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Article

# Quantifying Capacity-Commitment Gap: Household Willingness to Pay and Blended Finance for Climate Adaptation in Bangladesh's Char Regions

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## Abstract

**Background:** The char regions of Bangladesh — temporary riverine islands — experience compound climate vulnerability intensified by chronic structural poverty, yet sustainable financing models for community-based adaptation remain underdeveloped. **Aim:** This study diagnoses the capacity–commitment gap between households' expressed willingness to support climate adaptation and their actual financial capacity, and proposes an evidence-based blended finance instrument. **Methods:** Using the Contingent Valuation Method (CVM) with a payment-card format and an open-ended follow-up, we surveyed 400 households across two char sites (Bahadurpur and Vasarpara). Probit models estimate the binary decision to contribute; Tobit models estimate the determinants of the contribution amount conditional on willingness. **Results:** Willingness to pay is high (65% of households), but capacity is sharply constrained: 90% of willing households pledge  $\leq 400$  BDT/month (mean = 244.5 BDT, median = 220 BDT). Probit and Tobit estimates show that education ( $\beta = 1.46$ ,  $p < 0.001$ ;  $\beta = 101.39$ ,  $p < 0.001$ ) and direct disaster experience ( $\beta = 1.49$ ,  $p < 0.001$ ;  $\beta = 153.85$ ,  $p < 0.001$ ) are three-to-eight times more influential than income ( $\beta = 0.49$ ,  $p < 0.001$ ;  $\beta = 19.33$ ,  $p = 0.034$ ). An institutional-trust paradox emerges: lower trust in government effectiveness is weakly associated with higher stated contributions (Tobit  $\beta = -17.88$ ,  $p = 0.066$ ), consistent with compensatory self-reliance. Near-universal clustering of WTP in the lowest payment class across seven adaptation strategies (89.7–100%) indicates a binding affordability ceiling rather than strategy-specific variation in valuation. **Conclusions:** These findings invalidate user-pays models for char populations and reframe household WTP as a signal of prioritised demand under a structural affordability ceiling. We translate this diagnostic into the Char Resilience Bond — a blended-finance instrument that securitises formalised in-kind community co-investments (labour, local knowledge, materials) to credit-enhance and leverage external capital, offering a replicable template for financing adaptation public goods in subsistence economies.

**Keywords:** climate adaptation finance; willingness to pay (WTP); contingent valuation method (CVM); institutional trust; char regions; blended finance; resilience bonds; Bangladesh; capacity-commitment gap

## 1. Introduction

The char areas of Bangladesh exemplify the vulnerability of compound climate, the geomorphological instability of temporary riverine islands meeting with a deep socio-economic marginalization (Rahman, 2017; Hossain et al., 2022). Climate change enhances these dangers by increasing cyclones, unpredictable rainfall, and temperature, keeping char communities in a loop of displacement, poverty, and food insecurity (Sarker et al., 2021; Hossain, 2023). The Government of Bangladesh and development partners have responded by launching a number of top-down adaptation initiatives, such as embankments and early warning systems (Kabir et al., 2021). Nevertheless, the effectiveness of these interventions tends to be hindered by deficits in finance,

governance, and absence of fusion with local knowledge systems (Hossain, 2023; Rahaman, 2023). Although community-based adaptation (CBA) has been promoted due to its effectiveness and fairness (Haque, 2020; Rahaman, 2023), its expansion is crippled by a long-standing funding shortage. Communities have the willingness, local knowledge, and labor absence of the capital to transfer substantive infrastructure or technology (Kabir et al., 2021). This is fundamentally an economic issue: how can one finance publicly-provided goods in situations where the willingness to pay (WTP) is no longer linked to the capacity to pay?

To comprehend this decoupling, it is necessary to place it in the context of the developed theory of development economics. Even where perceived gains of protection are high, households that face a chronic risk and structural poverty pursue behavior that is loss avoidance- and short-term resilience-oriented, not long-horizon investment (Dercon, 2002). The difference between the willing and the capacity is therefore structural in nature and theoretically predicted-a rational reaction to continued vulnerability as opposed to an anomaly of preference. This framing is critical in understanding WTP data of subsistence economies where financial constraint is an overriding factor when responding to surveys.

Contingent Valuation Method (CVM) is a methodology commonly used in eliciting the WTP to make decisions regarding the allocation of resources (Luzar and Cosse, 1998). Its use in extreme poverty situations is however conceptually disputed because financial constraints can expose an affordability ceiling, and not real valuation (Luzar and Cosse, 1998). Moreover, the current research in Bangladesh has been preoccupied with areas of coastal or technical solutions, and has not given much attention to the role of institutional trust a mediator of the social contract and financial commitment in weak-state contexts (Akter, 2020). A cross-cutting study of socio-economic capacity, experiential drivers, and institutional trust to influence financial behavior in char regions is lacking.

The current research paper directly fills this gap by carrying out a dual diagnostic and design exercise. To begin with, we empirically diagnose the disconnection between household commitment and financial capacity to adapt to climate in two different char regions. We go beyond the quantification of WTP, and we incorporate institutional trust and perceived need of external assistance in our econometric model of financial behavior. Second, and most importantly, we refer to this diagnostic evidence not in order to suggest some small changes in policy but in order to create a new blended finance mechanism. We show that household WTP, correctly understood as a signal of prioritized demand and a potential source of in-kind co-investment, can be designed to take advantage of external capital.

## 2. Literature Review

To find effective financing of climate adaptation in vulnerable areas, it is necessary to base on three interrelated bodies of literature, namely the specific socio-ecological vulnerability of the target area, the development of adaptation strategies and their funding dilemmas, and the economic techniques of valuing the willingness of the community to invest.

The char areas of Bangladesh are examples of complex climate vulnerabilities with geomorphological instability and socio-economic marginalization forming a riskful cycle. These temporary riverine landscapes, which are characterized by ongoing erosion and accretion, are physically characterized by the fact that they undermine the very basis of permanent settlement and agricultural sustainability (Rahman, 2017). This ecological vulnerability intersects with a socio-economic character of extreme deprivation: populations of char are often excluded, landless, with little or no access to formal education, healthcare, and credit (Abedin et al., 2019; Mamun et al., 2022). The livelihoods mostly rely on climate-sensitive industries such as rain-fed agriculture and fishing, which directly depend on hydrological fluctuations, temperature increases, and saline intrusion (Sarker et al., 2021; Khatun et al., 2022). This forms a vicious cycle where environmental shocks undermine livelihood assets, which undermine the ability to invest in resilience and traps households in a cycle of poverty and exposure (Hossain, 2023; Hossain et al., 2022). This association has been empirically measured recently, with climate-induced displacement and loss of assets as the main

factors contributing to food insecurity and economic vulnerability in such regions (Hossain et al., 2022). This literature confirms that the vulnerability in the chars is not simply an environmental effect but a combination of intertwined physical and socio-economic forces, preconditioning the financing problem, which is based on structural poverty.

Historically, responses by the government and non-governmental units have focused on structural and top-down interventions, including embankments, cyclone shelters, and early warning systems (Kabir et al., 2021). Although they offer vital defense, these interventions are sometimes associated with difficulty in terms of expensive cost, maintenance requirements, and failure to integrate with local socio-ecological settings, which may result in maladjustment or the intensification of equity problems (Hossain, 2023). Conversely, an influential literature praises the Community-Based Adaptation (CBA) that builds upon indigenous knowledge, developing agency locally, and tends to be more culturally acceptable and sustainable (Haque, 2020; Rahaman, 2023). Char-based empirical evidence shows the effectiveness of localized CBA measures, such as planting salt-tolerant crops, raising homesteads, and diversifying livelihoods (Sarker et al., 2022; Uddin, 2023).

Nevertheless, there is one important and not sufficiently discussed obstacle: financial scalability of CBA. Although communities have a chance to provide labor and knowledge, the initial capital needed to maintain communal infrastructure or transfer technology can be greater than local capacity (Kabir et al., 2021). This reveals a systemic funding issue: CBA is promoted as sustainable and equity-based, but its implementation and expansion are challenged by the inability to find feasible funding patterns that would balance between small local potential with the required minimum of external capital. This void points, without any doubt, to the necessity of new hybrid or blended finance models which can unlock the commitment of communities to enable greater investment.

An economic value of non-market goods such as climate security is crucial to policy design and allocation of resources. Contingent Valuation Method (CVM), a stated-preference survey approach, is a known approach to eliciting Willingness to Pay (WTP), by exposing respondents to hypothetical markets (Luzar & Cosse, 1998). CVM has found use in climate adaptation studies in different parts of the world in order to value interventions such as flood defenses to early warning systems. It has the advantage of capturing the use and non-use values. CVM has been applied in the studies on coastal areas in Bangladesh, with WTP positively affected by income, education, and direct disaster experience (Abedin et al., 2019; Khalid and Rahman, 2023).

However, there are critical methodological and contextual critiques that are relevant. To begin with, the standard applications tend to ignore behavioral and institutional-specific variables such as trust in the implementation of the agencies that may have a considerable impact on hypothetical valuation and results to protest zeros (Akter, 2020). Second, more fundamentally, the use of CVM in extreme poverty situations is conceptually challenged. According to the scholars, in subsistence economies, it might be the willingness to wish or the level of need and not a sure revelation of capacity to finance as financial constraints dominantly influence the responses (Luzar and Cosse, 1998). Whittington (2010) presents a simple synthesis of the conceptual difference between expressed demand and effective demand, in contexts of developing countries, and shows how low and compressed values of WTP in such areas are better understood to be indicators of affording limits, as opposed to low valuation or apathy. This literature requires a cautious approach to WTP data, as an indicator of demand, priority, and a legitimizing instrument of seeking progressive external finance.

An overview of existing global and regional studies shows that there are consistent determinants of willingness to pay (WTP) of environmental goods that can be clustered into three related groups. First, there is a direct relationship between socio-economic capacity (household income and assets ownership) and the ability to pay, and there is a positive correlation between education and risk perception and understanding of long-term benefits, which is also strong (Kabir et al., 2021; Abedin et al., 2019). Second, risk perception and experience are very important; despite the fact that subjective risk awareness, which is a result of climate knowledge, is important, personal experience of climate-related disasters is a better predictor, as it makes threats tangible and immediate (Abedin et al., 2019; Brouwer et al., 2007; Al Mamun et al., 2023). Third, institutional and social aspects are relatively

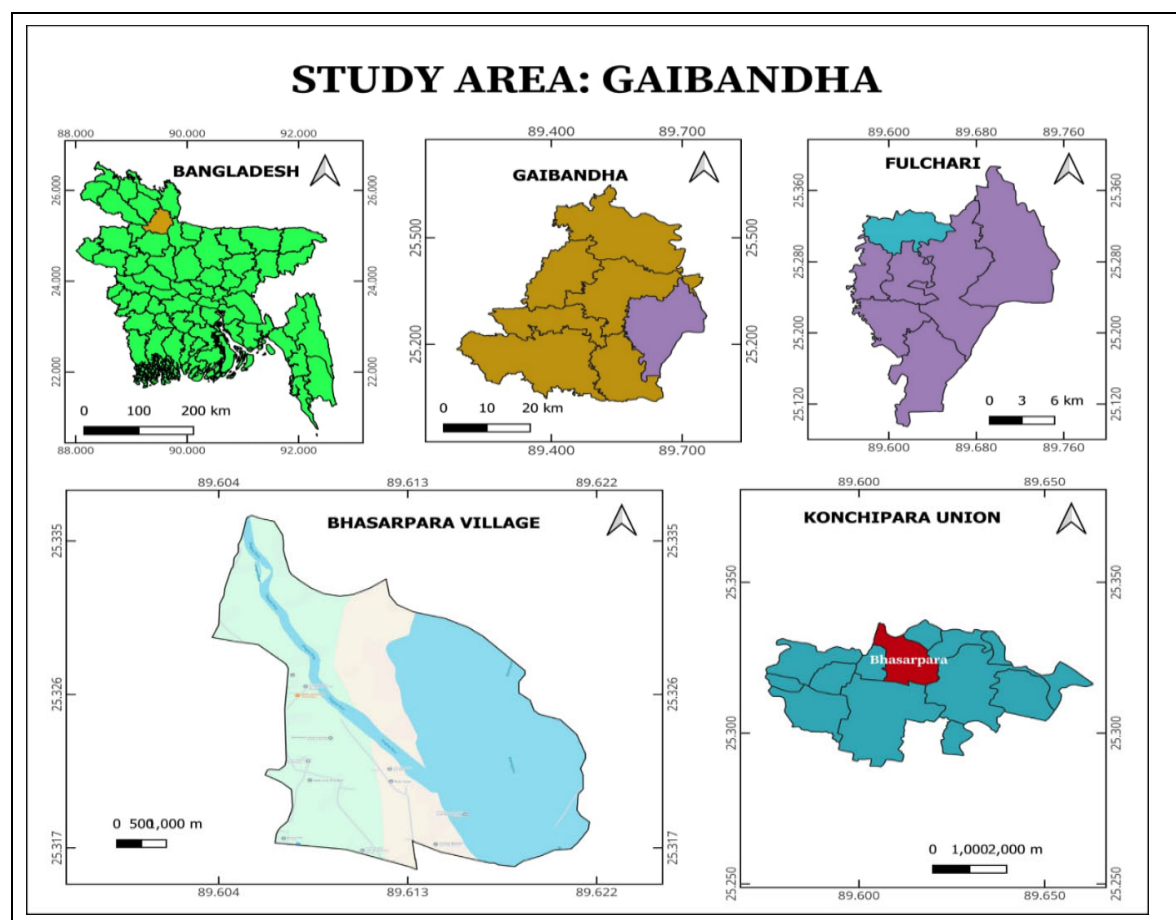
unexplored in char situations, where there is a need to trust governing institutions, low trust can block WTP because of cynicism over effectiveness or regulation instead of value (Akter, 2020), and social capital, which is often facilitated by community organizations, can drive collective action and further affect willingness to contribute.

The literature that is already available on Bangladesh offers a baseline but has evident weaknesses. Research has been conducted on either general WTP in coastal areas, or technical adaptation options without an integrative study of the financial behavior specific to the riverine char system. There is no systematic approach that, at the same time, takes into consideration the tripartite framework of socio-economic capacity, experiential drivers, and, crucially, institutional trust. This research bridges this mixed gap.

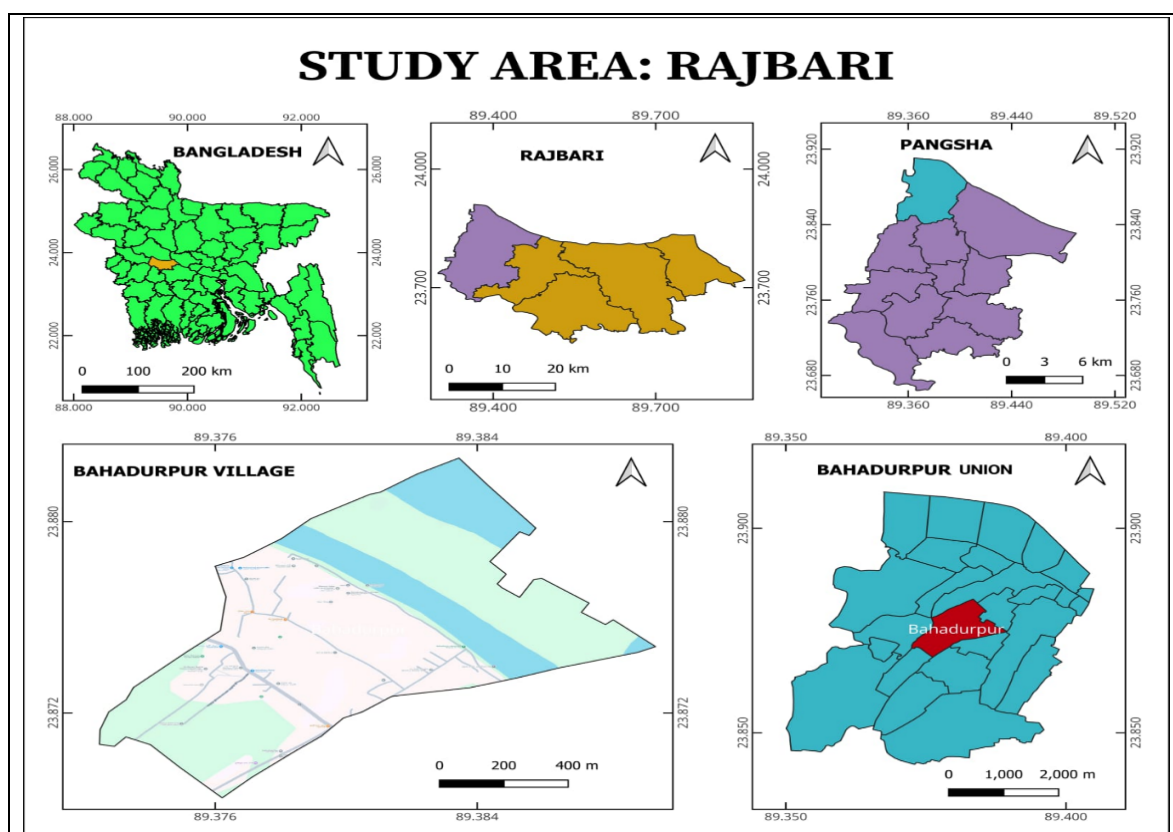
### 3. Methodology

#### 3.1. Study Area and Site Selection Rationale

The present study was carried out in two geographically and hydrologically different char areas to take a range of climate vulnerabilities in Bangladesh (Figure 1). The purposive selection was aimed at assessing the strength of results in various hazard profiles and socio-ecological systems. Bahadurpur, Rajbari District (Padma River Basin) was chosen as an example of chars that experience chronic and seasonal flooding and are undermining at the riverbank with settled agriculture as the main income source. Vasarpara, Fulchhari, Gaibandha District (Brahmaputra River Basin) is another example of chars that are subjected to acute and flash floods and high erosion and have more diversified livelihoods. This comparison enables us to explore the possibility of the capacity-commitment gap to exist between dissimilar hazard types (chronic vs. acute) and large river systems.



**Figure 1.** Study Area. Map 1 (top): Bahadurpur, Rajbari District. Map 2 (bottom): Vasarpara, Fulchhari, Gaibandha District.



### 3.2. Sampling Framework and Implementation

The stratified random sampling method was used to ensure representation of the major socio-economic strata known to have significant effects on adaptive capacity and WTP. The sampling frame was made up of all households in the two villages chosen as char villages and the baseline frame was the voter lists in local government (Union Parishad) which was updated through field verification. Households were categorized according to income level, major occupation and education level. A design effect of 1.5 was considered (because of stratification) and a target sample of 400 households (200 per site) was calculated using the standard formula to a 95% confidence level and a 5% margin of error.

### 3.3. Survey Instrument and CVM Scenario Development

Data were collected through structured, face-to-face interviews using a pre-tested questionnaire developed through a multi-stage process including qualitative reconnaissance (FGDs and KIIs) and cognitive pre-testing with 30 households. The final questionnaire contained five modules: (A) socio-demographic and economic characteristics; (B) climate risk perception, awareness, and disaster history; (C) institutional trust, finance access, and external aid experience; (D) the CVM Core Section presenting a hypothetical, community-managed "Climate Adaptation Fund" scenario; and (E) strategy-specific WTP elicitation and debriefing questions.

### 3.4. Elicitation Method: Payment Card with Follow-Up

WTP was elicited using a payment card format followed by an open-ended question, selected over dichotomous choice formats for cognitive suitability in a low-literacy setting. Respondents were presented with five ordered monthly payment classes: PC-1 (0–200 BDT), PC-2 (201–400 BDT), PC-3 (401–600 BDT), PC-4 (601–800 BDT), and PC-5 (801–1,000 BDT). After selecting a range, respondents were asked to specify an exact maximum amount, which was used as the continuous variable for econometric analysis. Protest zeros were identified through follow-up questions and excluded from primary WTP analysis.

### 3.5. Econometric Model Specification

To analyze the determinants of WTP, we employed two complementary models that address the dual nature of our dependent variable (decision and amount).

#### Model 1: Probit Model for the Binary Decision to Pay

This model estimates the probability that a household has a positive WTP ( $WTP_i = 1$ ). It is specified as:

$$P(WTP_i = 1 | X) = \Phi(\gamma_0 + \gamma_1 X_{1i} + \gamma_2 X_{2i} + \gamma_3 X_{3i} + \gamma_4 X_{4i} + \gamma_5 X_{5i} + \gamma_6 X_{6i} + \gamma_7 X_{7i} + \gamma_8 X_{8i} + \gamma_9 X_{9i})$$

where  $\Phi(\cdot)$  is the cumulative distribution function of the standard normal distribution and  $X_s$  are independent variables. This model is appropriate as the decision is binary and we assume the error term follows a normal distribution. It identifies factors that push a household over the threshold from unwillingness to willingness.

#### Model 2: Tobit (Censored Regression) Model for the Amount to Pay

This model estimates the determinants of the latent desired WTP amount ( $WTP$ ), acknowledging that we observe it only *when it is positive (censored from below at zero)*. It is specified as:

$$WTP^*_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + \epsilon_i$$

The observed WTP amount is:  $WTP_i = WTP^*_i$  if  $WTP^*_i > 0$ ;  $WTP_i = 0$  if  $WTP^*_i \leq 0$ ; where  $\epsilon_i \sim N(0, \sigma^2)$ . The Tobit model is estimated via Maximum Likelihood Estimation (MLE), which provides consistent and efficient estimates in the presence of censoring. It tells us how the independent variables influence the *underlying willingness amount*, conditional on being willing.

### 3.6. Variables and Hypotheses

The nine independent variables span the tripartite framework of socio-economic capacity (Income, Education, Occupation, Savings Access), risk perception and experience (Climate Awareness, Disaster Experience), and institutional context (Government Effectiveness, External Assistance), plus Age as a demographic control (Table 1).

Table 1. Variables Included in the Probit and Tobit Models.

Category	Variable	Description	Measurement
Dependent	WTP (Probit)	WTP for climate adaptation	1 = Willing; 0 = Not willing
	WTP Amount (Tobit)	Maximum amount willing to pay	Continuous (BDT/month, censored at 0)
Independent	Income ( $X_1$ )	Monthly household income	1=<5K; 2=5–10K; 3=10–20K; 4=20–30K; 5=>30K
	Education ( $X_2$ )	Level of education	1=None; 2=Primary; 3=Secondary; 4=Higher Sec.; 5=Graduate+
	Occupation ( $X_3$ )	Main occupation	1=Agri; 2=Fishing; 3=Labor; 4=Business; 5=Service; 6=Other
	Age ( $X_4$ )	Age of respondent	Continuous (years)
	Climate Awareness ( $X_5$ )	Aware of climate change effects	1=Yes; 0=No

	Disaster Experience (X <sub>6</sub> )	Experienced disaster in last 5 years	1=Yes; 0=No
	Govt Effectiveness (X <sub>7</sub> )	Trust in govt climate risk management	1=Strongly Disagree to 4=Strongly Agree
	Savings Access (X <sub>8</sub> )	Access to savings or microcredit	1=Yes; 0=No
	External Assist. (X <sub>9</sub> )	External assistance necessary	1=Yes; 0=No

Source: Author Estimation (2025).

### 3.7. Hypotheses

Based on the theoretical framework and literature, we test the following directional hypotheses:

- **H<sub>1</sub>:** Education level and direct disaster experience have a positive and significant effect on both the probability (Probit) and the latent amount (Tobit) of WTP.
- **H<sub>2</sub>:** Household income positively influences WTP, but its marginal effect will be smaller than that of education and disaster experience.
- **H<sub>3</sub>:** Lower trust in government effectiveness increases the likelihood of a "protest zero" but, conditional on willingness to pay, may be associated with a higher stated WTP amount, reflecting a compensatory logic of self-reliance.
- **H<sub>4</sub>:** The perception that external assistance is necessary for adaptation has a positive effect on WTP, signaling community openness to blended finance models.

### 3.8. Model Justification

Selecting the Dual-Model Approach is highly rational because it involves two latent processes: first, a *participation decision* (to pay or not), and second, conditional on participation, a *contribution decision* (how much to pay). Using a single model (e.g., OLS on all data, including zeros) would yield biased estimates because it fails to account for the clustering of observations at zero and the fact that the factors influencing the initial participation decision may differ in magnitude or significance from those influencing the amount. Our two-model strategy is standard in the valuation literature for capturing this two-stage process without bias. The Probit model is ideal for understanding the factors that push a household over the threshold from unwillingness to willingness. The Tobit model is necessary because OLS regression on the observed WTP\_Amount (including zeros) would yield biased and inconsistent estimates, as it fails to account for the clustering of observations at the limit (zero). Using both models allows us to distinguish whether a variable influences the *likelihood* of paying, the *amount* paid, or both.

### 3.9. Data Collection and Analytical Tools

Six trained enumerators conducted surveys between January and March 2024 using KoboToolbox. Verbal informed consent was obtained. All statistical analyses were performed using Stata 18 and Eviews 14. Robust standard errors were used; VIFs were all below 3.

## 4. Results

### 4.1. Socio-Demographic Profile of Respondents

A total of 400 households were surveyed across the two char study sites. The sample was predominantly female (85.0%), consistent with the well-documented pattern in char communities

where male household members are typically engaged in seasonal wage labour outside the locality. The majority of respondents were in older age brackets, with 30.0% aged 46–60 years and 30.3% aged above 60 years, while only 9.5% were between 18 and 30. Educational attainment was markedly low: 53.1% had received no formal schooling, and only 3.5% had attained graduate-level education or above. The income distribution revealed pronounced polarisation — 32.3% reported monthly household incomes below 10,000 BDT, whereas 21.0% reported incomes exceeding 30,000 BDT, with the modal category falling in the 10,001–20,000 BDT range (29.3%). Land insecurity was pervasive, with 58.8% of respondents classified as landless. Table 2 presents the complete socio-economic profile of the sample.

**Table 2.** Socio-Economic Characteristics of the Respondents (n = 400).

Characteristic	Frequency (%)	Characteristic	Frequency (%)
<b>Age</b>		<b>Income (BDT/month)</b>	
18–30	38 (9.5%)	< 5,000	39 (9.8%)
31–45	121 (30.3%)	5,000–10,000	90 (22.5%)
46–60	120 (30.0%)	10,001–20,000	117 (29.3%)
60+	121 (30.3%)	20,001–30,000	70 (17.5%)
<b>Education</b>		> 30,000	84 (21.0%)
No Formal	212 (53.1%)	<b>Land Ownership</b>	
Primary	131 (32.8%)	No	235 (58.8%)
Secondary	31 (7.8%)	Yes	165 (41.3%)
Higher Secondary	11 (2.8%)		
Graduate and Above	14 (3.5%)		

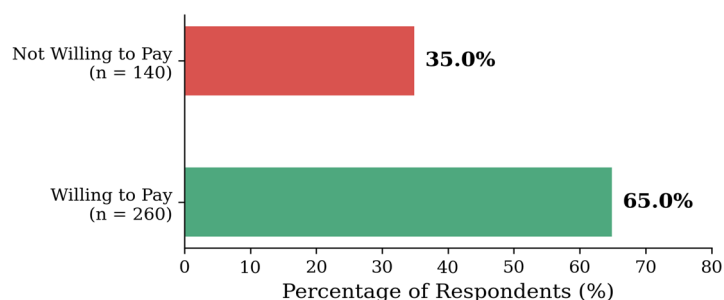
Source: Authors' own estimation (2025).

#### 4.2. Aggregate Willingness to Pay: Evidence of a Capacity–Commitment Gap

Survey results reveal strong foundational support for community-based climate adaptation among the char population: 65.0% (n = 260) of respondents expressed a positive willingness to pay (WTP), while 35.0% (n = 140) declined to contribute (Figure 2). Although the majority WTP rate indicates meaningful social mobilisation potential, a detailed examination of stated contribution amounts exposes a significant capacity–commitment gap (Figure 3; Table 3).

Among willing respondents, over half (51.5%, n = 134) would contribute only within the lowest payment class (PC-1: 0–200 BDT/month), and an additional 38.5% (n = 100) fell within PC-2 (201–400 BDT/month). Only 10.0% of willing respondents indicated contributions exceeding 400 BDT/month. The resulting distribution is notably right-skewed, with a mean of 244.5 BDT, a median of 220.0 BDT, and a standard deviation of 136.5 BDT (range: 50–1,000 BDT). The divergence between the mean and median confirms that aggregate WTP estimates are disproportionately influenced by a small cohort of high-contributing households, thereby inflating the apparent central tendency. These distributional characteristics underscore the critical distinction between the willingness to support

adaptation in principle and the financial capacity to do so in practice — a gap with direct implications for the design of community-based blended finance instruments.

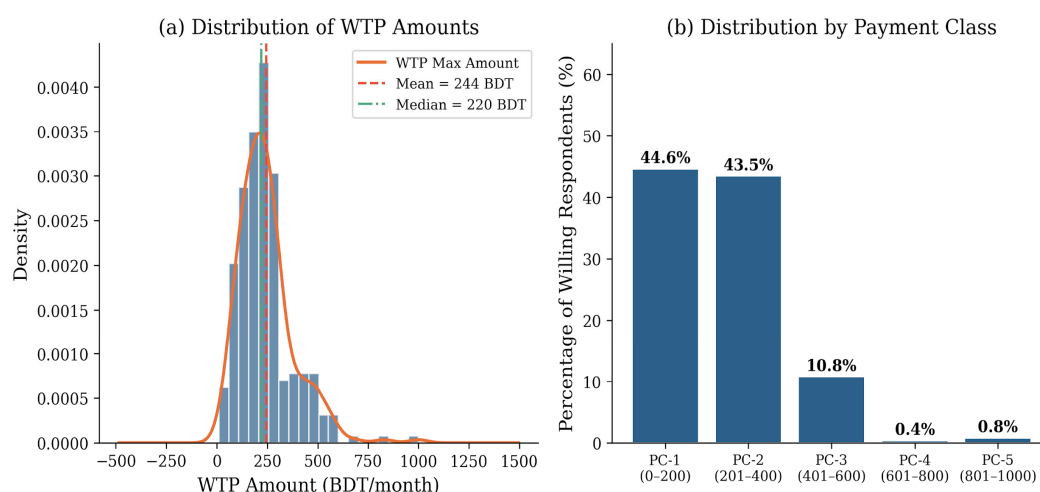


**Figure 2.** Aggregate Willingness to Pay for Community-Based Adaptation (n = 400).

**Table 3.** Distribution of Stated WTP Amounts and Descriptive Statistics among Willing Respondents (n = 260).

Payment Class	Amount (BDT/month)	Frequency	Percentage (%)	Descriptive Statistics
PC-1	0–200	134	51.5	Mean: 244.5 BDT
PC-2	201–400	100	38.5	Median: 220.0 BDT
PC-3	401–600	23	8.8	Std. Dev.: 136.5 BDT
PC-4	601–800	1	0.4	Maximum: 1,000 BDT
PC-5	801–1,000	2	0.8	Minimum: 50 BDT

Note: PC = Payment Class. Source: Authors' own estimation (2025).



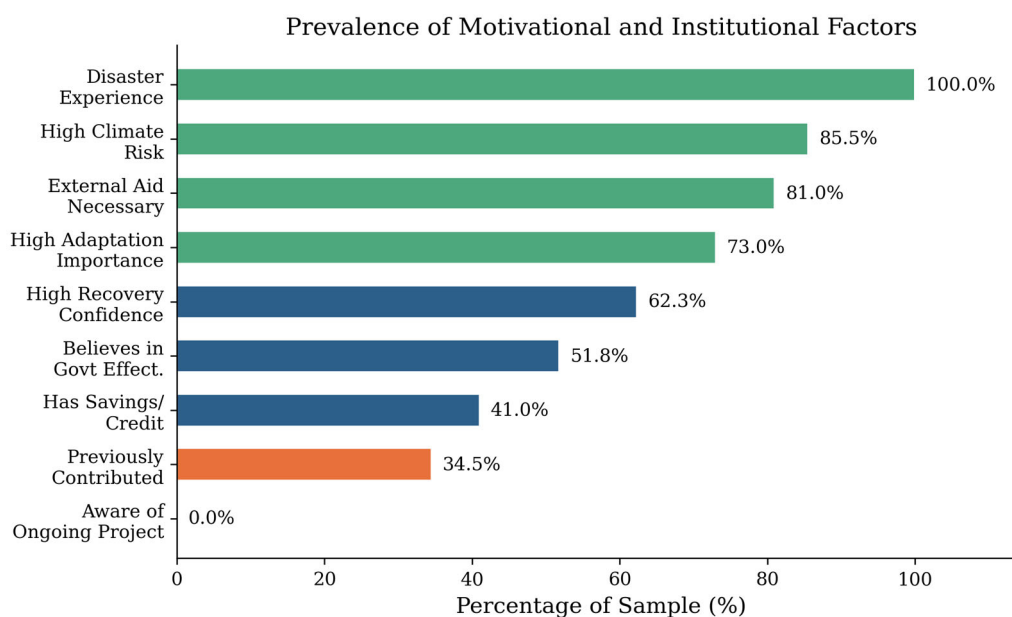
**Figure 3.** Distribution of Stated WTP Amounts: (a) Kernel density plot with mean and median reference lines; (b) Frequency distribution by payment class.

#### 4.3. Motivational Drivers and Institutional Context

Figure 4 summarises the prevalence of key motivational and institutional contextual factors among the full sample. All respondents (100%) reported direct experience of at least one climate-

related hazard event within the preceding five years, and 85.5% perceived high personal climate risk — reflecting the near-universal physical exposure characteristic of riverine char environments. A majority (73.0%) considered adaptation investment to be important, indicating a broad cognitive awareness of the need for adaptive action.

The institutional context presents a more complex and somewhat paradoxical picture. While 51.8% of respondents expressed some degree of confidence in government effectiveness, not a single respondent (0.0%) reported awareness of any ongoing local climate adaptation initiative or programme. This institutional awareness deficit is a critical finding, as it implies that community WTP is being formed in an information vacuum with respect to formal adaptation governance structures. A strong consensus (81.0%) emerged around the perceived necessity of external financial assistance for meaningful adaptation, signalling broad community receptivity to blended finance models. Additional contextual indicators include recovery confidence (62.3%), access to savings or credit facilities (41.0%), and prior participation in community-level collective action (34.5%).

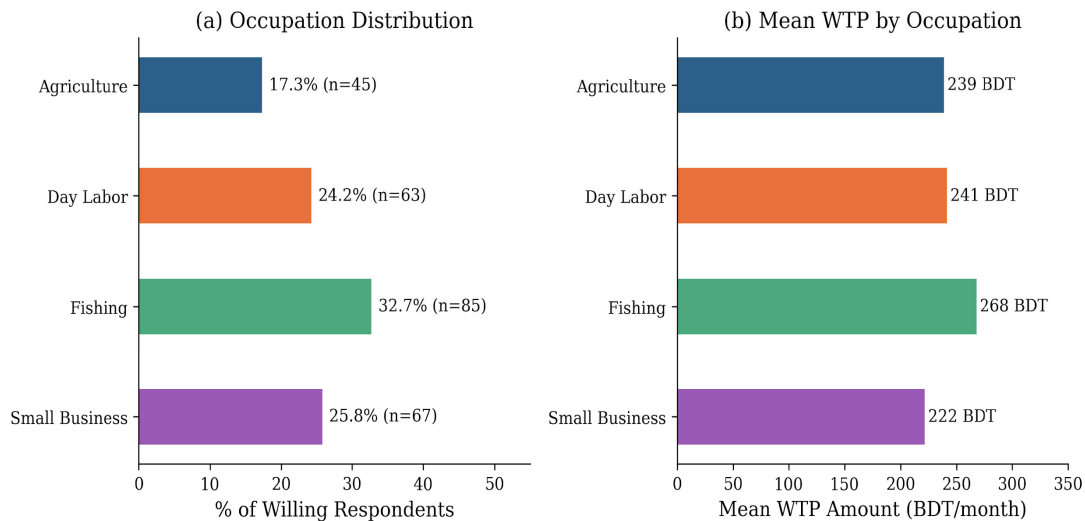


**Figure 4.** Prevalence of Motivational and Institutional Factors Among Respondents ( $n = 400$ ). Horizontal bar chart displaying the percentage of the sample for each factor.

#### 4.4. Occupational Vulnerability and Payment Patterns

Occupational disaggregation of willing respondents (Figure 5; Table 4) reveals that individuals employed in directly climate-exposed livelihoods constitute 83.8% of the willing sub-sample: Agricultural workers ( $n = 102$ , 39.2%), Day Labourers ( $n = 64$ , 24.6%), and Fishers ( $n = 52$ , 20.0%). Notably, these same occupational groups are concentrated overwhelmingly in the two lowest payment classes: 87.3% of willing farmers and 92.2% of willing day labourers fall within PC-1 and PC-2 ( $\leq 400$  BDT/month).

This pattern constitutes a fundamental targeting dilemma for programme design: those households with the highest motivation to contribute — by virtue of their direct livelihood exposure to climate risk — are simultaneously those with the greatest financial constraints on their stated contributions. Fishers recorded the highest mean WTP among climate-exposed groups (268 BDT/month), compared to 241 BDT for day labourers and 239 BDT for farmers, yet all three remain well below 300 BDT. These findings imply that occupational vulnerability functions primarily as a motivational factor for participation rather than as a determinant of contribution magnitude.



**Figure 5.** Occupational Patterns of WTP: (a) Percentage distribution of willing respondents by occupation; (b) Mean WTP amount by occupation (BDT/month).

**Table 4.** Occupation-wise Distribution of Willing Respondents by Payment Class.

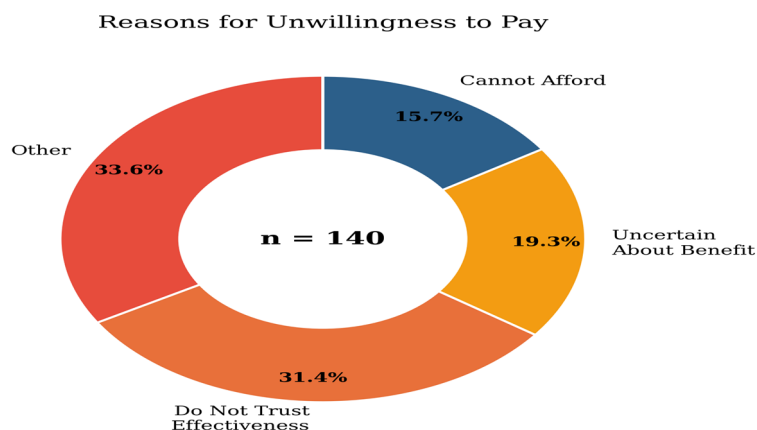
Occupation	n	PC-1	PC-2	PC-3	PC-4	PC-5	Mean WTP (BDT)
Agriculture	102	50	39	11	1	1	239
Day Labour	64	38	21	4	0	1	241
Fishing	52	21	28	3	0	0	268
Small Business	29	18	9	2	0	0	222
Other	13	7	3	3	0	0	—

Note: PC-1 = 0–200 BDT; PC-2 = 201–400 BDT; PC-3 = 401–600 BDT; PC-4 = 601–800 BDT; PC-5 = 801–1,000 BDT.  
Source: Authors' own estimation (2025).

#### 4.5. Reasons for Unwillingness to Pay

Among the 140 respondents who declined to pay, affordability constraints — while significant — were not the dominant explanatory factor (Figure 6; Table 5). Approximately 30.0% (n = 42) cited financial inability as the primary reason. However, a combined 49.3% of non-participating respondents attributed their unwillingness to perception-based barriers: 23.6% (n = 33) expressed distrust in the effectiveness of adaptation programmes, and 25.7% (n = 36) reported uncertainty regarding the likely distribution of benefits.

This finding carries important policy implications. If affordability were the sole barrier, financial subsidy mechanisms would suffice to expand participation. Instead, the data indicate that institutional credibility and transparent benefit communication are equally — if not more — critical to broadening community engagement. The prevalence of distrust and benefit uncertainty suggests that demand-side constraints are at least partially rooted in weak institutional accountability and limited experience with prior adaptation interventions in the region, a conclusion consistent with the 0.0% project awareness rate documented in Section 4.3.



**Figure 6.** Reasons for Unwillingness to Pay ( $n = 140$ ). Pie chart displaying proportional breakdown: Cannot Afford (30.0%), Uncertain About Benefit (25.7%), Do Not Trust Effectiveness (23.6%), Other (20.7%).

**Table 5.** Stated Reasons for Unwillingness to Pay ( $n = 140$ ).

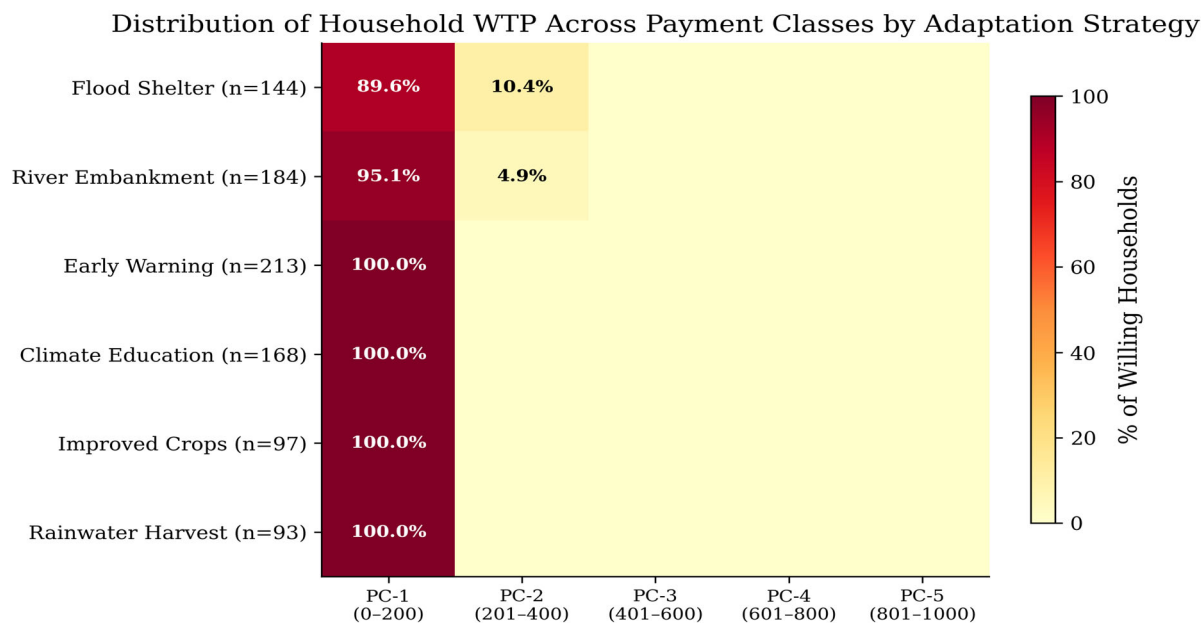
Reason for Unwillingness	Frequency	Percentage (%)
Cannot Afford	42	30.0
Distrust of Programme Effectiveness	33	23.6
Uncertainty Regarding Benefits	36	25.7
Other	29	20.7
<b>Total</b>	<b>140</b>	<b>100.0</b>

Source: Authors' own estimation (2025).

#### 4.6. Stated Preferences and Valuation for Specific Adaptation Strategies

Household WTP distributions across seven specific adaptation strategies are presented in Figure 7 and Table 6. Across all strategies, the stated contribution amounts are almost entirely constrained to the lowest payment class (PC-1: 0–200 BDT/month). For early warning systems ( $n = 217$ ), climate education ( $n = 169$ ), improved agricultural inputs ( $n = 97$ ), and rainwater harvesting ( $n = 93$ ), 100.0% of willing respondents fell within PC-1. Even for flood shelters ( $n = 145$ ) and river embankments ( $n = 184$ ) – the two strategies associated with the most tangible and direct protective infrastructure – PC-1 captured 89.7% and 95.1% of respondents, respectively.

The near-total convergence of WTP amounts in the lowest payment tier across all strategy types, irrespective of the nature or scale of the adaptation measure, provides compelling evidence that financial capacity – rather than heterogeneous preferences for specific strategies – is the primary constraint on stated WTP amounts. This uniformity effectively decouples strategic preference from contribution magnitude, and has important implications for strategy prioritisation: investment sequencing cannot rely on WTP amounts to differentiate community preferences, and alternative non-monetary indicators of community priority must be incorporated into participatory planning processes.



**Figure 7.** Distribution of Household WTP Across Payment Classes by Adaptation Strategy — Heatmap. Darker red shading indicates higher concentration of willing households in that payment class.

**Table 6.** Percentage Distribution of Stated WTP Across Payment Classes for Specific Adaptation Strategies.

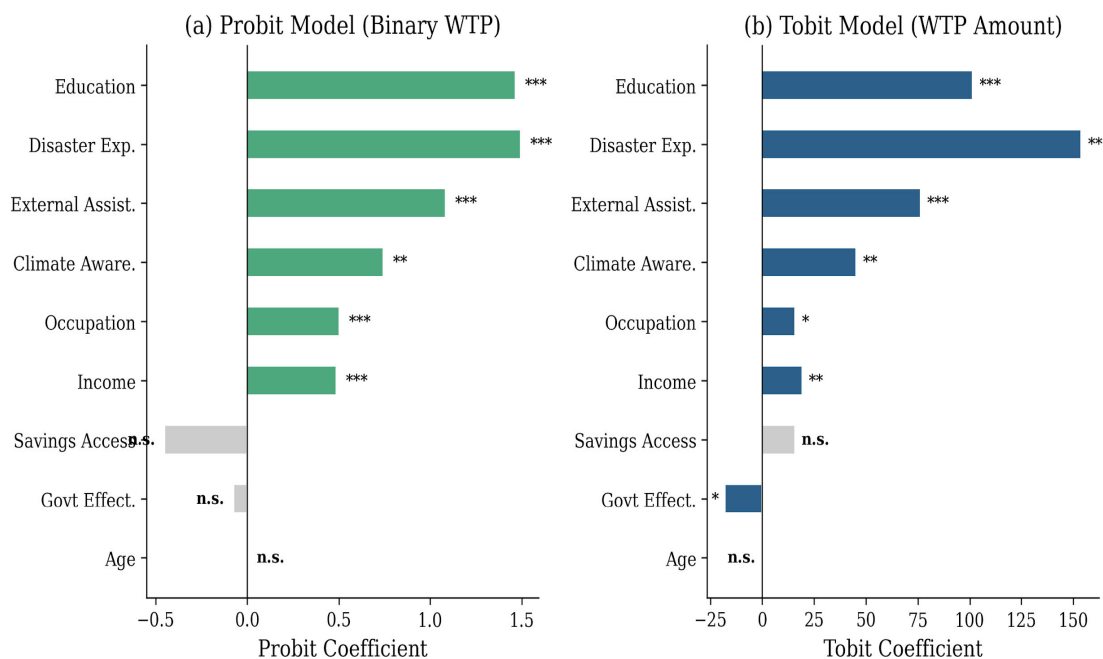
Adaptation Strategy	n	PC-1 (%)	PC-2 (%)	PC-3 (%)	PC-4 (%)	PC-5 (%)
Flood Shelter	145	89.7	10.3	0.0	0.0	0.0
River Embankment	184	95.1	4.9	0.0	0.0	0.0
Early Warning System	217	100.0	0.0	0.0	0.0	0.0
Climate Education	169	100.0	0.0	0.0	0.0	0.0
Improved Seeds/Inputs	97	100.0	0.0	0.0	0.0	0.0
Rainwater Harvesting	93	100.0	0.0	0.0	0.0	0.0
Other	5	100.0	0.0	0.0	0.0	0.0

Note: PC-1 = 0–200 BDT; PC-2 = 201–400 BDT; PC-3 = 401–600 BDT; PC-4 = 601–800 BDT; PC-5 = 801–1,000 BDT.

Source: Authors' calculation based on survey data (2024).

#### 4.7. Econometric Analysis of Determinants of Willingness to Pay

Results from the Probit model (determinants of WTP participation) and the Tobit model (determinants of WTP amount, conditional on participation) are reported in Table 7 and visualised in Figure 8. The Probit model demonstrates excellent fit, with a McFadden pseudo- $R^2$  of 0.41 and a likelihood ratio statistic of 221.26 ( $p < 0.001$ ), indicating strong discriminatory power. The Tobit model yielded a log-likelihood of  $-1,134.29$  with  $\sigma = 159.29$ . The following sub-sections discuss the results by thematic hypothesis.



**Figure 8.** Econometric Coefficient Comparison: (a) Probit model coefficients with significance markers; (b) Tobit model coefficients with significance markers. \*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.10$ ; n.s. = not significant.

#### 4.7.1. Education and Experiential Learning as Primary Drivers

Education emerges as the single strongest predictor of both the decision to pay and the amount contributed. In the Probit model, the coefficient on education is 1.46 (SE = 0.20,  $p < 0.001$ ), while in the Tobit model the marginal effect on WTP amount is 101.39 BDT (SE = 9.64,  $p < 0.001$ ). Direct disaster experience yields virtually identical predictive power: Probit  $\beta = 1.49$  (SE = 0.39,  $p < 0.001$ ) and Tobit  $\beta = 153.85$  BDT (SE = 32.84,  $p < 0.001$ ). Across both model specifications, the effect magnitudes for education and disaster experience are approximately three to eight times larger than those for income (Figure 11). These results confirm  $H_1$  and  $H_2$ , establishing that human capital and experiential learning are quantitatively more consequential motivators of adaptation investment than raw financial capacity. The finding aligns with the theory of risk perception and learning, wherein personal hazard experience functions as an information mechanism that updates households' subjective estimates of climate threat and the utility of collective protective action.

#### 4.7.2. The Institutional Trust Paradox

Trust in government effectiveness produces a counterintuitive pattern. The Probit coefficient is statistically indistinguishable from zero ( $\beta = -0.07$ , SE = 0.16,  $p = 0.637$ ), indicating that institutional trust does not significantly influence the binary participation decision. However, in the Tobit model, the coefficient is negative and marginally significant ( $\beta = -17.88$ , SE = 9.73,  $p = 0.066$ ), suggesting that, conditional on participation, higher trust in government effectiveness is weakly associated with lower stated contribution amounts. Descriptive analysis corroborates this pattern: WTP participation rates are broadly invariant across trust levels (ranging from 62.7% to 70.0%), yet willing respondents who reported the lowest institutional trust recorded higher mean contributions (276 BDT/month) than those reporting the highest trust (229 BDT/month). This institutional trust paradox — wherein scepticism of government capacity is associated with higher self-reported WTP — is consistent with  $H_3$  and may reflect a substitution logic: households that perceive government-led adaptation as inadequate or unreliable may be more inclined to invest in community-level self-organised mechanisms, thereby expressing higher WTP for alternative governance arrangements.

#### 4.7.3. External Assistance Orientation and Blended Finance Receptivity

Perceived necessity of external assistance is statistically significant in both models (Probit  $\beta = 1.08$ , SE = 0.32,  $p = 0.001$ ; Tobit  $\beta = 76.31$ , SE = 24.40,  $p = 0.002$ ), supporting H<sub>4</sub>. This result implies that households which recognise the limits of community self-financing are not deterred from participation; rather, they are more likely to engage and to commit higher amounts, presumably under the expectation that external co-financing will supplement local contributions and improve programme viability. This finding provides direct empirical support for blended finance structures in which international climate finance catalyses local cost-sharing.

#### 4.7.4. Role of Income, Occupation, and Climate Awareness

Income is a statistically significant predictor in both models (Probit  $\beta = 0.49$ ,  $p < 0.001$ ; Tobit  $\beta = 19.33$ ,  $p = 0.034$ ), though its effect size is considerably smaller than that of education and disaster experience, confirming that non-financial drivers dominate the WTP decision in this context. Occupation (Probit  $\beta = 0.50$ ,  $p < 0.001$ ; Tobit  $\beta = 15.88$ ,  $p = 0.068$ ) and climate awareness (Probit  $\beta = 0.74$ ,  $p = 0.018$ ; Tobit  $\beta = 45.30$ ,  $p = 0.036$ ) are both statistically significant positive determinants. By contrast, age ( $p = 0.916$  in Probit;  $p = 0.890$  in Tobit) and savings or credit access ( $p = 0.200$  in Probit;  $p = 0.469$  in Tobit) are not significant determinants in either model specification.

**Table 7.** Determinants of Willingness to Pay: Probit and Tobit Model Results.

Variables	Probit Model (Binary WTP)			Tobit Model (WTP Amount)			Sig.
	Coeff.	S.E.	P-value	Coeff.	S.E.	P-value	
Income	0.49	0.13	0.000	19.33	9.12	0.034	***/**
Education	1.46	0.20	0.000	101.39	9.64	0.000	***
Occupation	0.50	0.14	0.000	15.88	8.71	0.068	***/*
Age	0.00	0.01	0.916	-0.10	0.72	0.890	n.s.
Climate Awareness	0.74	0.31	0.018	45.30	21.61	0.036	**
Govt. Effectiveness	-0.07	0.16	0.637	-17.88	9.73	0.066	n.s./*
Disaster Experience	1.49	0.39	0.000	153.85	32.84	0.000	***
Savings Access	-0.45	0.35	0.200	15.88	21.90	0.469	n.s.
External Assistance	1.08	0.32	0.001	76.31	24.40	0.002	***
Constant	-8.17	1.36	0.000	-461.72	68.85	0.000	***

Notes: \*\*\*, \*\*, \* denote statistical significance at the 1%, 5%, and 10% levels, respectively; n.s. = not significant. Probit model: McFadden  $R^2 = 0.41$ ; LR statistic = 221.26 ( $p < 0.001$ ). Tobit model:  $\sigma = 159.29$ ; Log-Likelihood = -1,134.29. Robust standard errors reported throughout. Variance Inflation Factors (VIFs) all below 3, confirming absence of multicollinearity. Source: Authors' own estimation using Stata 18.

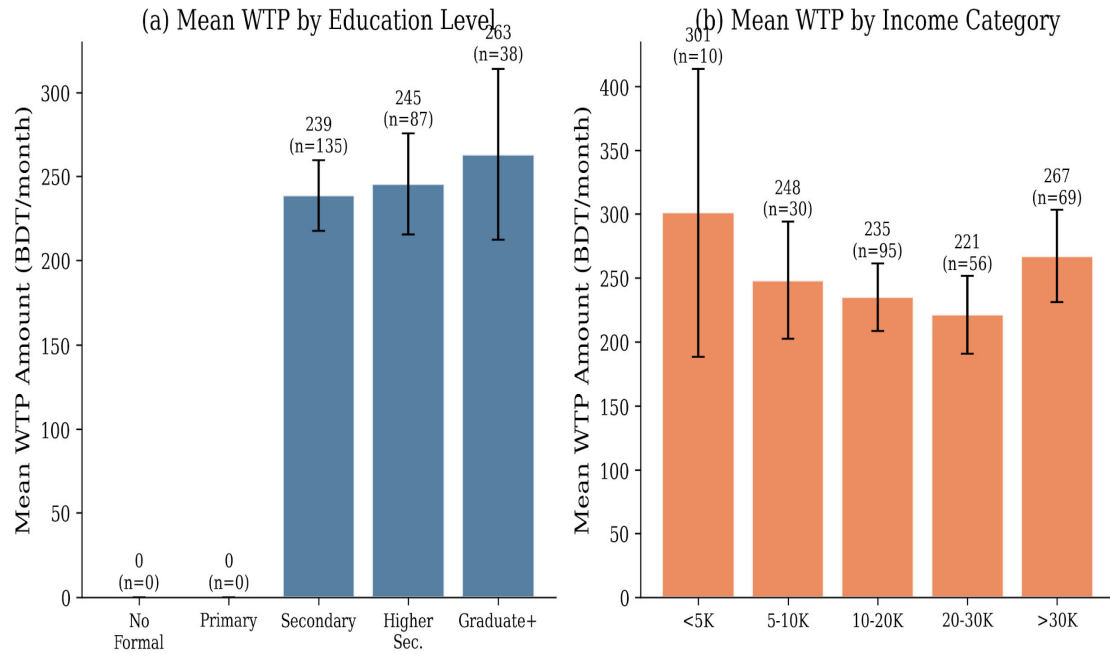
## 5. Discussion

The diagnosis of a pronounced capacity–commitment gap constitutes the central empirical contribution of this study. Although 65.0% of the 400 surveyed households expressed willingness to pay, stated contribution amounts were sharply bounded: 90.0% pledged  $\leq 400$  BDT/month, with a

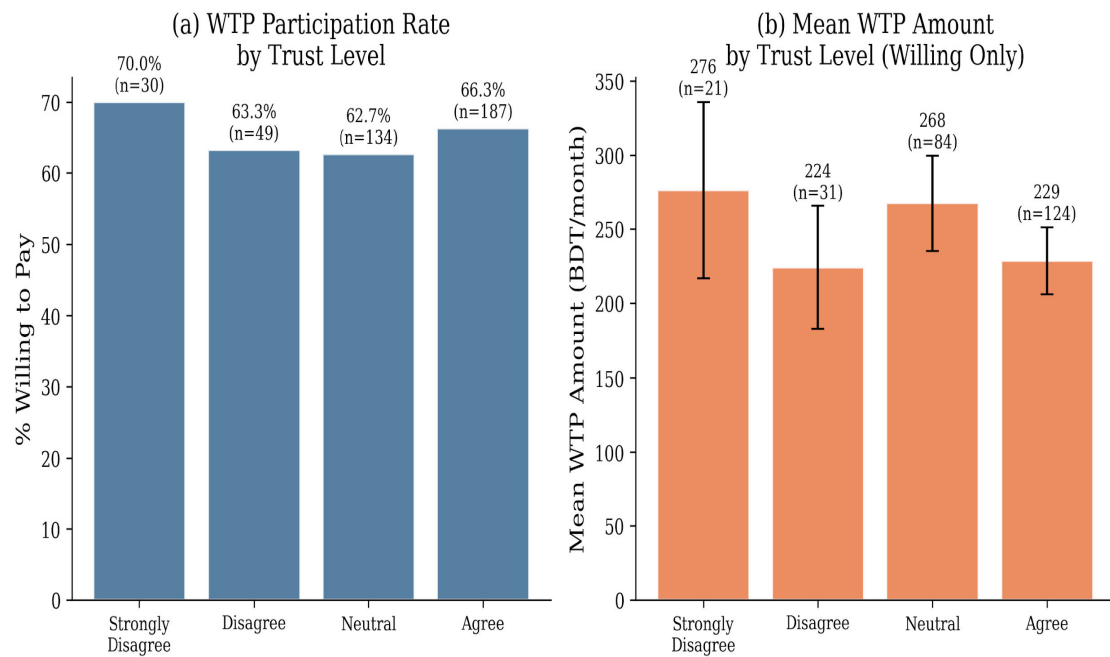
mean of 244.5 BDT, a median of 220 BDT, and a standard deviation of 136.5 BDT (Table 3). This pattern is theoretically anticipated rather than anomalous. Dercon (2002) demonstrates that households facing persistent income risk adopt loss-avoidance and short-horizon coping strategies in preference to long-horizon investment, even when the perceived benefits of protection are high. Viewed through this lens, the gap between willingness and capacity in char households is a structurally determined, rational response to chronic vulnerability — not a preference anomaly or a failure of valuation. Whittington (2010), synthesising two decades of stated-preference research in developing countries, reinforces this reading by distinguishing expressed demand from effective demand, and by showing that low and compressed WTP values in low-income settings are better interpreted as affordability ceilings than as indicators of low valuation or indifference. Our payment-class distribution — with 89.7%–100% of households clustered in PC-1 (0–200 BDT) across all seven adaptation strategies (Table 6) — provides direct empirical confirmation of such a ceiling. The policy implication is therefore not the specific monetary amount pledged, but the co-existence of high expressed demand with severe financial incapacity, a configuration that invalidates user-pays financing models for char populations.

Education ( $\beta = 1.46$  in Probit;  $\beta = 101.39$  in Tobit) and direct disaster experience ( $\beta = 1.49$ ;  $\beta = 153.85$ ) exert effects on WTP that are approximately three-to-eight times larger than those of income ( $\beta = 0.49$ ;  $\beta = 19.33$ ), as illustrated in **Figure 11**. Descriptive analysis (**Figure 9**) shows a clear education gradient in mean WTP: 238.6 BDT at the secondary level rising to 263.2 BDT among graduates. The dominance of education suggests that cognitive capacity to understand long-horizon climate threats and evaluate collective action is a more important motivator of commitment than marginal disposable income (Kabir et al., 2021), and it positions human capital as a necessary enabling condition for adaptive behaviour. The strong effect of disaster experience is consistent with experiential-learning accounts of risk perception (Abedin et al., 2019), in which personal exposure to hazard events updates subjective estimates of climate threat and of the utility of protective action. A practical implication is that investments in climate literacy and the systematic documentation of lived experience — for example through community risk archives and participatory scenario planning — can expand adaptation demand without requiring prior income growth.

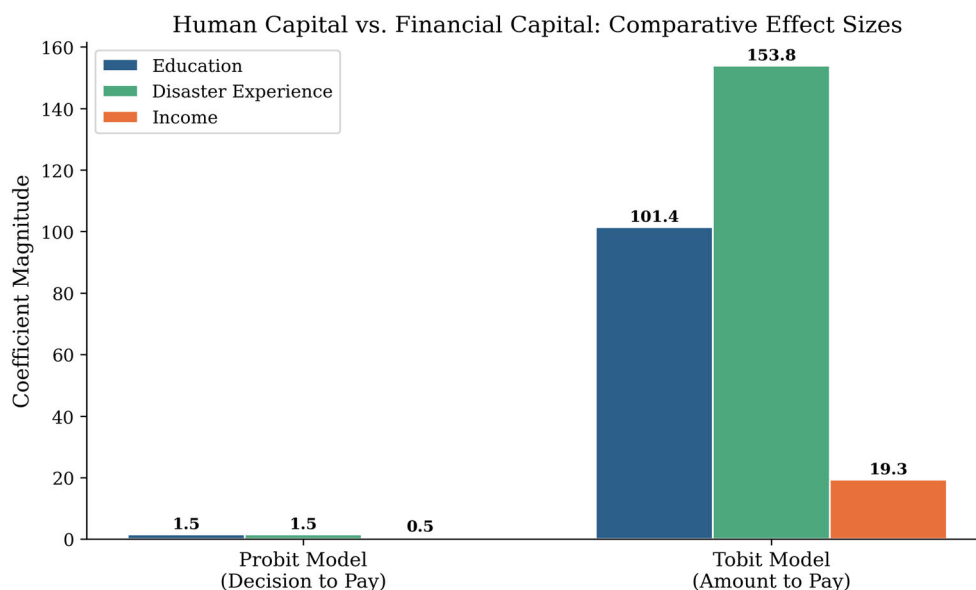
The paradoxical role of institutional trust (**Figure 10**) warrants careful interpretation and is arguably the most theoretically interesting finding of this study. Trust in government effectiveness is not a significant predictor of the binary participation decision (Probit  $p = 0.637$ ), yet is negatively and marginally significantly associated with the contribution amount conditional on willingness (Tobit  $\beta = -17.88$ ,  $p = 0.066$ ). Descriptively, respondents reporting the lowest trust pledge a mean of 276 BDT/month, against 229 BDT/month among those reporting the highest trust. At least three non-exclusive interpretations are consistent with this pattern. First, an *adaptive self-reliance* reading holds that households substitute their own commitment for perceived state incapacity, increasing personal contributions toward community-managed alternatives when they judge state-led protection to be unreliable. Second, a more sobering *desperation-driven* reading holds that those who most distrust the state are also those who have been most exposed to past institutional neglect during disasters; their higher stated contributions may reflect acute vulnerability and a willingness to pay more even when they doubt the funds will be well used, simply because no other protection is available. Third, a *signalling* reading, drawing on Solodoha and Blaywais (2023), suggests that even small or symbolic contributions can function as credible signals of engagement and commitment when structural constraints limit the scale of feasible payment; under this reading, higher contributions among low-trust households are a communicative claim on alternative governance arrangements. Although the three readings differ sharply in their view of respondent agency, they converge on a single policy requirement: transparent, community co-managed governance is a prerequisite for mobilising char-household commitment, and programme designers cannot wait for institutional trust to be rebuilt before acting.



**Figure 9.** Mean WTP Amount by (a) Education Level and (b) Income Category, with 95% Confidence Intervals (BDT/month).



**Figure 10.** The Institutional Trust Paradox: (a) WTP Participation Rate by Level of Trust in Government Effectiveness; (b) Mean WTP Amount by Trust Level (Willing Respondents Only).



**Figure 11.** Human Capital vs. Financial Capital: Comparative Effect Sizes for Education, Disaster Experience, and Income Across Probit and Tobit Models.

The occupational analysis (Figure 5 and Table 4) reveals a fundamental targeting dilemma: the most willing groups are also the most cash-constrained. Climate-exposed livelihoods — agriculture (39.2% of willing respondents), day labour (24.6%), and fishing (20.0%) — cluster overwhelmingly in the two lowest payment classes, with 87.3% of willing farmers and 92.2% of willing day labourers concentrated in PC-1 and PC-2 ( $\leq 400$  BDT/month). Cash-centric financing mechanisms would therefore be regressive in this setting, extracting the highest relative burden from households with the most motivation but least capacity. Drawing on Solodoha and Blaywais (2023), who show that even small or symbolic economic actions can function as credible signals of engagement and commitment when structural constraints limit feasible contributions, we interpret char-household WTP as a signal of prioritised demand rather than as a failed market test. The design response is to construct standardised in-kind contribution equivalencies — monetising community labour, local materials, and indigenous knowledge at defensible shadow prices — so that willingness is converted into a balance-sheet resource capable of credit-enhancing external finance.

## 6. Conclusions and Policy Framework

This study set out to diagnose the financial viability of community-driven climate adaptation in Bangladesh's char regions, and to translate that diagnosis into an evidence-based financing mechanism. Taken together, our three empirical findings do not simply describe a setting — they define the design space within which any credible financing instrument for char adaptation must operate.

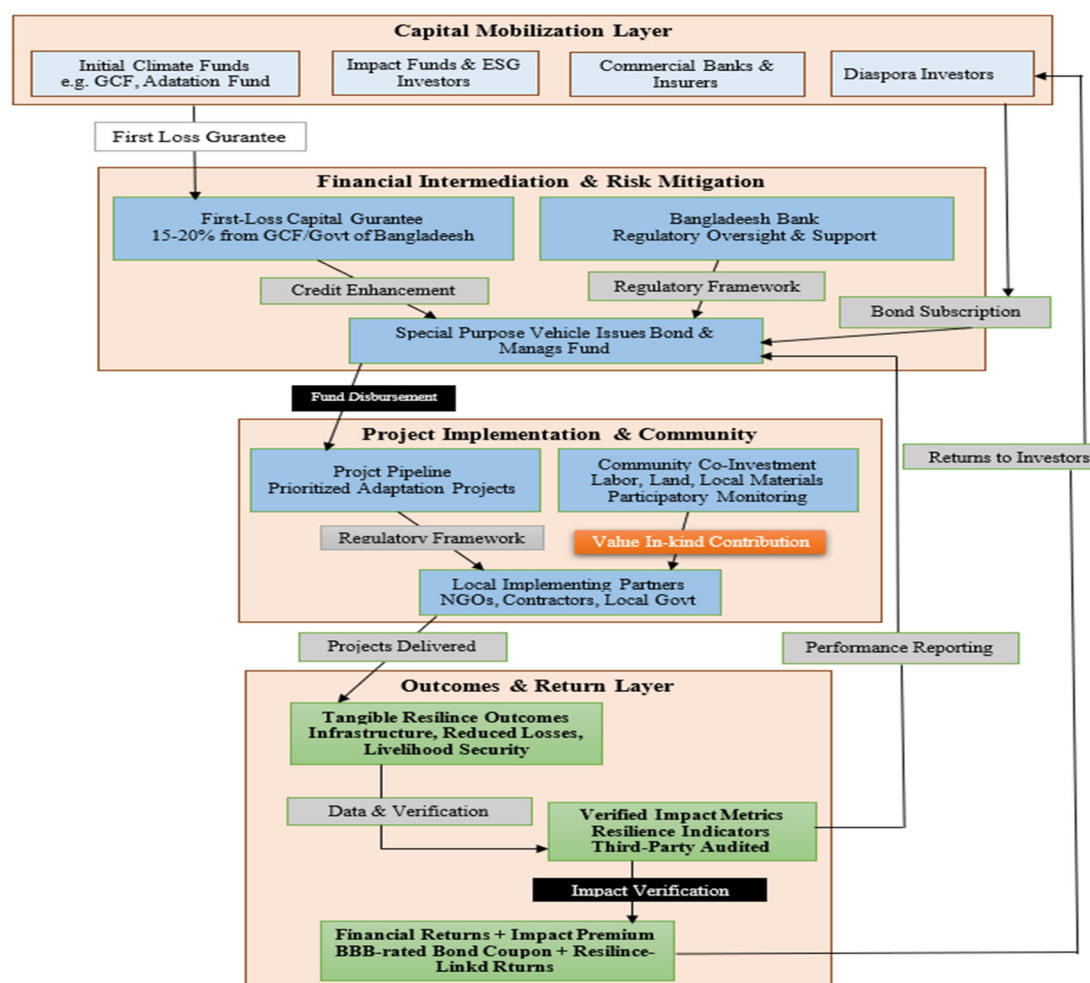
First, the capacity–commitment gap is structurally entrenched, not transient. A 65.0% willingness rate coexists with a 90.0% cap at  $\leq 400$  BDT/month (mean = 244.5 BDT) and with near-universal clustering in PC-1 (89.7%–100% across strategies). This is an affordability ceiling in the Whittington (2010) sense, and it establishes that any financing mechanism relying on user fees will systematically fail in this setting. The corollary for instrument design is direct: the Char Resilience Bond must decouple the volume of community co-investment from the cash contribution of households, by formalising in-kind co-investments (labour, local materials, indigenous knowledge) at defensible shadow prices.

Second, commitment in this context is driven by human capital, not financial capital. Education (Probit  $\beta = 1.46$ ; Tobit  $\beta = 101.39$ ) and direct disaster experience ( $\beta = 1.49$ ;  $\beta = 153.85$ ) dominate income ( $\beta = 0.49$ ;  $\beta = 19.33$ ) by three-to-eight-fold ( $\beta$  in effect size). Consistent with Dercon (2002), this does not

imply that households value protection less than they could pay for; it implies that cognitive and experiential resources, rather than marginal disposable income, are the binding inputs to participation. The Char Resilience Bond therefore incorporates targeted climate-literacy programming and the documentation of lived disaster experience as complementary inputs that expand adaptation demand without requiring prior income growth.

Third, the institutional-trust paradox — lowest-trust respondents pledge 276 BDT/month versus 229 BDT among the highest-trust, while 49.3% of unwilling respondents cite trust-related concerns — implies that trust is not a precondition for mobilisation but a design constraint on governance. Whether one favours the adaptive-self-reliance, desperation-driven, or signalling reading (see Discussion), the policy implication is identical: community co-management, transparent benefit tracking, and independent fiduciary oversight must be built into the bond's architecture at inception, not retrofitted after the fact. Without these features, the same distrust that currently accompanies higher stated WTP would reappear as implementation-phase disengagement and protest behaviour.

These three findings jointly specify the Char Resilience Bond (Figure 12) as the direct, evidence-based response to the diagnosed conditions. The instrument is structured across four layers that map one-to-one onto the diagnosis. A Capital Mobilisation layer substitutes external concessional capital for user fees where an affordability ceiling has been demonstrated; a Financial Intermediation layer with first-loss guarantees de-risks that capital using formalised in-kind community co-investments as credit enhancement; a Project Implementation layer operationalises the human-capital finding by bundling climate-literacy programming and disaster-experience documentation alongside physical adaptation measures; and an Outcomes-linked Returns layer institutionalises the transparency that the trust paradox demands. In this way, the bond does not extract cash the respondents have said they cannot spare; it converts the demand they have revealed into a bankable balance-sheet resource.



**Figure 12.** The Char Resilience Bond Mechanism: Translating Community Commitment into Bankable Investments.

Several limitations should be acknowledged. The CVM scenario may partially conflate WTP for the adaptation good with preferences over the governance arrangement proposed for its management; the cross-sectional design precludes strict causal claims about the determinants identified; and the household-level survey design does not fully capture intra-community power dynamics that may shape who is willing, and for whom. Future research should employ longitudinal and experimental designs, extend the analysis to coastal and haor chars, and pilot the Char Resilience Bond mechanism with a pre-registered impact evaluation comparing cash-only, in-kind-only, and blended co-investment arms.

Beyond Bangladesh, the analytical move at the heart of this paper — treating stated willingness under a binding affordability ceiling as a signal of prioritised demand, and converting it into in-kind balance-sheet collateral — is transferable to a wide set of settings. Wherever subsistence populations face high climate exposure alongside severe fiscal constraint — the deltaic Sundarbans, the lower Mekong, Sahelian pastoral corridors, and low-lying Pacific atolls — the same diagnostic logic applies, and a Char-Resilience-Bond-type instrument can be parameterised to local shadow prices, risk profiles, and governance capacity. A pilot implementation in Bangladesh's Padma and Brahmaputra chars, with transparent outcome tracking, would provide the proof of concept required to scale this model into a replicable template for inclusive climate-adaptation finance across the world's climate-vulnerable frontiers.

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