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Climate change investments in Bangladesh: leveraging dual-use characteristics as an anti-corruption tool

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Contents

Acronyms and abbreviations 3

Acknowledgements 3

Executive summary 4

1. Introduction 5

2. Climate change investment in Bangladesh 8

2.1. The threat of climate change in Bangladesh's coastal regions 8

2.2. Investments in adaptation and sources of climate finance 8

2.3. Types of climate adaptation infrastructure 10

3. Corruption in climate change investments in Bangladesh 12

4. Theoretical approach 15

5. Data sources: surveys and key informant interviews 16

6. Empirical approach 18

6.1. Local beneficiaries of climate adaptation projects 18

6.2. Local interests and household involvement in implementation 20

6.3. Impact of household involvement on corruption 23

7. Conclusion and policy implications 30

References 31

Appendix A: Descriptive statistics of survey data 33

Appendix B: Overview of project locations 34

Appendix C: Key informants in study areas 36

Figures

Figure 1: Predicted probability of household involvement as agricultural income increases 22
Figure 2: Predicted probability of household involvement as business income increases 23
Figure 3: Involvement of households and 'influential' households in monitoring 26
Figure 4: Share of 'influential' households participating in monitoring 28
Figure B 1: Map of sampled climate project locations 34

Tables

Table 1: Domestic and international sources of climate finance 10
Table 2: Overview of project locations and surveyed households 16
Table 3: Household perceptions of community beneficiaries 19
Table 4: Households' own benefits from a project 19
Table 5: Determinants of citizen involvement 21
Table 6: Corruption scores based on key informant interviews 25
Table 7: Households (HHs) involved in monitoring project implementation and their characteristics 25
Table 8: 'Influential' households (HHs) involved in monitoring as a proportion of all influential households in the project areas 27
Table A 1: Descriptive statistics 33
Table C 1: Numbers of key informants in different study areas 36

Acronyms and abbreviations

BCCRF	Bangladesh Climate Change Resilience Fund
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BCCTF	Bangladesh Climate Change Trust Fund
BDT	Bangladesh Takas
BWDB	Bangladesh Water Development Board
GBM	Ganges, Brahmaputra and Meghna Basin
LGED	Local Government Engineering Department
TIB	Transparency International Bangladesh

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Executive summary

Bangladesh is one of the world's most climate-vulnerable countries. The government and international development partners have committed billions of dollars in adaptation infrastructure to mitigate the effects of storms and flooding as a result of climate change. Unfortunately, corruption has severely impacted the implementation of these projects – estimates suggest that around 35% of project funds are embezzled and around 80% of projects are poorly constructed.

However, corruption has not affected all climate change projects equally or in the same way, even when implemented by the same agency, funded by the same funder, and therefore with identical formal governance arrangements. In this paper, we show that the *effectiveness of monitoring* by local communities plays an important role in explaining these differences. We also demonstrate that this effectiveness relates to the involvement of influential individuals in particular, who can use informal power and networks to put pressure on contractors and officials, and this involvement can be encouraged through policy design.

To show this, we use intensive surveys of local communities in four project sites: two embankments and two cyclone shelters. We also use estimates of corruption in these projects from 30 key informant interviews. Our analysis finds strong relationships between the participation of influential land and business owners in monitoring, the overall community participation in monitoring, and lower levels of corruption.

We find that variations in local involvement relate to the extent and distribution of the dual-use benefits of climate investments. Embankments are also used as roads, and cyclone shelters are used as schools, offices and community centres. These dual-use benefits are disproportionately beneficial for individuals with above-average incomes from land and businesses. And the greater their immediate dual-use benefits, the more involved these individuals become in informal monitoring of climate projects. In turn, when the involvement of influential local individuals increases, the involvement of all citizens increases, and anti-corruption efforts become much more effective.

Conventional anti-corruption approaches that focus on transparency and accountability have had limited effects in Bangladesh. But our evidence suggests a feasible strategy to improve anti-corruption in these adverse contexts by *designing climate change projects to maximise dual-use benefits for local communities*. The developmental benefits of dual-use designs are well understood, but their significance for governance and anti-corruption less so. We argue that self-interested monitoring, particularly by more powerful individuals, is especially effective in these informal contexts. This can be triggered by engaging local communities at the project design phase to maximise dual-use benefits while also delivering against climate mitigation objectives. If this proves difficult, development partners and anti-corruption activists could ensure that projects consider alternative designs for location, specification and uses, and deliberately select designs that provide the highest level of dual-use community benefits. Our evidence suggests this would be a feasible and effective strategy for reducing corruption in these contexts.

1. Introduction

Bangladesh is a low-lying country that faces severe threats from rising sea levels and other effects of climate change due to global warming. The government and international development partners recognise that billions of dollars need to be invested in adaptation infrastructure to mitigate the effects of more intense and frequent storms and flooding. These investments have already started and include the construction of embankments along rivers prone to flooding and cyclone shelters in exposed areas. Implementation has, however, often been disappointing, with projects suffering from corruption, patronage and other weaknesses that affect implementation and management.

Like many developing countries, Bangladesh has high levels of corruption across the economy, but climate change investments face additional challenges. The social benefits of constructing embankments and cyclone shelters to a high quality are only established when adverse events happen, and these are usually in the indefinite future. On the other hand, the political and economic benefits of patronage and corruption are immediate. The temptation to use climate change investments as sources of patronage and resource extraction is therefore harder to resist than in other public construction projects. Not surprisingly, the usual mechanisms of corruption-control through improvements in procurement processes, community monitoring and political accountability have been even less effective than usual in climate change investments.

However, corruption has not affected all climate change projects equally. Similar projects run by the same implementation agency have often suffered from different levels of corruption in different locations. This has resulted in differences in construction quality that affect current and future welfare, particularly of poor people. Of the location-specific variables that can explain these differences, the *effectiveness of monitoring* by local communities plays an important role in influencing the quality of the outcome. Yet this observation only has policy significance if we better understand how to make local monitoring more effective.

The voice exercised by the local community is much more likely to be effective as an anti-corruption tool if individuals with the *capacity* to influence can be incentivised to engage in monitoring to ensure that leakages are limited. When corruption affects a project, powerful interests (including local ones) are likely to be involved. In the context of a rural developing-country community, these interests are only likely to be constrained if the monitoring and resistance to their activity comes from a sufficiently effective counter-group of local people. But this is by no means always assured. It is only likely if individuals in the local community who have the capabilities to influence the implementation of climate projects take an interest in these activities. Village communities in Bangladesh are poor and most individuals are relatively poor in absolute terms. In this context, relatively small differences in the economic, political and organisational capabilities of those actively involved in corruption and anti-corruption can matter greatly in determining anti-corruption outcomes.

Governments in Bangladesh have long recognised that the benefits of climate change projects are greatly enhanced if they are designed as dual-use investments. This means investments are intended to deliver immediate benefits for the local community as well as helping them to respond to future climate change challenges. For instance, river embankments have served as roads, and cyclone shelters as schools or community centres, contributing to immediate improvements in welfare and income for those who can benefit from them. This has an obvious developmental justification in a developing country, but it also has a potential governance logic that is less well understood. The more effectively climate change projects provide immediate benefits – particularly to groups with the capacity to play an effective monitoring role – the more likely they are to take an interest in the quality of construction and monitor progress on an ongoing basis. The more they do this, the better the quality of project implementation and the control of corruption.

We explore this possibility by comparing four climate change projects with different levels of reported corruption. We use extensive surveys of local communities affected by the projects to identify the level of engagement in monitoring, the types of individuals who get involved, and the effects on anti-corruption. To test our hypothesis, we conducted intensive surveys in these four project sites to identify the distribution of benefits and levels of participation in each community. The intensive data requirements for testing our hypothesis limited the number of projects we could feasibly compare. Nevertheless, the survey evidence and the comparisons of anti-corruption effects are compelling. Given the dual-use design of embankments and cyclone shelters, anti-corruption efforts were more effective when there was greater involvement of influential segments of the local community in monitoring activities.

This finding has potentially far-reaching policy implications. It identifies a feasible and effective anti-corruption strategy that exploits the dual-use characteristic of climate adaptation projects to reduce corruption and improve the quality of climate investments. While dual use is already built into the design of climate change projects, local communities are usually not deeply engaged in the design of dual-use benefits. Our strategy is to deliberately design projects so that the dual-use aspect is highlighted from the outset, with local communities being explicitly invited to provide inputs into the dual-use design.

The goal is to identify a design that achieves an acceptable balance between optimising climate change adaptation results and the broadest distribution of benefits across the community, including groups with the capacity to effectively monitor and influence the quality of implementation. Managing this process will have its challenges but none as severe as trying to control corruption in these projects through conventional measures, which have generally proved insufficient. The governance benefits are likely to far outweigh any additional effort to design projects that satisfy these conditions. The strategy exploits horizontal ‘peer-to-peer’ monitoring that is often a necessary condition for effective anti-corruption in developing countries (Khan et al., 2019).

The remainder of this paper is structured as follows. Section 2 outlines the challenge of climate change in Bangladesh and current adaptation steps. Section 3 describes corruption in the climate investment sector that motivates our research. Section 4 presents the Anti-

Corruption Evidence (ACE) consortium's approach to strengthen anti-corruption in climate change investments. Section 5 and 6 present our data and empirical evidence to support this strategy, while the final section discusses the broader policy implications of our findings and concludes.

2. Climate change investment in Bangladesh

2.1. The threat of climate change in Bangladesh's coastal regions

Bangladesh is one of the world's most climate-vulnerable countries. Situated in the Ganges, Brahmaputra, and Meghna (GBM) basin, two-thirds of Bangladesh is less than five meters above sea level (Adams et al., 2011). The country's vulnerable coastal zone spans over 580 km and comprises 12 districts that are home to over 40 million people. Every year, flooding and cyclones threaten lives, property, land and infrastructure in the country's low-lying coastal regions. Rising global temperatures are expected to increase the frequency and intensity of cyclones and monsoon rainfall that result in severe floods. These events are expected to exceed the country's current level of disaster preparedness (ibid.).

The challenge of climate change is amplified by Bangladesh's high level of poverty and population density. Nearly 12 million people – approximately 30% of the population – live in poverty in the coastal regions (World Bank, 2016). Sea-level rises and saltwater intrusion pose a severe challenge to the livelihoods of these households by decreasing food security, access to fresh water and secure housing. As a result, environmental factors have become an important factor that drives migration into the country's cities, predominantly the capital, Dhaka, and further afield. A World Bank study estimates that the number of Bangladeshis displaced by climate change could reach 13.3 million by 2050 (Rigaud et al., 2018).

2.2. Investments in adaptation and sources of climate finance

Climate change adaptation refers to the adjustment of natural or human systems in response to actual or expected climate changes to reduce potential damage or exploit beneficial opportunities (IPCC, 2018). Due to the risks posed by severe weather events and sea-level rises, adaptation is essential for Bangladesh's development and requires significant investments. Since the 1960s, the Government of Bangladesh, with the help of international donors, has invested $10 billion in the construction of polders protected by embankments, cyclone shelters, and emergency warning and awareness-raising systems to protect low-lying coastal areas (Adams et al., 2011). These investments have significantly reduced cyclone-related loss of life and property damage over time. However, climate change is expected to increase cyclone-induced storm surges and monsoon flooding to levels that exceed the capacity of existing coastal infrastructure (ibid.).

In 2007, Bangladesh experienced its worst natural disaster since 1991. Cyclone Sidr struck the south-west coast of Bangladesh, killing 3,500 people and causing $1.5 billion in damages (Government of Bangladesh, 2008). Two years later, the Government of Bangladesh

produced the *Bangladesh Climate Change Strategy and Action Plan* (BCCSAP) (Ministry of Environment and Forests, 2009), which presents a pro-poor climate change strategy that is built on six pillars: food security, social protection and health; comprehensive disaster management; infrastructure; research and knowledge management; mitigation and low carbon development; and capacity building and institutional strengthening (Khan et al., 2012). The plan identifies storm surges from tropical cyclones and monsoon flooding as two primary climate hazards facing the country (Adams et al., 2011).

The adoption of the BCCSAP resulted in the creation of two separate funds to support climate adaptation and mitigation: the Bangladesh Climate Change Trust Fund (BCCTF), and the Bangladesh Climate Change Resilience Fund (BCCRF) (Khan et al., 2012). The Government of Bangladesh established the BCCTF, based on revenue from the national budget, to address the adaptation needs of the most vulnerable sectors. To date, the government has committed approximately $450 million of its resources to the fund (Government of Bangladesh, 2020). In addition to the BCCTF, the government allocates approximately $1 billion annually, or 7% of its total budget, to climate-related activities.

In 2012, the BCCRF was created to pool climate funds from bilateral donors. The BCCRF consisted of funds provided by the United Kingdom (UK), the European Union, Sweden, Denmark and Switzerland. In total, the donors pledged $187 million and contributed $130 million to the fund (Anderson et al., 2017). However, the fund only implemented five projects with a total cost of $71 million (Government of Bangladesh, 2020). The World Bank served as the initial trustee of the fund and exercised control over its governance. The BCCRF was discontinued in 2017, however, as many donors had concerns about its rate of progress and felt that the government had not yet established effective institutional arrangements to comply with the monitoring, reporting and verification systems required when fund management was transferred from the World Bank to the Government of Bangladesh (Anderson et al., 2017). Informally, it was widely known that donors were concerned about high levels of corruption that were distorting the selection and implementation of projects. Monitoring by Transparency International Bangladesh (TIB), referred to later, confirms widespread corruption in climate change projects.

Multilateral development banks, multilateral climate funds and bilateral donors remain important sources of climate finance for Bangladesh. Bangladesh receives climate adaptation support from the World Bank, the Asian Development Bank and the United Nations Development Programme (UNDP) amongst others. In particular, the World Bank has been working closely with the Government of Bangladesh to strengthen coastal embankments, construct multi-purpose cyclone shelters (MPCS), and improve early warning and evacuation systems (World Bank, 2013; 2015). Other notable sources of multilateral finance include the Global Environmental Facility, the Climate Investment Fund, and the recently established Green Climate Fund. Lastly, Bangladesh receives climate adaptation assistance from bilateral donors including the UK, Germany and the United States (US) (Anderson et al., 2017).

Table 1: Domestic and international sources of climate finance

	Total amount (US$ million)	Number of projects	Time period	Annual average (US$ million)
Domestic sources				
GoB Development Budget	4,519		2016-2020	1,130
BCCTF	447	788	2012-2019	64
International sources				
Global Environmental Facility	160	43	1998-2020	7
Climate Investment Fund	185	9	2010-2020	19
Green Climate Fund	85	4	2015-2020	17
BCCRF	71	5	2012-2018	12

Note: Estimates are not included for the World Bank, UNDP and major bilateral donors.

Source: Government of Bangladesh (2020).

Table 1 presents an overview of international and domestic sources of climate finance in Bangladesh using available estimates. The Government of Bangladesh estimates that 75% of its annual climate-related expenditures are funded domestically, while international development partners fund the remaining 25%. The largest single source of climate finance is the Government of Bangladesh's Development Budget, which allocates approximately $1 billion to climate-related expenditures each year. Despite this significant allocation, the current annual expenditure levels are far below the $5.7 billion that the World Bank estimates that Bangladesh needs to spend annually on climate adaptation (Government of Bangladesh, 2020). As a result, a substantial increase in climate finance from both domestic and international sources is required for the country to make the necessary investments in climate adaptation infrastructure.

2.3. Types of climate adaptation infrastructure

This study focuses on two types of climate adaptation infrastructure: river embankments and cyclone shelters. Coastal and river embankments are an integral part of disaster risk reduction investments in Bangladesh. They are meant to provide protection from tidal and river flooding inundations, cyclone-induced storm surges and salinity intrusion. Embankments are often used to create polders, which are tracts of floodplain enclosed by embankments. By providing increased resilience to flooding, embankments can help increase agricultural production and food security during normal weather and reduce the loss of life, assets, crops and livestock during natural disasters (Adams et al., 2011). Additionally, embankments provide benefits to local communities because they can also serve as roads and enhance connectivity between communities. By lowering travel times, embankments improve access to healthcare, schools and local markets.

The first embankments were constructed in Bangladesh in the 1960s as public goods primarily to prevent saltwater intrusion and to facilitate agricultural development (Saari and Rahman, 2003). In recent decades cyclone protection has become one of the primary functions of coastal embankments as populations have increased in vulnerable areas and the number and strength of cyclones affecting these populations has also increased. The

Bangladesh Water Development Board (BWDB) maintains 9,943 km of river embankments, 5,111 km of drainage canals and 13,949 flood control structures (Adams et al., 2011).

A second important type of climate investment are cyclone shelters. These provide temporary shelter to disaster-affected communities. Cyclones hit the country's coastal region nearly every year and a severe cyclone strikes the country every three years on average (ibid.). An increase in ocean temperatures and rising sea levels are expected to further increase the intensity of natural disasters in the GBM basin. A World Bank study predicts that cyclonic storm surges will affect an additional 15% of Bangladesh's coastal area by 2050 (ibid.).

Typically, cyclone shelters are multistoried, reinforced concrete buildings that can, on average, accommodate 1,600 people (Mahmood et al., 2014). The shelters generally have an open ground-floor structure to avoid flooding from the storm surges and top floors designed to accommodate people during and after a disaster (ibid.). Approximately 2,500 cyclone shelters have been constructed across Bangladesh's coastal districts as part of disaster risk reduction strategies. However, the World Bank further estimates that there is a need for 5,500 additional shelter facilities (Huq et al., 2010). Additionally, many existing shelters are in poor condition due to a lack of maintenance funds (Haider and Ahmed, 2014; Mahmood et al., 2014).

Like embankments, cyclone shelters also provide dual-use benefits. They are often multi-purpose structures that serve as schools, community centres or business locations during normal times that can create business opportunities in the neighbourhood. Approximately 82% of shelters are used as education centres, 8% as offices, 1% as health centres and 1% as community centres. Only 6% of shelters do not have a dual use (CEGIS, 2009).

3. Corruption in climate change investments in Bangladesh

Corruption is a central challenge in the construction of climate adaptation infrastructure in Bangladesh. Since 2010, TIB has tracked the implementation of more than 100 climate projects run by the government and non-governmental organisations and has documented pervasive corruption in the sector (Mohiuddin et al., 2017; Sharmin et al., 2017). In particular, TIB has documented the embezzlement of project funds, the violation of procurement laws, poor-quality construction and unfinished projects (ibid), which have resulted from low levels of transparency, community engagement and independent monitoring.

Based on an analysis of 38 climate projects for which detailed information is available from TIB, we estimate that, on average, 35% of climate project funds are embezzled (Haque et al., 2012 and 2013; Mohiuddin et al., 2017; Sharmin et al., 2017; Masum and Khan, 2020). Extraction operates through different mechanisms. A contractor can use lower quality materials, can leave a project incomplete or can extract margins through illegal subcontracting. The latter operates through a contractor selling on their contract before or during construction at a lower price, with the seller capturing the difference. This type of subcontracting can happen multiple times with each new contractor offering to complete the work at a lower price. Subcontracting more than 20% of the overall approved project budget is illegal and violates government procurement laws. Yet illegal subcontracting has been observed in nearly two-thirds of climate projects (ibid.). Embezzlement and illegal subcontracting clearly have a detrimental impact on the quality of project implementation. Of the 38 projects referred to earlier, 30, or nearly 80%, were poorly constructed as a result of corruption-related leakages (ibid.).

Corruption on this scale can only happen if contractors collude with implementing agencies, representative bodies and enforcement agencies. Formal institutional processes of ensuring transparency and community engagement are well-known to be weak in Bangladesh. Formal demands for disclosure of information are unlikely to be very effective – implementing agencies rarely disclose information about project selection and design, including climate vulnerability assessments, site selection criteria, or details of project funding and procurement contracts. As a result, rural communities are excluded from relevant information. Moreover, as communities are generally not involved in project design, they have very limited ongoing involvement in monitoring activities. When community consultations do take place, they are often superficial, usually a tick-box exercise to show that the community has been consulted. Community-led monitoring, reporting and verification mechanisms are usually weak or non-existent.

It is useful here to make a distinction between formal and informal processes of information generation and enforcement in these contexts. The formal processes of accessing information (transparency) or ensuring enforcement (accountability) are weak in Bangladesh, and even more so in remote rural areas where climate adaptation investments

are located. Information about procedural violations or the extraction of resources, even when common knowledge, rarely leads to action because contractors collude with implementation and enforcement agencies to block these efforts (Khan et al., 2019). As a result, attempts to strengthen enforcement in developing countries using technical support, better equipment, training or higher salaries for enforcement agencies have usually failed to improve anti-corruption outcomes (Johnsøn et al., 2012). This is not surprising, because in the absence of a strong rule of law, not only is there no reward, there are instead substantial penalties for officials who try to enforce rules against powerful coalitions and networks. The failure to enforce in these contexts is therefore mainly a problem of power and the exercise of informal influence rather than the absence of technical enforcement capabilities (Khan, 2018).

To improve anti-corruption outcomes in these contexts, we explore a different approach. We test the possibility that enforcement can be improved if coalitions emerge that exploit conflicts of interest between influential groups. If climate change investments can deliver immediate benefits to broad groups of people – including, in particular, some who are influential – the latter may become sufficiently interested in the implementation of a project to change the balance of forces that can affect implementation outcomes in different directions. Rule violators may suddenly perceive a higher probability of exposure and punitive measures and they can begin to scale back their extraction. When influential individuals in these contexts exercise voice, they do so through both formal and informal channels, and the latter may be decisive in contexts where formal institutions and processes are weak.

A focus on formal processes has meant that anti-corruption efforts to date have ignored informal mechanisms of accessing and using information that may often be more effective in controlling corruption. If all the influential parties engaging with a project happen to be interested in extracting resources, the formal anti-corruption processes are unlikely to be effective because of concerted informal pressures. In the political settlements of developing countries, the distribution of power in society does not support a general rule of law and the average citizen is unlikely on their own to gain access to actionable information about who is extracting resources and how (even if the broad outlines are known at the local level). They are even less likely to be able to act upon this information to ensure enforcement. But if a large enough group of individuals with informal power become interested in a project, the effective pressure for better implementation can dramatically increase.

Informal power in these contexts usually relates to the networks that individuals can access to get information, or to pass on information in ways that create more effective constraints on others. For instance, information on violations can be particularly useful if the violator has powerful competitors who can use this information in their own interest. An influential citizen who is networked is more likely to be able to identify these vulnerabilities, and violators are correspondingly careful if they are being challenged by individuals with power. As a result, citizens who are somewhat influential in the local context (even if they may be quite poor in absolute terms) are much more likely to be able to access information, and more importantly, to put pressure on contractors and officials to take corrective action if delivery quality is deteriorating. An informal chat with a contractor in a tea shop about the

quantity and quality of cement or bricks may be much more effective in exerting pressure than the threat of a formal enquiry coming from the average citizen with poor access to powerful networks. Indeed, just the fact that influential individuals in the locality are taking an active interest in the quality of a project may be enough to constrain more egregious extractive acts.

4. Theoretical approach

Climate change projects are large projects that take several years to complete, and their designs are already determined by the time implementation begins. Not many of them are being implemented concurrently at any time. It is therefore not possible to directly test the proposition that if the design of some ongoing projects provided greater dual-use benefits to the community and to influential citizens, anti-corruption outcomes would be better relative to other projects. So, we devised indirect ways of testing this hypothesis. We selected recently completed projects with known levels of corruption problems (corroborated by key informants) and then conducted extensive surveys of local communities to see if variations in the characteristics of benefits and citizen involvement across the projects were in line with our theoretical expectations.

Our nested hypotheses are as follows:

H1: The size and distribution of dual-use benefits can determine the engagement of individuals in monitoring, as rural households are more likely to be interested in the immediate rather than the long-run benefits of adaptation projects.

H2: The higher the proportion of local citizens involved in monitoring, and in particular, the higher the proportion of influential citizens engaged in monitoring, the more effective the monitoring and enforcement, and the lower the corruption.

We cannot test H1 directly because we cannot measure the effect of specific changes in project design on the involvement of different types of households in monitoring activities. However, using intensive surveys in selected project sites, we provide evidence consistent with hypothesis H1. The surveys reveal that the dual-use benefits of climate change were of greatest benefit to owners of land, and to a lesser extent, owners of businesses, and that these types of citizens were also most likely to engage in monitoring activities, particularly owners of land.

Our survey approach provides strong support for the more important hypothesis H2. We find that projects that have higher levels of engagement of more influential households also have higher levels of citizen engagement overall; *and these projects achieve lower levels of observed corruption in project implementation.*

5. Data sources: surveys and key informant interviews

To test our main hypothesis, H2, our analysis examines the relationship between the levels of involvement of citizens and influential groups and the prevalence of corruption in four recently completed climate adaptation projects. As our approach requires intensive surveys of project areas, we have been constrained in the number of projects that we can study. We selected two cyclone shelter and two embankment projects located in the comparably remote climate-vulnerable coastal districts of Barishal, Barguna and Satkhira. For each type of project, we selected one project that earlier TIB work suggested had lower corruption and better project implementation and another that appeared to have higher corruption and poorer implementation. We then conducted in-depth interviews with key informants to corroborate or qualify these prior perceptions. In all cases, our prior perceptions of higher or lower corruption were corroborated through key informant interviews, which added further detail on the dimensions of corruption in each case.

In order to control for other explanations of differences in levels of corruption, the projects were selected so that the implementing agency was the same for each type of project, the project sizes were comparable, and the funding sources the same. Both embankment projects were constructed by the BWDB.[1] Both cyclone shelters were constructed by the Local Government Engineering Department (LGED).[2] Each pair was subject to the same formal governance arrangements, such as formal arrangements for citizen engagement, procurement processes and oversight. All four were funded by the BCCTF and completed at various times between 2013 and 2015. A summary of project locations is presented in Table 2, with additional details in Appendices A and B.

Table 2: Overview of project locations and surveyed households

Survey area	Type of project	Completion date	Implementing agency	Households surveyed
Fingri, Satkhira	Polder embankment	2015	BWDB	600
Nalua, Barishal	Polder embankment	2014	BWDB	488
Bhoroshakathi, Barishal	Cyclone shelter	2013	LGED	407
Gulishakhali, Barguna	Cyclone shelter	2015	LGED	406

Source: The authors.

[1] The BWDB is one of the principal agencies involved in implementing climate projects funded by the BCCTF. To date, the BWDB has been involved in the implementation of 132 climate finance projects, receiving a total of about 10,437.7 million Bangladesh Takas (BDT) or 32% of the total allocated BCCTF funds to the climate sector (Ministry of Finance, 2020).

[2] The LGED is one of the largest engineering agencies of the Government of Bangladesh. The LGED has implemented 441 climate finance projects totaling 13,130 million BDT or 39.5% of the total allocated BCCTF funds (Ministry of Finance, 2020).

The primary data were collected in intensive surveys of the four project areas. The aim of the surveys was to understand the distribution of benefits and the involvement of different types of households in monitoring activities during the implementation phase of the projects. The surveys covered 1,901 households living near the four climate adaptation projects over 2018 and 2019. We asked respondents about who they thought benefited from the projects, their own direct household benefits and costs from the project, their involvement in the project monitoring and implementation, and their household income from agriculture, business and wages.

The projects selected were all completed within 3–5 years of the surveys, which was the closest we could achieve in terms of getting a spread of comparable projects. As any benefits from the dual-use characteristics of the projects would persist over this period, we do not believe there is a significant problem with recall with respect to benefits, and it is unlikely that respondents would forget their level of involvement in a major project that had been completed during this time frame. This strategy allows like-for-like comparisons without significantly exposing the study to time-variant factors that could affect the degree of corruption or quality of implementation of the projects. There were no changes in government or other significant time-variant events over the relevant period that could independently affect corruption levels across our projects.

We employed random sampling procedures to select households living near the climate projects. For each location, *mouzas* (administrative districts) or villages were selected using a probability-proportional-to-size sampling strategy. Each *mouza* was then divided into clusters of 100 households. We then randomly selected 20 households from each cluster. To ensure data quality, senior researchers directly supervised the data collection and completed quality checks on the interviews.

We are not directly able to observe individuals who are 'influential' in the sense of belonging to powerful networks. So, as a proxy, we identified individuals as influential if they had higher than average agricultural or business incomes in the local context. Not all of these individuals may be influential in terms of network power, and it is possible that some individuals with network power may have lower than average incomes. Nevertheless, it is very likely that influential individuals have higher than average agricultural or business incomes in the local community, and therefore a higher share of involvement of the latter group is a reasonable proxy for the involvement of influential individuals.

In order to score the level of corruption affecting the implementation of each project, we conducted a separate set of in-depth interviews with 30 key informants across these projects (see Appendix C). Key informants included government and implementing agency officials, contractors, members of civil society organisations and journalists. Each interview included open-ended questions about: 1) the degree of transparency in the project; 2) instances of corruption by public employees, politicians and implementing agencies; 3) observations of resource leakages or the use of poor quality materials; 4) observations of collusion between contractors and implementing agencies; 5) observations of collusion between contractors and political leaders; and 6) observations of corruption in the land-acquisition process. Based on these observations we scored the overall level of perceived corruption in the four projects.

6. Empirical approach

Our empirical strategy consists of three parts. First, we use descriptive statistics from our household survey to identity the types of households that benefited from the construction of the relevant climate adaptation projects. Our findings indicate that landowners and businesses were two of the biggest beneficiaries of the dual-use aspects of the climate adaptation projects in our sample.

Second, we examine the levels of household involvement in the implementation and monitoring of climate projects. The results from our regression analysis show that citizens with higher than average incomes from agriculture and business are more likely to be involved in the monitoring of these projects. These two parts of the approach provide a consistency check for our hypothesis H1. They show that participation in monitoring is related to the immediate benefits that individuals and households derive from climate change projects. The households with above-average incomes gain more from dual-use infrastructure projects and they are also more likely to engage in monitoring activities. There may be other reasons for their greater engagement, such as more leisure time, but in rural Bangladesh, most households with above-average incomes are poor in absolute terms. We believe the link between immediate dual-use benefits and the extent of household engagement is the most plausible explanation. This evidence is consistent with our hypothesis H1.

Third, we combine our survey data on household involvement in project monitoring and implementation with the project-level scores for corruption from our key informant interviews. This part of the evidence finds strong support for hypothesis H2. The survey evidence suggests that climate projects with high levels of engagement by households with above-average incomes from agricultural and/or business activities also had somewhat higher levels of overall participation by households and were much less susceptible to corruption.

6.1. Local beneficiaries of climate adaptation projects

First, we examine which social groups particularly benefited from the climate projects. Our survey included a question that asked respondents, ‘Which categories of people benefited the most from the project?’. The answers reflect perceptions of who benefited most from the dual-use characteristics of these projects. A summary of responses from this question is presented in Table 3. The descriptive statistics suggest that respondents believed that landlords, the landless and business owners benefited most from the projects. Note that the benefit to the landless includes employment during construction as well as other dual-use benefits like improved road connectivity. The descriptive statistics also highlight the broader dual-use benefits of climate projects as respondents believed that schools and hospitals benefited from completion of the climate adaptation projects.

Table 3: Household perceptions of community beneficiaries

Which categories of people benefited the most from the project?		Response count
1)	Large landlords	856
2)	Medium landlords	813
3)	Small landlords	743
4)	Landless	377
5)	Business owners (small/medium/large/retail/wholesale)	229
6)	Construction	111
7)	Fish farming	106
8)	Farming	89
9)	Schools	193
10)	Hospitals	64
11)	Political leaders	90
12)	Local power groups	65

Note: Respondents reported their perceptions of beneficiaries in their community. Multiple category responses were allowed.
Source: The authors.

Our survey also included a question that asked respondents, 'How did *you* or *your family* benefit from project implementation?'. A summary of the responses to this question are reported in Table 4. Again, the data suggest that land and business owners are the two social groups that benefited most from the climate projects. Of all respondents, 407 (over 20%) stated that they directly gained from increased agricultural/fishing activity enabled by the projects. Additionally, 162 respondents (8.5% of respondents) reported that they directly gained from increased business/trading activity as a result of the climate project, related to improved transportation networks in the case of embankments or business opportunities that could develop around dual-use cyclone shelters. Importantly, the responses also document the substantial direct benefits of these climate projects for disaster-preparedness, as well as secondary benefits on social activity including reduced travel time to schools, mosques and markets.

Table 4: Households' own benefits from a project

How did you or your family benefit from project implementation?		Response count
1)	Enhanced agricultural/fishery activity	407
2)	Enhanced business/trading activity	162
3)	Enhanced employment opportunities	90
4)	Better wages or prices that benefit business or employment	125
5)	Better disaster preparedness (from waterlogging, flooding, cyclones, storms)	662
6)	Improved welfare as a result of reduced travel time to school, mosque or market	405
7)	Any other beneficial effects	5

Note: Responses refer to benefits for the responding household. Multiple responses were allowed.
Source: The authors.

Together, we view these survey responses as evidence that climate adaptation projects provide significant benefits to landowners and business owners.

6.2. Local interests and household involvement in implementation

Second, we examine if households with higher than average agricultural and/or business incomes are more likely to be involved in the implementation and monitoring of climate adaptation projects. For this analysis, our primary outcome variable of interest is household involvement in a project. To measure involvement, our survey asked, 'Were you or any of your household members involved in project implementation as a local citizen?'. Survey responses were used to create a binary variable, *Household involvement*, equal to one for respondents that answered yes and zero otherwise. Nearly 20% of households reported involvement in project implementation. Respondents were provided an opportunity to describe their involvement in the implementation process. Reported responses included 'provided support or cooperation', 'reported to authorities/local administrators if construction works were not going well', and 'involved in conflict resolution'. The latter is important because large-scale constructions provide many opportunities for land-grabbing and other forms of extraction. The involvement of citizens in conflict resolution is also an indicator of their interest in how a project is being implemented.

Our independent variable of interest is respondents' income level and source of income. Our survey data allow us to construct a profile of respondents in terms of their annual incomes from agriculture, business and employment. Values are reported in thousands of BDT. We used the survey data to create variables for *Agricultural income*, *Business income* and *Wage income* by household. In our sample, 40% of respondents reported household incomes from agriculture, 16% from a business, and 39% reported income from wages.

We estimate the following model:

$$Involvment_{ij} = \beta_1 Agricultural\ income + \beta_2 Business\ income + \beta_3 Wage\ income + \lambda\, w_{ij} + \epsilon_{ij} \quad (1)$$

where $Involvement_{ij}$ is involvement in project monitoring for household i in project-region j; w_{ij} is a vector of demographic and project controls; and ϵ_{ij} is the error term. Control variables are included for age, education, gender and project type (cyclone shelter or embankment). Equation (1) is estimated with a logistic regression as we have a binary outcome variable. Standard errors are clustered at the project location.

Table 5 presents the regression results on the effects of the source and level of household income on involvement in project implementation. Remember that household involvement includes supporting cooperation, reporting to the authorities that construction was not proceeding well or at the appropriate quality level, and resolving conflicts. The results support our hypothesis that levels of agricultural and business incomes have a positive impact on a household's willingness to be involved in the implementation of climate adaptation projects.

The level of *Agricultural income* has a positive and statistically significant effect on the probability of household involvement in project implementation. Similarly, the level of *Business income* also has a positive and significant effect on the probability of a household's involvement in project implementation. However, the effect size of *Business income* is smaller relative to *Agricultural income*. *Wage Income* does not appear to have a significant effect on household involvement in climate projects. Project type is not estimated to have a significant effect on household involvement in project implementation. Similarly, respondent age does not have a significant effect on household involvement, which is not surprising since the involvement reported is for the household and not for the respondent. Turning to education, we find that a household where the respondent has secondary education is statistically more likely to be involved in project implementation relative to ones where respondents are illiterate. Lastly, the respondent's gender has a statistically significant impact on household involvement. Male respondents are statistically more likely to report household involvement in project implementation. This is puzzling but could reflect the fact that female members of households are less likely to be themselves involved in monitoring activities and are less likely to be aware of monitoring activities that male members of the household may have been engaged in.

Table 5: Determinants of citizen involvement

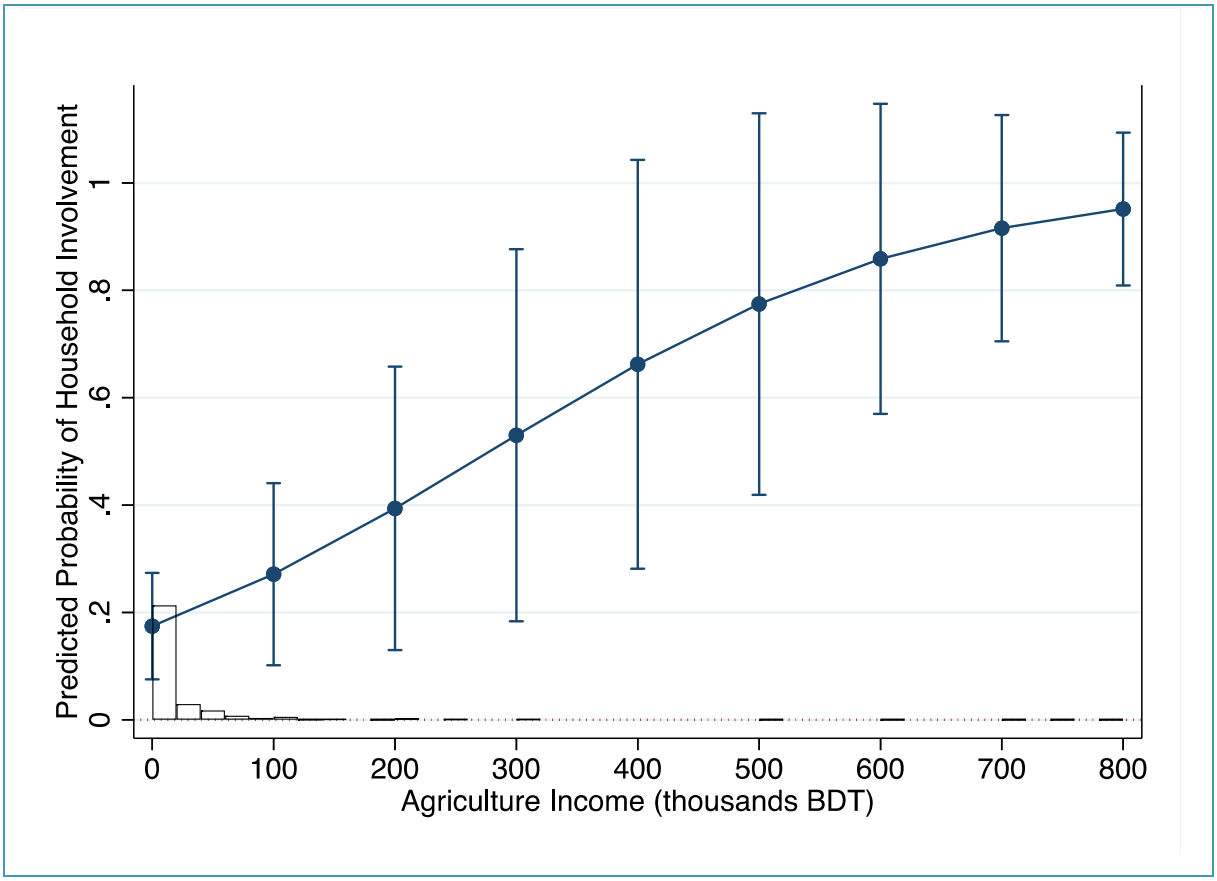
	Dependent variable: Citizen involvement in project (1)
Agricultural income	0.006***
	(0.002)
Business income	0.001**
	(.0004)
Wage income	0.0005
	(0.001)
Cyclone shelter	0.887
	(0.909)
Male	0.692*
	(0.373)
Age	0.005
	(0.005)
Education	
Only read and write	0.525
	(0.636)
Pre-primary to primary	0.749
	(0.480)
Secondary to higher	1.107*
	(0.641)
Undergraduate or above	0.728
	(0.512)
Survey respondents	1901
No. of projects	4

Note: * p<0.10, ** p<0.05, *** p<0.01. Coefficients are reported as change in log-odds. Standard errors are clustered on project location. The excluded project type is Embankment. The excluded education level is Illiterate.

Source: The authors.

Because the change in log odds is difficult to interpret, Figure 1 presents the predicted probability of a household's involvement in project implementation across different levels of *Agricultural income*. A change in agricultural income from zero to 100,000 BDT per annum is associated with a 7.5% increase in the predicted probability of involvement. Figure 1 also demonstrates that respondent households with substantial income from agricultural activities have a high predicted probability of involvement. For example, an otherwise typical respondent household with 400,000 BDT of agricultural income has a predicted probability of involvement of 65%. The predicted probability of involvement further increases to 95% if the household earns 800,000 BDT in agricultural income. This suggests that landowners with higher incomes are very likely to take an interest in project implementation.

Figure 1: Predicted probability of household involvement as agricultural income increases



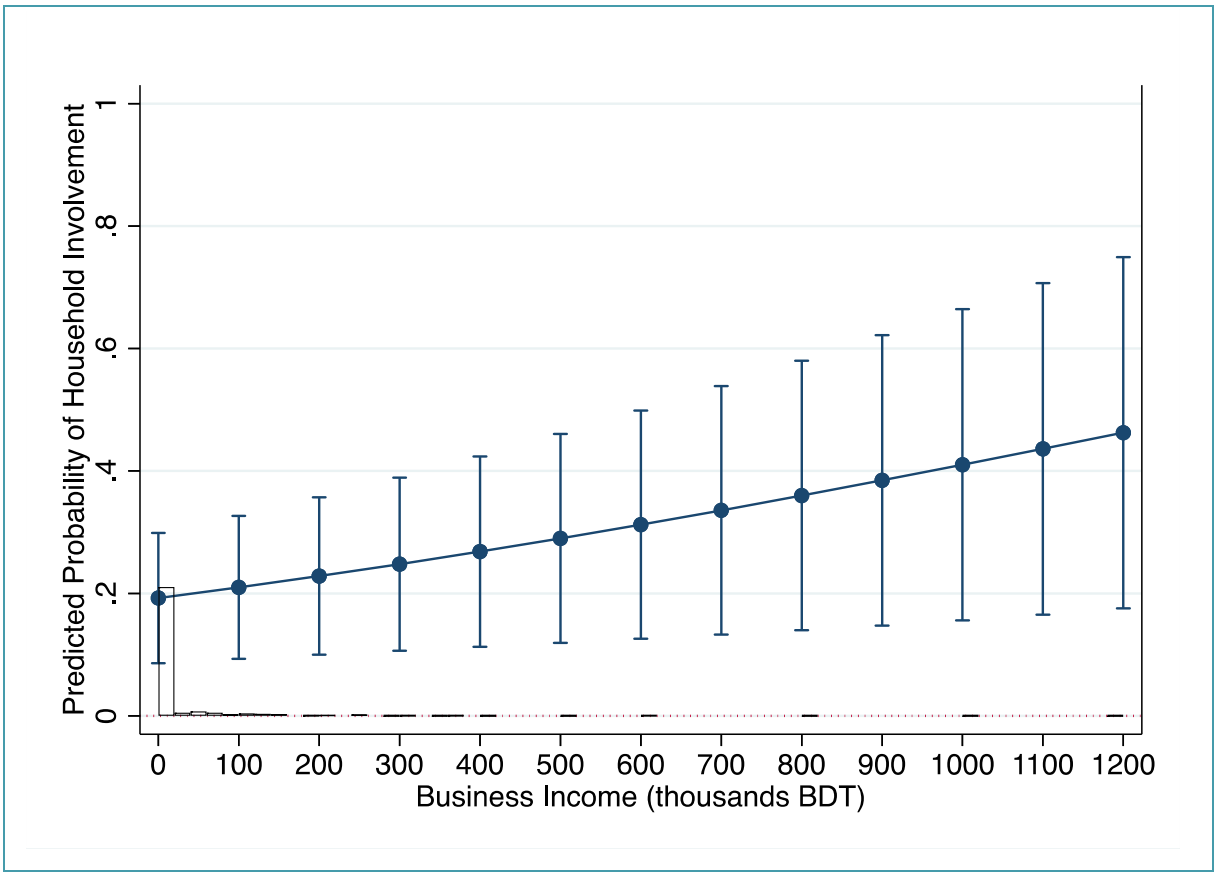
Note: Predicted probabilities are based on the regression shown in Table 5. The dotted lines represent 95% confidence intervals. Agriculture income has a mean of 20,500 BDT and standard deviation of 60,000 BDT.

Source: The authors.

Figure 2 reports the predicted probability of household involvement across levels of *Business income*. A change in business income from zero to 100,000 BDT is associated with a 1.7% increase in the predicted probability of household involvement in project implementation. This estimated effect size is less than a quarter of the effect size estimated for a similar increase in *Agricultural income*. However, as in the case of agricultural income, the findings suggest that the largest business owners are likely to be involved in project implementation.

The predicted probability of household involvement is above 35% for respondents with business income of more than 800,000 BDT. In contrast, the predicted probability of household involvement is 19.2% for respondents with no business income.

Figure 2: Predicted probability of household involvement as business income increases



Note: Predicted probabilities are based on the regression in Table 5. The dotted lines represent 95% confidence intervals. Business income has a mean of 19,780 BHT and standard deviation of 73,450 BHT.

Source: The authors.

6.3. Impact of household involvement on corruption

Lastly, we examine the effect of levels of household involvement and the involvement of more influential citizens on the level of corruption observed in climate projects. To score the level of corruption in each of our four climate adaptation projects we conducted interviews with 30 key informants selected for their knowledge of each implementation project (Appendix C reports their distribution across the projects).

The key informants included:

- Officials from the Ministry of Environment and Forest, BWDB and LGED;
- Civil society representatives including local business owners, farmers and traders, and representatives from non-governmental organisations;
- Representatives of funding bodies;

- Third party officials involved in project supervision;
- District-level executives;
- Project contractors;
- Investigative journalists.

To assess the extent of corruption during project implementation we conducted open-ended interviews, with interview questions aiming to assess the level of corruption in each project along six dimensions:

1 The degree of transparent community engagement during project implementation. This includes differences in the use of information boards, community information sharing and consultation. Low levels of community engagement by contractors and implementing agencies may indicate higher levels of resource extraction, particularly if this is supported by responses to other questions.

2 The level of confidence the informant had in the probity of key public officials (local government; government workers, implementing agencies, community and political leaders).

3 The level of leakage and use of poor-quality materials in construction.

4 The level of collusion between contractors and implementing agencies.

5 The level of collusion between contractors and local political leaders.

6 The extent of corruption in land-acquisition processes.

We followed a saturation approach, conducting interviews with successive key informants in the same locality until the overall assessment of corruption appeared to be relatively robust. The responses recorded are averages of respondents who gave more detailed answers backed with examples, which is why in some project areas a larger number of key respondents were consulted (Appendix C). The responses of key respondents were strongly aligned with each other and also with our prior assessment of corruption based on TIB's earlier observations in these areas. The key informant interviews should therefore be interpreted as corroborative of widely held local perceptions rather than as scoring exercises standing on their own. They provide more detail on the dimensions of corruption in each of the sites.

We coded the qualitative responses to each question for the four projects. We then aggregated the scores and classified each project as *Low*, *Moderate* or *High corruption*. The level of corruption was assessed as Low if the overall score was between 0 and 2; Moderate if the score was greater than 2 but less than 4; and High if the score was greater than 4. It is important to remember these are relative judgements: even the sites scoring Low levels of corruption experienced some corruption.

Table 6 presents the corruption scores and the classification of each project. The cyclone shelter in Barguna was a low corruption project. But even here, there were reports of leakages and/or the use of poor-quality materials in construction. In contrast, the cyclone shelter in Barishal was a moderate corruption project where the incidence of corruption was

much higher. Here, key informants reported the corruption of key officials, collusion between contractors and the implementing agency, as well as resource leakage and use of poor-quality materials.

The Barishal embankment project was also classified as having low corruption. Key informants reported collusion between contractors and the implementation agency, and corruption in the land-acquisition process. In contrast, the Satkhira embankment project suffered from high levels of corruption. Key informants in this project referred to all six dimensions supporting the presence of corruption.

Table 6: Corruption scores based on key informant interviews

	Cyclone shelters		Embankments	
Dimension	**Barguna**	**Barishal**	**Barishal**	**Satkhira**
1. Absence of transparency	0	0	0	1
2. Corruption of key individuals	0	1	0	1
3. Leakage and use of poor-quality materials	1	1	0	1
4. Collusion between contractors and implementing agencies	0	1	1	1
5. Collusion between contractors and local political leaders	0	0	0	1
6. Corruption in land-acquisition processes	0	0	1	1
Overall score	**1**	**3**	**2**	**6**
Classification	**Low**	**Moderate**	**Low**	**High**

Note: The score for each project for each category is based on the balance of key informant interview responses: 1 = yes, 0 = no.
Source: The authors.

To test H2, we combine our survey data with our key informant scores to examine the relationship between household involvement in monitoring during implementation and the observed levels of corruption in the four projects. Table 7 reports the survey statistics across our four sites on the involvement of households in project monitoring.

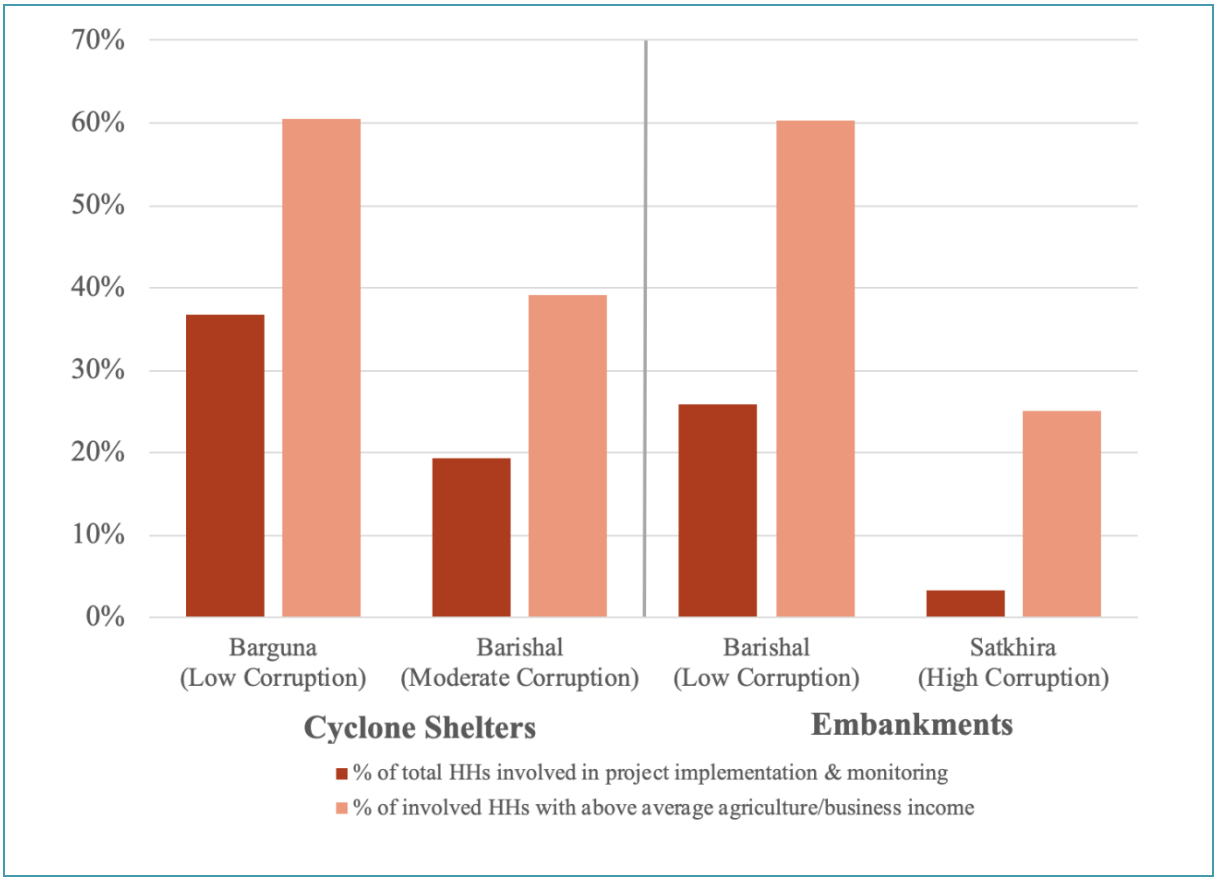
Table 7: Households (HHs) involved in monitoring project implementation and their characteristics

	Cyclone shelters		Embankments	
Outcome measure	**Barguna**	**Barishal**	**Barishal**	**Satkhira**
Key informant corruption index	1	3	2	6
Corruption rating	Low	Moderate	Low	High
HHs surveyed	406	407	488	600
HHs involved in project implementation & monitoring	149	79	126	20
% of HHs involved in project implementation & monitoring	36.7%	19.4%	25.8%	3.3%
% of involved HHs with high agricultural income	53.7%	17.7%	54.0%	20.0%
% of involved HHs with high business income	11.4%	22.8%	15.1%	10.0%
% of involved HHs with high agricultural/business income	60.4%	39.2%	60.3%	25.0%

Note: HH income is defined as high for values that exceed the category sample mean.
Source: The authors.

Projects with higher overall levels of household involvement experienced lower levels of corruption. But, if we look at our proxy measures for 'influential households' (households with above-average agricultural and business incomes), the differences in their participation is even more dramatic between the higher- and lower-corruption projects. These conclusions are summarised in Figure 3, which shows both total household involvement and the share of influential households in the group of involved households.

Figure 3: Involvement of households and 'influential' households in monitoring



Source: The authors.

Comparing the two cyclone shelters, we see the lower-corruption shelter at Barguna had nearly 37% of households involved in monitoring, while in the higher-corruption shelter at Barishal, less than 20% of households were involved. But now if we add the figures for influential households, we see that at Barguna, of the 37% who were involved, as many as 60% were 'influential'. In contrast, at Barishal, not only were only 20% of households involved, only 39% of that smaller number were influential. As a share of the total population, the involvement of influential individuals was therefore around three times greater at Barguna.

Comparing the two embankment projects, the low-corruption project in Barishal had 26% of all households involved and 60% of these were influential households. In contrast, only 3% of households were involved in the high-corruption embankment project in Satkhira, and only 39% of these were influential. Here, the involvement of influential individuals as a share of the population was around 13 times higher in the lower-corruption project.

Table 7 also shows that most of the difference in influential household participation is accounted for by the greater participation of influential agricultural households in the lower-corruption project areas. This is consistent with the plausible possibility that the dual-use benefits of climate projects have a bigger impact on land values or on incomes from agriculture, relative to the impact on the value of businesses.

To summarise, lower levels of corruption are associated with much more significant levels of involvement by influential households. Not only were a higher percentage of *all households* involved in monitoring the lower-corruption projects, the percentage of these households that were also *influential* is significantly higher in the lower-corruption projects. Taken together, the figures show that lower-corruption projects had significantly higher numbers of influential individuals taking an interest in monitoring during the implementation phase. The involvement of ordinary households is likely to be interdependent with the participation of more influential households. The greater involvement of influential individuals will not only arithmetically increase the share of households involved in monitoring overall, it is likely to make less-influential individuals involved as well, who may not otherwise have bothered on the grounds that they were unlikely to have any effect on outcomes on their own.

Table 8 provides further support to our hypothesis. It reports the share of households with above-average agricultural and/or business incomes who were involved in monitoring as a proportion of the total number of households with above-average agricultural and/or business incomes in the project areas. This statistic captures the intensity of involvement of influential households in our four project areas. The results are summarised in Figure 4.

Table 8: 'Influential' households (HHs) involved in monitoring as a proportion of all influential households in the project areas

	Cyclone shelters		Embankments	
Outcome measure	**Barguna**	**Barishal**	**Barishal**	**Satkhira**
Key informant corruption index	1	3	2	6
Corruption rating	Low	Moderate	Low	High
HHs with high agricultural income	133	61	158	77
HHs with high business income	45	81	74	97
HHs with high agricultural/business income	167	134	206	167
HHs with high agricultural income involved	80	14	68	4
HHs with high business income involved	17	18	19	2
HHs with high agricultural/business income involved	90	31	76	5
% of HHs with high agricultural income involved	60.2%	23.0%	43.0%	5.2%
% of HHs with high business income involved	37.8%	22.2%	25.7%	2.1%
% of HHs with high agricultural/business income involved	53.9%	23.1%	36.9%	3.0%

Note: HH income is defined as high for values that exceed the category sample mean.

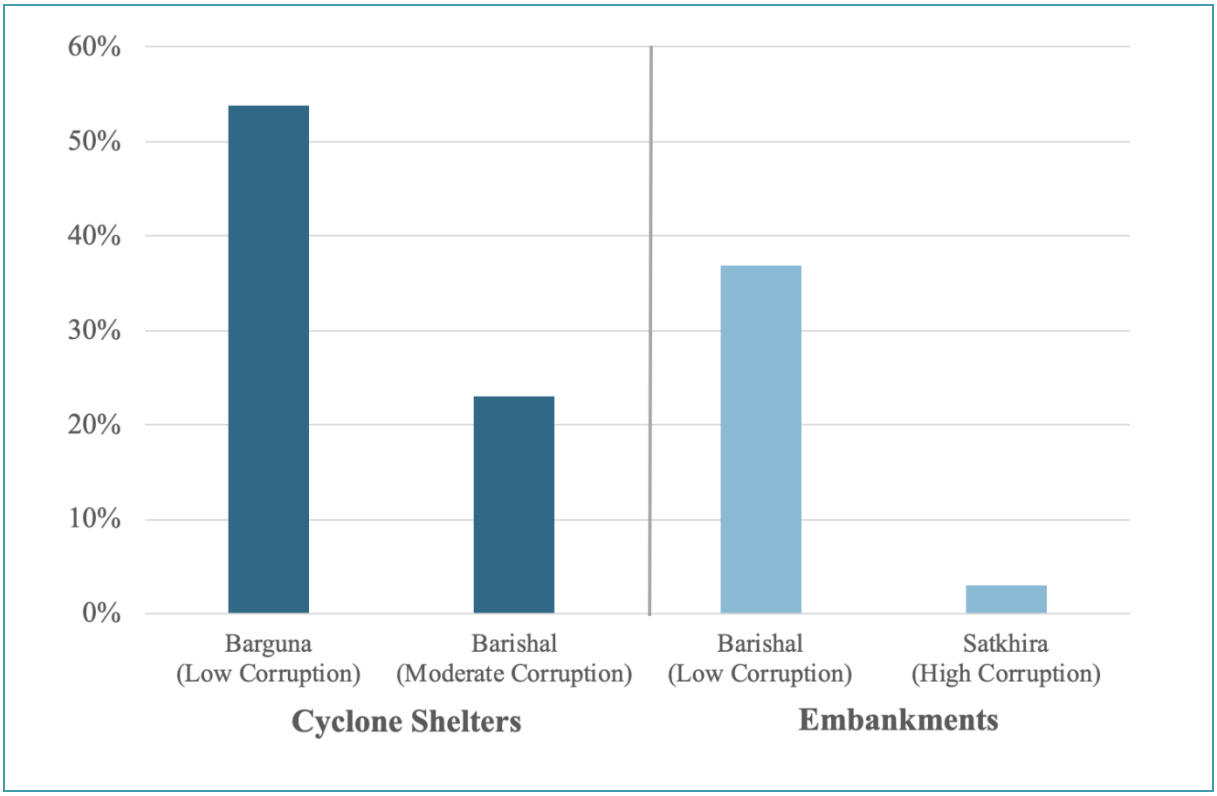
Source: The authors.

Comparing the two cyclone shelters, the low-corruption project at Barguna had nearly 54% of households with high agricultural and/or business incomes involved in project implementation. This compares to only 23% of influential households being involved in the

moderate-corruption shelter project in Barishal. The 'intensity of participation' of influential households is therefore more than double in the low-corruption cyclone shelter project compared to the moderate-corruption one.

Similarly, in the embankment projects, 37% of influential households were involved in the low-corruption project in Barishal. But only 3% of influential households were involved in the high-corruption embankment project in Satkhira. Here, the intensity of participation of influential households is more than 10 times higher in the low-corruption project compared to the high-corruption one.

Figure 4: Share of 'influential' households participating in monitoring



Note: Percentages of involved individuals with above-average agricultural or business income as a share of all individuals with above-average agricultural and business incomes in the project areas.

Source: The authors.

Table 8 and Figure 4 show that there were features of some projects that attracted the involvement of much higher shares of locally influential people in the projects. As we have defined more influential groups as those with agricultural or business incomes higher than the *average* in that area, and since we also measure the intensity of participation as a percentage, differences in the structure of local economies and therefore the absolute numbers of richer people cannot explain differences in these shares. The most plausible explanation is that the design of the projects themselves created potential benefits for both ordinary and influential households, and in some projects, both groups were more involved than in other projects. Most importantly, the projects in which overall household involvement was greater are also projects where the involvement of influential groups *was more than proportionately greater.* This means the two are not just arithmetically related.

The most plausible explanation is that in projects where influential individuals were very interested, their involvement drew in ordinary households in project monitoring activities.

Finally, the level of involvement of both influential individuals and of ordinary households is correlated with observed levels of corruption in projects. Our hypothesis is that greater involvement of influential citizens who can work through informal power networks to restrict corruption in their own interest has a significant anti-corruption effect. And that is exactly what we observe. While their involvement does not exclude corruption entirely, the difference in incidence is significant from a policy perspective – particularly as policy to enhance their participation is one that is likely to be feasible to implement by improving the design of projects to enhance dual-use benefits for local communities.

7. Conclusion and policy implications

Pervasive corruption in the implementation of climate adaptation projects in Bangladesh has impacted significantly on the country's ability to prepare for the effects of climate change. Conventional anti-corruption approaches that have attempted to improve transparency and accountability have had limited effects. But our analysis suggests that much more could be done to exploit the informal processes through which corruption is already better controlled in some projects – namely, where influential individuals (and with them greater numbers of ordinary citizens) are involved in informal monitoring with significant effects.

We observe substantial differences in levels of corruption across similar projects, and these differences are at least partly related to the greater involvement of influential groups in monitoring. We explain this in terms of the informal pressures that influential groups can bring to bear on contractors and officials when they have a strong interest to do so. In contexts of weak formal governance, these informal pressures are an immediate and effective way of constraining corruption while formal institutions and the rule of law are strengthened, a process that can take decades.

Our evidence also suggests a feasible strategy for enhancing the involvement of influential groups in monitoring projects – to design climate change projects to maximise dual-use benefits for local communities. The best way of doing this would be to engage local communities at the design phase. If this proves difficult, development partners and anti-corruption activists could at least ensure that projects have been deliberately and carefully designed to provide the highest level of dual-use community benefits based on comparisons of alternative designs.

Obviously, many features of project design will be technically determined by the location of rivers, feasible sites for cyclone shelters and so on. But, in practice, there are significant design choices at relatively low cost, for instance by asking if the benefits of new roads could be enhanced by linking to other roads, selecting the precise location of embankments or shelters, changing the specifications of roads and shelters to maximise benefits to the local community, and so on. Ideally, local communities should be actively engaged in discussing alternative designs. But a 'good enough' response may be for government and development partners to ensure that designing authorities evaluate the community benefits of several alternative project designs before selecting the one that yields the greatest community benefits while also meeting the climate change adaptation requirements. This may be sufficient to ensure that projects deliver enough immediate benefits to trigger the types of community involvement that can control corruption.

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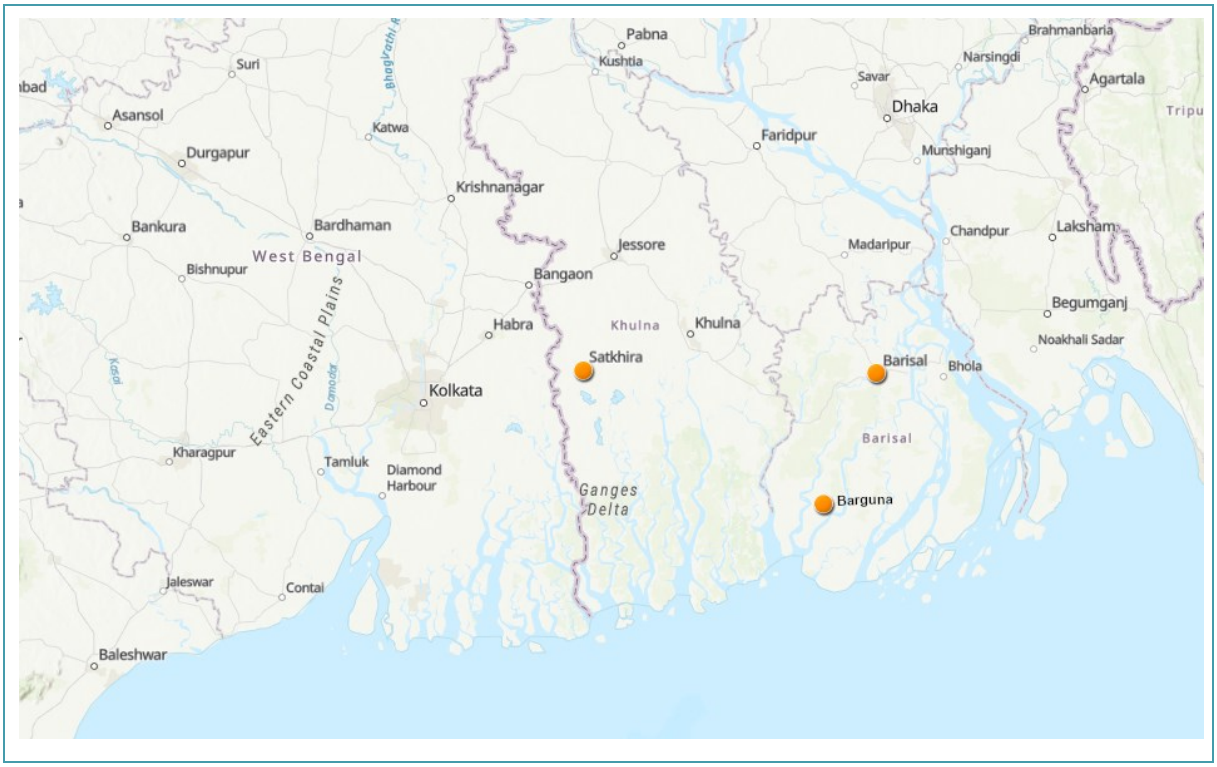
Appendix A: Descriptive statistics of survey data

Table A 1: Descriptive statistics

Variable	Count	Mean	Standard deviation	Min.	Max.
Household involvement in project	1901	0.197	0.398	0	1
Agriculture income ('000s BDT)	1901	20.506	59.814	0	800
Business income ('000s BDT)	1901	19.78	73.456	0	1200
Wage income ('000s BDT)	1901	36.522	100.113	0	2000
Gender	1901	1.572	0.495	1	2
Age	1901	44.632	14.783	18	97

Appendix B: Overview of project locations

Figure B 1: Map of sampled climate project locations



Source: Environmental Systems Research Institute (ESRI) open source and the authors.

The four projects selected were funded by the BCCTF and implemented by the BWDB and LGED. Two of the projects were embankments/polders and two were cyclone shelters. Of the two polder projects, one was a 24 km-long dam in Nalua union of Bakerganj *upazila* (sub-district) in Barishal district and the other pertained to the reconstruction of Polder-1 affected by climate change and located in areas spanning parts of Fingri union, Labsha union and Satkhira municipality in Satkhira district. The polder in Nalua was constructed by the BWBD, the implementation period of which was July 2013 to June 2014. The reconstruction work of Polder-1 in Fingri union in Satkhira district (a 24 km-long dam) was also undertaken by BWDB and the construction work spanned from July 2011 to June 2015. The total cost for each project amounted to BDT 99.758 million and BDT 114.645 million, respectively.

The project document for the polder in Nalua underscores that the project covers various themes encapsulated in the BCCSAP, namely, infrastructure development, comprehensive disaster management, food security, social protection and health, and mitigation and low-carbon development. The project aimed to create a sense of security among the people of the project area by tackling the effects of climate change. The objectives of the project were: flood control, drainage and irrigation facilities; improvement of the communication system by constructing dams around the project area and creating opportunities for afforestation

on both sides of the dam; creation of opportunities for poultry, fish and cattle rearing; alleviation of poverty and improvement of socio-economic conditions by involving destitute women and workers as day labourers in project work; and to balance the environment through greenhouse effect promotion through polder development. Local communities of Bakerganj *upazila* constituted the direct and indirect beneficiaries.

The project document for the polder in Fingri mentions that the project covers various themes underscored in the BCCSAP, namely, infrastructure development, food security, social protection and health. The project aimed to increase food production by alleviating flood and saltwater, cyclones, tidal surges and water logging caused by climate change by repairing dams, constructing sluice gates and re-excavating canals, increasing food production, alleviating human suffering and socio-economic development. The objective of the project was to rehabilitate and repair the ineffective polder system in the Satkhira area, which was severely damaged due to storms, tidal surges and rising sea level induced by climate change. Communities of Satkhira Sadar *upazila* constituted the direct and indirect beneficiaries.

The cyclone shelters, referred to as Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP), were built by the LGED with funds from the BCCRF (created by donor/developed countries). These projects, which basically comprised the construction of cyclone shelters which would also function as schools at normal times, were implemented in Bamrail union of Ujirpur *upazila* in Barishal district (Bhoroshakathi Government Primary School cum cyclone shelter) and in Gulishakhali union of Amtali *upazila* in Barguna district (Haji Abdul Goni Madrasa and cyclone shelter). The Bhoroshakathi project cost BDT 21.6 million and the project Abdul Goni Madrasa cost BDT 25 million. The construction work at Bamrail commenced in April 2011 and ended in June 2013, while the one at Amtali spanned from July 2011 to June 2015.

The projects at Amtali and Bamrail aimed to address several themes highlighted in the BCCSAP, which include comprehensive disaster management and infrastructure development. Food security, social protection and health were added as cross-cutting issues. The purpose of the projects was to finance the reconstruction and improvement of multi-purpose shelters and rehabilitation of coastal embankments using cyclone-resistant building techniques. They also purported to support activities in the agriculture sector to help farmers prepare for the next growing season and strengthen their ability to cope with future disasters, as well as strengthening the government's medium- and long-term disaster risk mitigation and reduction capacity, including support to the Department of Disaster Management. A further objective was to support government efforts to facilitate restoration and recovery from the damage to livelihoods and infrastructure caused by cyclones and to develop long-term preparedness through strengthened disaster risk management. Direct and indirect beneficiaries are local communities of Gulishakhali village of Amtali *upazila* and Bhoroshakathi village of Uzirpur *upazila*, respectively.

Appendix C: Key informants in study areas

Table C 1: Numbers of key informants in different study areas

Survey area	Key informant numbers
Nalua, Barisal (BWDB)	11
Satkhira (BWDB)	6
Bharasakathi, Barisal (LGED)	8
Gukishakhali, Barguna (LGED)	5
Total	**30**

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