



Adaptation as a Means to an End: Conceptual Underpinnings and Empirical Affirmations

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Abstract: Rooted in the concept of adaptation are *change*, *action*, *stimulus*, *means* and *end*. Whilst these elements are fundamental in clarifying the complex actor relationships surrounding adaptation, literature has tended to concentrate on the *end* (adaptation practice). Inherent in the provisions of interventions aimed at minimizing the specific impacts of climate change is the notion that adaptation will be automatically triggered. This article, which focuses on concepts and theories, argues that adaptation is more than mere action or what is usually described as the *end*. Using the Theory of Action (ToA) and the Framework for Analyzing Climate Change Adaptation as Actions (FACCAA), this article attempts to clarify the relationships between the key terminologies and contributes to knowledge on the adaptation discourse. Using empirical shreds of evidence from the Talensi District, the article underscores the proposition that water interventions are not necessarily adaptation practices neither are they automatic activators of adaptation. They are rather *means* expected to propel action for adaptation. The article concludes that elements, such as *change*, *action*, and *means*, are of equal importance as the popularly documented adaptation practice (*end*). All the elements deserve equal attention to unravel the complexities underpinning the concept of adaptation.

Keywords: Adaptation, Action, Means and End, Change, Water Interventions

1. Introduction

The provision of water interventions principally targeted at farmers facing water stress conditions have been largely assumed to trigger corresponding responses and improve livelihoods through adaptation. Under the wide climate literature, adaptation is commonly expressed as change or adjustment to change [46]. However, what triggers the change often considered implicitly obvious, is hardly discussed. Increasingly, within the field of climate change adaptation, the focus of research is shifting from dominance by models and theories to examining the characteristics of society and the role of individuals and or

institutional actors [49, 10].

The Framework for Analyzing Climate Change Adaptation as Actions (FACCAA) [16] drawing from the Theory of Action (ToA) [41, 43] expounded the popular view of adaptation as actions asserting that adaptation is more than mere action. It requires purpose backed by *means* to propel action in others to achieve an intended *end*. Although the ToA and the FACCAA recognize *means* (interventions) as fundamental, majority of the studies on climate change adaptation largely incline towards adaptation as an *end*, (adaptation practice) [4, 14]. Thus, what triggers the action, a whole decision-making process dominantly driven by *means* is scarcely emphasized.

Furthermore, a widely used definition of adaptation proposed by the Inter-governmental Panel on Climate C (IPCC) [31] emphasizes the systemic nature of adaptation rather than considering adaptation as a process that involves action taken by specific actors [15]. Thus “the predominant framing of adaptation does not adequately consider the notion of agency” [33]. Yet, the few that discuss the actor view largely lean on the supposition that responses to interventions are conventional. What exists is that these theories have been perceived as straightforward downplaying the fact that there are a diverse set of complex competing actors.

Besides, the literature hinges on the reasoning that adaptation is perceived as a set of interventions or projects to minimize the specific impacts of climate change. On the contrary, adaptation simply goes beyond a set of interventions or projects to minimize specific impacts. Whereas interventions in themselves cannot be ignored, the reality of dealing with change through responses to the interventions remains a challenge [12]. Thus, strewn with a complex set of varied actors, knowing and understanding the responses to the provisions of *means* (water interventions) and how this influences livelihoods, is not as simple as it connotes.

This article, which focuses on concepts and theoretical frameworks, argues that adaptation is more than mere action or what is usually described as the *end* (adaptation practice). The article underscores the proposition that water interventions are not necessarily in themselves adaptation practices but rather *means* expected to propel action for adaptation. Thus, it is not automatic that the mere presence of *means* such as water intervention will trigger adaptation practices. Embedded in the concept of adaptation are elements such as change, action, purpose, and means that are of equal importance as the end (adaptation practice).

Drawing empirical examples from the Talensi District, this article aims at unravelling the complex actor responses to water interventions in the context of elucidating the conceptual underpinnings of action, change, means and ends as they relate to climate adaptation. This article seeks to achieve the following intended objectives:

- 1) Clarify the interrelationships among the key elements of climate adaptation.
- 2) Examine the empirical affirmations of the ToA and the FACCAA.
- 3) Draw lessons regarding the implications of the elements in the concept of adaptation.

2. Concepts Underpinning Climate Adaptation

The manifestation of climate has been obscured in a complex set of interactive processes involving variabilities and seasonal changes as part of a purportedly *natural* rhythm, resulting in the earth’s surface maintaining an average temperature of 16 degrees celsius [50]. In the last few

decades, however, there has been an increasing acknowledgement that climate is no longer ‘natural’ [6]. This seemingly natural phenomenon in itself is not absolved of challenges. What has aroused concern in the last few decades is the increasing amounts of Green House Gases (GHGs) in the atmosphere as a result of the intensification of human activities on the surface of the earth [57]. Such increasing concentration of GHGs has culminated in global warming and ultimately triggers a change in the global climate system [34]. Vast amounts of GHG emissions from anthropogenic sources have altered the earth’s climate, further raising temperatures to 0.88°C above pre-industrial levels, increasing the frequency and intensity of droughts and floods, and rising sea levels [30].

Article 1 of the United Nations Framework Convention on Climate Change (UNFCCC), defines climate change as: “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods” [59]. According to the IPCC, climate change is any “change in climate over time whether due to natural variability or as a result of human activity” [29]. The UNFCCC thus recognizes the differences between climate change due to human activities altering the composition of the atmosphere, and climate variability as a result of natural causes. The IPCC diverges by considering a wider view on ‘climate change, maintaining that climate change can occur as a result of natural variability and human activity. Nevertheless, what is of essence is that both climate variability and climate changes accompanied by occasional extreme weather events reveal the broad and complex nature of climate. The challenges mainly posed by climate and the corresponding responses by mankind to the proposed interventions thereof are the nub of this study.

Accordingly, this article interprets climate to include variabilities, climate change as well as extreme weather events. Smit et al. [51] consider all three as climate stimuli and have argued that it is very difficult to separate them, as they are interrelated and part of a complex whole.

Another aspect of climate is the wide scientific consensus that the climate is changing and that human activities are the prime reasons for the increasing GHG which aggravates the climate changes. This view is exemplified by a group of IPCC researchers who generally concur that increases in atmospheric concentrations of GHGs (mainly carbon dioxide, methane, nitrous oxide and ozone) since pre-industrial times have led to a warming of the surface of the earth [30]. The emissions are mainly due to the use of fossil fuels, but changes in land use, as well as agriculture, are also major sources of emissions [49]. The consensus is not only among scientists but has also permeated many governments the world over. This *consensus* is a giant step in managing climate change. However, it does not terminate the climate debate concerning the causes, as the consequences of global warming persist [57, 9].

Essentially, there are lead proponent scientists who have

argued to the contrary that the earth's climate is not changing and that the seemingly climatic manifestations are shrouded in scientific uncertainties, repudiating the need to take action now. Much as global warming issues may be laced with uncertainties, it equally does not justify the grounds for inaction. The world cannot wait for certainty before action "uncertainty cuts both ways as there is as much chance of outcomes being more malign as there is some of them being more too benign" [56]. Viewed from another perspective, scientific uncertainties should propel action with a determination to minimize climate risks and take advantage of the opportunities [56]. Increasing scientific progress though critical to facilitating understanding, will not cause the disappearance of uncertainty. The two perhaps need to coexist [43, 23].

2.1. Mitigation and Adaptation Dichotomy

Conceptual understanding of climate has long been encapsulated in the debates on mitigation and adaptation.¹ The literature on climate change splits mitigation and adaptation with mitigation focusing on reducing GHG as the main cause of human-induced climate change, and adaptation centering on adjustments to the consequences of climate change on natural and social systems [26]. The separation of mitigation and adaptation by the UNFCCC may aid international policy formulation but could be intellectually problematic [44]. However, there has been a realization for more than two decades that adaptation to the impacts of climate change is both necessary and inevitable, and that acting on climate change impacts does not diminish the case for continued and urgent mitigation [46, 54].

The international community has over decades been making efforts to address climate change through mitigation especially after enforcing the Kyoto Protocol, developed countries have failed to meet their emission reduction targets under the first commitment period of the Protocol [5, 58] and have not been ready to commit themselves to higher targets in line with available scientific information. Therefore, it means that adaptation should be given high priority since the impacts of climate change particularly to poor countries are not only expected but also taking their toll and are expected to increase.

*"More than twenty years of international cooperation to tackle the problem of climate change have seemingly not produced the desired results in terms of climate stabilization"*² [59].

Even though there is a solid scientific basis for

international action to mitigate the causes and impacts of climate change, the gap between pledged emission reductions and the internationally agreed goal to keep temperature increases below 2°C relative to preindustrial times is still widening" [57].

The international and scientific community realized that mitigation alone could not address climate change hence, there was the need to treat adaptation on equal footing with mitigation [48, 45]. In recent years, adaptation has emerged as a strong area of interest, not only for climate change research but also as an important policy response to impacts of climate change alongside mitigation [51].

The original debate contended that there was nothing such as climate change and indeed the earth's climate was not changing. Okonski [40] argues that the earth's climate is not changing disastrously, such that policies being pursued to prevent climate change will have negative consequences for consumers, taxpayers, and the poor. He opposes the uncertainty, inaccuracies and unreliability of models used to predict future conditions. Hence the attempts to restrict 'greenhouse gas emissions will be costly and futile as people in poor countries will suffer from the actions taken to prevent climate change, through slower economic growth. The best approach to climate change is adaptation. For most people, this means escaping from subsistence agriculture and creating wealth through sustainable development. This should not downplay the role of mitigation as some adaptation efforts have overlapped with mitigation.

Thus, the urgency to reduce GHG is necessitated but not sufficient, since mitigation and adaptation work in unison. Adaptation is called, for now, even if significant changes to reduce GHG, are made, it will take several decades for the GHGs to leave the atmosphere [25, 61]. Furthermore, mitigation and adaptation involve actions and processes that feed into each other; thus the distinction between the two is often blurred especially at a more localised level [32, 2, 11].

The Human Development Report opines that adaptation deals with the symptoms of a problem that can be cured only through mitigation. However, failure to deal with the symptoms will lead to large scale human development losses [57, 36].

The point of discussion is that climate change is already evident and given the inertia, the climate system will inevitably intensify [28]. Despite the debates, both mitigation and adaptation are inclined towards the minimization of risks associated with climate change. Perhaps, that is partly the reason the debate has moved from one of neither adaptation nor mitigation to an integrated approach to ensure long term sustainable development. While both mitigation and adaptation are taking place, they do not affect persons equally. Adaptation includes a variety of measures at different levels to prepare for, or reduce the harm from, the impacts of climate change [60]. Suffice to state that while adaptation does not downplay mitigation and associated links, this article concentrates on adaptation and how farmers especially are responding to the provisions of interventions to improve their livelihoods.

¹ Two strategies (mitigation and adaptation) are necessary to reduce the risks of climate change. The IPCC assessment report, defines adaptation as "Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities". In comparison, the definition of mitigation is simply the reduction of GHG. (Intergovernmental Panel on Climate Change (IPCC), 2007, p.869).

² United Nations Framework Convention on Climate Change (UNFCCC), Decision 1/CP.16, Outcome of the Work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention, UN Doc FCCC/CP/2010/7/Add.1 (15 March 2011) para 4.

2.2. Adaptation to Climate Variability and Change

In the last two decades, there has been a surge in interest concerning the concept of adaptation taking a foothold in the climate change literature [7, 52]. Examining the word *adaptation* in the climate change literature using four IPCC reports and four major journals,³ the review of literature addressed the said articles focusing on the word “adaptation” as it showed up in either the title, abstract or keywords. Three-quarters of all the adaptation articles in these four journals appeared between 2006 and 2011. Out of the 558 articles in which “adaptation” was a principal theme, 68% appeared between 2007 and 2011 [7].

The term “adaptation” takes its roots from evolutionary biology [52]. In evolutionary biology, adaptation generally refers to the genetic development which enables organisms or systems to cope with environmental changes to survive and reproduce [21]. One of the more commonly used definitions for adaptation, in the climate change context, is suggested by the Intergovernmental Panel on Climate Change, [29] that define adaptation as “an adjustment in human or natural systems in response to observed or expected changes in climatic stimuli and their effects and impacts to alleviate adverse impacts of change or take advantage of new opportunities”.

Pielke [47] defines adaptations as the “adjustments in individual groups and institutional behaviour to reduce society’s vulnerability to climate”. Similarly, [52] refer to adaptation in the context of the human dimension of global change as “a process, action or outcome in a system (household, community, group sector, region and country) in order condition, stress, hazard, risk or opportunity”. Smit *et al.*, [51] refer to adaptation as “adjustments in ecological-socio-economic systems in response to actual or expected climatic stimuli, their effects or impacts”. Brooks, [13] describes adaptation as “adjustments in a system’s behaviour and characteristics that enhance its ability to cope with external stress”.

Some scholarly works have attempted to suggest forms of adaptation, namely, reactive vs anticipatory; planned vs natural; substitute vs complement and short-term vs long-term [18, 1]. Anticipatory adaptations are deliberate decisions to prepare for the potential effects of climate change [53].

Autonomous adaptation also referred to as spontaneous alteration, constitutes a conscious response to climatic stimuli, but is triggered by ecological changes in natural systems and by market or welfare changes in human systems [29]. They are “considered to be those that take place—invariably in reactive response (after initial impacts are manifest) to climatic stimuli—as a matter of course, without the directed intervention of a public agency” [29]. A planned adaptation is the result of a deliberative policy decision, based on an

awareness that conditions have changed or are about to change and that action is required to return to, to maintain, or to achieve the desired state [24].

The similarities and differences tend to be so thin that they ultimately appear blur, which in a way also assist the concept as one that is subject to mean different things to different people. Be that as it may, in whichever form adaptation is described, and while this article does not downplay the types of adaptation, an examination of the role of (*means*) water interventions play in facilitating adaptation responses is fundamental.

2.2.1. Adaptation as Adjustment and or Change

Common threads running through the definitions are change and or adjustment to change to minimize the current or anticipated impacts. Smit *et al.* [51], also noted that most of the definitions of climate adaptation imply a change “to better suit” the new conditions. While there is evidence of change, it is more about changes in response to stimuli. Bassett and Fogelman [7], observe the similarity in a plethora of definitions as having “adjustments” to climate stimuli. The commonality is that most of the definitions emphasize adjustment to some form of stimuli, a large number of these also relate specifically to climate stimuli, while a number of them do acknowledge the role of non-climatic factors in stimulating climate adaptation [34]. Although most of the definitions recognize the role of non-climatic forces, there appears to be much more emphasis on climate acting as stimuli. Despite this, literature seems to be widely silent on the responses to climate stimuli and therefore appears to concur with those responses to stimuli occurring inevitably.

Adaptation should not be viewed as an independent process. It is usually dependent on the role and influence of different factors such as socio-economic, cultural, political, geographical, and ecological to institutional, each of which independently and/or collectively influences the human-environment interactions [18]. Ensor and Berger, [17] argue that adaptation goes beyond reducing vulnerability and preparing for hazards and involves an ongoing change process where communities can make decisions about their lives and livelihoods in a changing climate.

Furthermore, the change is also inclined towards processes and or structure. According to IPCC [29], the term adaptation refers to changes in “processes, practices, or structure to moderate or offset potential damages or to take advantage of opportunities associated with climate changes”. Thomas *et al.* [55] viewed adaptation as a *process* that involves *changes* in a particular system’s coping range, involving various geographical scales and social agencies.

Adaptation is a process of deliberate change in anticipation of or reaction to external stimuli and stress [37]. Adaptation to current or expected climate variability and changing climate conditions or their effects involves an adjustment in natural or human systems which moderate harm or exploit beneficial opportunities [30]. The notable thing about this definition is that adaptation does not only focus on minimizing the impacts of the change but also being active

³ The climate change literature embraced four IPCC reports (IPCC, 1990, 1996, 2001, 2007) and four scholarly journals: Global Environmental Change, Climatic Change, Climate and Development, and Mitigation and Adaptation Strategies for Global Change.

by taking advantage of the opportunities related to the changes being occurred or anticipated to occur.

In effect, adaptation is not merely an adjustment to change, but the whole concept is shrouded in change. Thus, in this article, therefore, adaptation refers to adjustments to changes in climate (including taking proactive advantage of opportunities offered by the change) to minimize societies vulnerability to current or anticipated impacts of climate.

2.2.2. *Adaptation as Actions and Means*

The prevailing research convention on adaptation to environmental change primarily takes an actor-centered view, focusing on the agency of social actors to respond to specific environmental stimuli and emphasizing the reduction of vulnerabilities [37]. Even though it takes an actor view, it largely leans on the implicit assumption that action is spontaneous. Aside from being perceived to be spontaneous, it appears action necessarily connotes adaptation. Adger et al [1] argued to the contrary that explicit adaptation is not recognized as a simple and straightforward substitute for action. Nyong et. al., [38] viewed climate change adaptation as a package of actions through which individuals or communities adjust themselves to the impacts or threats posed by climate change.

Nelson et al [37] define adaptation as “a process of deliberate change in anticipation of or reaction to external stimuli and stress”. In this definition, [37] adaptation is described as *deliberate change*, but embedded in deliberate change is action related to intention as well as purpose. “Adaptation involves deliberate action or inaction taken by individuals and through collective action” [2]. Thus, to a large extent, much as adaptation is described as an action or some form of action is needed for adaptation to take place, the action needs to be purposeful and intentioned. Consequently, the notion of adaptation considered as action may be subject to debate. The decision-making process backing the action is what is of the essence. Nelson et al, [37] perceive adaptation as “the decision-making process and the set of actions undertaken to maintain the capacity to deal with current or future predicted change”.

Adger et. al. [2] maintain that, given that any response to changing conditions is in part moulded by entrenched practices, beliefs and perspectives, adaptation itself can result in deficient outcomes or maladaptation [2]. This argument by Adger alludes to the fact that adaptation is not perfect. In addition, it is influenced by several factors other than climate and thus responding to *means* (water interventions) will not happen spontaneously.

In sum, adaptation in itself requires change. Although the change may be geared towards the minimization of risks as a result of climatic hazards, which form and what type of change is another strand to be considered subsequently. However, what literature hardly discusses is the triggers of the change. In other words, how do persons respond to the means or interventions for adaptation? In a few instances, studies have focused on the impacts of some interventions such as dams on people. Other studies have also focused on

the *end* for example dry season farming, omitting key interventions such as water intervention as the *means* that can trigger the action for adaptation. Thus, this article dwells on how water interventions as *means* trigger adaptive practices and influences livelihoods.

The concepts such as mitigation, climate variability, climate change, actions, change, adjustments and means and end, discussed above may appear independent but are interrelated and these must be considered as a composite whole in an attempt to elucidate the concept of adaptation.

2.3. *Theoretical Underpinnings*

2.3.1. *Overview of the Theory of Action*

The theory of action [40, 42] pivots on the interest in man, highlighting man's behaviour, his activities and the *ends* he accomplishes. Parsons aimed at understanding society from the perspective of social action. In his earlier work, he focused on the nature of human action holding the view that every act induces two vital elements: the agent or actor and a set of goals towards which the action is directed. He perceived human action as creating choices between *means* and *ends*. An action comprises *conditions of action* and the *means of action*. The *means of action* is largely inspired by rationality and refers to the situation over which the actor has control while the physical, social systems and cultural environment define the *condition of action*. He further espoused that “the condition of action” is a situation where the actor has no control or ability to cause change.

Parsons gave some expositions about an “act”. He explained that reasonably an “act” infers an agent, an “actor”, and is continually a process in time. This act obligates an “end,” which he described as a future state of affairs toward which the process of action is oriented. In analytical philosophy, action is defined to be an act, exercised by an actor with an intention [61]. The concept *end* always implies a future reference, to a state which is either not yet in existence; and which would not come into existence if something were not done about it by the actor; or if already existent, would not remain unchanged. This process, perceived principally in terms of its relation to ends, is variously called “attainment,” “realization,” and “achievement.” Parsons also argued that an “act” ought to commence in a “situation” of which the trends of development differ significantly in one or more dimensions from the situation to which the action is oriented, the end. In another dimension, Parsons maintained that markedly human action is a cultural action influenced by norms, beliefs and values which have social interpretations and consequences. In his view, these terminologies cannot be perceived in isolation. For effective operation, there is a strong interrelationship between the elements-*means*, *ends* and *action*.

2.3.2. *The Framework for Analyzing Climate Change Adaptations as Actions (FACCAA)*

Eisenack and Stecker [16], drew inspiration from the pioneering work by Parsons [40-42] related to the Action

Theory and further to climate adaptation. The FACCAA centered on actor relations involved in adaptation. The FACCAA further considered the challenges posed by implementation, actors and agency in the adaptation discourse. It again espoused how key concepts interrelate to clarify adaptation as actions in the general context of means and end.

The FACCAA restricts adaptation to actions by humans although recognizes the role of the ecosystems. The FACCAA posits that adaptation needs to be considered in a *means-ends* relationship. The basic proponents of the FACCAA are that: Adaptation requires a *means* to propel action to achieve an intended *end*. Behaviour is conceived of as geared towards the attainment of ends.

Action requires a stimulus to achieve intended ends⁴. The action involves actors whose acts are based on intentions that are directed towards the impact of climate change. Means comprises resources, knowledge, power etc. that are needed to facilitate adaptation.

2.3.3. A Critique of the FACCAA

The FACCAA focuses on human action with less emphasis on the ecosystem which appears to elude the practical functioning of the ecosystem. Eisenack and Stecker [16] place less emphasis on the role of the ecosystem though they do acknowledge it. Therefore, implementing adaptation activities should not only be viewed as separate units but also be considered from a system perspective, taking into consideration interaction between the biotic and abiotic factors within the environment.

Adaptation requires a *means* to propel action to achieve an intended *end*. This action does not come automatically and may not necessarily be driven by means such as infrastructure or water interventions. Means may come with their challenges. There is a range of snags surrounding the concept of the rationality of action in the ordinary sense of the maximization of "efficiency" or "utility" by the adaptation of means to ends. A recurring feature of the analysis of action is its conception as a *process* of attaining specific *ends* by the choice of the "most efficient" *means* available in the circumstances of the actor. This, in turn, implies a standard according to which the selection among the many possible alternative means is made [41].

The action involves actors whose acts are based on intentions. Lane [33], has argued that while the means-end terminology is usually applied to various kinds of action phenomena; the concept of action is not a simple one. It requires a difference between behaviour (act) and action. Chisholms upheld the view that intention is essentially derivative of action. He further clarified that "Intentional behaviour" ("intentional act") generally refers to a behaviour

that is deliberately directed towards a certain state. Implicitly, there is a connotation of *purpose* relating to an *end*. This reinforces the point under the FACCAA that not all the activities of operators are actions. Activities are described as purpose only when there is an intention. For an action to be purposeful before it is called adaptation can be a bit subjective [16]. Thus, while intention and behaviour are identifiable elements of action, the term "intention" refers to purpose as well as motive. Invariably, Fishbein and Ajzen [19] perceive the action as a response to interventions. This argument reinforces the need to study the reasons behind actions taken by farmers in response to water interventions.

The argument is on action often triggered by a stimulus. In this view, the process of rational choice is fundamental in achieving the best adaptation of means to ends. Taken from another strand, this may connote an implicit assumption that one will behave rationally, in maximizing the availability of what would otherwise have been a scarce commodity to safeguard livelihoods. However, the concept of rationality is and could be subjective. Human behaviour can hardly be predicted, it could be complex.

Stimulus according to the FACCAA is relevant for adaptation only when it influences an exposure unit [16]. The extent to which a stimulus will propel change however, appears debatable. It is not simple to conjecture how stimulus determines response.

Furthermore, the FACCAA seems to suggest that stimulus is mainly from climate, placing less emphasis on non-climatic stressors. Smit [51] argues that climatic factors although are critical in bringing about a change, the role of non-climatic stressors cannot be ignored. Subsequently, the role of non-climatic factors such as institutions, processes and laws are taken into consideration.

3. Empirical Affirmations

3.1. Study Contexts

Protracted climate variabilities coupled with changes and extreme events have often resulted in water stress conditions in the northern part of Ghana including the Talensi District in the Upper East Region (UER). This water stress situation has fundamentally driven the provision of water interventions by governments and other organizations in the pursuit to propel adaptation practices and influence livelihoods. These efforts have supposedly been shrouded in the assumption that water interventions⁵ will quell the impacts of harsh climatic conditions through adaptation practices, and ultimately improve livelihoods.

A study was conducted in the Talensi district, located on latitude 10° 15' and 10° 60' north of the equator and longitude 0° 31' and 1° 0.5' west of the Greenwich meridian, in the Upper East Region. The district is strewn

⁴ **Stimulus** is a change in biophysical (meteorological) variables associated with climate change. It could be statistical parameters such as average intensity, frequency, high variance or large scale events in the earth system. Adaptation is carried out when a stimulus affects the exposure unit. They maintain that a stimulus is only relevant for adaptation when it influences an exposure unit. Eisenack and Stecker, p.245.

⁵ Water Interventions refer to the provision of structural or physical measures such as dams, farm wells and dugouts and related non-structural or non-physical measures such as laws, training and education, policies, plans, usually provided by governments, NGOs, Communities meant to facilitate livelihoods of farmers.

with numerous dams and dugouts that support dry season farming and to some extent, fish farming. Generally, the rainfall pattern within the ecosystem is unimodal, spreads over 8 months, from March to October and records lower annual rainfall (between 900 mm and 1,100 mm) with higher variability per year [50]. Amekudzi et al [3] observed the shortest length of the rainy season in Ghana of 140 (plus or minus 5 days) in the UER. This has resulted in water scarcity on one hand, and further dependence on water for farming especially during the dry season [22].

A total of 320 farmers, selected from 3 communities were interviewed using an open and closed-ended questionnaire. Data collected from surveys and FGDs were analyzed using both quantitative methods such as logit regressions with the help of STATA as well as qualitative using Atlas Ti software.

To address the complex nature of the phenomenon in the reasoning that adaptation is considered as action based on stimulus, which requires rational behaviour in a *means-ends* relationship, the study explored the Theory of Action and adopted the Framework for Analyzing Climate Change Adaptation as Actions (FACCAA). Principally, within the overall contexts, it investigated how water interventions impel climate adaptation practices and enhance livelihoods.

For purposes of the analysis, *means* denotes water intervention such as Pusu Namongo, Baare dams and on-farm wells in the Talensi District; *ends* refer mainly to dry season farming; *stimulus* refers to the climatic conditions in the Talensi District that triggers *actions* taken by farmers.

3.2. Expositions

The literature hinges on the reasoning that adaptation is perceived as a set of interventions or projects to minimize the specific impacts of climate change. On the contrary, the provisions of interventions proved that it will not necessarily bring about a conforming response in terms of using water directly to do adaptation and consequent improvement in livelihoods. This is consistent with current theories regarding adaptation as action and cognitive behaviour; and inconsistent with old thinking that once interventions are provided, one would automatically adapt.

There is a wide array of literature on water interventions. Most of them, mainly on dams incline towards impacts and sometimes indicate positive or negative and more often than not arguing that dams are more impactful to livelihoods as it generates all sorts of adaptation such as dry season-farming. What is however assumed in these studies is the fact that once the dams are placed in these water-stressed areas, farmers would correspondingly respond and in most cases through the traditionally obvious dry season-farming. The study revealed that responses to the interventions are not always positive.

In their work, Innes and Booher [27] criticized and reasoned that collaboration is more than just getting a group of people to cooperate. They contend that beyond cooperation there is rationality. The ToA argues that the provision of water interventions is perceived as opportunities that necessitate some rationality and stimulus. Although

individuals may react differently to the *means*, what emerged was *collective stimulus* demonstrated by the social capital in adapting communally. Thus, the ToA could be strengthened and given more attention to group responses to stimuli rather than the current assumption in the ToA of adapting individually.

Adaptation to water interventions is not mere action. It requires rational and purposeful thinking on the part of the beneficiary. To reiterate, the ToA considered two types of action, which are *conditions of action* and *means of action*. The ToA posited that the means of action is largely rational as it is within the control of the adaptor. Rationality could be subjective, but it turned out that even when water interventions were available for farming, the responses turned out otherwise. This could be largely attributed to the conditions of action where most farmers did not have control of the level of water in the dam. Thus, in the light of the ToA, a combined relationship between the *means* as well as the *conditions of means* are required to facilitate the change.

The ToA also does not consider means on a broad level but breaks it down into available, employed and necessary means. Taking water interventions simply as *means* could be a misnomer. It is therefore important to consider the various segments of means that facilitate adaptation and how they are used. These are related to the means and therefore substantiate the argument that not only the hard side of water interventions will facilitate an adaptation, but will require a blend with the soft such as laws, institutions, and policies. This suggests holding water interventions as *means* under the assumption that it could influence adaptation practices, may be too simple to deal with the realities.

The TOA considered the role of stimuli and argued it out as individual responses to climatic variables in decision making. Furthermore, the FACCAA generally acknowledges the role of stimulus and adduce that behaviour cannot exist without a stimulus of some sort at least. However, the mere presence of a stimulus may not necessarily trigger a response. These factors enumerated by Whitehead need to be taken into consideration as they are necessary to initiate not just a mere response but a specific kind of response⁶.

The role of non-climatic factors such as poor water management practices are equally critical and could factor into the ToA. Furthermore, the study revealed that stimulus is based on individual beliefs but also as a community, there emerged collective stimulus. Water interventions are not private goods, so the collective stimulus or stimuli are areas of reflection.

The tenets of the ToA emphasize the abilities of persons to make choices on their future development by undertaking specific measures for the attainment of their development aspirations [35]. Moran, [36] indicates that human beings are endowed with action with which they make decisions that harm or improve their sources of livelihood. This brings into perspective the ontological stance of the article, which focused on the being, in this case, smallholder farmers in the

6 www.psychologistworld.com/behaviour/stimulus-response-theory

Talensi district, the nature of reality and the different categories within reality. Thus, the theoretical stance influenced the selection of which holds the view that there is no single reality and that there are multiple realities created by individuals and groups. As a result of this, different people take different measures when confronted with similar difficulties or circumstances.

The research problem required the *rationality* of farmers in terms of making decisions in response to water interventions. This enquiry calls for a more in-depth understanding of social reality. It calls for taking into consideration human behaviour and motivation in responses to climate stimuli, water interventions and other non-climatic factors such as laws, policies and procedures.

4. Conclusions

The responses and or reactions to water interventions as means require cognitive behaviour that embraces human actions based on one's multiple realities of the phenomenon. These responses are not as simple as they connote and therefore the elements in the concept of adaptation such as *stimuli*, *action*, *means* and *ends* should be defined and interpreted collectively as part of a complex whole in the context of rational and *irrational* behaviour.

The concepts and theoretical frameworks acted as unifying set of narratives about the phenomena to give meaning to knowledge. They also provided the basis for exploring the relationship between the variables.

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