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Developing a Conceptual Model for Identifying Determinants of Climate Change Adaptation

Muhammad Humayun Kabir* and Md Mahbubul Alam

Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh
✉ mhumayunsau@gmail.com

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Abstract: The conceptual model seems to be an integral part of academic research. Any conceptual model should be developed based on theoretical reasoning and practical relevance of the topic. However, for most instances, climate change adaptation studies do not ground on such rationale and relevance. A relatively lower R^2 value of such studies further indicates a lack of care for developing the conceptual modelling of the study. Thus, the current study attempted to propose a conceptual model for assessing the determinants of farmers' adaptation to climate change in Bangladesh. A three-stage approach was used in constructing the model. First, relevant literatures were collected and analysed. Second, a list of factors compiled from the first stage (i.e., analysis of literature review) was refined using the Delphi method. Finally, the result of the Delphi method was cross-evaluated by Focus Group Discussion (FGD). Based on this, the present study proposes a multi-dimensional conceptual model that includes personal, economic, institutional and environmental determinants and might influence farmers' adaptation decision to climate change. This finding is expected to be suitable, in particular, for Bangladesh and other developing countries in general. Most importantly, it is expected to guide future research in assessing the factors influencing farmers' adaptation strategies to climate change effect and other similar events such as adopting agricultural technologies.

Keywords: Conceptual framework; Delphi method; FGD; Adaptation; Climate change.

Introduction

Climate change is a global phenomenon. It has both positive and negative effects on the environment as well as on people's livelihood (Sabate et al., 2002; Dang et al., 2014). Most scholars dealt with its negative effects on various aspects of human lives. Several studies proved the negative effects of climate change on health, agriculture, education, industry, and so on. A considerable number of such studies focussed on agriculture (Bryan et al., 2013; Obayelu et al., 2014). Climate change affects agricultural production in many ways. To minimise the negative effects of climate change on crop yields, farmers adopted several adaptation strategies such as tree plantation, change of cropping time, use of the resistant variety, etc (Uddin et al., 2014; Deressa et al., 2009).

Adaptation is an alternative yet successful strategy in dealing with the climate change effect and thereupon, it has gained considerable attention in climate change studies. Adaptation refers to the process of modification of one's behaviour that makes it more fit for existence under the varied condition in an environment (Merriam-Webster dictionary). Adaptation of the agricultural system implies that farmers can adapt to the changed conditions better (Aurther and Van Kooten, 1992; Smith et al., 1999). However, farmers' adaptation strategies vary greatly and is mostly influenced by a considerable

*Corresponding Author

number of factors. The prominent factors as cited by prior researchers are psychological, socio-economic, biophysical, environmental, social capital, household, farm and institutional (Tam and McDaniels, 2013; Mertz et al., 2009; Boko et al., 2007; Komba and Muchapondwa, 2012).

Albeit several studies have already been conducted on this area of interest, yet the development of a conceptual framework of those studies is unclear. Moreover, a relatively lower pseudo R^2 value of such studies indicates a lack of care to develop a conceptual framework (Deressa et al., 2009; Tazeze et al., 2012; Hassan and Nhemachena, 2008) and variables selection. Most studies were conducted in a country other than Bangladesh. Therefore, the identification of context-specific factors is more pertinent than the generic factors. Due to socio-economic and environmental variations, factors identified in one setting have often proven to be inadequate to explain the phenomenon of interest in other settings. This study, therefore, fulfils this void by identifying the determinants of farmers' adaptation to climate change in Bangladesh.

This paper is constructed as follows: The theoretical background is highlighted in the next part. In the third section, the data collection method and analysis are presented. Findings are presented in the fourth section, while discussion and conclusions are highlighted in the fifth and sixth sections, respectively.

Theoretical Background

The primary purpose of this paper is to study the current state of factors that determine the farmers' adaptation strategy to climate change effect and understand them. Hence, at first, a literature search was carried out to find relevant studies and reviewed to develop a unified conceptual model on farmers' adaptation factors concerning climate change based on the conceptual and empirical underpinning of the studies. Thereafter, we adopted a 'meta-theorization' approach (e.g., Bostrom et al., 2009). This approach outlines the ontological network of factors and their relationship in an area of investigation. It describes the utility of a theory by critically reviewing the related literature. By synthesizing the prior studies, this meta-theory thus allows researchers to develop an enhanced understanding of the phenomenon of interest within a nomological net. A meta-theory should satisfy three criteria (Ritzer, 2001). These are (i) the ability to provide overarching perspectives (i.e., summarise prior research and identify research gap which helps to understand the phenomenon of interest better); (ii) ability to facilitate theory development (i.e., provides a lens to study the context and therefore offers guidelines for developing context-specific model); and (iii) the ability to provide a deeper understanding of a theory (e.g., it offers a comprehensive understanding of a chosen subject-matter).

Based on the review of the existing body of knowledge concerning factors that determine farmers' adaptation strategy to climate change, we noticed a rather ungoverned set of constructs and causal relationships. The use of selected adaptation strategies to climate change was found as the most common outcome variable of those studies; however, antecedents were found to vary in number and nature. Thus, reaching an overarching understanding of climate change adaptation strategies were often found difficult. With that regard, a meta-theoretical approach allows the researchers to find the research gaps and motivates them to work to fill up the void. Moreover, prior work has struggled to capture context-specificity, thereby their findings offer less usability in explaining farmers' adaptation strategies, particularly in Bangladesh. To summarise, this theoretical approach adds a unique value to the literature by expanding the understanding and discussion of climate change adaptation strategies taken by farmers. This study used a qualitative technique of critically reviewing existing literature related to climate change adaptation. To make it more context-specific, the Delphi technique was used to seek experts' opinions regarding the value of different climate change adaptation strategies, particularly in Bangladesh. These findings were further validated by the farmers' participation in Focus Group Discussion (FGD). The outcome of this work offers a comprehensive outline of determinants impact farmers' decision of choice regarding climate change strategies that can guide future research in studying climate change phenomenon.

Research Method

This section describes the methods used in this study. Three methods viz a critical review of relevant literature, Delphi method, and Focus Group Discussion (FGD) were employed to satisfy the objectives of this study. A description of these techniques is presented below.

Selection of Relevant Literature

The literature review is a basic part of all studies irrespective of their type (exploratory vs. explanatory, qualitative vs. quantitative). The basic premise of this

research is qualitative and exploratory. Hence, the secondary data source was a prime concern of this study. This study limited its literature search within journal articles using two keywords, 'climate change' and 'farmer's adaptation' using the Google Scholar search engine. To emphasise the recent research, we only considered articles published in a period of the last 11 years (from 2008 to 2018). A list of the constructs and their respective studies have been shown in Table 3. An initial pool of the factors was identified based on the frequency of each construct. This pool of factors was further verified by the Delphi method.

Delphi Technique

Delphi technique is a method of collecting experts' opinions to solve a complex issue. Researchers (e.g., Green, 2014; Yousuf, 2007; Aquailano and Jacob, 2003) widely use the technique to collect experts' opinions on various issues such as developing indicators to assess agricultural sustainability, compile key issues in Information Systems, selecting quality indicators in healthcare, identify potential drivers of change, investigate factors related to rural development, and so on (Belanger et al., 2012; Dekleva and Zupancic, 1996; Bulkedid et al., 2011; Manoliadis et al., 2006; Namdar and Sadighi, 2013). In the study, the Delphi technique was applied to determine more context-specific and salient factors in impacting farmers' adaptation decisions towards climate change as experts perceived it.

In Delphi, a set of questions[1] is sent to a panel of experts. Anonymous responses are aggregated and shared after each round. The procedure of Delphi can be repeated several times. However, the success of the Delphi method lies in two aspects; first, the selection criteria of a panel of experts, and second, the number of experts for each round of procedure. Ideally, a person with adequate service experience in a particular field of study and knowledge about a subject matter is considered an expert (Delworth, 1993; Moral et al., 2010). Keeping this in mind, a panel of experts were selected for this study from various professions, including academicians, researchers, policymakers, lead/progressive farmers. Following the study conducted by King et al. (2000) and Rigby et al. (2001), we included progressive farmers as panel experts because they are the key stakeholders of climate change incidence. Moreover, Rossing et al. (1997) clearly defined farmers' aspirations as a key aspect in the selection of factors in assessing agricultural systems.

Regarding the second aspect (e.g., number of experts for each round), many studies recommended 4 to 27 persons for each round (see, Table 1). In the study, a panel of twelve (12) experts was considered based on their expertise and availability during the procedure. In the first round, a pool of factors that came up through the process of the literature search (Table 2) was sent to the selected experts and asked them to rate each factor on a scale of 1 to 5, while '1' indicates the least important and '5' indicates the most important factor. Apart from the rating, participant experts freely added any other factor they deemed important and rated them accordingly. Upon completion of that round, mean, score variation and quartile deviation for each item were calculated as described by Chu and Hwang (2008). To eliminate the potential bias, the result of the first round was sent to experts once again and requested to rate in the same way. After the end of the second round, mean, score variation and quartile deviation were calculated in order to summarise the factors (see Table 2).

Table 1: Number of participants for each round used in prior studies for Delphi technique

Authors	*No of participants*	*No of rounds*
Roy et al. (2013); Chu et al. (2008)	7	2
Moral et al. (2010)	8	2
Okoli and Pawlowski (2004)	10-18	3
Hugé et al. (2011); Brockhoff (1975)	4-6	2
Belanger et al. (2012)	21	2
Doke and Swanson (1995)	27	3

Table 2: Rules for analyzing item scores using Delphi technique

Round 1	*Round 2*
Mean score of the factor F $\geq$3.5	If Mean score of the factor F $\geq$3.5 and Q $\leq$ 0.5, then factor F is accepted
Mean score of the factor F <3.5	If Mean score of the factor F < 3.5 and Q >0.5, then factor F is rejected

Note: 'Mean' is the average score for each indicator, 'score variance' is the ratio of the two scores given by a single expert for the same indicator in two successive rounds, 'Q' is the inter-quartile range.

Source: Chu and Hwang (2008); Roy et al. (2013).

[1] For this study, a set of salient factors identified from literature searched was sent to an expert for evaluation.

Focus Group Discussion

FGD is an approach that is widely applicable for qualitative research; however, this can also be used as a part or basis for quantitative study (Tey et al., 2012). In this study, FGD was applied to verify the result obtained from the Delphi method. FGD allowed us to validate the selected determining factors for climate change adaptation strategies by the grassroots level farmers. Three FGDs were carried out, and each from three districts proved as vulnerable due to climate change events, namely Sirajganj, Jashore and Patuakhali. These districts are one of the most vulnerable areas to climate change in Bangladesh as they are frequently affected by floods, drought, and salinity. About 8 to 10 people participated in each session of FGD, and every session lasted around 1 hour. All the FGDs were carried out in 2 months (January to February, 2017).

All the FGDs were conducted in line with the objectives of this study. During the exercise, the first author played the role of moderator while the second author played the role of a rapporteur (Barbour and Flick, 2007; Krueger and Casey, 2009 and Stewart et al., 2007). The researchers tried their best to make a friendly environment and encourage each participant to participate in the discussion willingly. Initially, a number of factors were identified by participants as important for climate change adaptation strategy. Afterwards, they were asked to rate the factors based on their perceived importance on a 5-point rating scale. Finally, the mean score for all the factors was calculated, and a cutoff point of 3.5 was considered to accept or reject a factor (e.g., Roy et al., 2013).

Results

This section presents the major findings of the study. First, the list of factors that were considered in past literature is presented. Second, the results of the Delphi method and finally, the results of FGD are presented.

Factors Identified through Literature Search

As stated in the section "Research Methods", two keywords (climate change and farmer's adaptation) were used to retrieve relevant literature using Scholar Google. Concerning the utility, scope, and limitation of this study, articles published in the last 11-year period (2007-2018) were surveyed for this search. Careful screening of the articles resulted in 63 factors from 19 studies, as shown in Table 3.

Table 3 shows all the variables used or considered in the studies pulled out through the literature search. The authors critically reviewed all the studies (here, 19 studies) and identified 63 factors. They also highlighted the factors using an asterisk (*), they were found to be the most contributing factors in respected studies. Table 3 thus provides a general overview of the factors that are related to climate change adaptation strategies.

Result of Delphi Technique

The set of factors (63) obtained from the literature search was then sent to the panel of experts for their opinion regarding the importance of these factors in influencing farmers' decisions in adopting climate change adaptation strategies. The Delphi method had two rounds. Based on experts' responses, the mean score for each factor was calculated. Factors that had a mean score of less than 3.5 on a scale of 5 were dropped from the list (Table 4). The remaining factors were sent back to the panel of experts for the second round.

Experts' responses in the second round were captured (Table 5) and calculated for factors' mean, quartile deviation and score variance (%). Based on the score of mean, quartile deviation and score variance, two items namely age and household size were dropped in this round, and the remaining items were used for the last stage (i.e., FGD) of analysis.

Result of FGD

Three FGDs were conducted in three different parts of the countries consisting of 8 to 10 respondents each. The respondents were given a total of fifteen (15) items and asked for scoring on a scale of 5, in order to identify the most important factors that helped to determine their choice for climate change adaptation strategies. Two of the factors (livestock ownership and distance from market) had a score of less than 3.5 and, therefore, were also dropped from the list. Thus, a total of thirteen (13) factors were finally screened out as the most salient factors to determine farmers' adaptation strategies towards climate change (Table 6).

A careful observation of the remaining 13 factors resulted in four major dimensions viz. personal, economic, institutional, and environmental factors. Based on this, a conceptual model is proposed (Figure 1).

Discussion

Climate change adaptation is not a single-dimension construct; instead, it is multi-dimensional. To succeed in mitigating the climate change effect, one has to

Table 3: Factors influencing farmers' adaptation decisions to climate change

Authors	*Study location*	*Factors/determinants*
Delaporte and Maure (2015)	Bangladesh	*Household size, *Age, *Gender, *Education, Religion, *Annual income, *Electricity facility, *Land size, Occupation, *Livestock ownership, *Exposure to mass media and *Marital status.
Uddin et al. (2014)	Bangladesh	*Farming experience, *Age, *Extension contact, *Education, number of plots, *Farm size, *Family income and *Cooperative involvement.
Deressa et al., 2008	Ethiopia	*Household size, *Age, *Gender, *Education, *Farm income, *Off-farm income, *Livestock ownership, *Information on climate change, Extension on crop and livestock, Farmer to farmer extension, *Farm size, *Credit, Number of relatives, *Distance to market, *Local agro ecology, *Temperature and *Precipitation.
Komba and Muchapondwa, 2012	Tanzania	*Annual income, *Farming experience, *Household size, *Gender, *Education, *Access to media, *Access to credit, *Average temperature, *Average rainfall, Frequency of drought, Frequency of flood, *Distance from market, Technical support, Grown major crop and *Agro-ecological zone.
Tazeze et al., 2012	Ethiopia	*Sex, *Age, *Education, *Family size, *Distance to market, *Livestock holding, *Off farm income, *Farm income, *Extension contact, *Agro-ecology, *Credit, Farmer to farmer extension, *Access to climate information and *Land holding.
Hasan and Nhemachena, 2008	Africa	*Temperature, *Precipitation, *Extension contact, *Access to credit, *Distance to market, *Farming experience, *Farm size, Ownership of heavy machine, *Access to electricity, *Household size, *Age and *Gender.
Bryan et al., 2013	Kenya	*Gender, *Education, *Farming experience, *Household size, *Access to electricity, Receive food or other aid, *Associations membership, Soil fertility, *Land area, Irrigation, Mix crop and livestock production, Extension field visit, Crop extension, Livestock extension, Seasonal forecast, Weather forecast, Early warning, *Credit and *Off farm income.
Shongwe et al., 2014	Swaziland	*Sex, *Age, *Education, Occupation, *Member of social group, Land category, *Access to credit, *Extension contact, High pest infestation, High input price, High food price and *Perception towards climate change.
Gorst et al., 2015	Pakistan	Canel, Tubewell, Tractor, *Total land, *Education, *Household size, *Gender, *Credit, *Off farm income, Land ownership, Flood, Drought, *Livestock, *Temperature, *Precipitation, *Extension service, *Media, Landlord and Middleman.
Obayelu et al., 2014	Nigeria	*Age, *Household size, *Gender, *Education, *Farm income, *Farming experience, *Credit, *Off farm income, *Information on climate change, *Livestock farming and *Contact with extension agent.
Regmi et al., 2017	Nepal	*Economic active member, *Education, *Farm size, *Gender, *Experience, Training, *Membership of organization, *Livestock ownership, Family type, *Information on climate change, Distance to agriculture office and *Credit access.
Sahu and Mishra, 2013	India	*Age, *Level of education, *Family size, *Years of farming experience, *Number of family agricultural laborers, and *Annual income of the family.
Fadina and Barjolle, 2018	Benin	*Gender, *Educational level, *Farm income, *Farm size, *Farming experience and *Belong to farmer organization.

(*Contd*.)

Table 3: (*Contd.*)

Authors	*Study location*	*Factors/determinants*
Dang, 2014	Vietnam	*Age, *Gender, *Education, *Income, Assets, *Household size, *Farm size, *Farming experience, *Availability and access to credit/capital/funds, Availability and access to subsidy, *Availability and access to information (climate change, adaptation methods), *Availability and access to agricultural extension, Access to land/labour, Access to irrigation, *Access to market (input/output), Infrastructure, technologies, *Organization structure of interactions, Government policies/directives, Institutional arrangements on land, Cultural/social norms, Shared values and understandings, Social capital, *Belief in the reality or impacts of climate change, Trust, Denial, Perceived successfulness and Risk perception
Menike and Arachchi, 2016	Sri Lanka	*Household size, *Income, *Media, Crop, *Group member, Distance to input, *Location, *Loan access and *Education.
Arbuckle jr. et al., 2013	US	Ingenuity, *Belief, *Age and *Education
Afroz and Akhtar, 2017	Malaysia	*Access to extension media, *Age, *Education, *Off farm income, Knowledge about climate change, *Farm size and *Farming experience.
Fagariba et al., 2018	Ghana	*Gender, *Education, *Farm labour, *Household size, *Access to weather information, *Access to credit facilities, Deforestation, *Temperature pattern and Evaporation.
Baiyegunhi, 2018	Nigeria	*Gender, *Age of the household head, *Marital status, *Educational status, *Household size, *Off-farm income, *Farming experience, *Access to credit, *Farm size, *Access to climate information, *Access to extension contact, *Membership of organization, *Mean annual temperature, *Mean annual precipitation and *Location.

* = commonly used by the authors and most of the cases got a significant relationship with these factors and the use of adaptation strategies

Table 4: Results of first-round Delphi Method

Factors having mean score ≥3.5	*Factors having mean score <3.5*
Age, Level of education, Household size, Annual income, Media contact, Group membership, Distance from market, Access to the credit facility, Off-farm income, Farming experience, Farm size, Information on climate change, Livestock ownership, Mean temperature, Mean precipitation, Farm labour, Belief/ Perception towards climate change	Gender, Access to electricity, Marital status, Location, Ago-ecology

Note: Mean value computed on a scale between 5 = Most important and 1 = Least important

Table 5: Results of second round of Delphi Method

Factors	*Round*	*Ratings by each expert*								*Mean*	*Quartile deviation*	*Score variance (%)*
Age	1	4	4	5	3	5	4	4	4	4.12	0.4	20.55
	2	3	3	5	4	4	3	4	4	3.75	0.5	
Level of education	1	5	5	5	4	4	5	5	5	4.75	0.4	
	2	5	5	4	5	4	5	5	4	4.62	0.5	10.70
Household size	1	3	4	5	4	3	5	4	4	4.00	0.7	
	2	4	3	4	3	4	4	4	3	3.62	0.5	28.55
Annual farm income	1	5	5	5	4	5	5	4	5	4.75	0.5	
	2	5	5	5	5	5	5	5	5	5.00	0	10.70
Off-farm income	1	4	4	4	4	5	4	5	4	4.25	0.4	
	2	4	4	4	3	4	3	5	4	3.87	0.4	10.70
Media contact	1	5	5	4	5	5	5	5	5	4.87	0	
	2	4	5	5	5	5	5	5	5	4.87	0	6.25
Group membership	1	4	4	5	5	4	5	5	4	4.50	0.5	
	2	4	4	4	5	5	5	4	4	4.37	0.5	14.30
Distance of home to market	1	4	4	3	4	4	3	4	3	3.62	0.5	13.40
	2	3	4	4	3	5	3	5	4	3.87	0.4	
Access to credit	1	4	4	5	5	4	4	4	4	4.25	0.4	
	2	4	4	5	4	4	4	3	3	3.87	0.4	10.70
Farm size	1	5	5	4	5	5	5	5	5	4.87	0	
	2	5	5	5	5	5	5	5	5	5.00	0	6.25
Experience in farming	1	4	4	5	4	5	5	4	4	4.37	0.5	13.40
	2	5	5	4	4	5	5	5	3	4.50	0.5	
Information on climate change	1	5	5	4	5	4	5	4	4	4.50	0.5	14.30
	2	5	4	5	4	5	4	5	5	4.62	0.5	
Livestock ownership	1	3	3	4	4	3	4	4	4	3.62	0.5	13.40
	2	4	3	4	3	3	5	4	4	3.75	0.5	
Mean temperature	1	4	4	5	5	3	4	4	5	4.25	0.4	10.70
	2	4	5	4	4	4	4	4	4	4.12	0	
Mean precipitation	1	4	4	4	5	4	4	5	4	4.25	0	10.70
	2	4	4	5	5	4	4	5	4	4.37	0.5	
Farm labour size	1	3	4	4	4	3	3	4	4	3.62	0.5	13.40
	2	4	4	4	4	4	3	4	4	3.87	0	
Perception towards climate change	1	5	5	4	4	4	3	5	5	4.37	0.5	13.40
	2	5	4	5	5	4	3	5	5	4.50	0.5	

Table 6: Results from Focus Group Discussion (FGD)

Factors having mean score ≥3.5	*Factors having mean score <3.5*
Level of education, Annual income, Media contact, Group membership, Access to credit facility, Off-farm income, Farming experience, Farm size, Information on climate change, Mean temperature, Mean precipitation, Farm labour, Perception towards climate change effects	Livestock ownership, Distance from market

Note: Mean value computed on a scale between 5 = Most relevant and 1 = Least relevant

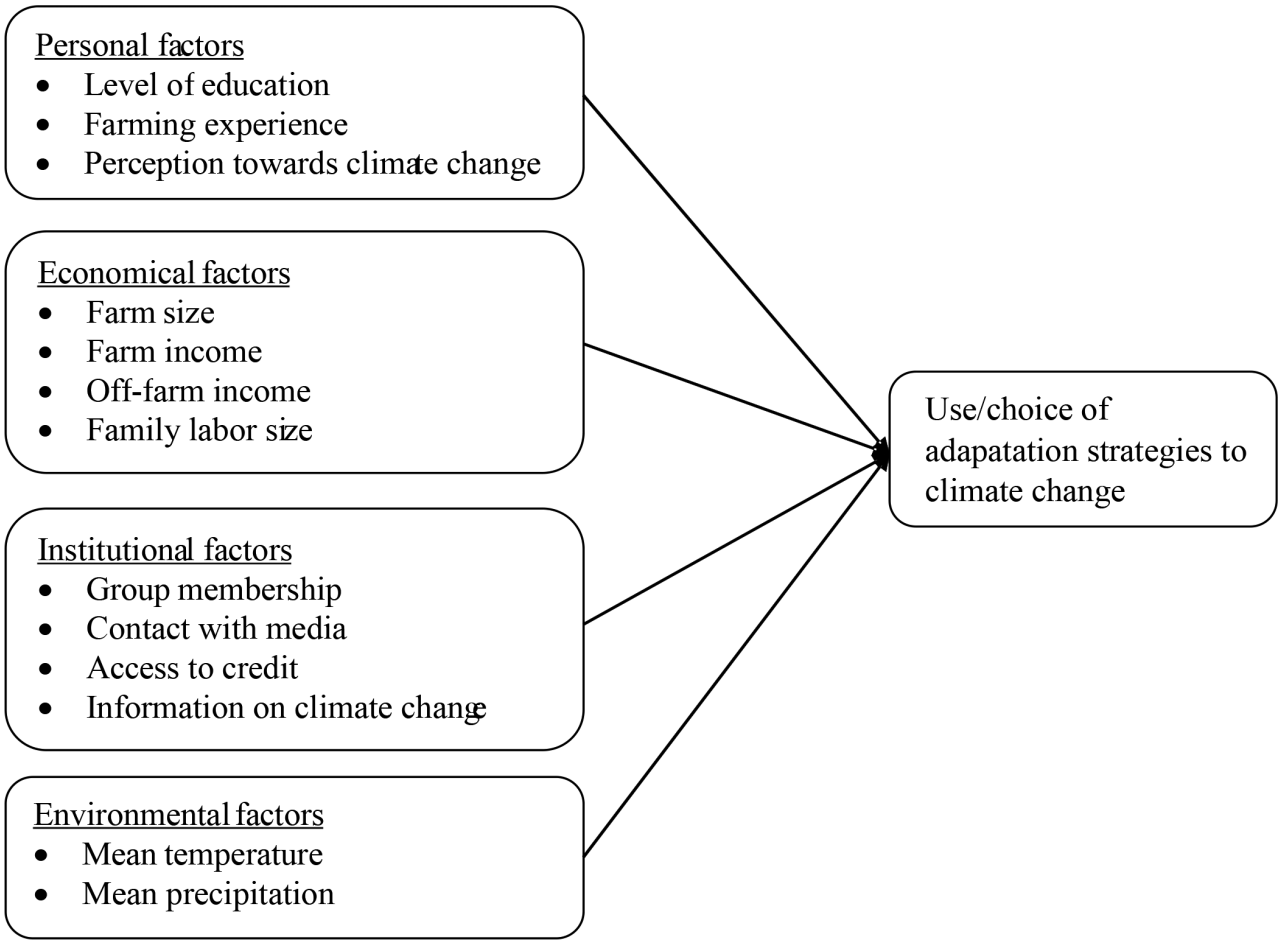

Figure 1: A proposed conceptual framework for assessing factors that affect farmers' choices of adaptation strategies to climate changes.

address multiple factors simultaneously. Regarding the aspect, the personal-economical-institutional-environment (P-E-I-E) framework provides rich content to its intended readers and policymakers to better understand the phenomena than any single dimension-based framework. The proposed framework is unique and generic, particularly in Bangladesh. The framework is participatory and captures the opinions of almost all stakeholders involved in the climate change mitigation programme. The framework thus covers multiple aspects affecting farmers' choice for various alternative decisions with regard to climate change. The framework can also be adapted in other country conditions, despite it mainly focusses on Bangladesh, by only considering the factors that apply in their situation.

Personal Factors

The personal factors mainly refer to as an individual's self-efficacy in dealing with the climate change effects and his attitude towards the climate change impacts on different aspects of agriculture. An individual's level of education denotes his earlier preparation in tackling an adverse situation using the right course of action. Such an individual can better find the right resources (e.g., information, availability of different alternatives) and positively choose the right strategies to safeguard his farm and produce. Educated people are likely to be more innovative and more cosmopolite—qualities that are often proven vital to sourcing input supplies and market products as per the situation demands. Moreover, they are expected to cope better with the situation compared to less educated people (Bryan et al., 2013).

Farming experience is another important factor that often mitigates the negative impact of having lower education or less economic resources. An experienced farmer can realise the climate-induced changes and predicts his farming better. Accordingly, the farmer might prepare well in advance for adopting several adaptation strategies such as changing crop calendar, managing farm practices (e.g., pest, disease, irrigation,

weed), selecting appropriate crop varieties (Uddin et al., 2014).

From the belief-attitude-behaviour model, it is evident that the human course of action/behaviour (here, adaptation strategies) is formed based on his presumptions, (+/-) beliefs and attitude towards the action. Therefore, knowing farmers' perception of climate change events is vital in knowing the underpinning of farmers' choice of particular adaptation strategies. It is so far the most compelling factor in motivating farmers to adopt mitigation strategies or know the rationale behind their choice about climate change adaptation strategies.

Economical Factors

The second dimension of this framework is economical factors. The economical factors have been traced back as an important factor that propels fuel to survive in adverse situations. Larger farm size is expected to yield higher economic output, and higher family income (off-farm and on-farm) provides higher buying capacity and creates more opportunities to try out different adaptation strategies during adverse climate events.

Despite larger family size competes for economic resources and negatively impacts a family's well-being in many aspects such as health, education, nutrition, food; during adverse climate events like floods, cyclones, storms, larger family labour positively impact a family's farm by providing extra labour as needed for activities such as early harvesting, proper management, storing and marketing (Deressa et al., 2008). Therefore, the identified economic indicators seem to positively influence farmers' adaptation decisions with regard to climate change.

Institutional Factors

Institutional support seems to be an integral part of enhancing farmers' capacity and ability to choose the right course of action during climate change events. Farmers' skills and experience, plus their family resources might often feel insufficient without having proper institutional support such as information and credit support. Membership in a group or organisation and farmers' access to different information sources allow them to receive time demanding information that enables them to make rational decisions based on their situations (Kabir and Rainis, 2014). When it comes to local agricultural extension service providers, they are obliged to provide a broad range of information support, including climate change. Extension service providers like the Department of Agricultural Extension (DAE) have the responsibility for agricultural development. However, during a critical period of adverse climate change events, like floods, cyclones, or increasing salinity and drought levels, their support to farmers becomes vital in dealing with climate change. Therefore, ensuring the institutional support at the local level enables farmers' to choose appropriate adaptation strategies towards climate change.

Environmental Factors

Although people have little or no control over environmental factors such as temperature and rainfall, one cannot discount the impact of these factors on farmers' choice of different agricultural practices. Selecting drought or saline resistant varieties, early varieties, changing management practices such as irrigation, pesticide, fertiliser application, and modifying crop calendar—some practices that are dependent on environmental factors. Moreover, environmental factors directly impact or moderate the relationship between other factors (i.e., personal, economic, institutional) and one's choice for adaptation strategies towards climate change (Gorst et al., 2015). Among various environmental factors, mean temperature and precipitation are most across the country.

Conclusion

Climate change has impacted the farming and farmers in Bangladesh in many ways. Increased level of salinity and drought in some parts of the country in addition with common natural hazards such as floods and cyclones across the country cost lives and resources every year. The lack of required skills among farmers and resource constraints make the situation even worse than usual. Several research initiatives and interventions have been implemented across the country, yet the comprehensive understanding regarding the factors that influence farmers' adaptation strategies is rarely studied. The participatory knowledge gain through this research may serve as an important guideline to design and implement further adaptation strategies concerning climate change, albeit not for international but at least for farmers of Bangladesh. More succinctly, exploring farmers' adaptation strategy as a multi-dimensional construct should provide more food of thought for research and practice. Academic researchers might think of empirically testing the model in the field setting, while policymakers might consider the underpinning in designing community based climate-smart agricultural practices.

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