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# SOCIAL SURVEYS TO SUPPORT PERSONAL EXPERIENCE IN HUMAN-WATER-CLIMATE CHANGE INTERACTIONS *A REVIEW ON FARMERS' BEHAVIOUR*

Theme 4. Innovative sensing, observing, measuring and analysing human-water data

*Theme 4.5 – Data mining and processing, social science surveying, human behavior experiments*

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MODFABE adapting by learning

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# CONTENT PRESENTATION

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Introduction

Aim and methods

Social surveys to deepen social learning

Surveys to farmers: an empirical approach

Farmers' behaviour through surveys

New insides for policy formulations

# INTRODUCTION

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The **transdisciplinary nature of water *domains*** (physical, social, political, and symbolic matters) and the **complexity of climate change scenarios** ask for considering **social learning**, personal experience, human observations, and end-users narratives.

Deepen **social perception** is fundamental for two main reasons: as a key component of a **comprehensive** socio-political context and as the first step for **behaviour transformation** and **attitude change**.

Farmers can provide **first-hand observations and narratives** of water resources availability and climate change impacts to **check adaptation options.**

Could **social surveys** contribute to **deepening farmers' behaviour on water supply and climate change impacts?**

Could **social surveys** provide **new social scenarios** to advance understanding of data-mining, processing, and modelling of **human-water systems**?

# AIM AND METHODS

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Literature review of **108 worldwide articles (2010-2020) applying social surveys** to deepen farmers' behaviour

To provide a **comprehensive overview** of:

**1**

Social surveys main characteristics to build a methodological approach and defining an intellectual structure

**2**

Social surveys added-value in monitoring farmers' behaviour on water-climate change nexus.

# SOCIAL SURVEYS TO DEEPEN SOCIAL LEARNING

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A **social survey** is a method of analysis in scientific and **orderly form** and for **defined purposes** of a given **social situation or problem**.

## Aims:

- Collection of data related to the social aspect of community → to study individuals' circumstances and problems as members of society
- Practical and utilitarian view point → to deepen suggestions for constructive programs in solving different problems
- Search for causal, relationship → to find out the reasons behind the incident
- Re–testing of social theories → to retest social theories and hypothesis

## Characteristics:

- Study of social phenomena from social-learning
- Related to a specific geographical area
- Based on a cooperative process

## Subject matter:

- Demographic features → individual/household composition
- Social activities → habits
- Opinion and attitude → perception and values on various topics

# SURVEYS TO FARMERS: AN EMPIRICAL APPROACH

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## **Variables:** Socio-demographic structure

Table 1
List, definition and mean statistics of variables

| Variable | Definition |
|---|---|
| **Continuous variables** | |
| Age | The number of years from birth |
| Sex | Dummy: 1 for males, 0 for females |
| Adults | Number of household members with 18 years and above |
| Children | Number of household members with ages less than 18 yearsWorld Bank |
| Education | Total number of years of formal education |
| Experience | Total number of years into farming |
| Remitters | Total number of family members outside the community who sends money home. |
| Farm size | Total acreage cultivated by a farmer |
| Flood | Total number of times in 5 years a farmer experienced floods on farm. |
| Drought | Total number of times in 5 years a farmer experienced droughts on farm. |
| Windstorm | Total number of times in 5 years where windstorm destroyed farmer's farm. |
| WTP-Amount | The premium (in Ghana cedis, GHS) a farmer is willing to pay to insure farm. |
| **Dummy variables** | |
| Extension | Dummy: 1 if a farmer had access to extension service and 0 if not. |
| Farmer group | Dummy: 1 if a farmer belongs to a farmer group and 0 if not. |
| Credit | Dummy: 1 for farmers who accessed credit,0 if otherwise |
| Contract farming | Dummy: 1 for contract farmers, 0 otherwise |
| Commercial production | Dummy: 1 if farmer produce for sale or partly for sale and 0 for sole subsistence |
| Climate perception | Dummy: 1 if farmer perceived rainfall as decreasing and temperature increasing, 0 if otherwise. |
| Shock awareness | 1 if a farmer was aware of a climate shock prior to its occurrence, 0 otherwise. |
| Off-farm | Dummy: 1 if a farmer engaged in off-farm activity and 0 if otherwise. |
| Rich class district | Dummy: 1 if a farmer is located in a rich class district and 0 if in a poor district |
| Middle class district | Dummy: 1 if a farmer is located in a middle class district and 0 if in a poor district |
| WTP-decision | Dummy: 1 if a farmer is willing to insure farm, 0 if otherwise. |

*Adzawla et al.* 2019. Doi:10.1016/j.envdev.2019.100466

| Variables | Description | Value | Expected sign |
|---|---|---|---|
| | Household characteristics | | |
| Gender | Gender of the farmer | Male = 1; female = 0 | (+ or −) |
| Farming experience | Years of farming of the farmer | years | Positive |
| Education level | Years of formal schooling attained by the farmer | years | Positive |
| Household size | Number of member | Person | Positive |
| *Farm characteristics* | | | |
| Land area | Number of hectares of land cultivated by the farmer | Hectarage | Positive |
| Soil fertility | Farmer's own perception of the fertility level of his/her land | fertile = 1; infertile = 0 | Positive |
| Tenure | Proportion of land use with Land Right Certificate | Yes = 1, no = 0 | (+ or −) |
| Non-agriculture income | Proportion of non-agriculture income in total income | % | (+ or −) |
| Distance to house | Distance from plot(s) to house | kilometers | (+ or −) |
| Distance to local market | Distance from plot(s) to local market | kilometers | (+ or −) |
| | Institutional factors | | |
| Access to extension | If the farmer has access to extension services | Yes = 1, no = 0 | Positive |
| Access to credit | If the farmer has access to credit from any sources | Yes = 1, no = 0 | Positive |
| Farmers' group membership | If the farmer is a member of a farmers' group | Yes = 1, no = 0 | Positive |
| Access to weather forecasting information | If the farmer gets information about weather, climate from any source | Yes = 1, no = 0 | Positive |

*Huong & Fahad* 2017. Doi:10.1108/IJCCSM-02-2017-0032

# SURVEYS TO FARMERS: AN EMPIRICAL APPROACH

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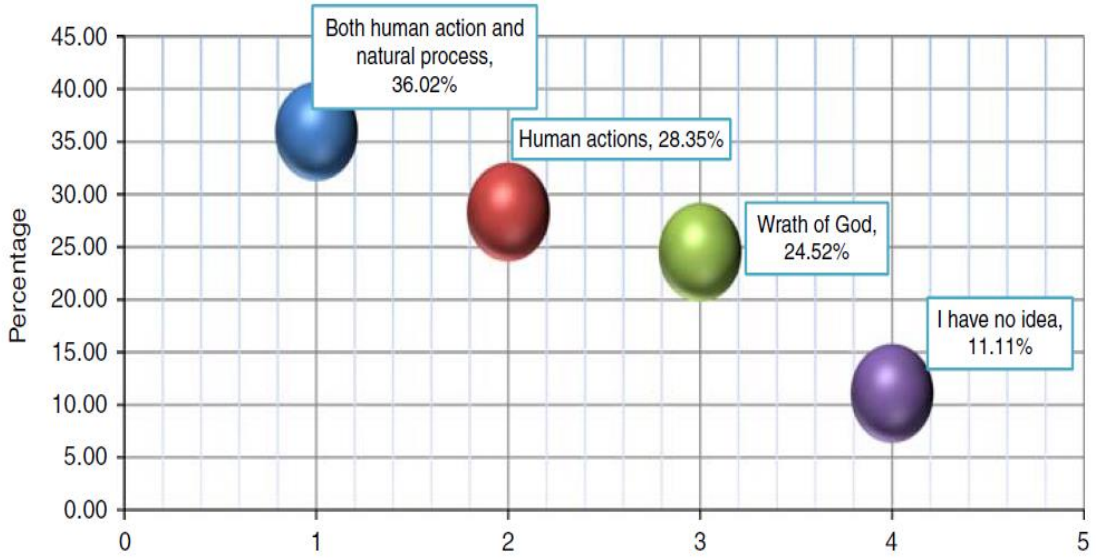
## **Variables:** Climate change awareness

**Table 2.** Distribution of farmers' beliefs regarding climate change.

| | | Strongly Disagree | Disagree | Neutral | Agreed | Strongly Agreed | | |
|---|---|---|---|---|---|---|---|---|
| **Item** | ***n*** | **%** | **%** | **%** | **%** | **%** | **Mean** | **SD** |
| Climate change is occurring because of human activities | 163 | 3.7 | 0.6 | 6.1 | 47.9 | 41.7 | 4.23 | 0.88 |
| Climate change is occurring because of natural change | 163 | 3.1 | 1.2 | 2.5 | 54 | 39.3 | 4.25 | 0.82 |
| Climate change is occurring equally because of natural changes and human causes | 163 | 7.3 | 7.4 | 4.3 | 50.3 | 30.7 | 3.9 | 1.14 |
| Insufficient evidence that climate change is occurring * | 163 | 29.4 | 25.2 | 4.3 | 19.6 | 21.5 | 2.79 | 1.56 |
| Climate change is not occurring * | 163 | 46.6 | 31.9 | 4.3 | 12.9 | 4.3 | 1.96 | 1.19 |

Summated Mean = 19.63; SD = 3.10; Range = 12; Low = 13; and High = 25; Item Mean = 3.92. * Scores were reversed for the negative items.

*Alotaibi et al.* 2020. Doi:10.3390/agriculture10070253




*Tesfahun & Chawla* 2019. Doi:10.1108/MEQ-04-2019-0076

*2.3.1 Climate change knowledge*

We inquired how ranchers and farmers thought about the following statements: "I believe that we are in a period of climate change" (Statement #1), and "I believe that human activity has been playing a significant role in recent climate change" (Statement #2). While for regression models the second statement was selected as the knowledge index, as it was related to the primary cause of contemporary climate change (role of human activity). Therefore, it serves as a more accurate measurement of scientific climate change knowledge.

*Liu et al.* 2014. Doi:10.1007/s10584-013-0979-x

# SURVEYS TO FARMERS: AN EMPIRICAL APPROACH

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## **Variables:** Climate change impacts

**Impact of climate variability**

1.Reduce of crop areas

2.Pest/insects infestations has increased

3. Rice paddy field has been change

4. Loss of yield

5 Disease has increased

6. Reduction of soil fertility

7.Rice planting has been changed to new methods

8. Reduction of varieties of rice

*Thangrak et al.* 2020. Doi:10.1007/s10113-014-0669-x

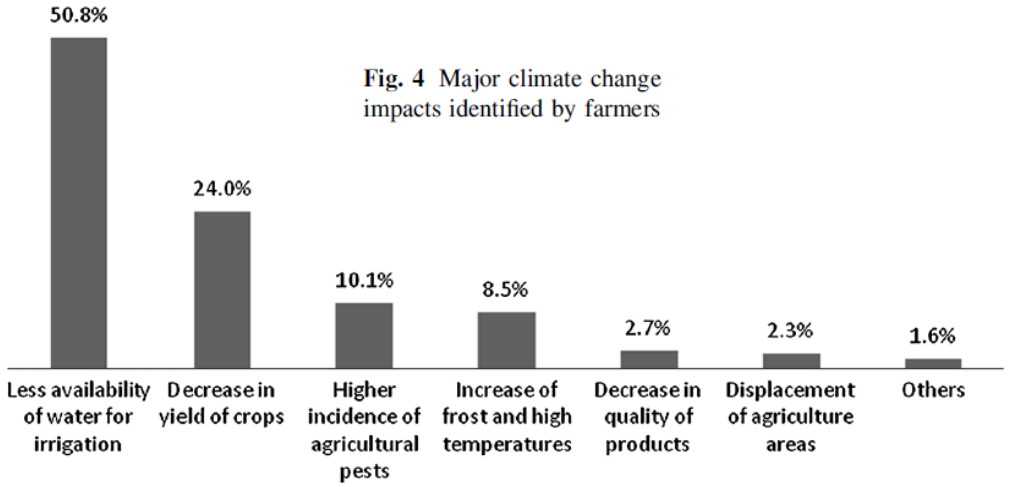



**Fig. 4** Major climate change impacts identified by farmers

*Roco et al.* 2020. Doi:10.1016/j.jaridenv.2020.104247

Perception of climate change impacts on crop production

There has been an increase in scarcity of water for production

The frequency of crop diseases has increased

Yields from crops have largely reduced

Crops have increasingly been stressed by drought conditions

The incidence of pests has risen

Timing of planting has been very irregular in recent years

Soil condition has become unsuitable for planting

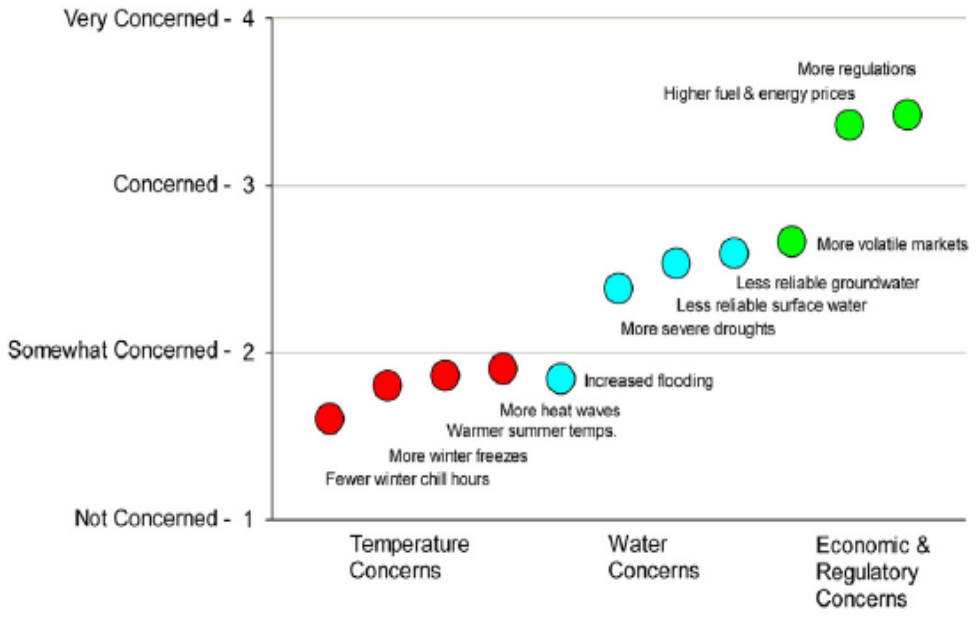
Drastic decline in sale of farm products

Harvesting of crops have become prolonged

Quality crops have become increasingly difficult to produce

Loss of farm income or earnings

*Popoola et al.* 2018. Doi:10.1007/s10708-017-9829-0




*Niles et al.* 2013. Doi:10.1016/j.gloenvcha.2013.08.005

**Meteorological**

**+**

**Agronomic**

# SURVEYS TO FARMERS: AN EMPIRICAL APPROACH

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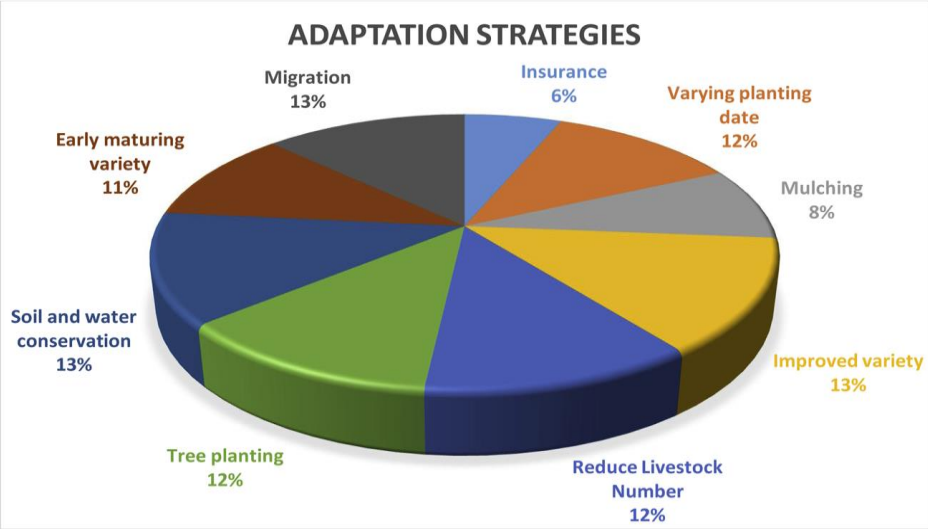
## **Variables:** Climate change adaptation



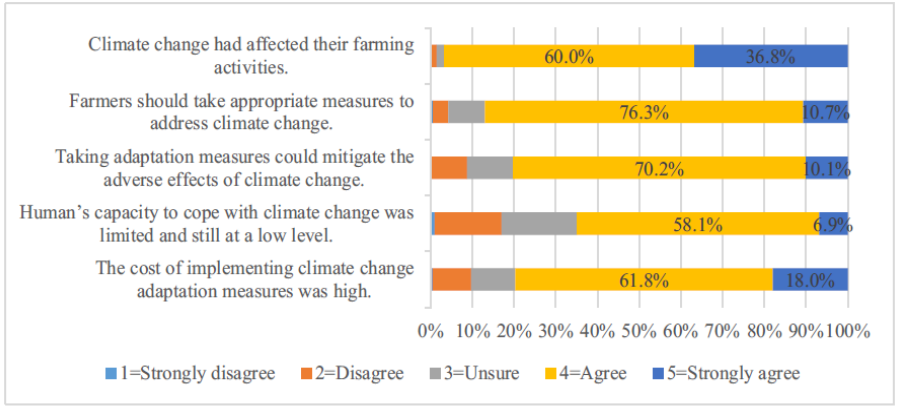

*Thinda et al.* 2020. Doi:10.1016/j.landusepol.2020.104858

**Table 3** Adaptation strategies utilised in coping with the challenges of climate

| Adaptation strategies |
|---|
| Adjustment of planting calendar |
| Use of fertiliser |
| Use of soil conservation practices (e.g. mixed and rotational cropping) |
| Use of weather and meteorological reports to guide farming |
| Construction of channels to drain off excess water |
| Planting of improved stress-tolerant, water-saving varieties |
| Use of integrated pest management (IPM) |
| Building of traditional dam to store water for dry period |
| Water conservation practices such as mulching |
| Making ridges across farm |
| Shift from vegetable production to other non-agricultural enterprises |
| Crop diversification |
| Temporary/permanent migration |
| Creation of cooperatives among co-farmers |
| Reduced space of land put under cultivation to minimise chances of loss |
| Crop insurance |
| Use of wind break structures |

*Fadairo et al.* 2020. Doi:10.1007/s10668-019-00514-1

**Fig. 4** Farmers' perceptions of climate change adaptation




*Zhang et al.* 2020. Doi:10.1007/s11356-020-09048-w

# SURVEYS TO FARMERS: AN EMPIRICAL APPROACH

## Scheme of the research

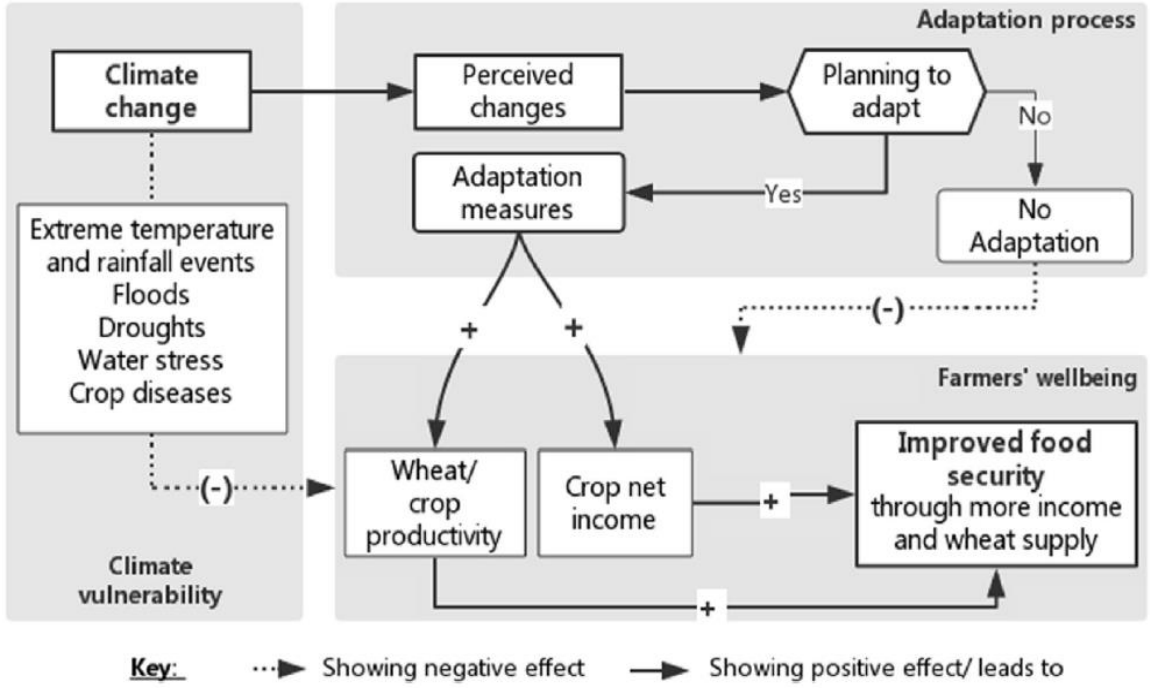
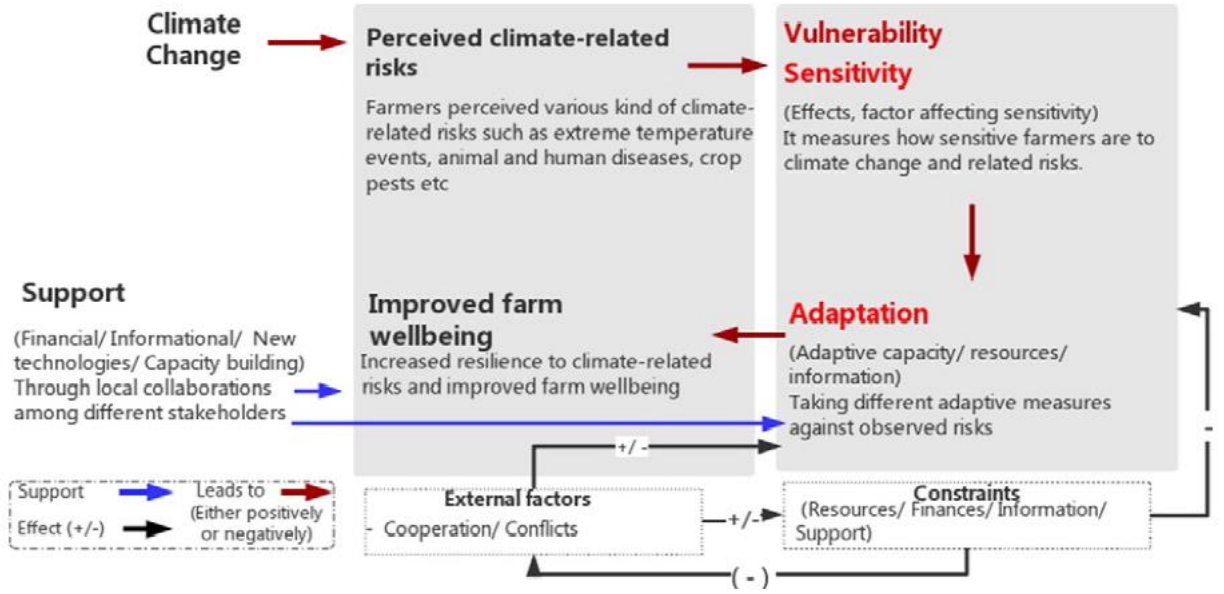



Fig. 2. Conceptual framework of the study showing interactions among climate change, adaptation and farmers' wellbeing.

*Abid et al.* 2016a. Doi:10.1016/j.jrurstud.2016.08.005




*Abid et al.* 2016b. Doi:10.1016/j.scitotenv.2015.11.125

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## Geographical context

Most of the explanatory factors for farmers' awareness, perceived risks, and adaptation capacity are common among geographically distant case studies, but they are not geographically representative.

- A low representation of Global North-based literature has been identified.
- A ratio of 1 to 9 in favor of Global South studies (mainly focused on African and Asian countries: 96 of 108 articles) has been identified (increasing the results obtained by *Soubry et al. 2020*).
- Both regions are leading the top-10 most affected countries according to the Global Climate Risk Index in 2020, but economic losses are concentrated in the USA and Asia (Natural disasters report 2020, EM-DAT).

# FARMERS' BEHAVIOUR THROUGH SURVEYS

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## Socio-demographic characteristics

The farmers' profile ask for basic information regarding **8 issues:** age, gender, education, farming experience, farm size, association membership, country and sample. **Top 3:**

**Age (in 70%)**

Mean age under 50 years in studies carried out in Niger (*Ado et al. 2020*), Zimbabwe (*Mutandwa et al. 2019*), Vietnam (*Nong et al. 2020*) or Philippines (*Lasco et al. 2016*)

Oldest farmers in the United States (*Liu et al. 2014*) and China (*Zhang et al. 2020*)

**Gender (50%)**

Men-focused studies, being only five those in which the female gender exceeded 50% (*Liu et al. 2014, Li et al. 2017, Ferdushi et al. 2019, Assan et al. 2020, Chhogyel et al. 2020*)

Just one study specifically addressed to female farmers' behavior analysis (*Lawson et al. 2020*)

**Education (75%)**

Years of formal education or degrees achieved.

Illiterate and primary education have been the dominant categories in half of the studies.

High school was the highest educational range in 11 studies.

# FARMERS' BEHAVIOUR THROUGH SURVEYS

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## Climate change awareness

**Studies reported 5 main perceptions**

**Top 5**

- Climate is changing
- Climate change is occurring because of human activities
- Climate change is occurring because of natural changes
- Climate change is occurring because of natural changes and human activities
- Climate change is not occurring (lack of evidences)

Most of farmers **agree with statements that the climate is changing or occurring** (*Niles et al. 2013, Ndamani & Watanabe 2017, Asrat & Simane 2018, Ferdushi et al. 2019, Biswas et al. 2020*)

Most of them highlighted that **climate is changing because of human activity** (*Fadina & Barjolle 2018, Agesa et al. 2019, McNally et al. 2020*)

**Few studies** (*Mase et al. 2017, Amir et al. 2020*) **mainly considered both** human activities and natural changes as causes of climate change

# FARMERS' BEHAVIOUR THROUGH SURVEYS

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## Climate change perceived impacts

Studies reported **13 significant impacts**

**Top 3**

1) Rising and extreme temperatures
2) Changes in rainfall pattern
3) Increase of drought periods and dry spells

- Extreme temperature
- Rainfall pattern (unpredictive, erratic)
- Droughts and dry spells
- Length of rainy season (stopped earlier)
- Flood frequency
- Rainfall amount intensity
- Rainfall season amplitude
- Length of summer season (started earlier)
- Windstorm and hailstorm
- Heatwaves and hot days

- Crop production
- Pest and diseases
- Soil fertility and land degradation

Some studies compare **farmers' perceptions and meteorological observations** of temperature and rainfall (*Elum et al. 2017, Bacha et al. 2018*)

Most of the studies reported an **increasing trend in temperature** (*Asfaw et al. 2019*), especially over the last 15–20 years (*Fosu-Mensah et al. 2012, Esham & Garforth 2013, Akhtar et al. 2019*), while considering **droughts periods** (*Comoé & Siegrist 2015, Tesfahun & Chawla 2019*)

# FARMERS' BEHAVIOUR THROUGH SURVEYS

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## Climate change adaptation measures

Studies reported **11 main adaptive measures**

**Top 3**

1) Changing cropping patterns
2) New crop varieties
3) Soil and water conservation techniques

Farmers apply adaptation methods **simultaneously** (*Funk et al. 2020*)

Some studies distinguished adaptation measures considering their **reactive** (*Budhathoki et al. 2020*) or **preventive** nature (*Myeni & Moeletsi 2020*)

- Changing cropping patterns (intercropping, calendar, crop rotation)
- New crop varieties (crop diversification, drought tolerance)
- Soil and water conservation techniques
- Planting shaded trees (agroforestry)
- Organic fertilizers or pesticides
- Promote of-farm activities
- Frequent or supplementary irrigation
- Water harvesting and build infrastructures
- Migration to other areas
- Purchasing agriculture insurance
- Reduce cultivated area or livestock diversification

Some adaptation options were applied thinking about their **long-term benefits** to overcome risks (*Gebru et al. 2020*)

# NEW INSIDES FOR POLICY FORMULATIONS

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A better understanding of farmers' behaviors is fundamental to promote accurate **actions** based on an **attitude change**. It allows:

- **focusing** the specific behaviors to be changed
- **examining** the driving factors motivating those behaviors
- **defining** and **applying** different interventions
- **evaluating** the effects of these interventions on the resulting behaviors

**Future work should move:**

✓ From **cross-sectional analyses** (one-off surveys at a point in time) to **over-time studies** (a panel to periodically repeat the survey)

✓ From **geographical analyses** (Global South to Global North studies) to **regional interdependencies** from social-learning, while checking best replicable, innovative and technological adaptation strategies

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# Thanks for your attention!

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