2%	0%[2]	5%	0%[2]	5%	2%	2%	4%	0%[2]	6%	3%	4%	0%[2]	6%	5%	0%[2]	0%[2]	0%[2]	3%

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion.
Significance level for upper case letters (A, B, C): ,05[3]
1. This category is not used in comparisons because the sum of case weights is less than two.
2. This category is not used in comparisons because its column proportion is equal to zero or one.
3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Table 3.2b: Adaptation strategies based on agricultural sources and methods.

Adaptation Strategies based on Agricultural Sources and Methods	Total	Main type of farming				Crops produced			Sales channel			Irrigation source				Irrigation method		
		Conventional farming	Organic farming	Subsistence farming	Greenhouse-conventional	Cereals	Cash crops	Fresh fruits&vegetables	Intermediary/private sector	State agency	I sell myself	Deep well	Lake-pond-dam water	Mains water	Only rainwater	Traditional irrigation	Pressurized irrigation	Only rainwater
	(A) Column N %	(A) Column N %	(B) Column N %	(C) Column N %	(D) Column N %	(A) Column N %	(B) Column N %	(C) Column N %	(A) Column N %	(B) Column N %	(C) Column N %	(A) Column N %	(B) Column N %	(C) Column N %	(D) Column N %	(A) Column N %	(B) Column N %	(D) Column N %
Increase in irrigation	47%	46%	50%	35%	58%	42%	35%	59%	49%	27%	52%	58%	39%	57%	0%[2]	26%	61% A	0%[2]
Increase in pesticides	43%	44%	30%	41%	53%	38%	35%	54%	46%	36%	40%	50%	39%	57%	0%[2]	35%	51%	0%[2]
Changes in sowing-planting-harvest time	38%	51% C	40%	6%	21%	49% C	35%	24%	26%	64% A	64% A	46%	30%	57%	0%[2]	38%	41%	0%[2]
Registration to agricultural insurance	35%	40%	50%	17%	22%	43%	25%	30%	28%	33%	57%A	40%	33%	14%	33%	35%	35%	33%
Following weather forecasts via smart phone	35%	41% C	10%	6%	53% C	36%	35%	34%	34%	45%	36%	50% B	22%	14%	33%	24%	41%	33%
Increase in fertilizer	33%	33%	30%	18%	53%	30%	24%	41%	41%	27%	16%	40%	30%	14%	17%	26%	38%	17%
Crop rotation	26%	32%	10%	18%	21%	36%	12%	20%	23%	45%	28%	31%	24%	29%	0%[2]	32%	25%	0%[2]
Info from agricultural engineers	23%	27%	20%	18%	21%	23%	29%	22%	22%	27%	28%	23%	26%	14%	17%	29%	21%	17%
Info from other farmers	20%	22%	20%	12%	21%	23%	6%	22%	15%	36%	28%	21%	17%	43%	0%[2]	18%	23%	0%[2]
Following frost warnings of meteorology	18%	24%	0%[2]	12%	16%	15%	18%	22%	16%	36%	16%	25%	11%	0%[2]	33%	12%	20%	33%
Changes in crop pattern	14%	13%	20%	12%	16%	17%	6%	12%	11%	18%	20%	12%	20%	0%[2]	0%[2]	29% B	7%	0%[2]
Leaving lands for fallow	14%	21%	10%	6%	0%[2]	19%	18%	5%	15%	9%	8%	19%	4%	14%	33%	9%	14%	33%
More using pressurized irrigation methods	13%	11%	20%	6%	21%	11%	6%	17%	9%	36% A	12%	21%	0%[2]	43%	0%[2]	3%	18% A	0%[2]
Other	9%	10%	0%[2]	0%[2]	21%	6%	0%[2]	17%	11%	0%[2]	8%	12%	9%	0%[2]	0%[2]	9%	10%	0%[2]
Using smart agriculture/tech	8%	10%	20%	0%[2]	5%	9%	6%	7%	4%	18%	16%	8%	11%	0%[2]	0%[2]	15%	6%	0%[2]
Reduction in tillage	5%	6%	10%	0%[2]	0%[2]	6%	0%[2]	5%	1%	9%	12%	6%	2%	0%[2]	17%	3%	4%	17%
Using early warning systems	5%	6%	0%[2]	0%[2]	5%	4%	6%	5%	3%	0%[2]	12%	4%	7%	0%[2]	0%[2]	6%	4%	0%[2]
Soil analysis more often	5%	6%	0%[2]	6%	0%[2]	8%	6%	0%[2]	5%	9%	0%[2]	4%	4%	0%[2]	17%	3%	4%	17%
Grow crops twice/three times a year	3%	3%	0%[2]	6%	0%[2]	6%	0%[2]	0%[2]	1%	9%	4%	4%	2%	0%[2]	0%[2]	3%	3%	0%[2]
Planting trees	3%	3%	10%	0%[2]	0%[2]	0%[2]	0%[2]	7%	4%	0%[2]	0%[2]	2%	4%	0%[2]	0%[2]	3%	3%	0%[2]

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion. Significance level for upper case letters (A, B, C): ,05[3]

1. This category is not used in comparisons because the sum of case weights is less than two.

2. This category is not used in comparisons because its column proportion is equal to zero or one.

3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Table 3.2c: Adaptation strategies based on farmers' scale and vulnerability index.

Adaptation Strategies Based on Farmers' Scale and Vulnerability Index	Total	Farmers Scale			Vulnerability Index		
		Small-scale farmers	Medium-scale farmers	Large-scale farmers	Less vulnerable	Vulnerable	Highly vulnerable
	(A) Column N %	(A) Column N %	(B) Column N %	(C) Column N %	(A) Column N %	(B) Column N %	(C) Column N %
	47%	41%	45%	59%	43%	48%	47%
Increase in pesticides	43%	45%	40%	44%	43%	48%	37%
Changes in sowing-planting-harvest time	38%	32%	43%	41%	26%	32%	53%
Registration to agricultural insurance	35%	41%	34%	26%	56%	35%	25%
Following weather forecasts via smart phone	35%	34%	40%	30%	22%	32%	47%
Increase in fertilizer	33%	34%	33%	33%	30%	38%	29%
Crop rotation	26%	27%	28%	22%	30%	16%	37%
Info from agricultural engineers	23%	16%	33%	22%	26%	36% C	5%
Info from other farmers	20%	25%	20%	11%	22%	20%	18%
Following frost warnings of meteorology	18%	11%	30%	11%	22%	12%	24%
Changes in crop pattern	14%	11%	18%	11%	13%	20%	5%
Leaving lands for fallow	14%	20%	10%	7%	4%	8%	26%
More using pressurized irrigation methods	13%	14%	18%	4%	4%	6%	26% B
Other	9%	9%	10%	7%	0%[2]	10%	13%
Using smart agriculture/tech	8%	5%	8%	15%	13%	12%	0%[2]
Reduction in tillage	5%	2%	5%	7%	4%	6%	3%
Using early warning systems	5%	2%	5%	7%	0%[2]	10%	0%[2]
Soil analysis more often	5%	5%	5%	4%	9%	4%	3%
Grow crops twice/three times a year	3%	2%	3%	4%	4%	2%	3%
Planting trees	3%	7%	0%2	0%[2]	4%	4%	0%[2]

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion.
Significance level for upper case letters (A, B, C): ,05[3]

1. This category is not used in comparisons because the sum of case weights is less than two.
2. This category is not used in comparisons because its column proportion is equal to zero or one.
3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Remarkably, farmers across various vulnerabilities, scales, who use different agricultural resources, and methods exhibit an inclination toward adopting maladaptive practices. This trend is particularly striking because, despite facing declining socio-economic conditions, debts, and soaring input costs—including electricity, water, pesticides, and synthetic fertilizers (Pitel, 2022), —farmers increasingly resort to measures that require significant capital. This inclination contradicts existing research which suggests that capital-intensive methods are predominantly favoured by larger, more affluent farmers (Agrawal, 2008; Alam et al., 2016; Nelson & Stathers, 2009). Among others, this finding could be interpreted as a consequence of prolonged reliance on industrial agriculture and farmers' unawareness of its consequences. Equally, it might reflect a lack of alternative options that can address challenges in farmers' adaptation to climate change, which is elaborated in subsequent sections.

3.5.3 Path Dependency Leading to Maladaptation

Farmers' adaptation tendencies discussed above, which become predominant across all three analysed regions and among many farmers, carry significant implications for the maladaptive potential of farmers' adaptation strategies in Turkey. This trend is affirmed by recent notifications from the EU Rapid Alert System for Food and Feed (RASFF).[18] As per RASFF data, Turkey held the top position in 2021 concerning notifications regarding lingering pesticides, with 405 out of 613 alerts linked to exported fruits and vegetables to EU nations (Buğday Association, 2023). Despite efforts by the Turkish Ministry of Agriculture and Forestry to oversee and limit the consumption of foods containing residual pesticides within Turkey, significant apprehension persists among the public about the circulation of such foods in the domestic market as well (Buğday Association, 2023). As stated by most farmers, they increasingly get dependent on more synthetic fertilizers and pesticides, as could be seen in the following remarks:

> What can I do else? It is the soil that demands more fertilizer and the plants that demand pesticides!

[18] A system established by the European Union (EU) to enable the rapid exchange of information regarding the safety and quality of food and feed products.

F3-RB

Such remarks also resonate well with the increasing dependence of farmers on extra capital-intensive protection products other than pesticides in the face of exacerbating effects of climate change:

> In the Mediterranean, the number of sunny days has increased, leading to an increase in sunburn on crops. There has been a significant rise in agricultural pests. As a result, the use of sunburn protection products has become more prevalent, and a significant amount of plant protection-nutrition products and chemical pesticides are being used. These also create additional expenses.

E1-RB-Public

Such short-term planning tends to play an important role in leading to maladaptation (Brooks et al., 2009; Sovacool&Linnér, 2016). Even though these actions lead to immediate benefits such as increased profits for farmers and improved food security, they bring about severe repercussions for various stakeholders, encompassing farmers, the agricultural sector, ecosystems, and food safety. In this respect, agricultural intensification measures, including intensive usage of nitrogen-based fertilizers which emit greenhouse gases, poses one of the most important challenges before sustainable development, thus prove to be maladaptive (Antwi-Agyei et al., 2018; Guodaar et al., 2020).

Along with the immediate causes of such maladaptive inclinations- such as farmers' short-term behavioural response to climate change-, the root causes of such maladaptive tendencies need to be highlighted for a better grasp of the consequences of dominating adaptation behaviour. Such tendencies could be dated to the Green Revolution, introducing high-yield grain varieties, coupled with heightened fertilizer usage and the widespread implementation of irrigation systems, which led to massive changes in the agricultural production of developing countries including Turkey (Bayri&Furtan, 1989).[19] Fertilizers permanently altered agricultural practices, as the success of high-yield crop varieties, (e.g. wheat, rice, and maize) developed during this era, is dependent on

[19] Mostly dated back to the 1950s and 1960s and covering roughly the national-developmentalist post-war period (Aydın 2010). Such dependency on industrial agriculture has accelerated and intensified since 1980 with the neoliberal transformation of agriculture, e.g., transnational agribusiness companies prioritizing production of high-value cash crops for high-value markets (Aydın, 2010).

fertilizer use. Similarly, such high yield varieties drastically decreased diversity of crops which had been resistant to disease and pests.

Such dependence on the capital-intensive measures have peaked with rapid neoliberal transformation of agriculture in Turkey particularly over the last two decades, with manifold consequences including a decline in agricultural employment, contraction of arable lands, and alongside exacerbating vulnerabilities of farmers -particularly small-scale ones- due to their dependence on market relations with unequal access to political and economic power (Adaman et al., 2020). In short, farmers' responses to climate change effects are more than a sole behavioural response, being intertwined with the existing agricultural structure and policies, which promoted intensive farm dimensions, specialized production, cultivation of single crop types, and automation (Altieri & Nicholls, 2001). With higher dependency on the market, diversity in agricultural sources and methods, which once provided strong resilience in the face of droughts and pest invasions, drastically declined.

Likewise, even though irrigation can reduce pressure against declining rainfall, it might also bring about unintended outcomes such as competition over irrigation sources or mean lesser availability of water for domestic uses (Antwi-Agyei et al., 2018; Guodaar et al., 2020). There have been several instances of competition over declining water resources within the context of this research. Farmers dependent on deep wells in Regions A and B have often criticized the advantageous position of those using dam water as a cheaper source of irrigation. Likewise, there are instances of disputes among farmers in Region A, who make use of jointly owned deep wells, over the fair share of declining underground waters. Besides, in Region A, as could be seen in the statements of the farmer below, overuse of underground waters creates underground sinkholes, which are likely to turn into sinkholes on the surface.

> Despite restrictions on opening deep wells, farmers find a way to do so. We used to draw water from 50-100 meters, which has now reached 200-250 meters. Farmers in the town must dive deeper and deeper to pump water. Holes started to appear underground in my neighbours' fields.
>
> F4-RA

As another maladaptive consequence of irrigation stands outs the salinization of lands and groundwater (Kendirli et al., 2005; Klein et al., 2007). Since farmers in Region C are overwhelmingly reliant on traditional irrigation methods like surface irrigation (73%) compared with their counterparts, land salinization is distinctively higher in Region C (Figure 3.2). Growing research in this area confirms that the salinization of land and groundwater has risen due to irrigation practices initiated by the GAP Project, another contributing factor being the inadequate drainage conditions in Şanlıurfa's Harran Plain (Aygüney, 2002; Akış et al., 2005; Kendirli et al., 2005).

Equally striking is the unequal impact of this developmental project on cash crop producers who rely on dam water and those heavily dependent on rainfed agriculture for cereal production. The following sayings of a farmer doing rainfed agriculture also highlight how the GAP project reproduced or exacerbated existing inequalities and vulnerabilities within the context of climate change:

> Those having the chance to irrigate their lands via GAP do not feel the impacts of drought as we do. We also want those channels to reach our lands.
>
> F5-RC

It could thus be stated that GAP project, instead of reducing social vulnerability and increasing adaptive capacity of low-income groups, e.g., those reliant on rainfed agriculture-, had disproportionate impacts on them by decreasing their adaptive capacity and competition capacity in the market (Barnett & O'Neill, 2010; Reckien et al., 2023). In other words, it *rebounded vulnerabilities* of rainfed farmers, by increasing both current and future susceptibility of rainfed farmers to climate change (Juhola et al. 2016). For it was before the severe impacts of climate change that agrarian populations, -living in mountainous areas and mostly consisting of smallholders, had not access to irrigation opportunities provided with the GAP Project (Bakırcı, 2012).

Such unintended consequences are more attributable to the large-scale infrastructural development which did not take into account the finer scale realities, worries and needs of the local peoples at an adequate degree before, during and after policies (Aygüney, 2002; Bilgen, 2020). Albeit not being an adaptation project *per se*, the primary reason behind the GAP Project was to enhance the irrigation and agricultural sector considering the arid and semi-arid climate of the region and close the developmental gap between the region and the rest of Turkey (Bilgen, 2020). Even though GAP has enhanced the socio-economic circumstances in the region to a certain degree, it has only to some extent improved living conditions of disadvantageous groups, even rendering some of them more marginalized while making the wealthy groups wealthier (Bilgen, 2020). It is thus climate change effects that have made more visible and intensified such inequalities and vulnerabilities.

Overall, maladaptive consequences of such tendencies are manifold. As in the case of years-long reliance on industrial agriculture, inadvertent consequences of GAP project have both diminished incentives for adaptation and created a path dependency (Barnett & O'Neill, 2010), and eroded sustainable development (Juhola et al. 2016; Antwi-Agyei et al. 2018; Guodaar et al., 2020; Reckien et al., 2023). Because, as a large-scale infrastructural project, it has made farmers dependent on traditional irrigation methods. Additionally, by entrenching the existing social inequalities between rainfed farmers and irrigation-based farmers, it has rebounded existing vulnerabilities (Juhola et al. 2016).

Likewise, both the unintended results of GAP project and long-reliance on industrial agriculture have shifted more vulnerabilities to future generations, creating common problem for society as a whole (Juhola et al., 2016; Antwi-Agyei et al., 2018; Guodaar et al., 2020; Nyantakyi-Frimpong et al., 2022). It is mainly because both shift the risks deriving from such short-term measures to other people, and particularly future generations, (e.g., consumers of food with pesticide residuals, more salinized, degraded lands and less water resources for future farmers). In other words, they have entrenched development-as-usual rather than enabling sustainable adaptation (Brown, 2011).

3.5.4 Autonomous Adaptation Measures Failing to Prevent Maladaptive Repercussions

Autonomous or spontaneous adaptation refers to those that take place in reactive response to climatic stimuli without the directed involvement of governmental entities (Smit & Pilifosova, 2003). In this regard, this research points to the following as the most utilized ones: *following weather forecast + frost warnings* (53%), *changes in sowing-planting-harvest time* (38%), *crop rotation* (26%), *changes in crop pattern* 14%, *leaving lands for fallow* (14%) and so on.[20] (Figure 3.3). Analysing autonomous adaptation methods based on farmers' socioeconomic factors, agricultural practices, and their scale and vulnerabilities, indicates several similarities and differences (Table 3.2a-3.2b-3.2c). To

[20] That more traditional methods such as "leaving lands for fallow" are on the decline could be attributed to farmers' food security concerns and their conceptions of such methods as a luxury now.

name but a few, farmers' autonomous adaptation strategies heavily rely on the type of produce they cultivate or engagement in livestock. For instance, it is cereal and cash crop producers in Region A who primarily implement autonomous techniques like altering planting and harvesting times, and crop rotation. Such measures mostly prove to positively contribute to food security and household income (Karapınar & Özertan, 2020; Zakari et al., 2022).

However, severe climate change impacts, particularly sudden occurrences such as flooding, frost, and hail, often render such measures ineffective. Many farmers express a sense of helplessness (e.g., *What can you do against the changing climate?; there is nothing much to do)* in dealing with particularly sudden weather events. Thus, perceived climate change impacts combined with other long-lasting problems in/of agriculture (Appendix 3.3) put farmers in distress, which results from despair and grief in facing the consequences of climate change.

The following sayings by an agricultural engineer also highlight how such autonomous adaptation tactics need to be complemented by more commercial measures (e.g., *shift in sowing-harvesting time as a measure to changes in seasons*):

> Producers do not only have to shift their sowing-harvesting time but also, they have to make use of more plant protection and nutrition products. Why? Because summer arrives late, fruits cannot enter the ripening period. Plants' phenological development cycle also changes. Seeing this, farmers increasingly have a recourse to such products to ripen fruits as soon as possible and avoid untimely frost and severe hail. What they want to achieve is to put their products on the market without any damage or loss. No need to mention how much these plant protection and nutrition products cost them!

E2-RB-Public

Additionally, there is increasing tendency among farmers to sell their livestock to cope with both climatic and non-climatic challenges. Most farmers in Region B reported that they recently sold their sheep and goats, while many in Region A indicated plans to sell animals due to rising costs of animal feed, diminishing wetlands, and drought. These observations align with a recent report from TURKSAT (TURKSAT, 2023), which revealed a 5.6% decline in the number of large cattle and a 2.2% drop in small cattle in 2022 compared to the previous year. Climate change, particularly drought, appears to be significantly facilitating this trend, as drought leads to a loss of green grass and its quality.

Selling livestock can provide a temporary income boost without disturbing other food production tasks. However, it carries the danger of exhausting livestock, prolonging poverty, and subsequently heightening vulnerability and leading to maladaptive outcomes (Haggblade et al., 2010; Antwi-Agyei et al., 2018). Hence, it could be suggested that such autonomous adaptation strategies tend to largely fall shorth in addressing climatic and non-climatic challenges.

3.5.5 Lack of Planned Adaptation Measures Entrenching (Mal)adaptive Tendencies

This study reveals a notably lower adoption rate of planned measures facilitated by the state ranging from technological methods like smart agriculture (8%) to ecosystem-based approaches like tree planting (3%), shading areas, and soil conservation practices such as reduced tillage (5%).[21] The only exceptions are *enrolment in Agricultural Insurance Pool (TARSİM)* with 35%, and an *increase in the use of pressurized irrigation systems*, standing at 13%.[22]

It even indicates a lower adoption rate of some of these measures among the less advantaged farmers. For instance, farmers with lower output (low-tonnage producers) tend to adopt lesser smart agricultural techniques such as implementing monitoring systems on their farms, precision agriculture including automated machinery and robotics for planting and fertilization and unmanned aerial vehicles for agricultural spraying (Table 3.2a). Such smart technics might also be less likely to be adopted by more vulnerable and smaller-scale farmers since such likelihood is also confirmed by in-depth interviews showing that farmers who are also agricultural engineers and/or better-off ones have more access to them. In that respect, it affirms the existing research that capital-intensive measures tend to be adopted mainly by larger and wealthier farmers (Agrawal, 2008; Nelson & Stathers, 2009; Alam et al., 2016). Likewise, such overall inclinations align with former studies indicating that farmers' adaptation strategies, particularly in developing nations like Turkey, tend to be mainly autonomous, reactive, and privately managed (e.g., Dhungana, 2018; Callo-Concha, 2018; Asrat & Simane, 2018; Zhai et al.,

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[21] It is noteworthy to highlight the low application rate of the *reduction in tillage or no-till* since it is a technique becoming one of the most popular measures supported by the Food and Agriculture Organization (FAO) and the World Bank. Even though the Turkish Ministry of Agriculture and Forestry (MAF) has initiated programmes to reduce tillage, -consisting of primarily region-specific and small-scale attempts (MAF, 2019), most cereal producers, during in-depth interviews, expressed a contrary belief, stating that more tilling of the soil is better.

[22]The rate 13% for "more using pressurized irrigation systems" should not conceal that *more than half of farmers (64%, primarily from Regions A and B)* have been using these systems for long years, even before observing climate change effects (Appendix 3.1).

2018; Abera & Tesema, 2019; Karapınar & Özertan, 2020; Tessema & Simane, 2020).

The rest of this section examines two planned measures (TARSİM and pressurized irrigation systems), which display a higher acceptance among farmers. TARSİM, formed through a collaborative effort involving the government, civil society, and the private sector in 2005 under the Agricultural Insurance Code No. 5363, primarily aims at enhancing the adoption of agricultural insurance among farmers, effectively managing risks stemming from disasters and other uncertainties (Ministry of Agriculture and Forestry -MAF et al., 2018). TARSİM offers various insurance lines, such as crop insurance (covering risks like hail, frost, and flood), greenhouse insurance, village-specific drought yield insurance, as well as insurances for cattle, poultry, each with specific requirements, changing rates of state subsidies and discounts (MAF et al., 2018).

The findings on the utilization of TARSİM as an adaptation strategy reveal that farmers involved in animal husbandry (Regions A and B) and those who directly sell their produce are more inclined to secure insurance compared to their counterparts. (Table 3.2a-3.2b). The primary reasons for farmers turning to TARSİM involve issues such as diseases, poisoning, disasters, and sunburn affecting livestock. The availability of various incentives offered by related agencies including banks, insurance companies, and agricultural credit cooperatives significantly contributes to the relatively higher acceptance rate of TARSİM. Notably, farmers are mandated to obtain insurance to qualify for credit with interest discounts or reduced delay interest from the Agricultural Credit Cooperative. In short, it provides compensation for losses and damages stemming from sudden-onset events and the gradual impacts of climate change, with state support for insurance premiums ranging from 50% to 66%, depending on the insurance line (MAF et al., 2023).

However, it is the real-life encounters of farmers that provide further insights into the practical functioning of TARSİM. For the dynamic and evolving procedures of TARSİM in practical terms may render it unfamiliar to farmers, leading to a perceived disconnect between experts and laypeople (Latour, 2004). As such, nearly half of the interviewed farmers (48%) cite high premium costs, requirements, and failure in compensating most of the losses and damages as the primary reasons for not registering. Confirming this trend, this Chapter also suggests the likelihood of TARSİM being embraced by farmers who are less vulnerable compared to those who are more vulnerable (Table 3.2c).[23]

[23] Although not statistically significant, this trend is supported by observations during in-depth interviews revealing that more vulnerable farmers are less likely to have TARSİM done.

Likewise, many, especially from Region B, also express challenges in keeping up with the rapidly changing procedures and policies as exemplified below:

> Requirements of TARSİM are always increasing. The expert comes and says, 'You don't have a retaining wall at the base of your greenhouse,' or they say, 'The plastic sheeting has exceeded its lifespan and won't be covered by insurance.
>
> F6-RB

In brief, even though TARSİM stands out as a structured risk management method gaining some recognition in response to escalating disasters, the registration rate for this system is not particularly encouraging (at 35%), owing to various reasons, a few of which have been previously outlined. Equally—if not more—significant is the reality that TARSİM operates reactively, offering compensation solely after the impact of climate change events. Consequently, it provides limited relief to farmers, contributing minimally to the long-term sustainability of their livelihoods, lands, income, households, and more. In that respect, it largely structurally embeds risky behaviour and constrain adaptive change after climate change affects (O'Hare et al., 2016). That is why, it might be viewed as inadequate or neutral adaptation measure sitting in between successful adaptation and maladaptation (Reckien et al., 2023; Mills-Novoa, 2023).

Concerning the growing importance of pressurized irrigation in Turkey, this research finds that over half of farmers (64%, primarily from Regions A and B) have embraced either drip or sprinkler irrigation even before recognizing climate change effects (Appendix 3.2b), which can be credited to the potential of planned initiatives as successful adaptation. The Ministry of Agriculture and Forestry in Turkey [24] has played a pivotal role since 2006 by offering state grants covering 50% of system costs and providing a zero-interest rate for the initial five years (Çetin et al., 2010).[25] Although the current adoption rate of modern irrigation systems in Turkish agricultural practices stands at 29%, future initiatives aim to cover 94% of irrigated land once envisioned projects are implemented (State Hydraulic Works-DSİ, 2021).

These climate-friendly modern irrigation systems significantly conserve water—e.g.,

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[24] Which was named as the Ministry of Agriculture and Rural Affairs in 2007, when state grants corresponded to 50% of system costs of pressurized irrigation systems.

[25] The same rate of grant is applicable today as well within the context of rural development on condition that the cost of individual modern irrigation systems does not exceed 1 million TLs (MAF, 2022).

sprinkler irrigation saving 35% and drip irrigation reaching up to 65% (DSİ, 2021)—besides showcasing positive economic impacts and promising outcomes for sustainable water and land use (Çetin et al., 2010). Furthermore, the preference for pressurized irrigation systems among *highly vulnerable farmers* illustrates that even less advantaged groups benefit from this method, thus increasing their adaptive capacity (Reckien et al., 2023). In summary, despite lower usage rates nationwide, modern irrigation systems emerge as the sole primary planned measure enhancing farmers' adaptive capacity within the scope of this research.

3.6 Conclusion

As this research displays, farmers are highly aware of the impacts of climate change, comprising disasters like frost, hail and storms and gradual effects such as changes in seasons, drought and change in precipitation regime. While some climate change effects, such as changes in seasons, precipitation regime and drought, are commonly experienced by farmers in three analysed areas, some of them are observed more by farmers in some regions, e.g., storm and flooding becoming more prominent in the coastal area (Region B) and land salinization in the southeastern part of Turkey (Region C). Accordingly, it shows that farmers in each analysed research areas endeavour to adapt to such variegated implications of climate change effects, complicated by non-climatic challenges, including surging input prices.

Nevertheless, their adaptation tactics tend not to be as variegated as climate change effects. As such, maladaptive tendencies, including increase in the usage of water, pesticides, and chemical fertilizers, tend to outweigh most other adaptation measures. This finding is particularly remarkable considering that such maladaptive tendencies are obvious regardless of farmers' most of socioeconomic features, agricultural sources, and methods, and farmers' differing vulnerabilities and scale. The only notable difference as such relates to education, years of engagement in agriculture, age, and some regional differences. For instance, it is farmers aged above 50 who tend to more increase irrigation compared to those aged 36-50 and more inclined to increase fertilizer usage compared to farmers aged 35 or below. Likewise, farmers of lower education are more inclined to increase their pesticide and fertilizer usage compared to farmers of higher education attainment. With Turkey's agricultural majority being older (Akdemir et al., 2021), this trend highlights a pressing issue. Conversely, it offers a chance if younger farmers are motivated to participate in agriculture through climate-friendly policies and initiatives.

This study attributes the underlying reasons behind such maladaptive inclinations not only to farmers' short-term behavioural responses to adapt, but also to long years-reliance on industrial agriculture and the inadvertent consequences of the developmental project GAP. For both have paved the way for maladaptive consequences by creating path dependency, reducing incentives for adaptive behaviour, eroding sustainable development by increasing GHG emissions and environmental degradation. Similarly, they have rebounded farmers' current and future vulnerabilities to climate change and even shifted them to external actors, particularly general food consumers and future generation of farmers. Thus, it suggests that farmers in each analysed region are close to the maladaptive end of continuum between adaptation and maladaptation. It also suggests the term *(mal)adaptive* considering the mutability of adaptation and maladaptation depending on actors, sectors, regions, and time spans (Mills-Novoa, 2023; Juhola & Käyhkö, 2023).

Likewise, this research underscores the lack of planned efforts, ecosystem-based approaches, alongside the inadequacy of autonomous adaptation action as factors that solidify maladaptive trends. Even though there are increasing attention and mechanisms to address climate change adaptation in Turkey, there are manifold barriers to the adaptive capacity of different actors, including farmers, agricultural institutions, and the agricultural sector itself, which is extensively debated in Chapter 5. Nevertheless, as this research presents, the primary boost to adaptive capacity is likely to come from state-backed and planned adaptation strategies. For instance, the adoption of modern irrigation methods like sprinkler and drip systems by over half of the farmers in two regions (Region A and B), especially by highly vulnerable ones, demonstrates this trend. The same does not hold for the second structured method, which is TARSİM for various factors, though. The reasons include elevated insurance premiums, escalating demands, and evolving procedures, coupled with TARSİM's failure to cater to proactive and sustainable objectives. That is why, this study reveals TARSİM as inadequate or neutral adaptation measure siting in between adaptation and maladaptation.

It is well settled in existing research that climate change disproportionately affects some populations, such as the older people, children, women, and people with disabilities (Ngcamu, 2023). However, there is limited understanding of how much vulnerable and less advantaged farmers vary in their ability to adapt. This research sheds some light on this by revealing that it is high-tonnage producers, who tend do more adopt smart agricultural techniques compared to small-tonnage and medium-tonnage producers. Albeit not significant difference, it also indicates the less likelihood of adoption of such smart technics by more vulnerable and smaller-scale farmers, which could be searched by further studies. Additionally, TARSİM might be less likely to be adopted by more vulnerable farmers compared to less vulnerable ones, which opens another room for more research in this direction. Limited access to such methods by less advantaged farmers might substantially reduce their adaptive capacity in the overly competitive market demands and thus, increase social vulnerabilities.

As this Chapter has also underscored regional similarities and differences, it has revealed that farmers in Region C may be experiencing fewer effects of climate change, particularly drought, compared to those in other regions. This is primarily due to an upper hand provided by dams and hydroelectric power plants with Southeastern Anatolia Project (GAP). Nevertheless, the long-term consequences of this advantage tend to be maladaptive given the pronounced risks of soil salinization and the limited use of modern irrigation methods alongside stark differences in the adaptive capacity of rainfed farmers and irrigation-based ones in Region C compared to other regions. Consequently, while farmers in Region C may make use of short-term benefits, their adaptive capacity over the long term seems lower compared to farmers in Regions A and B.

In brief, despite the dominating despair and maladaptive tendencies among farmers, this study suggests that if scaled up, diversified, and equally distributed, and preferably coupled with more technological approaches, state-supported measures as in the case of modern irrigation systems, might be a glimmer of hope to alleviate the consequences of maladaptive inclinations. Likewise, agricultural policies that consider farmers' dominating adaptation behaviour while providing information services to them are of equal importance. Such polices should not only target alteration of farmers' maladaptive behaviours via training, but also delve into the underlying reasons behind such maladaptive inclinations. This includes replacing dominant industrial farming practices with carefully implemented agroecological approaches and rethinking the likelihood of nearly irreversible impacts of large-scale projects for future generations. It is only then increasing and coordinated support for socially, economically, and ecologically viable projects and processes are likely to reverse such maladaptive outcomes, and thus, paving the way for sustainable development. It is mainly because climate change effects only -*but drastically and irreversibly*- intensify the severity of the deeply rooted social-political-economic and environmental degradation.

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3.8 Appendices

Appendix 3.1: Descriptive Statistics.

DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

AGE	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
35 years old&below	30%	13%	32%	42% A
36-50 years old	41%	50%	30%	45%
50 years old&above	29%	37% C	38% C	13%

EDUCATION	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Low Education	39%	56% C	46% C	18%
Intermediate Education	23%	28%	10%	30%
High Education	39%	16%	44% A	53% A

MAIN SOURCE OF LIVELIHOOD	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Agriculture+Retired	11%	25% C	8%	3%
Agriculture+Extra work	38%	25%	42%	45%
Agriculture	51%	50%	50%	53%

ANIMAL HUSBANDRY	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Cattles	17%	41% C	0%[1]	15%
Small cattles	14%	9%	28% C	3%
None	69%	50%	72%	83% A

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion. Significance level for upper case letters (A, B, C): ,05 [3]

GENDER	Total	District of farming		
	N:111	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Male	95%	94%	95%	98%
Female	5%	6%	5%	3%

YEARS OF FARMING	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
15 years old and below	35%	13%	38%	50%
15-25 years old	32%	31%	28%	35%
25 years old and above	33%	56%	34%	15%

PRODUCTION VOLUME	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Low tonnage producers	44%	33%	61%	35%
Medium tonnage producers	39%	33%	32%	51%
High tonnage producers	17%	33% B	8%	14%

DECARES OF LAND OWNED	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Smallholders	61%	52%	94% A C	36%
Medium-scale landowners	28%	38% B	3%	42% B
Large-scale landowners	12%	10%	3%	21%

LANDHOLDING or TENANCY	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Only tenant (incl. sharecroppers)	14%	9%	18%	13%
Both landholder & tenant	86%	91%	82%	88%

1. This category is not used in comparisons because the sum of case weights is less than two.

2. This category is not used in comparisons because its column proportion is equal to zero or one.

3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

AGRICULTURAL SOURCES AND METHODS

MAIN TYPE OF FARMING	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Conventional farming	58%	78% B	35%	63% B
Organic farming	9%	9%	8%	10%
Subsistence farming	16%	9%	14%	23%
Greenhouse & conventional	17%	3%	43% A C	5%

IRRIGATION SOURCE	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Deep well	47%	91% B C	54% C	5%
Lake-pond-dam water	41%	0%[1]	36%	80% B
Mains water	6%	6%	8%	5%
Only rainwater	5%	3%	3%	10%

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion. Significance level for upper case letters (A, B, C): ,05 [3]

CROPS PRODUCED	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Cereals	48%	75% B	10%	63% B
Cash crops	15%	9%	5%	30% B
Fresh fruits&vegetables	37%	16%	85% A C	8%

SALES CHANNEL	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Intermediary/private sector	67%	48%	85% A	65%
State agency	10%	26% C	0%[1]	8%
I sell myself	23%	26%	15%	28%

IRRIGATION METHOD	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Traditional irrigation	31%	3%	10%	73% A B
Pressurized irrigation	64%	94% C	87% C	18%
Only rainwater	5%	3%	3%	10%

1. This category is not used in comparisons because the sum of case weights is less than two.
2. This category is not used in comparisons because its column proportion is equal to zero or one.
3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

FARMERS SCALE

FARMERS SCALE	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Small-scale farmers	40%	41%	56% C	23%
Medium-scale farmers	36%	25%	21%	60% AB
Large-scale farmers	24%	34%	23%	18%

VULNERABILITY INDEX

VULNERABILITY INDEX	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Less vulnerable	21%	13%	15%	33%
Vulnerable	45%	31%	49%	53%
Highly vulnerable	34%	56% C	36%	15%

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion. Significance level for upper case letters (A, B, C): ,05 [3]

1. This category is not used in comparisons because its column proportion is equal to zero or one.
2. This category is not used in comparisons because the sum of case weights is less than two.
3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Appendix 3.2: Questions for vulnerability index.

1. How would you evaluate the increase in sudden-onset events (e.g., frost, hail, flooding) in recent years?

1	Increased excessively
2	Increased to a large extent
3	Neither increased nor decreased
4	Decreased to a large extent
5	Decreased excessively

2. How would you evaluate the increase in drought?

1	Increased excessively
2	Increased to a large extent
3	Neither increased nor decreased
4	Decreased to a large extent
5	Decreased excessively

3. Have you experienced any changes in crop productivity in recent years?

1	Increased
2	Remained stable
3	Decreased

4. Have you experienced any changes in crop quality in recent years?

1	Increased
2	Remained stable
3	Decreased

5. Is your income sufficient to act against climate change?

1	Quite sufficient
2	Sufficient
3	Neither sufficient nor insufficient
4	Insufficient
5	Rather insufficient

6. To what extent can you solve the problem by your own means?

1	Completely
2	To a large extent
3	I can neither solve nor unsolved
4	To a small extent
5	None

7. To what extent do you think the support/idea you take from people and/or agricultural institutions solves your problems?

1	Completely
2	To a large extent
3	It can neither solve nor leave them unsolved
4	To a small extent
5	None

8. To what extent do you find state support (state subsidy) sufficient?

1	Completely sufficient
2	Sufficient
3	Neither sufficient nor insufficient
4	Insufficient
5	Completely insufficient

9. To what extent do you find TARSİM* useful?

1	Very useful
2	Useful
3	Neither useful nor useless
4	Not much useful
5	Never useful

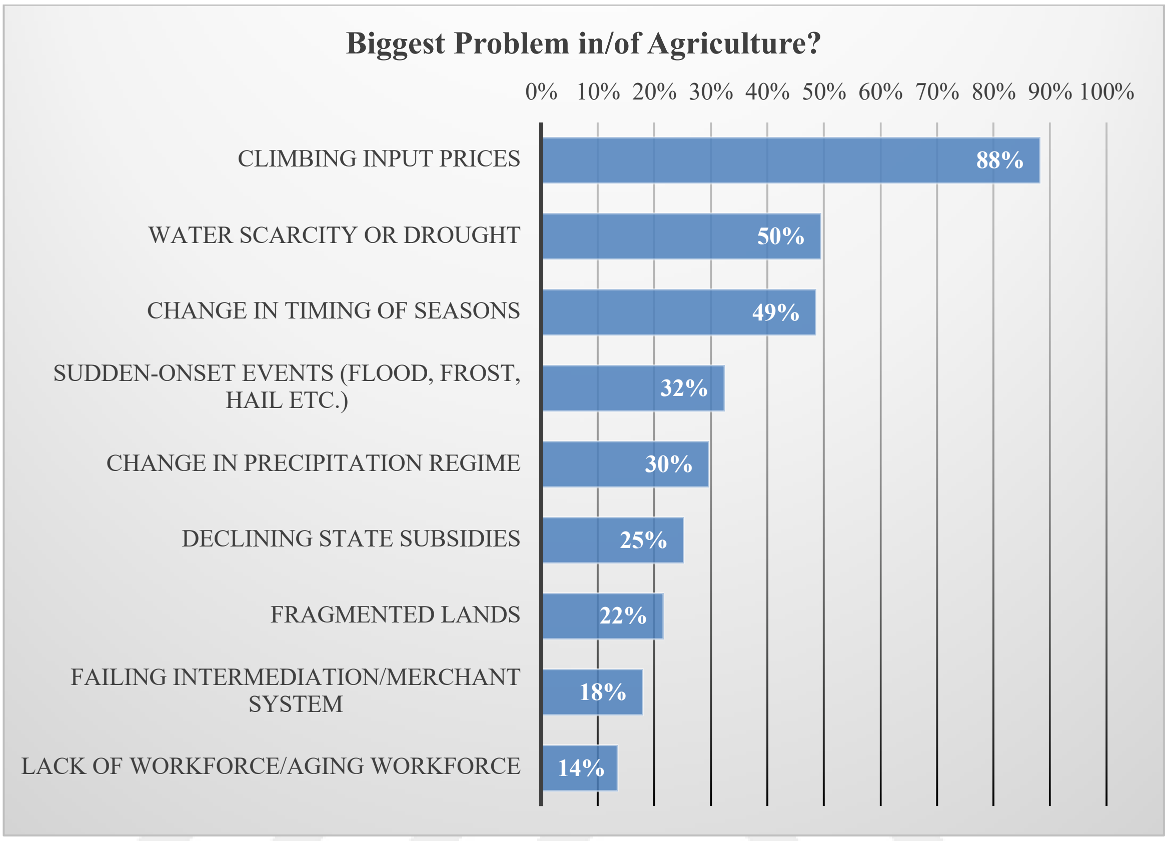
Likert Scale questions were converted into a scale where "100" corresponds the most vulnerable and "0" the least. The following accounted for the related questions:

Q1-Q2 (1=100) (2=80) (3=50) (4=20) (5=0)
Q3-Q4 (1=0) (2=50) (3=100)
Q5-Q6-Q7-Q8-Q9- (1=0) (2=20) (3=50) (4=20) (5=100)

Farmers non-enrolled in agricultural insurance pool (TARSİM)*- (dependent question on Q9) or who do not receive state subsidy (dependent question on Q8) were considered highly vulnerable and coded "100".

Based on the mean of 9 questions, Vulnerability Index was coded as follows: (0 thru 59.9=1) (60 thru 79.9=2) (80 thru 100=3**). 1= Less Vulnerable, 2= Vulnerable, 3= Highly vulnerable**

Appendix 3.3: Farmers' responses concerning biggest problems in/of agriculture in Turkey.



Chapter 4

BONDING AND BRIDGING-LINKING SOCIAL CAPITAL IN FARMERS' ADAPTATION TO CLIMATE CHANGE

Abstract

Revolving around the role of *social capital* in climate change adaptation practices and processes of farmers in three different regions of Turkey, this Chapter seeks an answer to the following central question: What kind of social capital is at work, for which farmers, and how (in)effective is it? It reveals that a) Farmers' reliance on social capital as a coping mechanism in the face of numerous climatic and non-climatic challenges tends to diminish over time; b) Farmers are more reliant on their *bonding social capital* compared to the *bridging-linking one*, while it is the latter that proves to be effective in solving farmers' problems; c) Despite some positive impacts of *bonding social capital* in the face of disasters, it often tends to enhance maladaptive behaviour; d) *Bridging-linking social capital*, albeit an effective one, tends to have significant constraints – support provided to farmers being confined to the provision of information, consultancy, and seed-fertilizers-pesticides; e) There is an evident need for more material means of support such as field visits and initiation of community-based initiatives which could be mobilised through farmers' dominating ties: *bonding social capital*. It primarily feeds on survey interviews with 111 farmers, semi-structured in-depth interviews with 53 farmers, and 29 with experts from meso-level agricultural institutions.

Keywords: climate change adaptation, bonding social capital, bridging social capital, agriculture, disasters.

4.1 Introduction

One of the most significant mechanisms in agrarian populations' adaptation to climate change tends to be their social ties with other farmers, family members, relatives, experts, and agricultural institutions. Hence, there has been a growing interest in research on the role of *social capital*, broadly defined as the effective possession of a network of relations capable of being mobilized (Bourdieu, 1990), in adaptation to climate change among rural communities.

The main reasons behind this attention could be attributed to two main inclinations. *First*, farmers, particularly small-scale ones in developing and the least developed countries, tend to adapt mostly and simultaneously via autonomous, reactive, and private means (e.g., Dhungana, 2018; Callo-Concha, 2018; Asrat & Simane, 2018; Zhai et al., 2018; Abera & Tesema, 2019; Karapınar & Özertan, 2020; Tessema & Simane, 2020). *Second*, albeit context-dependent, the most recurring barriers relate to the lack of planned interventions (Khan et al., 2018; Callo-Concha, 2018; Asrat & Simane, 2018; Abera & Tesema, 2019; Tessema & Simane, 2020); which is accompanied by a lack of financial and material capacity (e.g., Dany et al., 2015; Asrat & Simane, 2018; Khan et al., 2020; Sibiya et al., 2023; Adom et al., 2023; Ghorbani et al., 2024).

There is a general agreement that social capital has a beneficial impact on increasing the resilience and adaptive capacity of (rural) communities (Lo et al., 2015; Niles et al., 2021; De Grandpré et al., 2022; Cishahayo et al., 2023). However, the extent of such positive effect tends to be highly contextual, deeply entwined with existing circumstances and underlying vulnerabilities (Byg & Herslund, 2016; Li et al., 2023). To that extent, the relationship between climate change adaptation and social capital is remarkably complex instead of a uniform one (Li et al., 2023). As a manifestation of such complexity, the bonding/bridging-linking triad has formed one of the main lines of research on social capital (Pelling & High, 2005). The former one, *bonding social capital*, primarily refers to one's proximate ties within a defined socioeconomic group such as family, kinship, and locality, while *bridging social capital* mainly entails more distant ties that crosscut social divides based on socioeconomic status, race, religion, ethnicity (Woolcock &Narayan, 2000; Putnam, 2000). Mainly conceived as a sub-category of *bridging social capital*, *linking social capital* refers to vertical ties with more hierarchical structures, including governments, institutions, and organizations (Woolcock & Narayan, 2000; Woolcock, 2001).

Concerning climate change adaptation among rural populations, *bonding social capital* and *bridging-linking social capital* tend to provide different kinds of responses to different sorts of climate change effects (e.g., Jordan, 2014; Bello, 2014; Belay & Fekadu, 2021; Cohen-Salgado et al., 2021; Vasseur et al., 2022; Carmen et al., 2022; Cuaton & Su, 2023). The extent of such variation might even be discriminatory, depending on who has access to what sort of social ties, under which political-economic context and climate change impacts (Cohen-Salgado et al., 2021; Jordan, 2014; Bello, 2014; Belay & Fekadu, 2021).

Likewise, despite most attention being paid to promising aspects of social capital in rural communities' adaptation processes, pitfalls of some sub-types of social capital might even restrain farmers' adaptive capacity since agrarian populations are also situated in different classes (Woolcock & Narayan, 2000; Portes, 2010). It is essential mainly because which agrarian populations can use these connections under which conditions is as crucial -if not more- as simply having or lacking these connections (Byg & Herslund, 2016). Likewise, most studies dwelling upon social capital's role in increasing community resilience dwell upon reactive community resilience, which refers to actions that confront the immediate impacts of climate change after disasters and return to maintaining business as usual (Carmen et al., 2022). Nevertheless, it is equally important to pay attention to the effectiveness of social capital, which is latent or could be activated while handling the gradual effects of climate change like drought, land salinization, rising seas, and so on.

Against this background and addressing such gaps, this Chapter focuses on the role of *bonding* and *bridging-linking social capital* in agrarian adaptation to both gradual effects of climate change and sudden-onset events in Turkey - emphasizing its various implications for different groups of farmers. To this end, it focuses on three regions from Turkey, a country situated in the eastern Mediterranean, undergoing significant consequences of climate change ranging from drought and sudden-onset events such as hail, flooding, frost, and storms (Şenol, 2021 General Directorate of Meteorology, 2022).

Since agriculture in Turkey uses nearly 77% of the water consumed (Ministry of Agriculture and Forestry -MAF, 2023), the agricultural sector, thus farmers, are increasingly becoming more prone to water scarcity and other climate change effects. Such effects are further complicated by market fluctuations, rising agricultural input prices, and other long-lasting structural problems such as failing merchant systems and aging. Three towns from three regions of Turkey (Afyonkarahisar-Şuhut -called Region

A henceforth; Mersin-Erdemli, called Region B hereinafter; and Şanlıurfa-Eyyübiye, called Region C), which are heavily reliant on agriculture and under the impacts of climate change effects, constitute the primary cases to this end. Where relevant, regional similarities and differences are also central to its focus.

Consisting of five main sections, the following second section provides an overview of research on the role of social capital in climate change adaptation among agrarian communities. The third one looks at data and methods while the fourth section opens a discussion on the results of this study. The last section synthesizes research findings and provides recommendations with implications for policymaking and further research.

4.2 Background: Literature Review

Growing research interest in social capital's role in climate change adaptation also brings into light the significant divergence in defining, conceptualizing, and measuring social capital, which could be attributed to the epistemological differences originating with Bourdieu, Coleman, and Putnam (Woolcock & Narayan, 2000; Pelling & High, 2005; Lin, 2005; Portes, 2010). For instance, for Bourdieu, social capital, as in other forms of capital, tends to serve as a source of power within the context of the theory of social stratification and belong to individuals or small groups of individuals, whereas it comes to be more associated with the common goodness or civicness accrued through history, with seminal works of Putnam (Putnam, 1993; 1995).

Similarly, another divergence relates to the question of whether social capital is consciously maintained by individuals, as highlighted by Bourdieu, or an unintentional consequence of social interaction, as claimed by Coleman (Pellin & High, 2005). Although there is no uniform understanding of the sources, components, and units of analysis regarding social capital, the fact that social capital is network-based has come to be one of the central premises (Lin, 2005). Alongside ties or networks forming the backbone of social capital, among the most widely recognized components/sources of social capital tend to be trust, interpersonal relations, reciprocity, and norms or values (Putnam, 1995; Adger, 2003; Pelling & High, 2005; Woolcock & Narayan, 2000; Woolcock, 2001; Rivera et al., 2019).

Regarding the relationship between social capital and adaptation, there is widespread consensus on the positive effects of social capital in enhancing rural communities' adaptive capacity (Niles et al., 2021; Lo et al., 2015; De Grandpré et al., 2022; Cishahayo et al., 2023). The presence of robust social capital might even outweigh the impact of individuals' perceived risk and experience of damage in their readiness for potential climate change effects (Lo et al., 2015). Likewise, as *a soft adaptation tactic*, social capital underpins other forms of capital, including physical, financial, and environmental capital, and brings about both tangible and intangible benefits, thus increasing agricultural resilience as a whole (Grandpré et al., 2022).

Nevertheless, there is noteworthy variance among its sub-types (*bonding* vs. *bridging*) in serving as an adaptation strategy to climate change, a distinction which could be dated to the seminal work of Granovetter on *weak ties* and *strong ties* (Granovetter, 1973). As such, *bonding social capital* usually offers a substantial and immediate reaction to abrupt occurrences like storms and floods, whereas *bridging* or *linking social capital* is more likely to offer proactive and enduring responses (e.g., Jordan, 2014; Bello, 2014; Belay & Fekadu, 2021; Cohen-Salgado et al., 2021; Vasseur et al., 2022; Carmen et al., 2022; Cuaton & Su, 2023).

Agrarian populations are situated in different classes and other conditions that may restrain the thriving of social capital (Woolcock&Narayan, 2000; Portes, 2010). The latter is most pertinent to those having more bonding ties. For instance, albeit not in a rural context, Wolf et al. (2010) reveal that strong bonding networks could potentially perpetuate rather than reduce the vulnerability of older people to the effects of heat waves in the UK. Likewise, it might be the *bonding social capital* itself that discourages farmers from seeking new means of adaptive behaviour beyond the confines of their close relatives, friends, or neighbours (Belay & Fekadu, 2021).

As in the case of Mamanwas -subsistence farmers who were forcibly displaced and moved from Southern Mindanao to Eastern Visayas, the Philippines, - it was robust bonding ties that aided them survive and adjust to adverse weather conditions and problems of displacement, but such ties inadvertently contributed to weak or fragile connections with those who are not of same indigeneity and ethnicity (Cuaton & Su, 2023). As a result, they largely fell short of sustainable livelihoods and income opportunities due to their weak ties with non-indigenous people and local and national government agencies (Cuaton & Su, 2023).

Moreover, it is mostly *bonding social capital* that proves to be stronger among rural communities, particularly the rural poor, compared to bridging ones in their adaptation processes (Gong et al., 2018). This largely overlaps with the general understanding of social capital, suggesting that the poor often have weak *bridging social capital* but strong *bonding social capital* (Woolcock & Narayan, 2000). Likewise, under certain circumstances, it might be uneven power relations and clientelism that render the rural poor unable to reach *bridging* and *linking social capital*s, as highlighted by Jordan (2014), focusing on different groups of farmers in southwest Bangladesh. In others, high social capital might increase the probability of implementing more capital-intensive adaptation strategies for large and medium-scale farmers, such as diversifying crops and varieties. In contrast, it might increase the probability of less capital intensive and off-farm activities such as migration, homestead gardening, and diversifying income sources for small and landless farmers (Alam et al., 2016).

All combined lead one to question the role of social capital inherently increasing rural people's adaptive capacity as a uniform category, incognizant of people's different socioeconomic backgrounds and embeddedness in larger sets of institutional and political-economic conditions.

4.3 Data and Methods

Differences in defining and conceptualizing social capital also extend to how it is operationalized. Most studies focus on the structural accounts of social capital, such as network quantity and diversity, a deeper understanding of how such networks operate based on social norms, and other sociocultural factors receiving less attention (Carmen et al., 2022). Another prominent approach is to equate social capital with one of the components of social capital, such as group membership -e.g., group membership increasing food security during agricultural adaptation to climate change (e.g., Niles et al., 2021) or with the number of respondents' ties at a hierarchical level (e.g., Chen et al., 2014; Gong et al., 2018).[26]Through more inclusive perspectives,, a growing number of studies focalize on the main components of social capital, including trust, recurring relationship, and/or mutual help, which are likely to provide a deeper understanding of social capital in adaptation (e.g., Vasseur et al., 2022; Li et al., 2023).

In light of these, contributing to the latter line of research, this Chapter intends to bring a more profound comprehension of social capital based on its mostly widely recognized components/sources, which tend to be trust, relations, reciprocity, and norms or values (Putnam, 1995; Adger, 2003; Pelling & High, 2005; Woolcock & Narayan, 2002;

[26] For example, *Guangxi,* as equated to social capital in China, refers to the number of respondents' relatives employed in the government in a township or at a higher level.

Woolcock, 2001; Rivera et al., 2019). In this direction, *bonding social capital* refers to farmers' ties with their households, relatives, neighbours, and other farmers, while *bridging-linking social capital* entails their ties with people outside of their defined socioeconomic status and their vertical ties with experts from agricultural institutions, including chambers of agriculture, district/provincial directorate of agriculture, cooperatives, agricultural insurance pool and so on.

Unlike the majority of studies analysing the reactive role of social capital following disasters, which could be more simply observed (Chriest & Niles, 2018), it focuses on the role of *bonding* and *bridging-linking social capital* in the face of both sudden and gradual effects of climate change alongside non-climatic challenges. To this end, it undertakes a three-stage process. *First*, to see whether one can categorize farmers' existing ties and relations as *bonding* or *bridging-linking social capital*, ordinal-scale questionnaire, which was complemented by open ended questions, was directed to farmers (Appendix 4.1). *Second*, building upon this first step, to see the distribution of such *bonding* and *bridging-linking social capital* among different groups of farmers, column proportion tests via IBM SPSS Statistics (Version 24) were run. The distribution of farmers' *bonding* and *bridging-linking social capital* was analysed based on various variables across three broad categories: 1) farmers' socioeconomic characteristics, 2) agricultural sources and methods, and 3) farmers' scale and vulnerability index (Table 4.1a-4.1b-4.1c). Each stage in this direction is subject to a stepwise explanation, which is complemented by an overview of the overall descriptive statistics of the data (Appendix 4.2). *Third*, logistic regression analysis was run to see the effectiveness of *bonding* and *bridging-linking social capital* in increasing adaptive capacity of farmers (Results Section and Appendix 4.3).

This study utilizes both purposive and snowball sampling techniques. Two main criteria were applied to the selection of three research zones: 1) Areas heavily reliant on agriculture and under different impacts of climate change (sudden vs. gradual) 2) Areas where variance of agricultural products could provide a comparison among producers of cereal producers, cash crops, and fresh fruits and vegetables. To this end, three regions (Regions A, B, and C) were purposively selected, and the number of participants (a minimum of 34 for each region) grew mainly feeding on snowball sampling. Survey interviews with 111 farmers were complemented by semi-structured in-depth interviews with 53 farmers and 29 interviews with experts from meso-level agricultural institutions). Semi-structured in-depth interviews were coded via Maxqda Plus 2020. The coding system assigned *F* followed by numerical identifiers to farmers (e.g., F1, F2, F3…); *E* followed by numbers to experts or officials from agricultural institutions (e.g., E1, E2, E3…); *R* to regions followed by A-B-C (e.g., RA-RB-RC). Additionally, to ensure the anonymity of expert respondents, they are categorized as public, civic, or private.

4.4 Results and Discussion

This section primarily seeks to answer the question of which type of social capital farmers are more reliant on, alongside examining the effectiveness and limitations of their social capital depending on above-mentioned numerous variables.

4.4.1 A Weakening Social Capital amidst Climatic and non-Climatic Challenges

Among the general results of this research (common to each region) is the tendency that the role of farmers' both proximate ties and distant ties are noticeably weak in handling climatic challenges such as drought, seasonal shifts, frost, hail, and more structural challenges such as climbing agricultural input prices, market instability, inadequate state subsidies, and failing merchant system. The primary reason tends to be a prominent decline in trust, mutual help, and solidarity, irrespective of climate change effects. Most farmers highlighted this with such statements as *I am trying to survive on my own*, which could be well depicted with the following sayings of a farmer:

> I miss the days we used to cooperate. Two decades ago, or so, everyone used to aid one another in our town. Suppose that your crops have just been harvested and need storage. A neighbour would open her/his warehouse. And you would help him/her in return.
>
> F1-RA

Equally vital, among the most cited reasons behind decreasing mutual help, worsening economic conditions of farmers stand out, as could be seen below:

> If they had had money or anything to offer, they would share. But they don't have it either; everybody is in debt.
>
> F2-RB

One can conceive such remarks of a fading social capital amidst exacerbating climatic and non-climatic hardships rather than a complete absence of social capital. Only by building upon these tendencies can the subsequent research findings offer an accurate grasp of how this highly weakening social capital functions in farmers' adaptation practices and processes.

4.4.2 Farmers are More Reliant on Their Bonding Social Capital

As Figure 4.1 presents, farmers tend to have more bonding ties overall than bridging-linking relations.[27] One can observe the same inclination in each of the selected regions (Region A-B-C) since there does not exist any significant regional difference in this respect (Table 4.1a-4.1b-4.1c).

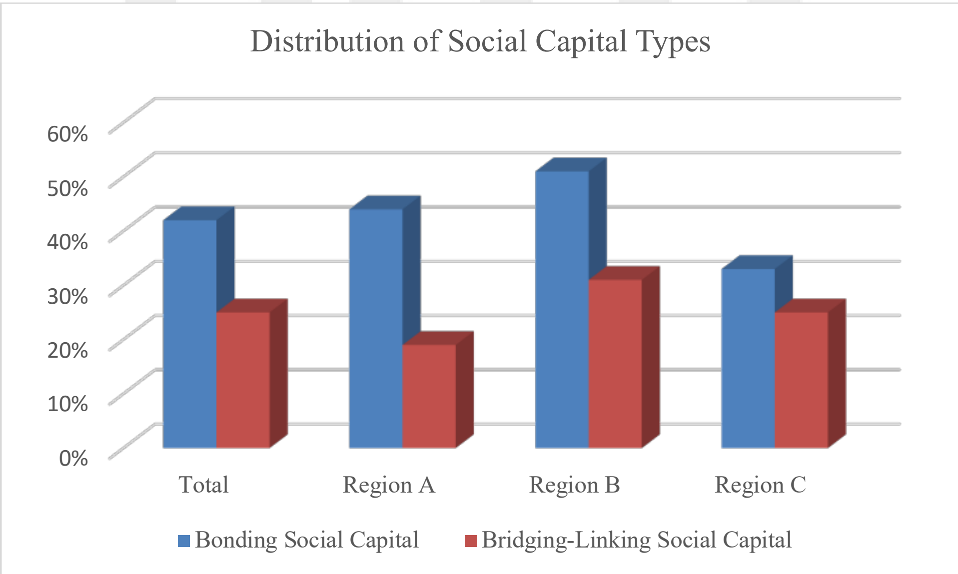


Figure 4.11: Distribution of farmers bonding and bridging-linking social capital.

When such tendencies are analysed based on multiple variables -ranging from socioeconomic features, agricultural sources, and methods to farmers' scale and vulnerability index, significant differences emerge concerning age, education level, the amount of land owned, primary type of farming and engagement in animal husbandry. To start with *bonding social capital*, it is particularly smallholders and farmers of lower

[27] The rate of those having no social capital as per the questionnaire in Appendix 4.1 is nearly one quarter of the sample.

education attainment who tend to have more *bonding social capital* compared to medium-scale landowners and farmers of intermediate-level education, respectively (Table 4.1a).

Table 4.1a: Distribution of social capital types based on socio-economic characteristics.

Social Capital Types Based on Socioeconomic Characteristics	Total	District of farming			Age			Education			Main source of livelihood			Years of farming			Production Volume			Decares of land owned			Landholding or tenancy	
	(A)	Region A (A)	Region B (B)	Region C (C)	35 years old and below (A)	36-50 years old (B)	50 years old and above (C)	Low education level (A)	Intermediate education level (B)	High education level (C)	Agriculture+Retired (A)	Agriculture+Extra work (B)	Agriculture (C)	15 years old and below (A)	15-25 years old (B)	25 years old and above (C)	Those earning low tonnage (A)	Those earning medium tonnage (B)	Those earning high tonnage (C)	Smallholders (A)	Medium-scale landowners (B)	Large-scale landowners (C)	Tenant (incl. sharecroppers) (A)	Landholder+tenant (B)
	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %
Bonding Social Capital (SC)	45%	44%	51%	33%	30%	50%	44%	60% B	20%	37%	58%	38%	43%	38%	40%	49%	43%	49%	17%	56% B	27%	18%	40%	43%
Bridging-Linking SC	27%	19%	31%	25%	24%	15%	41% B	30%	24%	21%	50%	19%	25%	31%	20%	24%	20%	37%	11%	28%	15%	36%	27%	25%

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion.
Significance level for upper case letters (A, B, C): ,05[3]
1. This category is not used in comparisons because the sum of case weights is less than two.
2. This category is not used in comparisons because its column proportion is equal to zero or one.
3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Table 4.1b: Distribution of social capital types based on agricultural sources and methods.

Social Capital Types Based on Agricultural Sources and Methods	Total	Main type of farming				Animal husbandry		Crops produced			Sales channel			Irrigation source				Irrigation method		
	(A) Column N %	Conventional farming (A) Column N %	Organic farming (B) Column N %	Subsistence farming (C) Column N %	Greenhouse cultivation (D) Column N %	0 (A) Column N %	Animal husbandry (B) Column N %	Cereals (A) Column N %	Cash crops (B) Column N %	Fresh fruits &vegetables (C) Column N %	Intermediary (A) Column N %	State agency (B) Column N %	I sell myself (C) Column N %	Deep well (A) Column N %	Lake-pond-dam water (B) Column N %	Mains water (C) Column N %	Only rain water (D) Column N %	Traditional irrigation (A) Column N %	Modern irrigation (B) Column N %	Only rain water (D) Column N %
Bonding Social Capital (SC)	45%	43%	20%	29%	63%	45%	33%	36%	35%	54%	49%	27%	28%	48%	35%	43%	50%	35%	45%	50%
Bridging-Linking SC	27%	24%	10%	6%	58% A C	30% B	8%	17%	29%	34%	26%	27%	24%	33%	22%	14%	0%[2]	24%	28%	0%[2]

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion.
Significance level for upper case letters (A, B, C): ,05[3]
1. This category is not used in comparisons because the sum of case weights is less than two.
2. This category is not used in comparisons because its column proportion is equal to zero or one.
3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Table 4.1c: Distribution of social capital types based on farmers' scale and vulnerability index.

Social Capital Types Based on Farmers' Scale and Vulnerabilities	Total (A) Column N %	Farmers' Scale: Small-scale farmers (A) Column N %	Medium-scale farmers (B) Column N %	Large-scale farmers (C) Column N %	Vulnerability Index: Less vulnerable (A) Column N %	Vulnerable (B) Column N %	Highly vulnerable (C) Column N %
Bonding Social Capital (SC)	45%	50%	38%	37%	22%	50%	45%
Bridging-Linking SC	27%	18%	28%	33%	13%	34%	21%

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion.
Significance level for upper case letters (A, B, C): ,05[3]
1. This category is not used in comparisons because the sum of case weights is less than two.
2. This category is not used in comparisons because its column proportion is equal to zero or one.
3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

In other words, farmers with less education and land tend to be more confined to their close network of relations while adapting to climate change. This inclination largely agrees with existing research suggesting that social connections among agrarian people, especially with limited resources, usually have more bonding ties compared to connections that span different groups of areas (e.g., Jordan, 2014; Alam et al., 2016; Belay & Fekadu, 2021; Cuaton & Su, 2023).

Concerning *bridging-linking social capital*, there is a significant difference between the following group of farmers: Farmers aged 50 years old and above compared to those aged 36-50 and farmers non-engaged in animal husbandry compared to those engaged in it are inclined to have more bridging-linking ties. This finding becomes more significant considering that having *bridging-linking social capital* or not does not differ based on years of farming or experience but on age (Table 4.1a). Moreover, farmers involved in greenhouse cultivation, compared to subsistence farmers and farmers doing conventional farming, are more inclined to have bridging ties (Table 4.1b). This finding might be attributed to the assemblage that greenhouse cultivation brings about since farmers engaged in the latter also consist of farmers producing crops of export value and engaged in multiple stakeholders like supermarkets and export chains, specifically in Region B.

Concerning other primary variables -farmers' scale and vulnerabilities- although there does not exist any significant difference, a likelihood suggests that small-scale farmers might have more bonding ties and less bridging ones compared to medium-scale and large-scale farmers. Likewise, vulnerable, and highly vulnerable groups of farmers might depend on more *bonding social capital* compared to less vulnerable ones (Table 4.1c). Overall, such tendencies and probabilities, combined with the former ones, might reinforce existing research which suggests that *bonding social capital* proves to be stronger among the rural poor or small-scale farmers compared to *bridging-linking social capital* (e.g., Woolcock & Narayan, 2000; Jordan, 2014; Alam et al., 2016; Gong et al., 2018; Belay & Fekadu, 2021).

Equally, if not more important, is the scope and content of the support (information, resource, and labour sharing) farmers receive from their proximate and distant ties, which is discussed in the rest of this section. As Figure 4.2 displays, farmers predominantly rely on their *bonding social capital* for an exchange of ideas and information, corresponding to 90% and 58%, respectively, as coping mechanisms against climatic and non-climatic challenges. This finding resonates well with the findings of Gong et al. (2018), who, focusing on the Lancang River basin in China, reveal that the advantages of *bonding social capital* are limited to mutual learning and information sharing during the adaptation behaviours of the rural poor. No significant difference emerges concerning regional characteristics in this direction, except for Region A regarding the exchange of equipment.

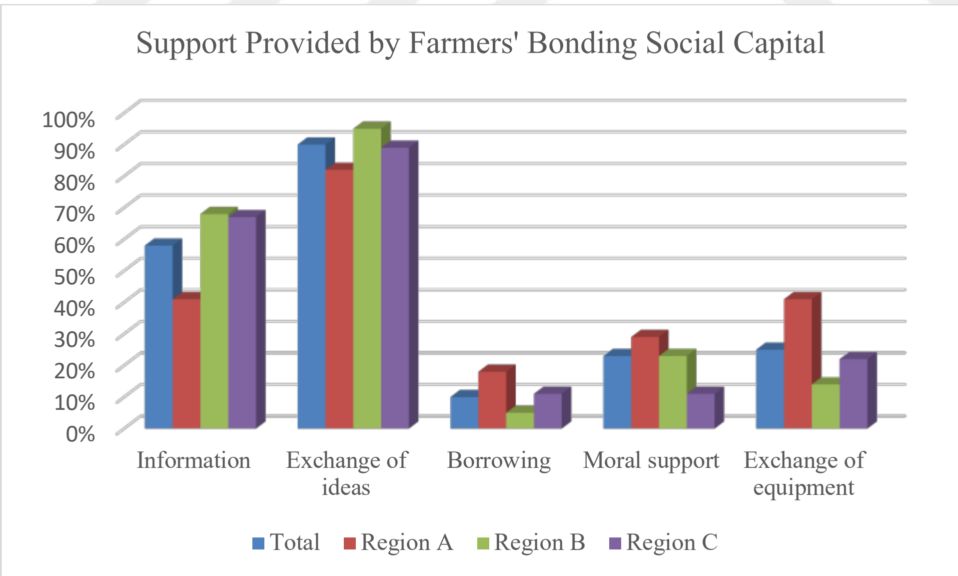


Figure 4.2: Distribution of support provided by farmers' bonding social capital.

Similar results also apply to the type of support farmers get based on their *bridging-linking social capital*, in other words, their relations with agricultural institutions. As depicted in Figure 4.3, 58% of farmers have recourse to their *bridging social capital* for information-consultancy and 48% of them for an exchange of ideas, and 46% of them for purchasing pesticides, fertilizers, and seeds. As in the case of *bonding social capital*, farmers are less reliant on their *bridging-linking social capital* for the purposes of more material means of support, such as getting a loan and receiving training, let alone more physical and infrastructural measures. This is not to deny the likely key role bonding and bridging-linking social ties might play in adaptation, but rather to state that information provided remains rather insufficient in the face of worsening impacts of climatic and non-climatic challenges. Besides, analysed regions do not display any significant difference in this direction, either.

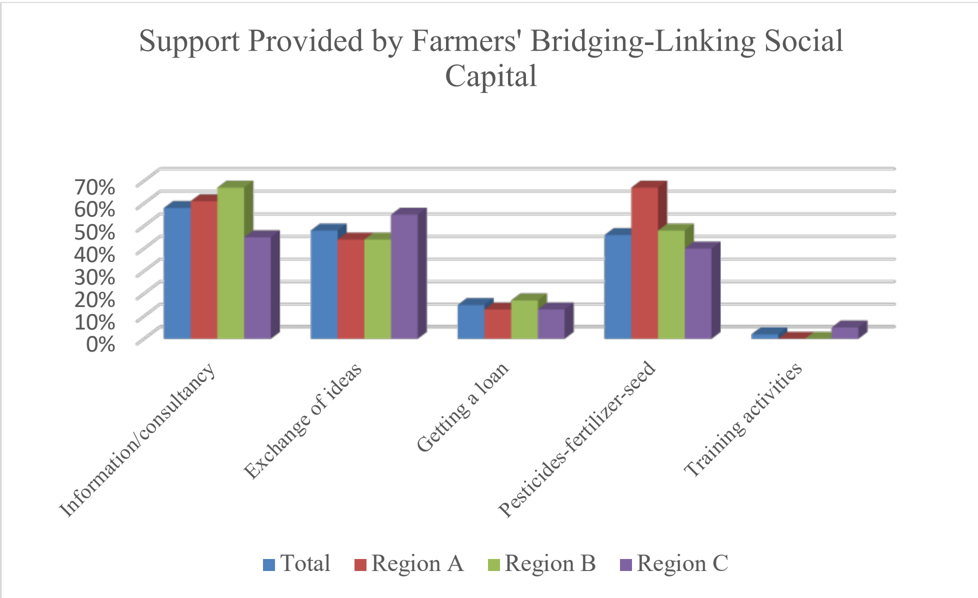


Figure 4.3: Distribution of support provided by farmers' bridging-linking social capital.

Building upon these general findings, the next section aims to bring a more in-depth understanding of the role *bonding* and *bridging-linking social capital* play in farmers' adaptation practices and processes.

4.4.3 Confines of Bonding Social Capital

As highlighted earlier, despair prevails among most farmers while coping with the exacerbating impacts of both climatic and non-climatic changes. A few solidarity examples appear, only in a limited scope, e.g., which manifest in the form of emotional support as in the experiences of a farmer below:

> Who can help you fight against frost and hail! They happen all of a sudden!... It was on the first of June 2020… We were preparing to hoe our lands where pole beans just started to grow. One day, we woke up only to see frost damage on our beans. Those very green beans turned into coal-black in one day! When the clock ran 9 am, one person appeared in each bean land. Women all cried… (silence). Holding up one another, we had to start from scratch!

F3-RA

In a similar vein, such solidarity in the form of immaterial support might translate into a comparatively more material means, as in the case of labour-sharing following the devastating impacts of the storm on greenhouse materials from Region B:

> Last year, a strong storm hit our greenhouses. It devastated all plastic covering, bending the whole greenhouse frame, and we lost more than half of the produce. A day later, a friend of mine gave me a hand to collect the remains.

F4-RB

While *bonding social capital* might provide such forms of support, it tends to dissolve when it comes to more material means of support, such as borrowing from one another, since many farmers underscore that they no longer borrow from one another and increasingly rely on loans from banks. Concerning more substantial solidarity examples, again, only few examples could be given, e.g., as highlighted in Region C:

> Our farmer friends mostly help one another. We fully support one another. Because we jointly perform most of our farming activities.

F5-RC

Such remarks from Region C are mostly from farmers of the same indigeneity and ethnicity, a region comprising farmers of multiple ethnicities, primarily Kurds, Arabs, and Turks. Particularly, farmers who operate their farming activities over shared lands have displayed stronger *bonding social capital*. It is not reflected in Figure 4.1, for they are restricted to a few examples. More importantly, such solidarity examples do not translate into effective ties leading to successful climate change adaptation since constraints of such bonding ties are easily observable, as could be understood from the following remarks of an agricultural engineer:

> Relying on their closely knit ties with one another, farmers often practice what they have heard or seen from other farmers or neighbours. Even if what they do is wrong, they keep on applying it. It is very common among farmers. It is very often to see wrong information or method being spread quickly among them.

E1-RC-Public

The flow of such wrong information among farmers' bonding ties during their adaptation to climate change is not peculiar to one region. As the following statements by an agricultural engineer from Region A indicate, farmers, instead of trusting agricultural engineers, tend to apply what their farmer friends suggest as a measure against increasing pest invasions, which are exacerbated by rising temperatures:

> I see more farmers applying more pesticides on their farms following a suggestion of their friends. It would be enough to hear from their farmer friends: "I tripled the dosage of this product, and it proved useful." They come predetermined to buy a certain product, not another. They do not listen to us -*agricultural engineers*-. Even though their produce is the same, the type of pest, soil, and other conditions of the farm might differ from one another. As a result, they come up with increasing cases of pest invasions. The increase is not only in their number but also in their types. *-emphasis added by the author-*

E2-RA-Civic

Combined with earlier findings, such inclination indicates significant downsides of bonding ties in each of the analysed regions since farmers' dependence on their bonding relations might result in maladaptive consequences (e.g., the flow of unsustainable means of adaptation, including an increase in pesticides), which unintendedly increase both their current and future vulnerabilities to climate change effects (Barnett & O'Neill, 2010; IPCC, 2022). That is why, despite certain benefits like moral support provision and labour-sharing activities after disasters, it might be, at times, *bonding social capital* itself that restricts farmers' adaptation behaviour by deterring them from searching for different methods of adaptation beyond their proximate ties with their farmer friends, relatives, and neighbours (Belay & Fekadu, 2021; Cuaton & Su, 2023).

Moreover, that *bonding social capital* has also been predominantly restricted to information sharing and exchange of ideas in the analysed regions also adds to the limits of bonding ties. In brief, this study suggests that such *bonding social capital,* owned chiefly by farmers of more disadvantageous groups such as smallholders and the low-educated ones, has only helped them manage risks and vulnerability and thus "get by" while what they need is often *bridging social capital* to help them "get ahead" (Putnam, 2000; Gong et al., 2018; Cuaton & Su, 2023).

4.4.4 A More Effective One with Limitations: Bridging-Linking Social Capital

Logistic regression analysis (Table 4.2a-4.2b and Appendix 4.3) was run to see whether the support provided by farmers' *bonding* and *bridging social capitals* (independent variables) could solve their problems (dependent variable, solving coded as 1 and non-solving 0). 80 out of 111 people are included in the analysis, which primarily comprises those having social capital. Overall model statistics suggest statistically significant results for the logistic regression with < .001, while the model summary explains the variance in the dependent variable at a moderate level with approximately 30.4% and provides a 77.5% predictive performance (Table 4.2a and Appendix 4.3).

Table 4.2a: Classification table.

Observed			Predicted: Could support provided by your social capital solve your problem? .00	1.00	Percentage correct
Step 1	Could support provided by your social capital solve your problem?	.00	44	9	83.0
		1.00	9	18	66.7
	Overall percentage				**77.5**

Table 4.2b: Variables in the Equation.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	Bonding social capital	.233	.552	.179	1	.673	1.263
	Bridging-linking social capital	2.241	.554	16.346	1	< .001	9.402
	Constant	-1.693	.449	14.183	1	< .001	.184

As Table 4.2b displays, it is *bridging-linking social capital*, with a statistically significance rate of < .001, that proves to solve farmers' problems (climatic or non-climatic), whereas *bonding social capital* does not have a significant effect in this respect. Having *bridging-linking social capital* increases the likelihood of solving farmers' problems with a higher log-odds (B) ratio of 2.241 compared with that of *bonding social capital* (.233), which also affirms the important role of *bridging-linking social capital* vis â vis *bonding social capital*.

The earlier findings further complement this finding in that *bonding social capital,* besides its positive role in providing more immaterial support such as information sharing or emotional support and labour sharing following sudden-onset events, has significant constraints, even leading to maladaptive consequences. That the *bridging-linking social capital* is significantly effective in solving farmers' problems also indirectly affirms that this type of social capital tends to prove effective not only in sudden-onset events but also in the face of gradual effects of climate change (Belay & Fekadu, 2021; Cohen-Salgado et al., 2021; Vasseur et al., 2022; Carmen et al., 2022; Cuaton & Su, 2023).

Likewise, as touched upon above, younger farmers, and subsistence and organic farmers and farmers engaged in animal husbandry have less *bridging-linking social capital*, while smallholders and farmers of lower education attainment are more reliant on their *bonding social capital*. Besides, despite no significant difference, small-scale farmers may have less *bridging social capital* than medium-scale and large-scale farmers, while vulnerable and highly vulnerable ones might have more *bonding social capital* compared to less vulnerable ones (Table 4.1c). Such results and likelihoods, once again, reinforce the general inclination that *bonding social capital* tends to be stronger among rural communities, particularly the rural poor, compared to bridging ones (Jordan, 2014; Alam et al., 2016; Belay & Fekadu, 2021; Cuaton & Su, 2023).

Overall, such tendencies reflect the discrepancy between which farmers own which social capital type and which social capital type tends to prove effective in handling their problems. In other words, farmers, specifically of less advantageous ones, tend to have lesser *bridging-linking social capital*, which proves to be effective, while what they possess most- b*onding social capital*- proves to be largely ineffective, with significant constraints. These, in fact, challenge some inclinations that equate social capital to the saviour/insurance mechanism of the poor (Woolcock & Narayan, 2000; Woolcock, 2001). It is mainly because solid *bonding social* capital needs to be complemented by substantial *bridging social capital* so that it can mobilize a diversity of people, events, and strategies to enhance the resilience of rural communities (Chriest &Niles, 2018).

When it comes to the type of support farmers' *bridging-linking social capital* provides, its overall effectiveness is somewhat challenged, however. For instance, 46% of farmers owning *bridging-linking social capital* (Figure 4.3) have recourse to their connections to purchase seed-fertilizer-pesticides as a coping mechanism for many reasons, including rising temperatures, increasing pest invasions, and land degradation. This support type indirectly indicates that farmers are increasingly reliant on private companies (pesticide-fertilizer-seed dealers) among other agricultural institutions, including public institutions such as the District and Provincial Directorate of Agriculture. It could also be well-observed in the following sayings of a farmer:

> I rarely visit the chamber of agriculture and district directorate of agriculture. When I do so, I go there either to pay my annual fee or have my paperwork done. Why shall I go there? Agricultural engineers and technicians are always at their desks. They rarely perform farm visits. Yet, this is different for the company X. Whenever I call him, we arrange a time to visit my farm, and observing soil and plants, he gives the most appropriate product for my produce. I also have a chance to come together with other farmers in his shop, drink tea, and have a talk.

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As could be seen in the above-mentioned statements of the farmer, such private companies tend to serve as 'social infrastructures' in Klinenberg's terms (Klinenberg, 2018), where farmers find a chance to assemble and foster social interaction and engagement regarding finding solutions to their climatic and non-climatic problems. Additionally, these inclinations indicate some of the reasons behind farmers' lesser engagement with public agricultural institutions, which hints at the lack of the state's active involvement in farmers' climate change adaptation practices and processes. This tendency, instead of a structural hole in networks, might indicate a loose connection between farmers and public organizations, which is somewhat filled by the private seed-fertilizer-pesticide companies. Additionally, this inclination is also affirmed and complemented by the findings of Chapter 3. Such lack mainly and eventually might refer to the absence of both what Woolcock & Narayan (2000) call *institutional view* and *synergy view vis â vis* the more preeminent roles of *communitarian* and *networks views* concerning social capital's role for development in general. *Institutional view* equates the vitality of civil society and community ties with the vitality of legal, political, and economic environment, while the synergy view centres itself upon the synergy between citizen action and government based on complementarities and partnerships formed both within and across different sectors and actors (Woolcock&Narayan, 2000).[28]

Such a tendency, to some extent, challenges the findings on the effectiveness of bridging-linking ties since farmers are more reliant on seed-fertilizer-pesticide sellers among other agricultural institutions, whose primary purpose is to market their industrial products. Such dependence on the market in the selected research zones also reminds one that climate change adaptation based on famers' social capital is also reminiscent of their dominating reliance on the market (Chapters 2 and 3).

4.5 Conclusion

This Chapter sheds light on the role of different types of social capital (*bonding* vs. *bridging-linking social capital*) in different groups of farmers' adaptation to both rapid-onset events and gradual effects of climate change within the context of three different regions of Turkey. Above all, it highlights a weakening social capital among the majority of farmers for manifold reasons, including declining trust and solidarity in the analysed regions. Moreover, research findings, substantially challenge the predominant line of research dwelling upon the positive contributions of social capital in rural populations' adjustment to climate change. In this respect, it reveals that farmers' *bonding social capital* tends to provide some sporadic support in the form of emotional support and labour-sharing activities for farmers facing the consequences of sudden-onset events such as flooding and storms.

[28]Centred on the vitality of horizontal community ties as if belonging to each member of the community, the first one (communitarian) tends to attach much importance to its positive aspects while networks view, considering both downsides and upsides of social capital, which is based on both vertical and horizontal associations within people and organizations, highlight the need for both robust intra-community connections and weak extracommunity networks to deal with poverty (Woolcock & Narayan, 2000).

However, it finds significant constraints regarding the role of *bonding social capital* overall, particularly in handling more gradual effects of climate change. These primarily relate to the overall support type it provides, which is restricted to information sharing and exchanging ideas among farmers. Equally important, it demonstrates that farmers' bonding ties lead them to engage in maladaptive behaviours such as increasing pesticide usage or spreading wrong information regarding agricultural practices. In short, the support provided by farmers' bonding ties does not make a significant difference in the overall adaptive capacity of farmers.

This study finds that farmers' *bridging-linking social capital,* which primarily refers to their relations with agricultural institutions, proves to significantly support farmers in their adaptation to climatic and non-climatic challenges. Nevertheless, bridging-linking ties are not exempt from substantial constraints. The latter includes the confinement of main support types to information sharing, consultancy, and the provision of pesticide-fertilizer seeds. The latter tendency, which reads that almost half of the interviewed farmers have recourse to agricultural institutions to purchase pesticides, fertilizers, and seeds, indicates a more prominent role of the private sector in solving farmers' problems. This finding, in turn, indicates a notably less visible role of public agricultural institutions in aiding farmers in terms of more material means of support other than providing information and consultancy.

Likewise, despite most studies that do not consider different positionalities of agrarian populations, this study also sheds light on which social capital types are within reach of which different groups of farmers (in terms of their socioeconomic characteristics, agricultural sources, and methods, vulnerabilities, and scales) and how (in)effective they are. In brief, it indicates that farmers of less advantageous positions tend to rely more on their *bonding social capital* while better-off ones on *bridging-linking social capital*, the latter proving to be the sole effective one.

For further research, it would be advisable to see how having both *bonding social capital* and *bridging-linking social capital* impacts farmers' adaptation capacity and practices. Of more practical recommendations, one can highlight the need for more material means of support such as field visits by public agricultural institutions and initiation of community-based adaptation projects which could be mobilised through farmers' dominating ties: *bonding social capital*. Similarly, closer attention to farmers' needs and problems is a pressing need for enhanced bridging ties between farmers and public agricultural institutions.

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4.7 Appendices

Appendix 4.1: Questionnaire to measure social capital.

<table>
<tr><td colspan="3">Q1: Whom do you mostly consult/depend on while dealing with climate change effects and other problems in agricultural activities?</td></tr>
<tr><td colspan="2">A. Family members and relatives; neighbours and other villagers; farmer friends</td><td>B. Farmers in other cities &Agricultural institutions (e.g., Chambers of agriculture, agricultural engineers, agricultural cooperatives, agricultural insurance experts, seed/pesticide/fertilizer sellers, district/provincial directorate of agriculture)</td></tr>
<tr><td colspan="3">Questions measuring whether ties with A) and B) could be regarded as bonding social capital or bridging/linking social capital</td></tr>
<tr><td rowspan="3">Trust</td><td>2a. Do you trust the person you have recourse to in solving problems of climate change and other agricultural activities?
a) I fully trust b) I trust c) I neither trust nor distrust d) I do not trust e) I never trust at all.</td><td>2b. Do you trust the institution you consult while dealing with climatic and non-climatic challenges in your agricultural activities?
a) I fully trust b) I trust c) I neither trust nor distrust d) I do not trust e) I never trust at all.</td></tr>
<tr><td>3. How did such trust relationship develop? Can you please exemplify?</td><td>N/A</td></tr>
<tr><td>4. Has there been a case when this person could not help you? Can you please exemplify?</td><td>3. Has there been a case when such institutions/experts could not assist you? Can you please exemplify?</td></tr>
<tr><td>(Recurring) relations</td><td>5. How often do you see each other?
a) Always b) Often c) Sometimes d) Rarely e) Almost never</td><td>4. Recurring relationship: How often do you consult such institutions?
a) Always b) Often c) Sometimes d) Rarely e) Almost never</td></tr>
<tr><td>Reciprocity and norms</td><td>6. What do you expect from one another while receiving-giving help?
a) They help me too b) Everybody in town helps each other c) Not helping one another is condemned here d) I expect nothing in return. e) Other</td><td>N/A</td></tr>
</table>

Explanatory Guide for the Steps Taken

Positive answers to the questions above were used as proxies for the components of social capital, which are trust, recurring relations, reciprocity, and norms. Farmers giving positive answers at least to two of the questions 2a, 5, 6 were coded as *having bonding social capital*. For farmers having strong trust yet lacking recurring relations or reciprocity, open-ended questions (3-4) assisted in measuring whether their ties could be viewed as *bonding social capital*.

The same method applied to the measure of *bridging-linking social capital*. Positive answers to the questions 2b and 4 were used as proxies for *bridging-linking social capital* while an open-ended question (3) has acted as complementary for this categorization. For instance, for participants having high trust yet lacking recurring relations, answers to the question 3 has acted complementary to determine whether such ties could be categorized as bridging-linking ties.

Appendix 4.2a: Descriptive Statistics.

DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

AGE	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
35 years old&below	30%	13%	32%	42% A
36-50 years old	41%	50%	30%	45%
50 years old&above	29%	37% C	38% C	13%

EDUCATION	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Low Education	39%	56% C	46% C	18%
Intermediate Education	23%	28%	10%	30%
High Education	39%	16%	44% A	53% A

MAIN SOURCE OF LIVELIHOOD	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Agriculture+Retired	11%	25% C	8%	3%
Agriculture+Extra work	38%	25%	42%	45%
Agriculture	51%	50%	50%	53%

ANIMAL HUSBANDRY	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Cattles	17%	41% C	0%[1]	15%
Small cattles	14%	9%	28% C	3%
None	69%	50%	72%	83% A

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion. Significance level for upper case letters (A, B, C): ,05 [3]

GENDER	Total	District of farming		
	N:111	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Male	95%	94%	95%	98%
Female	5%	6%	5%	3%

YEARS OF FARMING	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
15 years old and below	35%	13%	38%	50%
15-25 years old	32%	31%	28%	35%
25 years old and above	33%	56%	34%	15%

PRODUCTION VOLUME	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Low tonnage producers	44%	33%	61%	35%
Medium tonnage producers	39%	33%	32%	51%
High tonnage producers	17%	33% B	8%	14%

DECARES OF LAND OWNED	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Smallholders	61%	52%	94% A C	36%
Medium-scale landowners	28%	38% B	3%	42% B
Large-scale landowners	12%	10%	3%	21%

LANDHOLDING or TENANCY	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Only tenant (incl. sharecroppers)	14%	9%	18%	13%
Both landholder & tenant	86%	91%	82%	88%

1. This category is not used in comparisons because the sum of case weights is less than two.
2. This category is not used in comparisons because its column proportion is equal to zero or one.
3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

AGRICULTURAL SOURCES AND METHODS

MAIN TYPE OF FARMING	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Conventional farming	58%	78% B	35%	63% B
Organic farming	9%	9%	8%	10%
Subsistence farming	16%	9%	14%	23%
Greenhouse & conventional	17%	3%	43% A C	5%

CROPS PRODUCED	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Cereals	48%	75% B	10%	63% B
Cash crops	15%	9%	5%	30% B
Fresh fruits&vegetables	37%	16%	85% A C	8%

IRRIGATION SOURCE	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Deep well	47%	91% B C	54% C	5%
Lake-pond-dam water	41%	0%[1]	36%	80% B
Mains water	6%	6%	8%	5%
Only rainwater	5%	3%	3%	10%

SALES CHANNEL	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Intermediary/private sector	67%	48%	85% A	65%
State agency	10%	26% C	0%[1]	8%
I sell myself	23%	26%	15%	28%

IRRIGATION METHOD	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Traditional irrigation	31%	3%	10%	73% A B
Pressurized irrigation	64%	94% C	87% C	18%
Only rainwater	5%	3%	3%	10%

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion. Significance level for upper case letters (A, B, C): ,05 [3]

1. This category is not used in comparisons because the sum of case weights is less than two.

2. This category is not used in comparisons because its column proportion is equal to zero or one.

3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

FARMERS SCALE

FARMERS SCALE	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Small-scale farmers	40%	41%	56% C	23%
Medium-scale farmers	36%	25%	21%	60% AB
Large-scale farmers	24%	34%	23%	18%

VULNERABILITY INDEX

VULNERABILITY INDEX	Total	District of farming		
	N:111	Region A	Region B	Region C
	(A)	(A)	(B)	(C)
	Column N %	Column N %	Column N %	Column N %
Less vulnerable	21%	13%	15%	33%
Vulnerable	45%	31%	49%	53%
Highly vulnerable	34%	56% C	36%	15%

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion. Significance level for upper case letters (A, B, C): ,05 [3]

1. This category is not used in comparisons because its column proportion is equal to zero or one.
2. This category is not used in comparisons because the sum of case weights is less than two.
3. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Appendix 4.2b: Explanatory Guide for Three Broad Categories of Variables in Descriptive Statistics

Demographic and Socioeconomic Characteristics

Concerning the main sources of livelihood, the term ‘extra work’ refers to individuals involved in semi-proletarian occupations or formal jobs such as being an agricultural engineer in urban centres. Regarding engagement in animal husbandry, farmers in Afyonkarahisar-Şuhut predominantly rear cattle, whereas those in Mersin-Erdemli tend to focus more on smaller livestock. In contrast, farmers in Şanlıurfa-Eyyübiye are the least involved in animal husbandry. Across regions, the population is predominantly male, regardless of geographical differences.[29]

Regarding ‘Farmers Production Volume’ category, it classifies annual production in tonnes into three groups: Low-tonnage producers indicating 1-50 tonnes; Medium-tonnage producers, encompassing 50-300 tonnes; and High-tonnage producers, reflecting 300 tonnes and beyond. Based on Turkish Statistical Institute (TÜİK)’s standards, the variable ‘Decares of Land’ was formed as follows: Small-scale landowners (smallholders) with 1-100 decares; Medium-scale landowners with 101-300; Large-scale landowners with over 300 decares.

Agricultural Sources and Methods

Under the category of ‘Main Type of Farming’, ‘conventional farming’ within this study signifies reliance on industrial or capital-intensive agricultural practices, including synthetic fertilizers, pesticides, and high tillage. Greenhouse cultivation, considered a sub-set of conventional farming in this research, also involves heavy dependence on industrial or capital-intensive agricultural practices.

Concerning farmers' ‘sale channels’, the term ‘intermediary’ mainly entails middlemen and traders while ‘state agency’ primarily denotes Agricultural Products Office (TMO). The expression ‘I sell myself’ indicates those selling their goods at local markets or through their own shops.

Farmers’ Scale* and *Vulnerability Index

The categorization ‘Farmers’ Scale’, based on the average annual income for the related years 2020 and 2021, divided farmers into three groups: ‘small-scale farmers’, ‘medium-scale farmers’ and ‘large-scale farmers.’ Based on Likert Scale nine questions, ‘Vulnerability Index’ sought an answer to the fragility of farmers faced with climatic and non-climatic challenges common to each research site. As detailed below, answers to nine questions were converted into a scale where ‘100’ represents the most vulnerable and ‘0’ the least. Three groups of farmers were formed as follows: ‘less vulnerable’, ‘vulnerable’, and ‘highly vulnerable.’

Questions for *Vulnerability Index*

1. How would you evaluate the increase in sudden-onset events (e.g., frost, hail, flooding) in recent years?

1	Increased excessively
2	Increased to a large extent
3	Neither increased nor decreased
4	Decreased to a large extent
5	Decreased excessively

2. How would you evaluate the increase in drought?

1	Increased excessively
2	Increased to a large extent

[29] Since the rate of female participants is 5%, a proportion that does not provide significant comparison, the gender variable is dismissed from the analysis. Likely reasons for such lower rate of gender is detailed in Footnote 10.

3	Neither increased nor decreased
4	Decreased to a large extent
5	Decreased excessively

3. Have you experienced any changes in crop productivity in recent years?

1	Increased
2	Remained stable
3	Decreased

4. Have you experienced any changes in crop quality in recent years?

1	Increased
2	Remained stable
3	Decreased

5. Is your income sufficient to act against climate change?

1	Quite sufficient
2	Sufficient
3	Neither sufficient nor insufficient
4	Insufficient
5	Rather insufficient

6. To what extent can you solve the problem by your own means?

1	Completely
2	To a large extent
3	I can neither solve nor unsolved
4	To a small extent
5	None

7. To what extent do you think the support/idea you take from people and/or agricultural institutions solves your problems?

1	Completely
2	To a large extent
3	It can neither solve nor leave them unsolved
4	To a small extent
5	None

8. To what extent do you find state support (state subsidy) sufficient?

1	Completely sufficient
2	Sufficient
3	Neither sufficient nor insufficient
4	Insufficient
5	Completely insufficient

9. To what extent do you find TARSİM* useful?

1	Very useful
2	Useful
3	Neither useful nor useless
4	Not much useful

5	Never useful

Likert Scale questions were converted into a scale where "100" corresponds the most vulnerable and "0" the least. The following accounted for the related questions:

Q1-Q2 (1=100) (2=80) (3=50) (4=20) (5=0)
Q3-Q4 (1=0) (2=50) (3=100)
Q5-Q6-Q7-Q8-Q9- (1=0) (2=20) (3=50) (4=20) (5=100)

Farmers non-enrolled in agricultural insurance pool (TARSİM)*- (dependent question on Q9) or who do not receive state subsidy (dependent question on Q8) were considered highly vulnerable and coded "100".

Based on the mean of 9 questions, Vulnerability Index was coded as follows: (0 thru 59.9=1) (60 thru 79.9=2) (80 thru 100=3**). 1= Less Vulnerable, 2= Vulnerable, 3= Highly vulnerable**

Methods applied to avoid sampling bias:

First, considering that most farmers in Turkey are of ageing population, low education level, mostly consisting of small-scale and medium-scale farmers, an oversampling technic was used so that farmers of higher education, larger scales and younger generations are not excluded from the sampling. Second, considering that the interviews at agricultural institutions such as the district directorate of agriculture and chambers of agriculture might exclude farmers who are not registered in Farmer Registration System-FRS (ÇKS in Turkish), random visits were paid to farms and subsistence or small farmers so that they are not excluded from the sampling. The only sampling bias might relate to the skewed emphasis on male farmers for the majority of participating farmers are male, e.g., cereal producers consisting of mostly male farmers. This likely sampling bias might be disregarded since gender-based evaluation does not constitute one core foci of this Chapter Nevertheless, the latter should not blind one to the likely invaluable findings that could emerge from such a gender-oriented approach since female farmers are disproportionately impacted climate change effects compared with men.

Both the survey interviews and additional interviews were administered by the author herself, approximately 85% of which conducted through face-to-face interviews and the remaining 15% via telephone or Zoom interviews.

Appendix 4.3: A Glance at Logistic Regression Model.

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in analysis	80	72.1
	Missing cases	31	27.9
	Total	111	100.0
Unselected Cases		0	.0
Total		111	100.0

a. If weight is in effect, see classification table for the total number of cases.

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	19.812	2	<.001
	Block	19.812	2	<.001
	Model	19.812	2	<.001

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	82.486[a]	.219	.304

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Chapter 5

ADAPTIVE CAPACITY OF AGRICULTURAL INSTITUTIONS TO CLIMATE CHANGE AND BARRIERS: A COMPARATIVE STUDY

Abstract

Institutional adaptive capacity plays a central role in agrarian populations' adaptation to climate change, specifically in planned adaptation. Despite its pivotal importance, research concerning institutional adaptive capacity often focuses primarily on formal institutions. At the same time, studies related to climate change adaptation (CCA) in agriculture typically concentrate on adaptation at the farm level. With these two lines of research often operating independently, this Chapter aims to bridge the gap between them, with *two* specific objectives in mind. *Firstly,* it evaluates the adaptive capacity of formal agricultural institutions across three distinct regions of Turkey at two levels: first, the adaptive capacity of these institutions internally, and second, their capacity to enhance farmers' adaptive capabilities. *Secondly*, it identifies the most significant barriers to institutional adaptive capacity at both levels. Key regional differences in selected three research sites are central to its foci. Major findings indicate that: a) Institutional constraints, primarily stemming from path dependency and the centralized concentration of specific capacities, represent the most overarching barrier to the adaptive capacity; b) Significant barriers include a lack of financial and other resources, insufficient training and expertise in climate change adaptation, farmers' mistrust in experts/officials at agricultural institutions, limited integration of technology, and a lack of coordination, respectively. The study primarily draws on 48 survey questionnaires and 29 semi-structured in-depth interviews with experts/officials from meso-level agricultural institutions, along with an analysis of key plans and developments within this context.

Keywords: Climate change adaptation, adaptive capacity, institutional adaptation, formal institutions, barriers, agriculture.

5.1 Introduction

Formal institutions prove to play one of the most critical roles in shaping the adaptive capacity of rural communities (Agrawal, 2008; Rodima-Taylor et al., 2012; Chen et al., 2014; Raymond & Robinson, 2013; Islam & Nursey-Bray, 2017; Mubaya & Mafogonya, 2017; Khan et al., 2020; Karimi et al., 2021; Cohen-Salgado et al., 2021 Khan et al., 2021; Adom et al., 2023). Their roles are critical to planned adaptation (Islam & Nursey-Bray, 2017). In broad terms, institutions are humanly devised constraints that structure social, political, and economic interaction (North, 1991). Of a narrower focus, they can be defined as blueprints that manage the regular, patterned relationships among role occupants in organizations (Portes, 2010).

Institutions can comprise informal ones, including traditions, customs, and codes of conduct, and formal ones, such as laws, constitutions, and property rights (North, 1991). From a similarly broad perspective, *adaptive capacity* pertains to the capability of systems, institutions, humans, and other organisms to cope with likely harms, take advantage of opportunities, or deal with consequences (Intergovernmental Panel on Climate Change -IPCC, 2014). Concerning climate change adaptation (CCA) in agriculture, one can consider state policies, plans, and governmental and non-governmental organizations as formal institutions, while socially and culturally shared norms guiding the implementation of adaptation could fall into informal institutions.

Formal institutions -including public, private, and civic- impact adaptation and climate vulnerability in three significant ways. They might either exacerbate or alleviate the impacts of climate change on individuals and communities; mediate between individual and collective reactions to climate effects, thereby influencing the results of adaptation efforts; and serve as the conduits for providing external resources to enhance adaptation, thus governing the availability of resources (Agrawal, 2008, p. 3). To what extent such formal institutions increase or decrease the adaptive capacity of rural populations, including farmers, is profoundly contextual and intertwined with temporal and spatial features (Yaro et al., 2015). This, in turn, highlights the reality that adaptation to climate change is also a local process (Agrawal, 2008, p. 3). Accordingly, decentralizing adaptation programmes to local-level institutions can enhance climate change adaptation by strengthening latent institutions. (Stock et al., 2017).

Depending on such dynamics, existing formal institutions can positively contribute to the adaptive capacity of rural populations (Karimi et al., 2021; Chen et al., 2014; Islam &

Nursey-Bray, 2017) to the extent they might negatively impact their adaptation processes (Dixon & Challinor, 2014; Ghorbani et al., 2024). At this point, barriers to the institutional adaptive capacity appear as one of the most significant factors inhibiting effective climate change adaptation (Mandryk et al., 2015; Phuong et al., 2018; Karimi et al., 2021; Sibiya et al., 2023). Despite the critical role formal institutions play in climate change adaptation among agrarian populations, the predominant line of research still consists of farm-level empirical studies (Mubaya & Mafongoya, 2017; Khan et al., 2021).

In light of such inclinations, this Chapter centres on the role and adaptive capacity of agricultural institutions in three different regions of Turkey, a country experiencing various effects of climate change. Such climatic changes involve sudden-onset events such as hail, frost, flooding, and more gradual effects, including drought, seasonal shifts, changing precipitation regimes, and land salinization. On the one hand, Turkey has experienced substantial expansion in renewable sources over the past decade, particularly in solar, wind, and geothermal energy, resulting in renewable energy generation nearly tripling (International Energy Agency -IEA, 2021). On the other hand, it has become increasingly reliant on fossil fuels, leading to heated discussions about its stance on global climate efforts, as frequently observed in nations with escalating energy intensity (Şahin, 2016, 2018; Altaeb, 2021).

As elaborated in Chapter 2, similar to many other developing countries being party to the United Nations Framework Convention on Climate Change (UNFCCC) and its associated agreements, Turkey has prepared a series of institutional plans, programs and policies that address climate change effects in general and specific to agriculture. These include, to name but a few, Climate Change Adaptation Strategy and Action Plan (2011-2023) dated 2011, Agricultural Insurance Law dated 2005; Basin Based Support Model within the context of National Agricultural Project dated 2017; National Agricultural Drought Strategy and Action Plan (2013-2017), Strategy and Action Plan for Combatting Agricultural Drought (2023-2027) and so on.[30]

Among these, as highlighted in Chapter 2, Turkey's NAP (Climate Change Adaptation Strategy and Action Plan) constitutes the early basis of direct attention to CCA in agriculture. The plan divides climate change adaptation into five (thematic) vulnerability areas/fields. These consist of a) management of water resources, b) agricultural sector and food security, c) 'natural' disaster risk management, d) ecosystem services, biodiversity,

[30] See the more comprehensive list in this context in Table 2.1 within the Background Chapter (Chapter 2).

and forestry, and e) Public health (The Ministry of Environment, Urbanization and Climate Change, 2011, p. 30). In brief, the NAP associates adaptation to climate change in agriculture with water resources management, food security, disaster management, and ecosystem services.

The purpose of this Chapter is two-fold. *First*, it examines institutional adaptive capacity at two tiers. The first tier concerns meso-level agricultural institutions' adaptive capacity, based on the adapted version of the seven-indicator-based approach adopted by Khan et al. (2020). These institutions include district and provincial directorates of agriculture, chambers of agriculture, agricultural cooperatives, irrigation associations (IAs), and seed-fertilizer-pesticide companies. The second tier concerns the adaptive capacity of such agricultural institutions in increasing farmers' resilience.

Second, it focuses on the main barriers to institutional adaptive capacity. In doing so, it highlights vital regional similarities and differences all along. The Chapter consists of six sections. The second section elaborates on studies that focus on the role and adaptive capacity of formal institutions in CCA among rural communities. The third section glances at research zones, while the fourth dwells upon the main research approach and methods employed. The fifth one presents the main results, while the last section synthesizes key results with suggestions for further research and policymaking.

5.2 Background: Literature Review

Formal institutions such as state policies, plans, and organizations have wide-ranging positive implications for the adaptive capacity of rural populations. In this direction, they can positively contribute to learning and innovation (Karimi et al., 2021). Similarly, they can enhance adaptive capacity through the provision of technology, equipment, training, and advice, changing cropping patterns, and motivational and awareness-raising activities for farmers, as exemplified by Islam & Nursey-Bray (2017), who focus on the effectiveness of such institutions in climate change adaptation in Bangladesh's agriculture.

Likewise, as shown by Chen et al. (2014), who focus on six provinces in China, governmental backing in the form of issuing early cautionary notices regarding droughts and providing aid after disasters, has the potential to greatly improve farmers' capacity to adjust to drought conditions. Despite such positive effects, sometimes, it might be formal institutions themselves that decrease this very adaptive capacity (Dixon & Challinor, 2014; Ghorbani et al., 2024). More simply, such institutions might be inadequately equipped to aid farmers in their adaptation processes (Stock et al., 2017). Alternatively, due to project-based, short-term technology fixes acting primarily in a top-down manner, the effectiveness of formal institutions may be limited (Islam & Nursey-Bray, 2017; Upton, 2012).

Institutional barriers tend to constitute one of the primary hindrances to climate change adaptation in this context (Lebel et al., 2011; Upton, 2012; Biesbroek et al., 2013; Islam & Nursey-Bray, 2017; Karimi et al., 2021; Phuong et al., 2018; Khan et al., 2021; Sibiya et al., 2023; Ghorbani et al., 2024). Albeit largely context-specific and difficult to separate from each other, the most common barriers or constraints tend to be poor financial resources (Dany et al., 2015; Phuong et al., 2018; Khan et al., 2020; Khan et al., 2021; Sibiya et al., 2023; Adom et al., 2023; Ghorbani et al., 2024); lack of human capacity and resources (Khan et al., 2020; Karimi et al., 2021; Sibiya et al., 2023; Ghorbani et al., 2024), and lack of coordination among sectors or departments (Phuong et al., 2018; Khan et al., 2021; Ghorbani et al., 2024; Sibiya et al., 2023; Adom et al., 2023).

These are followed by a lack of engagement between formal institutions and communities of practice (Islam & Nursey-Bray, 2017; Raymond & Robinson, 2013; Gupta et al., 2015) and a lack of knowledge or training about climate change and adaptation (Khan et al., 2021; Sibiya et al., 2023; Ghorbani et al., 2024). Contrasting interests of different actors (Mandryk et al., 2015; Ghorbani et al., 2024) and other weak governance issues stand as another highlighted constraint (Dany et al., 2015; Khan et al., 2021).

As a distinct form of institutional barriers, *institutional traps*, which refer to *inefficient yet stable norms of behaviour* (Polterovich, 2008), decrease the resilience of institutions, and thus, rural communities. Such institutional traps, not mutually exclusive, include a focus on a singular level or centralized accumulation of capabilities (scale), inflexibility, institutional path dependency, dominance of agendas by technical experts, fragmentation within organizations, and excessive reliance on reactive crisis handling (Lebel et al., 2011; Gupta et al., 2016; Islam & Nursey-Bray, 2017). For instance, top-down policies might create institutional path dependency, not being able to respond to new needs or opportunities, as underscored by Gupta et al. (2016), who assessed the adaptive capacity of informal and formal institutions in four sectors in the Netherlands (water, agriculture, spatial planning, and nature). Likewise, the mismatch within the realm of formal and informal institutions might be another reason leading to institutional traps, as exemplified by Mdee & Harrison (2019), who, concentrating on sub-Saharan Africa, showcase how the complexity of on-ground practices of farmer-led irrigation practices surpasses the capability of existing institutions.

Moreover, under specific contexts, the provision of poor economic infrastructure or discriminatory relief efforts for the poor by local institutions in the face of climatic changes might even lead to maladaptation (Yaro et al., 2015).[31] Institutional weakness, capacity constraints, and the underlying causes behind these emerge as key concerns in ensuring effective climate change governance (Adom et al., 2023). Thus, it would not be wrong to state that institutional adaptive capacity and barriers to this very capacity thoroughly depend on such factors inasmuch as the impacts of climatic and environmental changes (Ghorbani et al., 2024).

5.3 Research Zones

This research was carried out in three towns from three different regions of Turkey. As highlighted in Figure 5.1 in red circles, these zones are Afyonkarahisar-Şuhut from the Inner Aegean Region of Turkey, -hereinafter referred to Region A-, Mersin-Erdemli, from the Mediterranean Region, -hereinafter Region B- and lastly, Şanlıurfa-Eyyübiye, from Southeastern Region of the country, Region C henceforth. The main selection criteria reside in the fact that the regions under analysis are prone to various consequences of climate change and agriculture in each constitutes one of the primary sources of livelihood.

In Region A, agriculture mainly relies on cereal cultivation, specifically wheat and barley, and cash crops like potato and opium poppy (Şuhut-District Directorate of Agriculture, 2022). In Region B, farmers predominantly grow high-profit export crops, citrus fruits, particularly lemon, and fresh fruits, and vegetables, mainly cultivated in greenhouses (Erdemli-District Directorate of Agriculture, 2022). The agriculture in Region C heavily depends on cash crops such as cotton, corn, and red lentils alongside cereals like wheat and barley (Şanlıurfa-Provincial Directorate of Agriculture, 2022). While such climate change effects as shifting seasons, drought, changes in precipitation regime, and frost are commonly perceived by farmers in each analysed region, some

[31] Maladaptation broadly refers to the present or future adverse effects resulting from adaptation efforts that worsen or alter the susceptibility or exposure of a system, sector, or population group (Barnett & O'Neill, 2010). For further insights, please see Chapter 3.

climate change effects are more experienced by farmers in particular regions, e.g., an increase in soil salinization by farmers in Region C; storm by farmers in Region B, frost by those in Region A (Gören, 2024).

Figure 5.12: Map of Turkey (Nations Online Project).

5.4 Approach and Methodology

This Chapter is mainly based on the adapted version of the seven-indicator approach developed by Khan et al. (2020), who focus on public institutions' capacities concerning climate change adaptation in agriculture in Pakistan’s Punjab Province. Such indicators include perception and knowledge, training and expertise, human resources, plans and priorities, coordination and collaboration, financial resources, and physical resources. This approach is complemented by *institutional traps* literature (e.g., Lebel et al., 2011; Gupta et al., 2016; Islam & Nursey-Bray, 2017; Mdee & Harrison, 2019).

The Chapter primarily utilizes purposive sampling. Pilot studies conducted from late 2020 to 2021 provide the initial phase of the sampling process in determining formal institutions on which farmers tend to rely to adapt to these effects. Such initial studies include on-site farm visits and telephone interviews with key informants from agricultural institutions. Since one of the primary purposes is to collect data from experts/officials who are directly in contact with farmers, the following experts from the following institutions were purposively selected: Agricultural engineers, environmental engineers, and agricultural technicians from the district and provincial directorates of agriculture, chambers of agriculture, agricultural cooperatives, irrigation associations (IAs), and seed-fertilizer-pesticide companies (Table 5.1). In total, 48 online survey questionnaires and 29 semi-structured in-depth interviews from among the surveyed people were conducted with experts and officials from these institutions from 2021-2023 (Table 5.1).[32] In line with pilot study and other preliminary inclinations, the adapted version of the above-mentioned seven-indicator approach included the following components regarding climate adaptation: perception and knowledge, financial and other resources (human), training and expertise, coordination and collaboration, technological integration, and farmers' trust in experts/officials.

Table 5.1: Distribution of surveys and interviews.[33]

PUBLIC				**CIVIC**				**PRIVATE**	
District Directorate of Agriculture		**Provincial Directorate of Agriculture**		**Chambers of Agriculture**		**Cooperatives & IAs**		**Seed-fertilizer-pesticide sellers**	
Survey interviews	Key informant interviews	Survey interviews	Key informant interviews	Survey interviews	Key informant interviews	Survey interviews	Key informant interviews	Survey interviews	Key informant interviews
12	7	8	5	8	5	8	5	12	7
The number of online survey questionnaires in total**: 48** The number of key informant interviews in total: **29** Time interval for all interviews: **2021-2023**									

This Chapter analyses the collected survey data through descriptive statistics, primarily

[32] This research was conducted following the approval of the Ethics Committee of the related university, with Decree No. 2021.350.IRB3.152, dated 23.09. 2021. The Ethics Committee Approval document could be submitted upon request. Congruently, all participants provided verbal consent; written consent was provided where necessary.
[33] This table covers only key informant interviews that are common to each region. Depending on fieldwork dynamics, additional interviews were conducted with people from municipalities in Regions B and C alongside people from a university in Region C. Besides, whenever feasible, semi-structured in-depth interviews were conducted with heads of the related formal institutions.

percentages, and semi-structured in-depth interviews through qualitative analysis. The analysis is performed via IBM SPSS Statistics (Version 24), while semi-structured in-depth interviews for more probing questions are coded and analysed via Maxqda Plus 2020 version. The coding system assigned *E* followed by numbers to experts or officials from agricultural institutions (e.g., E1, E2, E3…); *R* to regions followed by A-B-C (e.g., RA-RB-RC). Furthermore, to ensure the anonymity of expert respondents, they are categorized as public, civic, or private.

In contrast to the predominant approach in research, which primarily focuses on analysing the adaptive capacity of formal institutions within their structures, this Chapter offers a dual evaluation. It examines institutions' internal adaptive capacity and their endeavours to enhance farmers' resilience against the impacts of climate change.

5.5 Results and Discussion

In line with the main research questions, this section first highlights the internal adaptive capacity of agricultural institutions, with an emphasis on the main barriers to it. Then, it turns its focus to the adaptive capacity of these institutions in promoting farmers' resilience in the face of climate change effects.

5.5.1 Adaptive Capacity within Agricultural Institutions and Associated Barriers

This section looks at the internal adaptive capacity of formal agricultural institutions based on the adapted version of the seven-indicator approach by Khan et al. (2020), which includes the following components regarding climate adaptation: perception and knowledge, financial and other resources (human), training and expertise, coordination and collaboration, technological integration, and farmers' trust in experts/officials. Prior to this, it is valuable to consider certain developments at a larger scale (city level), both respective and irrespective of agriculture, which may have repercussions on the internal adaptive capacity.

While all analysed regions are in the initial phases of forming institutional frameworks for climate action, Regions B and C are, to some extent, in a better position than Region A. It is because Regions B and C have established some departments at the metropolitan municipality level that directly focus on climate action, such as the Directorate of Climate Change and Zero Waste. The existence of externally funded projects on climate action in Regions B and C might underlie the relatively better-off position of these regions in terms of raising awareness about climate change impacts. For instance, experts in Region B highlighted the key role existing EU-funded projects targeting climate action (such as pilot studies to raise awareness among children about climate change) might play for Region B.

Additionally, Region C has been among the few cities (along with İzmir) in Turkey to receive some of the first planned attempts by the Ministry of Agriculture and Forestry (MAF) regarding climate change adaptation. For instance, workshops addressing climate change, drought, and agriculture, as well as smaller-scale initiatives to raise awareness about climate change, comprise the primary activities concerning climate change adaptation (MAF, 2021). Additionally, partly due to the Southeastern Anatolia Project (GAP), Region C has been home to certain pilot research and development (R&D) activities, including the operation of the Agricultural Monitoring and Information System (TARBİL) project in 2008, one of the main purposes of which is to monitor climate change and drought through the establishment of agricultural and meteorological stations. Such developments at a larger scale may have either a direct or indirect impact on the internal adaptive capacity of the related institutions, as discussed in the rest of this section.

As depicted in Figure 5.2, the overall findings indicate that nearly 55% of the surveyed respondents from relevant institutions possess a high or very high level of awareness and understanding regarding climate change impacts on agriculture. Meanwhile, 36% of respondents demonstrate a moderate level of knowledge.

Regional patterns exhibit similar outcomes overall, with some distinctions noted, particularly within Region C. In contrast to Regions A and B, Region C displays a lower proportion of individuals with *high* levels of knowledge, while those with *low*, *very low* and *very high* levels of knowledge are relatively higher. This divergence, as supported by in-depth interviews, suggests potentially more pronounced differences in knowledge among various agricultural institutions within Region C compared to the other two regions. It is partly because certain experts and officials at agricultural institutions, such as District and Provincial Directorates of Agriculture in Region C, have demonstrated a heightened level of involvement in understanding the impacts of climate change on agriculture (*very high*). In contrast, others within IAs and cooperatives have exhibited lower awareness or interest (*low* and *very low*). *Inter alia*, one can attribute this inclination to a better engagement between experts at district and provincial directorates of agriculture and Harran University regarding the effects of climate change in Region C. Another likely reason is the inclination among irrigation associations to view the effects of climate change as secondary to more structural problems in the same region, an issue that will be discussed in the upcoming sections.

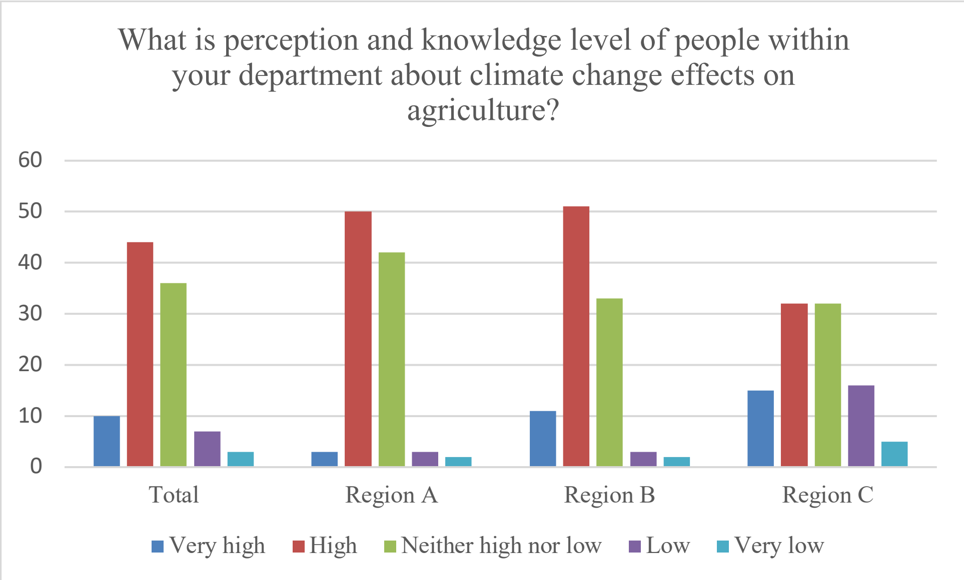

Figure 5.13: Perception and knowledge levels of experts/officials at agricultural institutions.

Inquiring about the most critical factors that impact the adaptive capacity of formal institutions, the general trend suggests that a shortage of financial resources and other means stands out as the most substantial, accounting for 40% of all those surveyed (Figure 5.3). This inclination complies with majority of research suggesting a lack of financial resources (Dany et al., 2015; Phuong et al., 2018; Khan et al., 2020; Khan et al., 2021; Sibiya et al., 2023; Adom et al., 2023; Ghorbani et al. 2024) and lack of human capacity and resources (Khan et al., 2020; Karimi et al., 2021; Sibiya et al., 2023; Ghorbani et al., 2024) as most important reasons decreasing their adaptive capacity. This prevailing trend is also aptly reflected in the examples provided by experts, as outlined below:

> Due to insufficient staff and equipment, we are unable to conduct field visits anymore. Previously, we would visit fields and physically demonstrate farming techniques to farmers. However, now we are overwhelmed with paperwork.

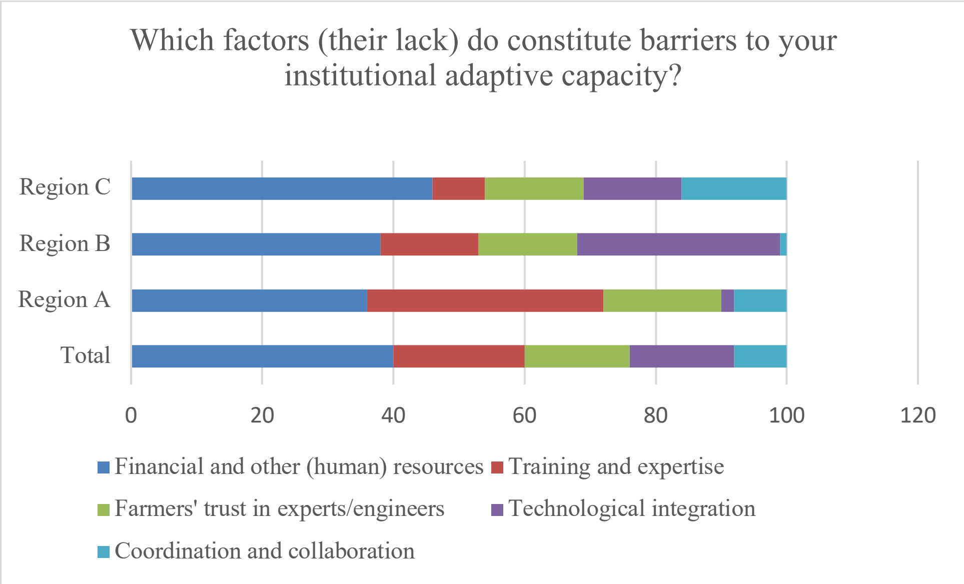

Figure 5.3: Most important factors/barriers to institutional adaptive capacity as highlighted by experts/officers.

Moreover, a notable trend, accounting for 20% of 48 people, highlights that inadequate training and expertise on climate change adaptation within relevant institutions is the second most significant barrier to their adaptive capacity. When juxtaposed with respondents' assessments of their perception and knowledge levels, which are relatively higher, it becomes more apparent that there is a disparity between their perceived level of understanding and actual expertise in climate change adaptation within the agricultural sector. This finding also resonates with the findings of Khan et al. (2021) and Sibiya et al. (2023), who highlight a lack of knowledge or training about climate change and adaptation as key significant barriers to the adaptive capacity in Pakistan and South Africa, respectively.

Equally noteworthy is the observation that among 48 respondents, the least attributed factor hindering successful climate change adaptation, accounting for 8%, is insufficient coordination among departments and other institutions. It essentially contradicts the typical trend observed in the literature, revealing a lack of coordination among departments and sectors as one of the most crucial constraints of adaptive capacity, including countries of Vietnam, Pakistan, and Iran (Phuong et al., 2018; Khan et al., 2021; Ghorbani et al., 2024; Sibiya et al., 2023; Adom et al., 2023). Described by Agrawal (2008, p. 23) as *institutional articulation*, which pertains to the interconnections and cooperation among institutions, it forms a crucial aspect of comprehending the adaptation process, particularly in situations involving conflicts among stakeholders. It is because adaptation capacity is not solely confined to individual organizations but depends on the diverse institutional connections and collaborative engagements they establish with other actors within the system (Robinson & Berkes, 2011).

However, the noted trend, indicating a lesser emphasis on coordination, might not necessarily imply a high level of institutional articulation among departments and agricultural institutions in three examined regions, for approximately 40 ministries and agencies could be counted if one juxtaposes the issue of climate change and agriculture (The Ministry of Environment, Urbanization and Climate Change, 2011). In this case, the extent of deficiency in factors such as financial resources and climate expertise probably outweighs the significance of coordination. Alternatively, since CCA is at an early stage of formation in the analysed regions, respondents might not have fully recognized the importance or lack of coordination as such. The heightened attention given to this factor by respondents from Region C might indirectly confirm this likelihood. This is because, in the latter region, the number of institutions and agencies responsible for managing water resources is much higher compared to two other regions, mainly due to the infrastructural development project- the Southeastern Anatolia Project (GAP)-, as detailed in Chapter 3.

Other regional distinctions concerning the most critical factors/barriers to institutional adaptive capacity involve higher proportions of respondents highlighting the lack of training and expertise in Region A (at 36%) and higher rates of individuals selecting the lack of integration into technology in Region B (at 31%) compared to the other regions. The former trend could be attributed to the lack of specific units or personnel responsible for climate action in Region A. The latter trend in Region B might indirectly suggest a need for increased technology integration between agricultural institutions and farmers, who are primarily engaged in greenhouse cultivation, which necessitates more technological materials and equipment.

5.5.2 Institutional Traps as Overarching Barriers to the Adaptive Capacity

Institutional traps, which can overlap, encompass various dimensions, including centralization of power at a single level, inflexibility, institutional path dependency, domination of agendas by technical experts, and fragmentation of organizations (Lebel et al., 2011; Gupta et al., 2016; Islam & Nursey-Bray, 2017). This study identifies two primary institutional traps, which will be the focus of this section.

The first one arises from the recentralization of irrigation associations (IAs), particularly notable in Region C and, to some extent, Regions A and B. The re-centralization of IAs is attributed to several systemic inefficiencies, including excessive water usage, low irrigation efficiency, administrative corruption, and disparities in the administrative and technical operations of IAs, such as water distribution. (Kibaroğlu, 2019).[34] Many participants expressed discontent with the centralization of IAs, highlighting their longstanding structural issues. Additionally, statements such as *We can address drought and other climate-related issues only once management issues are resolved*! encapsulate the sentiment expressed in subsequent comments:

> Irrigation Association is key to water distribution… A trustee was appointed by the central government. We want associations to belong to farmers. We need more support from the state to maintain and repair old infrastructure because farmers often experience unexpected bursts of irrigation pipes in the Harran Plain.
>
> E2-RC-Civic

As indicated in these remarks, the centralized concentration of certain capabilities resulting in a misalignment between formal and informal institutions represents one of the main institutional traps (Lebel et al., 2011; Mdee & Harrison, 2019). This is basically the issue of scale, where the recentralization of IAs might leave little room for local autonomy (Lebel, 2011). In other words, the disparity between farmers' desire for decentralized IAs and the reality of increased centralization could create a dilemma for the adaptive capacity of agricultural institutions. Without farmers' consent, climate policies and plans may struggle to gain acceptance among farmers and fail to induce behavioural changes in support of climate action.

Similarly, certain limitations in monitoring mechanisms, especially within public

[34] Operation and maintenance for irrigation systems in Turkey, which had been largely centralized up until the 1980s, were transferred to irrigation associations (IAs), particularly since 1993, with the advice of the World Bank (Global Water Partnership) as part of other privatization attempts. With many positive developments, such as an increase in the recovery rate of irrigation systems and overcoming the problem of collecting irrigation fees, the need for appropriate legal reform has caused some problems regarding their management. With the Irrigation Association Law numbered 6172 and dated 2011, they were legally recognized as decentralized bodies reporting to DSİ (General Directorate of State Hydraulic Works) and being responsible for the operation, management, maintenance, and repair of the systems (Kibaroğlu, 2019). For some reasons mentioned above, the government introduced an amendment to the IAs law in 2018, which put IAs under close control by trustees suggested by DSİ and appointed by the Ministry of Agriculture and Forestry (Kibaroğlu, 2019).

agricultural institutions, contribute to another *institutional trap* in the form of institutional path dependency, where earlier initiatives impede adaptive capacity. For instance, Basin Based Support Model within the context of the National Agricultural Project dated 2017 and initiated by MAF[35] has brought about certain restrictions and support mechanisms for encouraging climate- and nature-friendly crops. These include state subsidies conditional on crop rotation, heightened subsidies for water-efficient crops, and drip irrigation mandates for water-intensive crops such as corn in water-stressed areas (National Agricultural Project- Basin-based Support Model). Farmer Registration System (FRS) which emerged in the early 2000s with the Agricultural Reform Implementation Project (ARIP) in an attempt to adapt to the EU's Common Agricultural Policy (CAP), constitutes the main monitoring mechanism towards this end. It requires farmers to report what they produce yearly to receive state subsidies depending on crop type. However, in practice, farmers might misreport what they produce to receive more subsidy, as expressed by one of the participants below:

> … For instance, they plant potatoes but might report them as wheat because state subsidies for the latter for 2021 were higher. So, we cannot thoroughly monitor through FRS what farmers exactly produce. The precision of FRS is about 60-70%. It is more complicated with inheritance issues since farmlands are increasingly becoming fragmented and the landowner is unidentifiable.

E3-RA-Public

Such constraints deriving from the operation of FRS also lead to misfunctioning in Agricultural Insurance Pool (TARSİM), particularly in Village-based Drought Yield Insurance,[36] as shown below:

> To benefit from Village-based Drought Yield Insurance, farmers must engage in rainfed agriculture, in non-irrigated areas, and their registration in FRS needs to be updated. But because they can get higher credits for irrigated lands from Agricultural Bank (*Ziraat Bankası* in Turkish) they might report it as if they operated over irrigated lands.

[35] The name of the ministry then was the Ministry of Food, Agriculture and Livestock.

[36] In Village-based Drought Yield Insurance compensation calculations, the difference between the village's actual yield average and the village's threshold yield value is taken into account. If the actual yield average for the relevant year falls below the village's threshold yield value, all insured producers in the village are entitled to receive compensation (TARSİM website).

In brief, the current functioning of crucial mechanisms like FRS could impede the successful implementation of a new climate policy, as exemplified by the Basin-based Support Model and the operation of TARSİM. This situation fosters an institutional path dependency, preventing current structures from responding to emerging needs or opportunities (Gupta et al., 2016), envisioned by the relevant ministry with specific adaptation plans.

5.5.3 Adaptive Capacity of Agricultural Institutions in Increasing Farmers' Resilience to Climate Change and Main Barriers

Drawing from Figure 5.4,[37] this section examines primary adaptation measures agricultural institutions propose for farmers across two main categories. It highlights significant regional variations where applicable and identifies probable barriers to adaptive capacity. The two categories align with the IPCC's classification: *planned/structural* adaptation options, encompassing measures related to built-in environment, technology, and ecosystem-based approaches, and *social options*, which involve behavioural, informational, and educational adaptation measures. It is worth noting that these categories are not mutually exclusive (IPCC, 2014; Gören, 2022).

[37]The list comprises the most highlighted adaptation strategies to climate change in the existing literature and the analysed Turkish documents. The latter includes related national adaptation plans, drought and disaster risk management plans, R&D activities, and basin-based support models.

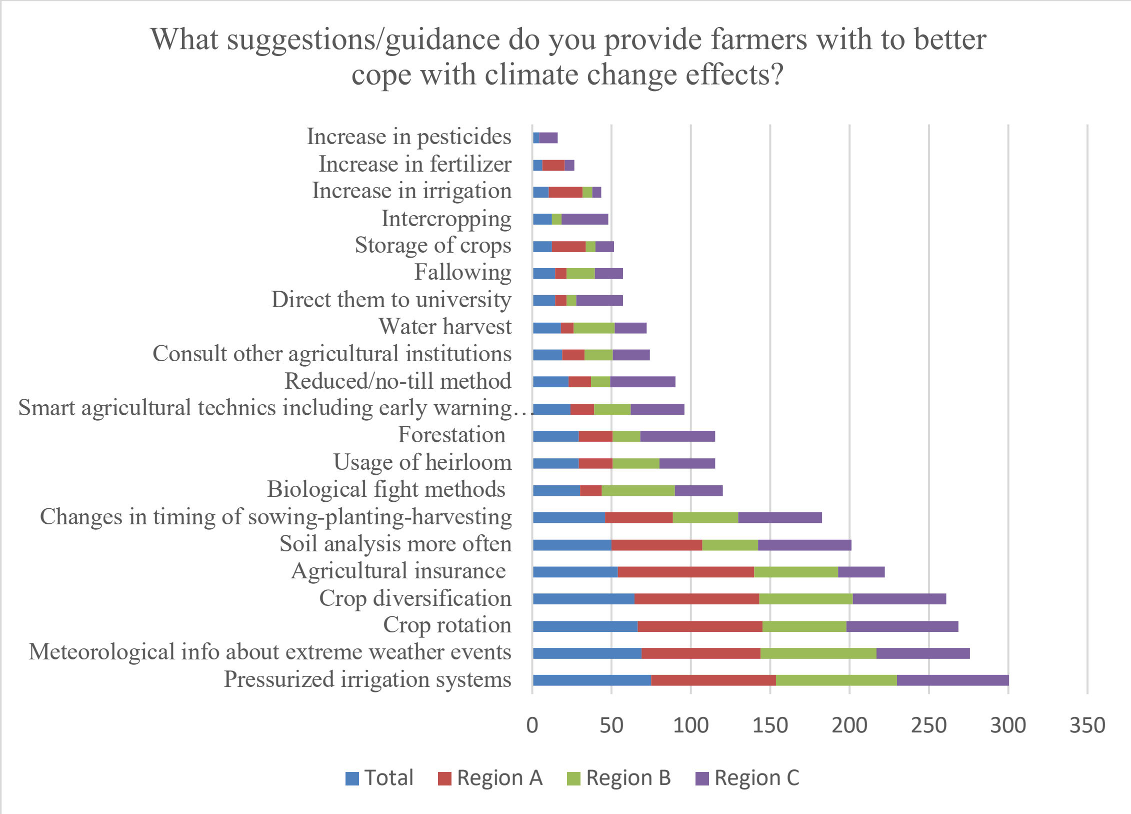

Figure 5.14: Most widely suggested adaptation strategies by experts/officials.

Within the first cluster of adaptation strategies (*planned/structural*), agricultural institutions predominantly advocate for pressurized irrigation systems (such as sprinkler or drip irrigation), accounting for 75% of recommendations. This observation holds considerable significance, as formal institutions across all regions prioritize this structured adaptation measure, recognized for its sustainability benefits and contribution to soil health, economic efficiency, and environmental well-being. Following closely behind is TARSİM, which emerges as the second most widely endorsed planned adaptation option by formal institutions, with a rate of 54% (affirming the findings of Chapter 3).

Regionally, respondents from Region A exhibit a higher propensity to involve farmers in this insurance mechanism, with a rate of 86%, whereas the rate decreases to 53% for Region B and 29% for Region C. Such inclination may be attributed, among other factors, to the observable organization and readiness of agricultural institutions in Region A for TARSİM. Additionally, the prevalence of drought and its associated implications, as well as occurrences of frost and hail, have been more pronounced in this region, given its location in the inner parts of Anatolia (Chapter 3).

Moreover, smart agricultural methods, including early warning systems and precision agriculture, are the primary recommended technological approach, with an overall rate of 24%. These efforts involve equipping farmlands with warning systems for soil moisture and crop health and employing precision agriculture techniques, such as automated machinery and robotics for planting and fertilization as well as unmanned aerial vehicles for agricultural spraying. Regionally, there is a slightly higher tendency among experts/officials in Region C, at 34%, to recommend such techniques as coping mechanisms for climate change effects, possibly due to close collaboration between Harran University and public agricultural institutions. This trend is reinforced by respondents in Region C, with a rate of 26% being more inclined to encourage farmers to consult universities when dealing with climate change impacts, compared to 7% in Region A and 6% in Region B (Figure 5.4).

Regarding *social adaptation options*, following meteorological information about extreme weather events like frost and hail is the most widely recommended option. This widespread attention may stem from the convenience of accessing information from the General Directorate of Meteorology via smartphones. Among behavioural methods, including autonomous adaptation techniques, crop rotation, and crop diversification are highlighted as key adaptation strategies by institutions. Region A and C emphasize these strategies more than Region B, likely due to the predominant cultivation of cereals and cash crops in the former two regions, while lemon trees and fresh fruits and vegetables grown in Region B render such techniques less effective.

Some behavioural or autonomous adaptation measures, which improve the sustainability of water and land resources, are less recommended, with the following rates: intercropping (13%), fallowing (15%), water harvesting (18%), and no-till or reduced till (23%), which largely agrees with the findings of chapter 3. This deficiency is significant for agriculture in the selected regions, as these adaptation options are globally recognized as highly impactful for climate change adaptation. (Coughenour, 2003; Dile et al., 2013).

Dissemination of Services and Main Barriers

Regarding agricultural institutions' dissemination of adaptation strategies (as depicted in Figure 5.5), nearly half (52%) encourage farmers to share information with others, while 41% organize training and awareness-raising activities. The latter include those on irrigation, fertilizer usage, seed varieties, livestock management, beekeeping, and desertification. Some awareness raising initiatives also focus on climate change adaptation in agriculture, a relatively recent addition to the agenda of these institutions in each region under analysis. These sporadic training activities include information sharing about agricultural drought with particular emphasis on declining underground and surface level waters (for Regions A, B, C); restrictions on opening new deep wells and extra sanctions on unauthorized deep wells (for Regions A and B); limitations on the usage of lake-pond water during summers (Regions A and B); water harvest (for Regions B and C).

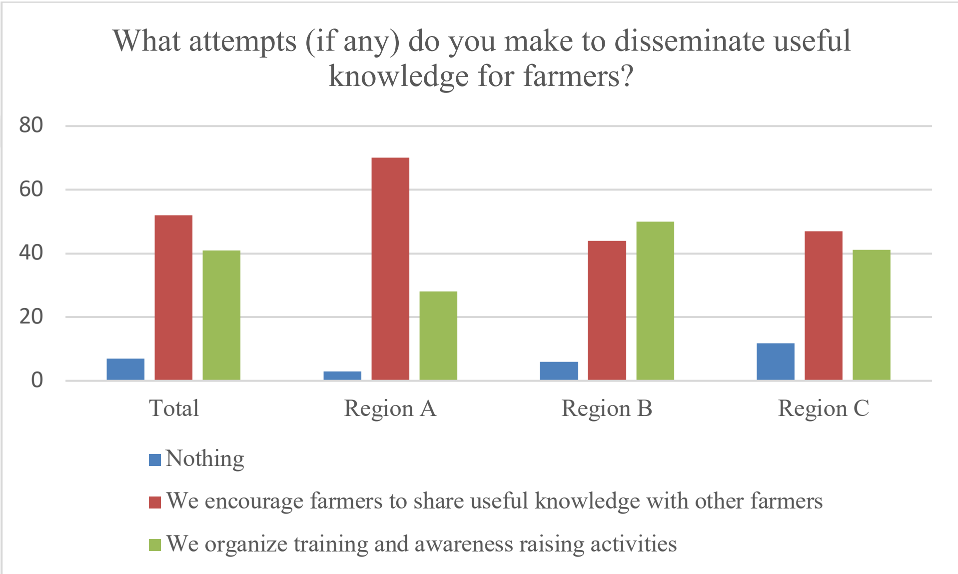

Figure 15.5: Institutional attempts to engage with farmers.

The general higher rate of respondents emphasizing the sharing of useful information among farmers, compared to that of more structured training and awareness activities (excluding Region B), suggests a necessity for more consistent and organized efforts to raise awareness about climate change and adaptation.

Furthermore, the lack of engagement between formal institutions and communities comprises a significant drawback for climate change adaptation (Islam & Nursey-Bray, 2017; Raymond & Robinson, 2013; Gupta et al., 2015). As one of the underlying causes, farmers' lack of trust in experts and institutions could be identified among the top three barriers to adaptive capacity, as highlighted in previous sections. This trend, widely noted during in-depth interviews, is also observed in other developing countries, e.g., a study conducted in India with similar objectives found few respondents expressing trust in governance institutions (Stock et al., 2017).

Another key finding that is closely linked to this is farmers' resistance to changing their behaviour. As depicted by Figure 5.6, there is a consensus among respondents across each region that a minimum of 40% of them experience resistance from farmers *very often* while at least 30% of them experience it *sometimes*. Ramifications of such resistance are observable in the following remarks as well:

> Our farmers are stubborn when adopting new methods or products. They do what they have seen from their antecedents or friends. There are many instances I have faced rejection when I recommended an equivalent product under a different brand for fungus, for example. They change their behaviour only if they see its benefits or hear from other farmers. But how can you see it without even trying once?

E5-RB-Private

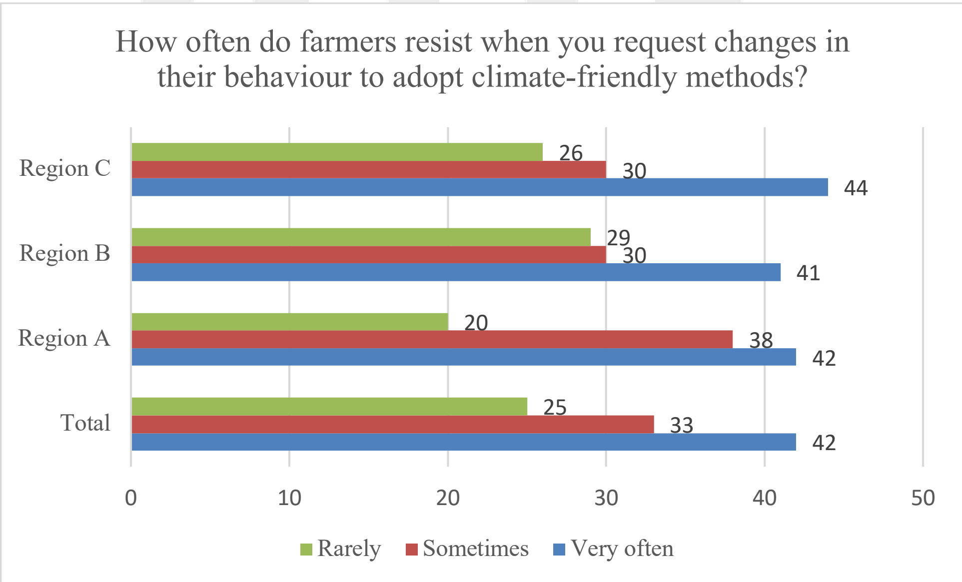

Figure 5.16: Frequency of farmers' resistance to change their behaviour.

In other words, farmers tend to rely more on their knowledge rather than expert knowledge. It raises the question of whether such traditional knowledge could be viewed as *mêtis*, denoting practical skills and knowledge rooted in local experience (Scott, 1998), or whether it aligns with the technical and standardized methods stemming from the principles of the Green Revolution. As the broader scope of this research also shows (Chapter 3), it tends to be the latter since the majority of farmers in many developing countries, including Turkey, India, Mexico, and Pakistan, have become more reliant on water-intensive plants, monocropping, pesticides, thus making them prone to unsustainable agricultural practices and thus climate change effects (Stock et al., 2017). Therefore, such institutional path dependency tends to be one of the primary root causes of farmers' reluctance to alter their behaviours.

Last but not least, since related organizations in analysed sites are mainly in the initial phase of integrating climate action into their agendas, most recommendations by related experts/officials also relate to the need for the co-formulation of general agricultural policies in tandem with climate action, as depicted below:

> Climate change presents one of the most significant challenges for agriculture. The state has a lot to do to alleviate these impacts on farmers. However, the impact of the ministry's (*Ministry of Agriculture and Forestry*) wrong policies competes with the effects of climate change. Climate change effects on agriculture should be included into policies that bring obligatory action by the ministry and all subsidies and sanctions should be arranged in line with this. - *emphasis added by the author.*

E6-RB-Private

5.6 Conclusion

Unlike most research dwelling upon the adaptive capacity of formal (agricultural) institutions, this Chapter has analysed institutional adaptive capacity at two levels: first, within institutions themselves, and second, in increasing farmers' adaptive capacity. It has also presented barriers to the institutional adaptive capacity, including institutional traps. Key regional differences between Region A Region B and Region C in this direction have been central to this Chapter.

While Turkish authorities have prepared central adaptation and other associated plans primarily relating to the management of water and land resources, drought, and disaster management, such plans face significant constraints in translating into measures at more regional or local governance levels. They are primarily at their early stages of formation or implementation, with certain attempts like training and awareness-raising activities remaining somewhat sporadic. Some exceptions emerging from this study relate to extending pressurized irrigation systems such as sprinkler and drip irrigation, sharing meteorological information, and widening TARSİM.

Regarding broader adaptive capacity of the analysed regions, this research has revealed Region C and B in a relatively better position compared to Region A since the former two have established more specific departments at the metropolitan municipality level directly addressing climate action, alongside more structured attempts made by the Ministry of Agriculture and Forestry including TARBİL and awareness raising activities in Region C. The collaboration between the university and public agricultural institutions in Region C has also enhanced this relatively better positionality.

Nevertheless, such a relative better positionality has rarely tended to translate into increased adaptive capacity at local levels. The primary common obstacles to implementing climate change adaptation policies and plans include inadequate financial and human resources to meet farmers' needs. Subsequently, challenges arise from insufficient professional training and expertise in climate change adaptation, farmers' mistrust of experts, limited technology integration, and inadequate coordination among departments and institutions.
The only aspect that the surveyed experts and officials have not observed as deficient, or constraining pertains to their knowledge and awareness levels regarding climate change.

Likewise, *institutional traps* tend to overarch such classified capability barriers to institutional adaptive capacity across each region under analysis. These barriers are exemplified by institutional path dependency, such as the failure of FRS to adapt to new climate policies and farmers' resistance to altering their unsustainable agricultural practices. Additionally, the centralization of certain capacities has created a discrepancy between informal and formal institutions, as seen in the centralization of IAs in Region C.

Concerning efforts by related institutions to enhance farmers’ resilience against climate change effects, agricultural institutions most widely promote pressurized irrigation systems, participation in TARSİM, and the adoption of small-scale smart agricultural techniques like early warning systems, precision agriculture including automated machinery and robotics for planting and fertilization alongside few cases of unmanned aerial vehicles for agricultural spraying. Recommendations about more social aspects of adaptation prioritize actions such as sharing meteorological information, implementing crop rotation, diversifying crops, and changes in sowing-planting-harvesting timing. However, despite their significance, sustainable adaptation options like intercropping, fallowing, water harvest, and reduced till/no-till often receive less attention (affirming the findings of Chapter 3). Consequently, there is a clear need for greater attention to be directed towards these overlooked methods by related formal institutions.

For effective and sustainable climate change adaptation (CCA) in agriculture of three analysed regions, it is necessary for policymaking first to consider constraints largely deriving from the above-mentioned institutional traps, such as path dependency and centralization of farmer led IAs. Addressing additional hurdles related to financial constraints, resource availability, training, expertise, coordination, and technological limitations should follow the resolution of these challenges. New policies and strategies aimed directly at climate change adaptation, such as those outlined in the Basin-based Support Model, are likely benefit most from building upon such a solid foundation. It is also crucial to consider common trends and significant variations across all three study areas. This underscores the importance of aligning plans and programs with the unique regional and local requirements of agricultural institutions alongside central-level initiatives.

Overall, as proposed by Lebel et al. (2011), the practical overcoming of existing obstacles and the development of robust climate policies require the integration of knowledge with practical application, the broadening of public engagement, the cultivation of adaptive capabilities across various levels, and the prioritization of vulnerable populations. For further research, it is advisable to undertake research centralizing on the comparative analysis of the adaptive capacity of public-private and civic institutions. This would yield invaluable insights into the evolving scope of institutional adaptive capacity. Furthermore, given that this study relies on general trends rather than statistically significant variances, conducting more comprehensive and large-scale research would provide further illumination on critical similarities and differences.

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Chapter 6

CONCLUSION

6.1 Restatement of Research Objectives

This dissertation sought an answer to *three* main research questions. The *first* one inquired about farmers' main adaptation strategies to climate change and where they sit in a successful adaptation and maladaptation continuum. The *second* primary question sought an answer to the role of *bonding* and *bridging-linking social capital* in differently situated farmers' adaptation practices and processes. The *third* one mainly examined formal agricultural institutions' adaptive capacity and the main barriers to this adaptive capacity. To provide a general ground for these three questions, it has examined Turkey's stance in the global arena of climate negotiations as well as its plans and programs concerning climate change adaptation (CCA) in agriculture. Consequently, it has shed light on Turkey's incremental adaptation to climate change in agriculture, by emphasizing the (mal)adaptive, relational, and institutional dynamics of it in the analysed research sites at micro-, meso-, and macro levels.

6.2 Summary of Findings

Before delving into specific original findings, one can summarize the overall argument of this dissertation as follows: Excluding certain promising institutional attempts and increasing adoption of some effective adaptation strategies like the adoption of modern irrigation systems and crop rotation, most of differently situated farmers in the analysed regions tend to be closer to the maladaptive end of a continuum between successful adaptation and maladaptation for numerous reasons. The latter include but are not limited to exacerbating climate change impacts, lack of adaptive capacities, path dependencies, partially effective social capital and formal agricultural institutions, and a lack of effective, sustainable, and inclusive climate policies.

Concerning more specific results leading to the above-mentioned general argument, this dissertation has revealed that, although Turkey is still in the initial phase of climate change adaptation both in general and specific to agriculture, it has made certain progress in terms of *soft adaptation* measures primarily referring to the preparation of institutional plans, programs, and capabilities. This dissertation has argued that Turkey's climate change adaptation plan (National Adaptation Plan-NAP) signifies an incremental process that builds upon existing legal and institutional frameworks, thus forming a continuation rather than a start from scratch process. However, translation of such soft adaptation tactics into more material, structured, and social ones faces significant constraints. Equally, it has disclosed how countrywide targets cannot find a ground to translate into more regional and local attempts in practice for manifold reasons.

Main constraints in this direction comprise both immediate and underlying more profound reasons such as lack of structured-planned interventions by the state; irreparable consequences of neoliberal transformation in agriculture; farmers' behavioural patterns and concerns for food security, not safety; lack of awareness and training regarding climate change (adaptation); farmers' long-years' dependence on agribusiness; inadvertent consequences of some large-scale developmental projects like the Southeastern Anatolia Project (GAP); unintended consequences of farmers' proximate ties (*bonding social capital*); farmers' weak ties (*bridging-linking social capital*) with public agricultural institutions; significant institutional barriers such as lack of financial and human resources and lack of expertise on climate change adaptation; institutional traps such as path dependency and central concentration of some capacities, alongside other challenges such as aging rural populations and climbing input prices.

It has come up with more specific results, which are discussed in the rest of this section. It has found that some climate change impacts such as seasonal shifts, drought, and changes in precipitation regime are common to each analysed region while some of them are more widely observed by farmers in certain regions, e.g., storms typically more by farmers in Region B (Mersin Erdemli), frost in Region A (Afyonkarahisar-Şuhut), and land salinization in Region C (Şanlıurfa-Eyybiye). Farmers' adaptation strategies proved not to be as variegated as the perceived climate change effects, however.

It has also revealed that most rural populations in the analysed three regions are close to the maladaptive end of the continuum between successful adaptation and maladaptation since they have drastically increased the usage of irrigation, pesticides, and chemical fertilizers. Interestingly and challenging existing research, it has found that such maladaptive tendencies manifest across many differently situated farmer groups, including small-, medium- and large-scale ones, as well as highly vulnerable and less vulnerable ones. The only notable differences relate to age, years of farming, educational attainment, and specific regional characteristics. Such findings have led to a refinement in one of my hypotheses (which read that farmers particularly in drought-prone areas might maladapt to climate change ***Hypothesis 3***), for such maladaptive tendencies were observable regardless of most analysed variables, including drought, sudden-onset events, and different characteristics of farmers from different classes.

Likewise, it attributed the leading causes behind such maladaptive inclinations to path dependency deriving from years-long dependence on industrial agriculture and the inadvertent consequences of the developmental project- Southeastern Anatolia Project (GAP), cemented by farmers' short-term behavioural responses. It has also underscored how autonomous adaptation measures tend to fail in the face of exacerbating effects of climate change -specifically sudden-onset events.

Furthermore, it has found a weak *social capital* overall in contributing to farmers' adaptation practices and processes for manifold reasons, which mainly comprise declining trust, reciprocity, and solidarity among rural populations. Despite a few sporadic solidarity examples farmers' *bonding social capital* provides, especially after sudden-onset events such as flooding and storms, it has disclosed limitations and pitfalls of *bonding social capital* in several respects. The latter includes confinement of bonding ties to information sharing and exchanging ideas. In contrast, more substantial means of support such ties provide, such as labour sharing and borrowing, remain very limited. Moreover, it has presented that agrarian populations' such proximate ties with other farmers, relatives, and neighbours tend to prevent them from seeking innovative or other means of adaptation, thereby approximating them to maladaptive behaviour (*supportive of the refined version of* **Hypothesis 3**).

As to *bridging-linking social capital*, this research has found that such a sub-type of social capital proves to be effective in solving farmers' climatic and non-climatic challenges as opposed to the insignificant role of the former capital type, *bonding social capital*. Thus, it has shown the critical role farmers' distant ties with agricultural institutions could play in their adaptation practices and processes. Nevertheless, farmers' *bridging-linking social capital* is not exempt from several significant constraints. The latter ranges from the limitations of the central role of bridging-linking social ties to provision of information, consultancy, and seed-fertilizer-pesticides. While information or consultancy might be a significant benefit provided by *bridging-linking social capital* provides in general, a limitation in this context is the partial effectiveness of such information in addressing the exacerbating impacts of climatic and non-climatic challenges. Likewise, more disadvantaged farmers tend to have more bonding ties, while relatively better-off ones have more bridging-linking ties.

Overall, such findings affirm one of my hypotheses which argued that social capital is likely to provide only a short-term or unsustainable means of adaptation behaviour, especially for smallholders and the poor due to their limited access to bridging and linking ties (***Hypothesis 1a***). Nevertheless, it disaffirms another related hypothesis that *bonding social capital* provides significant short-term and reactive responses to sudden onset events such as storms and floods (***Hypothesis 1***), since the role of such bonding ties tend to be restricted with few sporadic solidarity examples (such as emotional support and labour sharing after rapid-onset events) in three analysed regions. What is more, bonding ties in the long run tend to approximate farmers to the maladaptive end of the continuum (*supportive of the refined version of* ***Hypothesis 3****)*.

Likewise, as a continuation of the role of *bridging-linking social capital*, it has shifted its focus to the role and adaptive capacity of agricultural formal institutions such as district and provincial directorates of agriculture, chambers of agriculture, cooperatives, irrigation associations (IAs) and seed-fertilizer-pesticide companies, alongside main barriers to this adaptive capacity. It has revealed that while Turkey has made a progress in preparation of central adaptation and other associated plans primarily relating to the management of water and land resources, drought, and disaster management, such plans face significant challenges in transforming into attempts at more regional or local governance levels. They are mainly at their early stages of formation or implementation, with certain attempts like training and awareness-raising activities on climate change remaining somewhat sporadic.

Besides, as briefly touched on above, it has revealed the primary barriers to the adaptive capacity of agricultural formal institutions as follows: absence of adequate financial and human resources, inadequate training and expertise in climate change adaptation, farmers' lack of trust in experts, limited integration of technology and inadequate coordination among related institutions and departments, respectively. Certain institutional traps, such as institutional path dependency and centralization of some capacities, also tend to overlap such barriers.

Despite the above-mentioned proximate and more profound obstacles at the farm and off-farm levels, this research also found promising structured attempts inclined to increase the adaptive capacity of both farmers and agricultural institutions. These primarily include pressurized irrigation systems like drip and sprinkler irrigation, crop rotation, and, to some extent, the Agricultural Insurance Pool (TARSİM), as affirmed by Chapters 3 and 5. It has been a remarkable finding that even highly vulnerable farmers increasingly use pressurized irrigation systems. Likely reasons behind such wider acceptance of these means/mechanisms have been attributed to two main ones.

The first one is the existence of relatively continuous planned interventions, state subsidies, and incentive mechanisms provided by the state for such mechanisms. The other relates to farmers' belief in the efficiency of such methods through their own experiences (specifically for crop rotation and pressurized irrigation systems). Such inclinations are well- evidenced by the higher adoption rate of such measures by farmers (Chapter 3) and their higher extension rate by agricultural institutions (Chapter 5). This, consequently, signifies a likelihood of successful climate change adaptation when farmers and the state mechanisms invest in it. However, more mixed results have appeared for the operation of TARSİM, which provides a reactive risk management mechanism and tends to sit in between inadequate and neutral adaptation measures (Chapters 3 and 5). Reasons behind the latter mainly include high premium costs, changing requirements, and failures in compensating most of farmers' losses and damages.

All such inclinations have led to a refinement in my initial ***Hypothesis H2***, which read, *there might not exist a well-concerted, innovative state policy which pays adequate attention to social dimensions of agricultural adaptation to climate change in Turkey. The existing ones mostly consist of technocratic efforts, except for some training and awareness-building activities*. This is primarily because it has uncovered not just a few training and awareness-raising activities but also other specific incentives for TARSİM, alongside a broader adoption rate of the abovementioned pressurized irrigation systems by farmers and state entities alike.

Moreover, this dissertation also highlighted key regional similarities and differences concerning central research questions, which yielded mixed results on the overall adaptive capacity of each region under analysis. Results have indicated interesting regional similarities in terms of farmers' perceived effects of climate change, maladaptive tendencies, weak social capital in general, -with relatively strong but ineffective *bonding social capital*, effective but weak *bridging-linking social capital*,- common institutional barriers and traps such as path dependency, centralized concentration of some capacities, lack of financial and human resources, lack of expertise in climate change adaptation, farmers' mistrust in experts at agricultural institutions. More intricate similarities are subject to further elaboration in each chapter. While each region exhibits unique dynamics, these similarities could be seen as pivotal for the potential emergence of similar trends in numerous other regions across the country. Consequently, this could facilitate the initiation of country-wide research and policymaking processes.

This dissertation has also noted critical regional differences concerning the adaptive capacity of the analysed research sites on a larger level. Regarding overall soft adaptation measures, which mainly comprise institutional plans and programs alongside awareness raising at the city level, Regions C and B appear to be one step ahead of Region A, although all are still in the early stages of formation and implementation. The main reason might be that the former two regions have established specific units directly addressing climate action at the metropolitan municipality level, with meso-level agricultural institutions in Region C collaborating closely with Harran University's agricultural units. Another likely reason is the existence of planned attempts, such as EU-funded projects and research and development activities, in Regions B and C within the context of climate action.

Differences in terms of internal institutional adaptive capacity and thus barriers to this adaptive capacity relate to the lack of expertise in climate change adaptation (considerably more highlighted by respondents in Region A), lack of technology integration (more highlighted by respondents in Region B) and lack of coordination (underscored by respondents in Region C). As to the different abilities of formal agricultural institutions to improve farmers' adaptive capacity, experts and officials in Region A are more inclined towards furthering the utilization of TARSİM, while those in Region C emphasize more the implementation of smart agricultural techniques, compared to other regions.

Besides, some stark regional differences in the (mal)adaptive potential of farmers have emerged between those in Regions A, B, and C. Even though farmers in Region C have better access to irrigation resources due to the Southeastern Anatolia Project (GAP) and are in a relatively better position in the face of water scarcity and drought compared to others, this very upper hand tends not to automatically translate into successful adaptation. It is primarily because short-term benefits of such advantageous position inadvertently tend to result in higher maladaptive tendencies in this region in the long term. For instance, land salinization is highest in this region, farmers are more dependent on traditional irrigation methods instead of pressurized irrigation systems, and inequality between rainfed and irrigation-based farmers is getting starker.

In terms of the overall adaptive capacity of socially differed groups of farmers based on three main sets of variables - which comprise socio-economic characteristics, agricultural sources and methods, farmers' scale, and vulnerability index - it has come up with mixed results. Unexpectedly, as touched above, predominant maladaptive tendencies, albeit capital-intensive, have been commonly observed among farmers, irrespective of their scale and vulnerabilities. It has also been presented that farmers with higher vulnerabilities and fewer advantages might be more likely to have limited access to smart agricultural methods or agricultural insurance pool (TARSİM). Besides, it has underscored that farmers of less advantageous positions tend to rely more on their *bonding social capital* while better-off ones on their *bridging-linking social capital*, which has significant implications on their adaptive capacity, as detailed in Chapter 4 (affirming the **Hypothesis 1a**).

The tendency for farmers and the agricultural sector to be predominantly reliant on the private sector - particularly agribusiness comprising seed-fertilizer-pesticide companies- has been one of the most overarching findings of this dissertation. This inclination has manifested itself in the 3rd and 4th Chapters. Chapter 3 has found that farmers have predominantly increased the usage of pesticides and chemical fertilizers to adjust to climate change impacts. Similarly, the finding in Chapter 4 that farmers resort to their *bridging-linking social capital* to acquire chemical fertilizers and pesticides as one of the main reasons has reinforced this pattern. Such inclinations have consequently unveiled the repercussions of agribusiness dominance as one crucial factor inhibiting more sustainable agroecological means of adaptation to adverse impacts of climate change. Overall, it also brings into question whether the *double movement* as envisioned by Polanyi regarding the interplay between marketization and (state) protection has skewed towards unrestricted marketization, distancing from state protection.

Last but not least, this dissertation suggests that Turkey's overall path in CCA in agriculture within the context of three analysed regions is not within reach of *transformational or transformative adaptation*, which primarily indicates adaptation actions that alter the vital characteristics of a system in reaction to climate change impacts (IPCC, 2014). Instead, it tends to be close to *incremental adaptation,* with very few *transitional* aspects*,* the former referring to adaptation actions whose primary purpose is to retain the integrity and essence of a system or a process within a given scale, while the latter (*transitional adaptation*) signifies an intermediary space which denotes an incomplete form of transformational adaptation that falls behind initiating political or cultural regime change (Pelling, 2012; Hadariths et al., 2017).

6.3 Contributions to and Implications for Related Literature

This research provides novel and pioneering insights due to its theoretically and methodologically sound findings, which also carry substantial policy implications. *First*, against the dominating tendency to conceive rural populations as a uniform category or analysing them based on certain variables such as socio-economic and demographic characteristics, this study, from more sociological-critical perspectives, has expanded such most widely used variables by analysing farmers as consisting of, and embedded in different classes, vulnerabilities, and existing inequalities.

To this end, it has brought a nuanced perspective to farmers' agricultural sources and methods and added a *vulnerability index* (highly vulnerable-vulnerable-less vulnerable) and *farmers' scale* (small-, medium-, large scale- farmers). Such a basis eventually has provided a substantial ground to grasp better not only how different impacts of climate change influence different groups of farmers but also how farmers of various backgrounds differ in their capacity to adapt to climate change. By bringing a critical perspective to adaptation, it has thus challenged an *adaptation* used to speak the language of (linear) progress.

Second, contrary to the dominating tendency to solely focus on economic and technical dimensions of climate change adaptation, this dissertation has dared to analyse how climatic challenges (sudden- and slow-onset events) co-evolve with non-climatic challenges, primarily including economic, social, political, and historical in determining the capacity of multiple stakeholders, including farmers and meso-level agricultural institutions. Such non-climatic challenges range from the long-lasting repercussions of neoliberal policies on agriculture and farmers, market instability, failing agricultural policies, deeply rooted implications of the Green Revolution, impacts of developmental projects, weakening social ties, and related institutional, and formal frameworks. In that respect, this Dissertation substantially contributes to interdisciplinary critical adaptation studies by situating its analysis at the intersection of sociology of climate change, geography, political economy, and political ecology.

Third, combining qualitative and quantitative analysis, which lie at the heart of the mixed method approach, has presented both overall trends and a more in-depth analysis of each research question under analysis. Examples as such could be multiplied but suffice it to say that it would not have been possible to precisely uncover that *pressurized irrigation systems tend to be adopted by even highly vulnerable farmers* without column proportion tests and *it is bridging-linking-social capital that proves to be effective in solving farmers' challenges* without logistic regression analysis. Likewise, without listening to first-hand experiences of this study's participants, it would not have been possible to reveal the partial effectiveness of *bonding social capital* in the face of storms and flooding, and how the Southeastern Anatolia Project (GAP) has widened the adaptive capacity gap between rainfed and irrigation-based farmers.

Fourth, focusing on both divergences and convergences concerning each analysed region, this dissertation has shed light on adaptation as a central and local process. Regional similarities in this direction (e.g., commonly perceived climate change effects, adaptation strategies, overall weak social capital, influential role of *bridging-linking social capital*, common barriers to the adaptive capacity) could contribute to the further formation and implementation of central climate policies and NAPs for Turkey. Similarly, regional, and local divergences, which unfold adaptation as a local process, could contribute to the formation of tailor-made policies and plans that consider local and regional dynamics.

More specific contributions, as extensively discussed throughout each chapter, are manifold. They could be divided into four broad categories, some of which have been touched on earlier. *First*, challenging the predominant line of research on adaptation strategies that are taken for granted in terms of increasing the adaptive capacity of agrarian populations, this research has unfolded how such adaptation measures fail in the face of exacerbating impacts of climate change and tend to result in maladaptive tendencies. In doing so, it sheds light on both the proximate causes behind such maladaptive tendencies and more profound and sociological ones.

Second, by investigating the least examined dimensions of the role of social capital (*bonding social capital* and *bridging-linking social capital*) in climate change adaptation, it has provided deeper insights into not only the positive role of social capital but also its main pitfalls in the face of both rapid and gradual effects of climate change for different groups of farmers. *Third*, paying attention to one of the underexamined aspects of CCA in agriculture -the role of formal institutions- it has achieved the dual purposes of assessing the internal adaptive capacity of formal agricultural institutions and their role in increasing the adaptive capacity of farmers.

Fourth, it presented a periodization of Turkey's climate change adaptation in general and specific to agriculture, based on state policies, plans, programs, and other formations. All combined, this dissertation has shed light on the adaptive, maladaptive, relational, and institutional dynamics of CCA in Turkey’s agriculture, which has been the first attempt in each respect within the context of Turkey.[38]

This research also suggests some refreshed concepts throughout its chapters that could inspire further research. These include *(mal)adaptive* considering the mutability of adaptation and maladaptation depending on different spatiality and temporalities (Chapter 3). It has also offered the term *embedded embeddedness*, which builds upon the combination of two distinct terms of *embeddedness* proposed by Granovetter and Polanyi (Introduction). Likewise, to define Turkey's climate change adaptation (CCA) in agriculture, it offers that Turkey has so far adopted an *incremental adaptation, with few transitional aspects* (This section- Conclusion).

6.4 Suggestions for Further Research, Policy Recommendations and Limitations

Suggestions for further research could be divided into two: general and specific ones. The former highlights the necessity of similar studies for different regions of Turkey. It is mainly because, contrary to central adaptation plans, which tend to conceive adaptation as homogenous, linear, and progressive, on-ground conditions might suggest the reverse, as this study has revealed. Moreover, more ethnographic studies based on participant observation would yield significant insights into farmers' daily encounters with climate change effects. In that respect, the health impacts of climate change on farmers as embodied selves might be another room for further research to focus on, for the climate crisis, combined with environmental degradation and dependence on agribusiness, are likely to immensely impact farmers’ health and well-being.

This dissertation also offers more specific suggestions for future studies. While this research does not conceive each social capital type as mutually exclusive, with a larger sample size, an investigation of how farmers owning both *bonding social capital* and *bridging-linking social capital* adapt to climate change would seamlessly complement the findings of this research. Similarly, a larger sample size, which was not feasible due to

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[38] The originality of each specific research focus has been last checked in 25. 03.2024 through the database of YÖK (The Council of Higher Education), Web of Science, Proquest, and Google Scholar. See also similarity check results performed through Ithenticate, which was 8% for the whole dissertation.

the absence of external funding,[39] could have produced more region-specific comparisons for all analysed variables. Likewise, although not thoroughly absent in this dissertation, further research could specifically focus on how the adaptive capacities of various agricultural institutions -public, private, and civic ones- differ in themselves and in supporting farmers while adapting to the adverse impacts of climate change.

This dissertation also develops significant policy recommendations that could be evaluated within the context of analysed research areas, some of which have implications for policymaking of a broader scope. Initially, it suggests that CCA in agriculture should not be only countrywide but organized explicitly in line with more local needs and dynamics. In doing so, farmers should not be conceived as a homogenous group but rather as a heterogeneous one, ranging from large-scale, commercial ones to small or medium-scale farmers, and landless ones etc. Their different needs and vulnerabilities in the face of adverse impacts of climate change should be considered accordingly. Likewise, to address predominant maladaptive tendencies among the majority of farmers, more profound causes behind such maladaptive behaviour should be considered, one of which is the dominating influence of the private sector -industrial agriculture- on agriculture.

At this point, increased state engagement through protective measures and appropriate sanctions would establish a balance between state safeguarding and market dynamics. However, any sudden, and drastic implementation of measures without considering farmers' longstanding reliance on agribusiness will likely result in unforeseen consequences, as evidenced by the widespread farmers’ protests against climate action across Europe and other regions in the early 2024. Likewise, more continuous, and organized training and awareness-raising activities regarding climate change effects and more sustainable agricultural practices should be developed since most activities in this direction are at their early stages and tend to be somewhat sporadic.

Another general finding, affirmed by many other outcomes of this research, signifies the need for more structured and planned attempts by the state to enhance the adaptive capacity of farmers and agricultural institutions. Effective adaptation strategies, such as increased adoption of modern irrigation systems and crop rotation, as identified in this study, could serve as best practices within this context. Improving the operations of TARSİM requires addressing its partial success by understanding what farmers value and criticize about it, including its high premium costs and frequent changes in requirements.

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[39] Apart from the partial kind support from the Graduate School of Social Sciences and Humanities (GSSSH).

Moreover, initiatives incorporating physical, technological, and ecosystem-based elements (mostly lacking in the analysed research sites) should be developed concurrently with a rights-based approach.

Since this research reveals that social networks tend to weaken in the face of manifold climatic and non-climatic problems, community-based adaptation projects should be initiated that could foster solidarity and collaboration among farmers, considering that they own more *bonding social capital* than *bridging-linking social capital*. The underlying reasons behind farmers' lack of trust in experts/officials at formal agricultural institutions should also be more specifically searched and addressed accordingly. Since meso-level agricultural institutions grapple with many common barriers to their adaptive capacity, such barriers should be addressed by both local and central authorities. Besides, climate change adaptation policies should consider long-lasting problems of agriculture in Turkey, including rising input prices, aging agrarian populations, fragmented lands, and so on.

In this direction, this research also highlights the need to improve the Farmers Registration System (FRS) to embrace future climate policies better. Another highlight in this direction is the need to balance some central and farmer-led management mechanisms, as discussed within the scope of the re-centralisation of Irrigation Associations (IAs). Additionally, as the least suggested measures by agricultural institutions, water harvest, intercropping, and no-till or reduced till should be better engaged in related extension services.

This research has not been exempted from challenges. The timing of the pilot studies during the final phase of COVID-related closures in 2020-2021 presented challenges in reaching out to people. As a result, the initial phase of the pilot studies predominantly involved telephone or online interviews. Additionally, since the early stages of the primary research coincided with ongoing concerns about COVID-19 transmission, I also found myself torn between prioritizing the health of participants - including my own - and completing the pilot studies and initial phases of the research.

Conducting extended survey interviews and in-depth interviews has created another challenge since I had to perform interviews at various sites ranging from farms, farmers' houses, and local coffee houses alongside agricultural institutions in related rural areas. Internet connection problems have caused one major issue, which I tried to overcome by going back and forth between online and offline survey interviews, and where applicable, I used an audio recorder following the consent of respondents. This journey has also coincided with significant challenges in my life, including family health issues, my own health concerns, financial struggles, and the complexities associated with undertaking an interdisciplinary study in sociology.

Despite such challenges, I made every effort to ensure that they minimally affected my progress in completing my Ph.D. My passion for this research, coupled with its likely academic and societal contributions, has been a constant source of motivation and determination for me throughout this process. Therefore, I advise early Ph.D. researchers to persevere in pursuing what they are deeply passionate about, regardless of discouragements, obstacles, and other challenges.

This long journey has also provided me with distinctive perspectives, resilience, and fresh affiliations that will serve as a conduit for my post-doctoral research endeavours.[40] My conviction in this stems from my MA thesis, which explored the socioecological effects of energy transition, specifically those of hydroelectric power plants in rural regions as a planned response to climate change. This experience has motivated me to further delve into climate change adaptation in my PhD research.

Likewise, being engaged with farmers of different socio-economic backgrounds and experiences has provided me with unique insights of learning from the first-hand experiences of farmers, be it either climatic or non-climatic. At times, I found myself reiterating that few could better explain the effects of climate change than farmers, many of whom did not even utter the phrase *climate change.*

[40] See the list covering publications and conference presentations deriving from this dissertation in Appendix 6.1.

6.5 References

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6.6 Appendices

Appendix 6.1: Publications and Conference Presentations Deriving from this dissertation.

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GPA for graduation: 4.040/4

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"Unable or Unwilling to Move? How Does Climate Change Impact the Decision to Migrate? Evidence From Farmers in Turkey". [Policy Brief]. Rice University Baker's Institute for Public Policy & Lebanese American University. (co-authored with Ahmet İçduygu), May 2, 2024.

"The Role of *Social Capital* in Farmers' Adaptation to Climate Change: Comparative Study of Three Regions from Turkey" a paper presented at symposium, organized by Utrecht University, Netherlands, June 26-27,2024.

"Maladaptive Tendencies of Farmers' Adaptation Strategies to Climate Change: Comparison of Three Regions from Turkey" (under peer review).

"How Does Climate Change Affect Migration Intentions in Turkey? Evidence From Farmers". Presented at Climate-induced Displacement in the Middle East and North Africa Workshop, organized by Rice University Baker's Institute for Public Policy & Lebanese American University in Beirut, Lebanon, October 9-10, 2023.

Short presentation of my dissertation at ACCESS Summer School, 2023, organized by Universities of Exeter and Surrey in Devon, UK. September 12-15, 2023.

"Migration Intentions of Farmers under the Impacts of Climate Change: Evidence from Turkey". Presented at Environmental and Climate Mobilities Network (ECMN) 2023 Annual Conference, organized by the University of Vienna, Department of Geography and Regional Research, Vienna, July 12-14, 2023.

"(Un)sustainability of Farmers' Adaptation Strategies to Climate Change in Turkey." Presented at World PhD Students Sustainability Summit, organised by the European School of Sustainability Science and Research, the Inter-University Sustainable Development Research Programme and the European Alliance for Sustainability Research, Germany, March 8, 2022.

"Farmers' Responses to Climate Change and the Role of Social Capital in their Adaptation Practices in Turkey." Presented at World PhD Students Climate Change Summit, organised by the European School of Sustainability Science and Research, the Inter-University Sustainable Development Research Programme and the European Alliance for Sustainability Research, Germany, March 9, 2022.

Appendix 6.2: Select Photos from Fieldwork.