

Critical Perspective on Climate Change Adaptation among Farmers in Developing Nations: Unpacking Divergent Approaches

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Abstract

This paper seeks to explore and assess recent literature (2007-present) on climate change adaptation (CCA) among farmers in developing nations, to better understand the range of adaptation approaches prevalent in such nations. Unpacking what adaptation approaches exist in scholarly publications is relevant since scholarly ideas often shape policy directions and negotiations in climate-proof interventions. The study asks:

- 1) What are the different adaptation approaches authors employing in CCA studies among farmers in the developing nations?
- 2) What are the research methodologies prevalent in these climate adaptation studies to date?
- 3) What strengths and weaknesses can be unpacked in the different adaptation approaches.

Abbreviations: CCA: Climate Change Adaptation; IFATPC: International Food and Agricultural Trade Policy Council

Introduction

A report released by the International Food and Agricultural Trade Policy Council, [1] reveals that there is a huge difference in climate change [CC] impacts between nations whose economies and peoples rely on agriculture. Specifically, the report predicts that in terms of production and exports, the developing nations will be more disadvantaged compared to the developed economies. Similarly, a study by Dinar (2008) shows that farmers in developing nations bear the largest known economic impact of CC due to their high vulnerability levels. Kurukulasuriya et al. [2] attributes this high level of vulnerability to high sensitivity and poor adaptive capacity of farmers.

This paper seeks to explore and assess recent literature (2007-present) on climate change adaptation (CCA) among farmers in developing nations, in order to better understand the range of adaptation approaches prevalent in such nations. Unpacking what adaptation approaches exist in scholarly publications is relevant since scholarly ideas often shape policy directions and negotiations in climate-proof interventions. The study asks:

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- 2) What are the research methodologies prevalent in these climate adaptation studies to date?

3) What strengths and weaknesses can be unpacked in the different adaptation approaches.

This paper argues for a holistic approach in strategizing CCA frameworks in the developing nations, as adopting a single approach can lead to the loss of some important qualities inherent in other approaches.

Method

Search for relevant primary studies (based on empirical evidence) to include in this review was informed by the questions presented in Section 1. A search in web of knowledge/science (keywords: developing nations, climate change, adaptation, agriculture) brings up approximately 139 references. The web of science provides a unified and integrated platform that accesses a wide variety of quality literature with one search [3]. The review involved articles from the year 2007 to 2017, in order to focus on recent trends in adaptation approaches and methodologies.

Therefore, any study not conducted within the last ten years and outside the developing nation context was excluded. Table 1 gives a summary of article selection criteria. Finally, using a narrative method, the methodologies and approaches distilled from the included articles were discussed, in order to appraise recent progress and the current state of knowledge in CCA among farmers in developing nations.

Table 1: Summary of article selection criteria.

The article focused on farmers' adaptation to climate change impact in the developing nation context
The research was conducted within the last decade
The word "Adaptation" was mentioned either in the title, abstract or body of the article, apart from the reference list
Employed a clear research methodology and suggested clear adaptation approach farmers have or should employ (articles not showing a clear research methodology and adaptation approach were excluded)

Result and Discussion

Information synthesised from the studies are presented in table 2 below. Quoted information were extracted directly from the article abstracts. Three separate approaches to conceptualising CCA strategies have emerged within the last decade in the CCA literature: risk-based adaptation approach, resilience approach and vulnerability approach [4]. According to [5], these three approaches have shaped the different policy pathways for tackling

CC, in particular for advancing adaptation responses. These policy pathways are those centred around Natural Resources Management (Resilience Approach), Poverty and Social Welfare Investment (Vulnerability approach), and Climate Risk Mitigation (Risk Based Approach).

The literature surveyed (Table 2) shows that the majority of authors (45%) focusing on CCA among farmers in developing countries conceptualise CCA approach mostly from the poverty and social welfare investment thematic dimension. According to [4], taking only one approach can lead to the loss of some important qualities or aspects inherent in other approaches. Ignoring the trade-offs among the three adaptation approaches will have critical consequences in terms of effectiveness and sustainability of adaptation efforts [6]. The discussion presented here offers an analysis of the selected articles in Table 2 in order to unpack the different approaches to adaptation efforts and the associated trade-offs. Table 3 gives a summary of the process criteria for this classification.

Table 2: Characteristics and synthesis of articles included in the review.

Articles	Location	Methodology	Adaptation Approaches	Adaptation Strategies	Barriers To Adaptation	Drivers Of Adaptation
Arslan et al. [18]	Zambia	Econometric analysis of household survey data merged with climatic variables	Resilience approach	Soil conservation, tree planting, changing planting dates, irrigation, crop varieties		Access to information and farm inputs
Below et al. [11]	Six villages in Morogoro region of Tanzania	Econometric analysis of household survey data, rapid rural appraisal and, stakeholder workshop	Vulnerability approach	-	lack of access to information on adaptation strategies, financial constraints, and gender inequalities	investment in rural infrastructure, access to inputs, agricultural extension service and a good education system
Bryan et al.[12]	Ethiopia and South Africa	Econometric analysis of 1800 farm households in South Africa and Ethiopia	Vulnerability approach	Change in cultural orientations	lack of access to land, information, and credit in Ethiopia.	-
Claessens et al. [7]	Kenya	Trade-off analysis model using survey, experimental data combined with future socio-economic scenarios	Risk management approach			improved feed quality and quantity
Deressa et al. [13]	Nile Basin of Ethiopia	Econometric analysis of household surveys	Vulnerability approach	Education through extension services, access to land and credit facilities	lack of access to information on adaptation strategies and financial constraints.	
Freier et al. [14]	The High Atlas Mountains of southern	"interviews focus on livelihood strategy and expectations of well-being through alternative strategies of interviewed 25 transhumant pastoralists"	Vulnerability approach	Sedentary and localised pastoralism		

Gebrehiwot & Van Der Veen et al. [19]	Tigray, northern Ethiopian.	Econometric analysis of results from a survey of 400 farmers	Resilience approach	“using different crop varieties and changing planting dates”	“lack of access to information on adaptation measures and lack of finance are seen as the main factors inhibiting adaptation to CC.”	“appropriate policy measures and the design of successful development projects.”
Guan et al. [20]	West Africa	Sensitivity analysis	Resilience approach	“intensification of seeding density and fertiliser use, late sowing, increasing cultivars’ thermal time, increasing resilience to heat stress during the flowering period, water harvesting”		building relevant infrastructures
Hisali et al. [15]	Uganda	Econometric analysis of data obtained from the 2005/06 Uganda national household survey	Vulnerability approach	Increased labour supply		“security of land tenure, and access to credit and extension facilities”
Kahsay et al. [8]	East Africa	The study employed production function for agricultural output in Eastern Africa while incorporating climate variables	Risk management approach	“conventional technologies such as flexible planting and rainwater harvesting, raising flood barriers and terrace farming”.		“collaboration between farmers on collective investments in rainwater harvesting infrastructure”
Derbile	Ghana	Econometric analysis of 131 systematically and randomly sampled households	Risk management approach	“cultivation of drought resilient crop varieties, and complementary indigenous soil and water conservation measures”.		

Table 3: Different conceptualisation and implementation of adaptation strategies.

Process Criteria	Risk-Based Adaptation Approach	Vulnerability Approach	Resilience Approach
spatial scale of implementation	sector focus	Places, communities, groups	large scale coupled social-ecological systems, e.g. populated watersheds
Temporal emphasis of implementation	short-term & medium term future risks	past & present vulnerabilities	long-term future
actors	public -private partnership	public sector, vulnerable groups	civil society, public sector
policy goal	address known & evolving risks	protect populations most likely to experience harm	enhance systems capacity for recovery and renewal
desired outcome	maximum loss reduction at lowest cost	minimize social inequity & maximize capacities of disadvantaged	minimize propability of rapid, undesirable and irreversible change

The risk-based approach arises as a result of the need for risk assessment and risk management in CC scenarios [7]. Studies taking this approach focus on identifying the major climate risks confronting the farmers [7-9]. For instance, using climate and econometric models, Kahsay et al. [8] estimated a high chance of the farms within their study area being affected by flood. By identifying and estimating the climate hazards, the authors proposed

adaptation strategies that are focused, directed and cost-effective. Terrace farming and raising flood barriers were two common strategies proposed by the authors taking a flood risk management approach. Similarly [9], using a time series experimental findings from climate studies, identified the scourge of drought as the most significant climate hazard in the Atankwidi basin, Northeastern Ghana. The paper noted that through conscientious efforts of

indigenous knowledge of drought risk management systems [planting indigenous drought resistant crops], farmers will be able to reduce vulnerability to CC impacts.

According to Eakin et al. [4] authors who choose this approach do so to proffer adaptation recommendations based on some degrees of certainty about climate impacts. By identifying the climate hazards to be tackled, actions will be taken to some level of economic efficiency [4]. This approach differs from the vulnerability or resilience approach as it focuses on short-term risks. Bryan et al. [12] who employed the vulnerability approach argues that the risk-based approach focuses on reducing the most significant short and medium term hazards without considering other possible impacts. Through terrace farming and by raising flood barriers, farmers might be able to overcome the flood risk, however, this alone will not improve farmers' capacity against other potential risks.

According to Trærup [6], this adaptation approach is quite narrow as it ignores other socio-political concerns, such as income inequality, gender bias, etc., associated with climate change adaptation efforts. By taking a risk-based approach, these authors ignore the need for equitable distribution of CCA benefits and the system resilience. Although CC impacts affect everyone in a particular location, due to some socioeconomic, some farming households may be more vulnerable than others. As more attention is paid to specificity and economic efficiency, sustainability and equity will be unconsciously ignored. Given the increasing need for equity, poverty eradication and social welfare investment in CCA efforts [10], literature on climate change adaptation among farmers in developing nations have also highlighted the need to adopt the emerging vulnerability approach [11-15].

The Intergovernmental Panel on CC defined vulnerability to CC as "the degree to which human-environment systems are susceptible to and unable to cope with, adverse impacts of CC" [16]. This definition acknowledges that vulnerable systems are exposed, sensitive and less equipped in handling the impact of CC. The vulnerability approach emerged in response to the morality and considerations for social equity in CC responses Eakin et al. [4]. Studies applying this type of adaptation approach focus on past and present conditions of sets of farmers or systems that are disproportionately vulnerable. In the study by [11] the overarching aim was to "identify vulnerable entities and to develop well-targeted adaptation policies" [11]. This approach was also reflected in studies by [12] and Deressa et al. [13]. Bryan et al. [12] surveyed 1800 farm households with the main purpose of finding ways of improving their adaptive capacities. The findings from [13] suggest that among the farmers, women and small-scale farmers are the worst hit by CC impacts as they are highly marginalised and excluded from policy making processes.

To the proponents of this approach, the best way to increase adaptation will be to minimise inequality and maximise the adaptive capacity of the disadvantaged [4]. In taking this approach, authors propose for attention on policies that address inequality issues such as unequal access to land and credit facilities as the

dominant strategy for adaptation. The majority of the literature reviewed (45% of the selected articles) employed this vulnerability approach, suggesting that the perspective on CCA among scholars in the developing world is being shaped by this vulnerability approach - the need for reducing sensitivity and exposure, or improving the adaptive capacity of vulnerable sets of people to cope with present climate impacts.

The rising awareness to configure adaptation strategies in ways that farmers can easily recover from, and minimise long-term future impacts led to the emergence of the climate resilience approach. The resilience approach considers not just the current impacts and vulnerable systems, but also include elements that will build the systems' ability to withstand future climate events. The resilience approach is technically in line with the concepts of non-linear dynamics and ecological resilience, which entails the ability of the ecosystem to withstand disturbances without altering its structures and self-organized processes [17]. This approach has gained popularity among international donor organisations and foreign researchers.

All the selected empirical studies that employed this approach were conducted by foreign researchers [18-20] suggesting the influence of this approach, among international stakeholders, in fostering better adaptation debates/capacities of farming households in the developing nations [19], attributes the strength and popularity of the resilience approach to the need for achieving the Sustainability Development Goals (SDGs) and the recognition that CC carries with it the potentials to trigger unplanned events. However, on the whole, only a few of the articles (25%) reviewed took the resilience approach, although the selection process of articles/authors could be biased by time constraints and capacity to find more relevant articles.

Guan et al. [20] argues that adaptation strategy should enhance farmers' ability to function in the face of climate variability, and that resilience approach to adaptation provides this strategy. For instance, in assessing the resilience of climate adaptation options and uncertainties in West Africa agriculture [20], asserts that successful adaptations of agriculture to climate change should not only help farmers deal with current climate risks, but also reduce negative (or enhance positive) impacts associated with climate change using robust climate projection Guan et al. [20]. As a way of increasing farmers' ability to function in the face of climate variability, Guan et al. [20], proposed for a better agricultural extension service delivery, and educating farmers on climate-smart or climate compatible agricultural practices such as "intensification of seeding density and fertiliser use, late sowing, increasing cultivars' thermal time, and water harvesting". However, by focusing on sustainability alone, the resilient approach pays less attention to tackling inequitable distribution of CCA benefits Eakin et al. [4].

Finally, Table 2 further shows that majority of the authors employ econometric methods in identifying barriers and drivers of adaptation among farmers in the developing nations. Most of the research were quantitative (80%) and based on data collected



through household surveys (60%). Authors such as Sultan et al. [21] and Tesfaye [22] emphasised a paradigm shift from quantitative to qualitative CCA studies. Few of the authors who engaged with farmers and policy makers by means of interviews and focus group discussions had opportunities of probing for a deeper understanding of the underlying socioeconomic and institutional factors that need to be transformed within the study areas [11,23].

Way Forward

Scholarly works on CCA among farmers in the developing nations suggest a shifting focus from risk-based and vulnerability approaches to a resilience approach, which emphasises on the ability of a system to easily recover from CC shocks. This can possibly be attributed to the emerging initiatives of international donor agencies incorporating CCA in their developmental programmes in the developing nations. However, the analysis presented here shows that a range of trade-offs exist across the three approaches [4]. Trade-offs (in terms of cost efficiency, equity in benefit distribution and sustainability of adaptation efforts) suggest the need to first study and understand unique challenges within a particular context (based on spatial and temporal scale, and desired outcomes) in order to determine the appropriate approach to adopt [24].

According to Crane et al. [24] this will help maximise the benefits associated with the individual approaches at the same time reduce the inherent trade-offs. Another way of addressing these downsides of the individual strategies is by combining these approaches in developing robust adaptation strategies in order to overcome the weaknesses of individual strategies. Narain et al. [25] highlighted the transformative adaptation as a desirable outcome of integrating the different adaptation approaches. The authors argued that since socioeconomic and institutional factors are the most cited drivers/hindrances to adaptation among developing countries, [which is also evident in the findings of majority of the papers reviewed see (Table 2), a better approach would be a shift from incremental adjustments to transformational responses aimed at understanding and addressing the underlining challenges to adaptation.

In other words, existing customs, institutions, concerns, and structures must be thoroughly reconsidered going forward. A closer look at all the articles reviewed show that over 50% of the authors identified, lack of access to land, lack of access to credit facilities, and poor information delivery systems as the major hindrances to adaptation. In other words, the problem is not necessarily the unavailability of these resources but the lack of access to them. For instance, 80% of the farmers in the developing nations of Africa are women yet they are most times excluded in agricultural policy making processes thereby limiting their access to the facilities they require. The transformational response, therefore, entails a re-evaluation of political, cultural and socioeconomic dynamics or relations that determine the roles and responsibilities attached to the male and female sexes (gender transformation). Integrating the three approaches will help to foster transformation in farmers capacities to manage climatic stressors.

Concluding Thoughts

It appears that a robust argument can be made in favor of a transformational adaptation response arising from the combination of several adaptation approaches/processes, considering the complexity and multi scale nature of CCA issues. However, the reviewed literature showed that scholars and studies dealing with CCA among farmers in the developing world are yet to fully adopt this approach. Strategizing CCA efforts to achieve transformation outcomes in the developing nations suggest an area for future research in the region. Adopting this approach will not only facilitate more efficient adaptation but will also help to ensure sustainability of adaptation efforts. However, the concept of transformation will involve systemic shift which can be highly disruptive and contentious. Therefore, authors, funders and policymakers adopting this approach must prepare and factor in the potential consequences.

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