

The Role of Microfinance in Household Livelihood Adaptation in Satkhira District, Southwest Bangladesh

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Summary. — There is increasing interest in the potential of microfinance to foster climate change adaptation. However, existing literature over-relies upon theoretical arguments rather than empirical evidence, and until now the emphasis has been on potential positive linkages. We address these weaknesses by empirically examining the role of microfinance in adaptation, drawing from household-level quantitative and qualitative data gathered from Satkhira District, Southwest Bangladesh. We find evidence that microfinance facilitates coping by reducing sensitivity to environmental and climate hazards. Credit is especially important because its availability is uncorrelated with the occurrence of flooding, unlike many other traditional coping responses. We also find evidence that microfinance facilitates adaptation by helping households to overcome financial barriers of adopting adaptation options which reduce exposure or sensitivity. However, credit limits are likely to restrict its role to incremental adaptations, which may not meaningfully reduce vulnerability. Transformational adaptations at times required access to bank credit which the poorest cannot access. This restricts their ability to effectively adapt and are penalized financially by having to obtain loans to cope. We also find evidence that microfinance can lead to maladaptation when used in non-profit generating activities as income streams are not produced to help repay associated costs. Almost a fifth of all loans were obtained for repaying existing loans. Thus microfinance may undermine longer term adaptive capacity.

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Key words — Bangladesh, climate change, adaptation, flooding, microfinance, microcredit

1. INTRODUCTION

Climate change poses a particular threat to developing countries that lack the resources necessary to cope with the increasing climate variability and hazards it exacerbates (IPCC, 2014b). Climate change will have many negative consequences which will particularly impact on low-income and otherwise disadvantaged groups if no appropriate measures are taken. Consequently, adaptation to climate change (henceforth adaptation) is an important policy issue for developing countries. Three broad approaches to adaptation have emerged among practitioners: standalone adaptation, adaptation plus development, and adaptation as development (Ayers & Dodman, 2010). Each approach has implications for how adaptation is understood and operationalized. The standalone approach only tackles the additional anthropogenic aspect of climate change (see Hulme, O'Neill, & Dessai, 2011). 'Adaptation plus development' considers the two activities as distinct but sees that adaptation requires mainstreaming into development (see Sperling, 2003). 'Adaptation as development' considers the two activities as synonymous with 'good development', as is the case with community-based adaptation (see Forsyth, 2013).

Adaptation can take place in a top-down manner through planned measures undertaken by the public sector; and through autonomous bottom-up measures by households, businesses and other organizations. A combination of the two approaches is also possible (Smit *et al.*, 2001). Increasing flows of international and national finance are available to support adaptation. Much of these financial flows have been devoted to top-down adaptation efforts: only a small portion reaches the local-level and even less is available to support autonomous household adaptation (Fenton, Reid, Wright, & Huq, 2015).

There is growing interest in the potential of private finance to support autonomous adaptation. However, much

uncertainty exists regarding its role, despite it being widely used for mitigation. Microfinance is one key way of mobilizing private finance (and channeling public finance) for autonomous household adaptation (for overview see Fenton, Paavola, & Tallontire, 2015). Microfinance has been an important international development tool for over three decades, but little evidence exists beyond conceptual arguments on microfinance-adaptation linkages. Empirical studies adopting an adaptation lens are needed to address this evidence gap (Fenton *et al.*, 2015). This article seeks to contribute in this regard.

By microfinance we refer to formalized financial services to low-income and otherwise disadvantaged households that are not served by the conventional banking sector. We distinguish between formal and informal finance. Formal finance consists of financial exchanges between a legally recognized institution and individuals. Informal finance in turn consists of financial exchanges between individuals. Many approaches to microfinance exist in terms of the type of financial services offered, whether non-financial services are offered, the legal status of provider, ownership and management structures, source of funds, lending mechanisms, and borrower liability (de Aghion & Morduch, 2005; Dunford, 2001; Matin, Hulme, & Rutherford, 1999; Rutherford, 1996; Staschen, 1999).

We examine autonomous household adaptation and how microfinance influences livelihood outcomes in Satkhira District in Southwest Bangladesh. Bangladesh is a good location to examine the linkages between microfinance and household adaptation. It has a vibrant microfinance sector and is one

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of the most vulnerable countries to climate change. It is exposed to multiple environmental and climate hazards, particularly flooding which affects large parts of the country (MoEF, 2008). Our findings indicate that microfinance can facilitate adaptation by enhancing coping capacity and by enhancing adaptive capacity. However, microfinance can also lead to maladaptive outcomes via over-indebtedness. We conclude that better product design and integrating microfinance with wider top-down adaptation efforts would help microfinance to achieve its potential for adaptation.

In what follows, we outline our analytical framework and identify the pathways through which microfinance can influence adaptation. We then outline the materials and methods used and describe the case study site in terms of livelihoods, environmental and climate hazards and financial institutions operating in the area. We then report our findings, relate them back to the literature and conclude.

2. ANALYTICAL FRAMEWORK

There are three strands of adaptation literature (Eakin & Luers, 2006; Eakin, Tompkins, Nelson, & Anderies, 2009; Janssen, 2007). The ecological resilience approach originates from ecology and focuses on feedback loops and thresholds in socio-ecological systems (Folke, 2006). The political ecology approach originates from the poverty and geography literatures and focuses on concepts such as poverty, equity, and capabilities (see Adger, 2006). The risk-hazard approach originates from the natural hazards literature and focuses on practical risk reduction efforts which reduce exposure and sensitivity to environmental and climate hazards (Smit & Wandel, 2006).

We adopt the risk-hazard approach due to its greater compatibility for examining autonomous household adaptation. This approach has the premise that risk reduction efforts lessen future climate risks and contribute to ensuring the sustainability of future development (see Ayers & Dodman, 2010; Schipper, 2007). Consequently, while it recognizes linkages between vulnerability to environmental and climate hazards and wider vulnerability caused by structural causes it ultimately sees these as distinct. It is highly compatible with understanding autonomous adaptation by households that are likely to adapt through managing and reducing livelihood risk (Ayers & Forsyth, 2009; Fenton, Paavola, & Tallontire, 2016). It is also compatible with the assessment of microfinance for which households, livelihoods, and risk are important concepts. However, we seek to integrate the complementary insights provided by the political ecology approach on equity in the discussion section to compensate for the insufficient emphasis on equity considerations within the risk-hazard approach (Fenton *et al.*, 2016).

In the risk-hazard approach, household adaptation is the process through which households adjust to changing conditions, hazards, risks, and opportunities posed by climate change (Smit & Wandel, 2006). The need to adapt stems from vulnerability to environmental and climate hazards (henceforth vulnerability). We understand vulnerability as a function of exposure, sensitivity, and adaptive capacity (IPCC., 2014a). Exposure refers to the potential of assets, livelihoods, and environmental resources to be adversely affected by climate hazards and the likelihood of harm occurring (IPCC, 2014a). Sensitivity refers to the extent to which they can be affected by climate hazards (IPCC, 2014a). Adaptive capacity refers to the tangible and intangible factors enabling a household to adapt (Grothmann & Patt, 2005; Jones, Ludi, &

Levine, 2010; Smit & Wandel, 2006; Williams, Fenton, & Huq, 2015). It is affected by how wider social, cultural, political and economic forces are locally manifested (Smit & Wandel, 2006). The frequency by which hazards occur can influence adaptive capacity by depleting resources needed for future adaptation (Smit & Wandel, 2006). However, adaptive capacity does not necessarily lead to adaptation, reasons for which are insufficiently understood (Brown & Westaway, 2011; Grothmann & Patt, 2005).

The ways in which households can reduce vulnerability are known as adaptation options, while factors restricting the feasibility of adaptation options are known as adaptation barriers. The factors which limit the number of adaptation options available are referred to as adaptation limits (IPCC, 2014a). Adaptations can be characterized by the degree of change they entail. Adaptations that enable limits to be overcome can be deemed transformational; and those that manage changing risks posed by hazards are deemed incremental (Fenton *et al.*, 2016; Park *et al.*, 2012). Maladaptation occurs if adaptation measures inadvertently increase vulnerability (Barnett & O'Neill, 2010). Within the adaptation framing we utilize, maladaptation occurs if exposure or sensitivity to natural hazards and stresses is inadvertently increased or adaptive capacity reduced.

Adaptation is distinct from coping, which refers to immediate household responses to environmental and climate hazards when they occur, such as obtaining credit or selling assets (Berman, Quinn, & Paavola, 2012). Coping strategies often maintain current livelihoods when possible. Actions detrimental to future livelihoods are avoided if possible, but are taken as a last resort (Ellis, 2000). In contrast, adaptation consists of anticipatory or reactive changes which alter livelihoods and reduce long-term vulnerability (Vincent *et al.*, 2013). However, it has been noted that the categorization of an action as coping or adaptation can be context and scale dependent (Vincent *et al.*, 2013). Despite being distinct entities, coping and adaptation are linked in that coping capacity is a prerequisite for adaptive capacity (Berman *et al.*, 2012). Additionally, they are determined by the same context, resources, and exposure to hazards which underpin adaptive capacity (Smit & Wandel, 2006). Furthermore, the frequency by which hazards occur can deplete resources needed for both future coping and adaptation (Smit & Wandel, 2006).

Microfinance has been proposed to facilitate adaptation by (1) improving ex-post risk recovery by enhancing coping capacity (Heltberg, Siegel, & Jorgensen, 2009); and (2) improving ex-ante risk reduction by enhancing adaptive capacity (Agrawala & Carraro, 2010; Hammill, Matthew, & McCarter, 2008). Additionally, concerns have also been raised about possible links with maladaptation (Hammill *et al.*, 2008). There is a need for empirical evidence to substantiate these links in light of recent literature that questions the links between microfinance and poverty reduction (Duvendack *et al.*, 2011; van Rooyen, Stewart, & de Wet, 2012). We seek to contribute to filling this gap by examining the microfinance-adaptation linkages at household-level in the Satkhira District in Southwest Bangladesh.

3. MATERIALS AND METHODS

Our research was conducted in Noapara village in the Satkhira District of Southwest Bangladesh. The site was chosen on the basis of key informant interviews conducted with national and local non-governmental organizations (NGOs) and community representatives. Noapara village was selected

as typical of the area: it is exposed to flooding, served by multiple financial institutions, accessible and secure, and at a low risk of research fatigue. A single case was adopted to achieve an in-depth examination of the context-specific nature of vulnerability and adaptation. This required qualitative methods and a prolonged presence to gain familiarity and trust of research participants.

A mixed-methods strategy enabled the triangulation of participant experiences. In March 2014, 30 participants (11% of the population) engaged in focus group discussions to explore village life and its appropriateness for the study. Between May and June 2014, 266 households (99% of the population) were surveyed on topics such as assets and exposure to environmental hazards. A particular focus was on access to financial institutions.

Between March and April 2015, semi-structured interviews were conducted with 38 household heads (14% of the population) to explore household adaptation and the influence of microfinance. The interviews were informed by livelihood profiles, constructed from survey data. Interviewees were purposefully sampled in terms of land ownership, education, homestead quality, and credit usage. Additionally, short interviews were conducted with market stall owners regarding their experiences with credit (72% of the market stalls). Personal observation and informal conversations complemented the above data collection methods. Semi-structured interviews (20) were also undertaken with branch managers from institutions serving the village with financial services, including banks (4), NGOs (9), and savings-based credit cooperatives (SCOs) (7).

Examining microfinance-adaptation and microfinance-maladaptation linkages is challenging because observing adaptive capacity is difficult before it has been manifested (Adger *et al.*, 2007; Engle, 2011). Additionally, there is insufficient understanding of when adaptive capacity results in adaptations (Brown & Westaway, 2011; Grothmann & Patt, 2005). We focus on past instances of known autonomous household adaptations identified during exploratory research and hence reductions in sensitivity rather than increases in adaptive capacity. We sampled participants on the basis of survey data, snowballing and participant observation. Focus group findings were interpreted in situ with participants. Survey data were analyzed using SPSS and interpreted using literature. Semi-structured interviews were coded according to the types of coping mechanisms and household adaptations. Analytical categorization was then undertaken using an iterative process building on the initial descriptive coding, and drawing upon literature themes to interpret the material.

4. CASE-STUDY

Noapara Village has 267 households, 74% of which have 3–5 members, and 94% of which are male-headed. Livelihoods have been historically agricultural: cash crops are cultivated during summer and rice during winter. Livelihood activities also commonly include small-scale livestock, poultry, and aquaculture; and seasonal migration in search of agricultural wage labor opportunities. Less common activities include non-agricultural salaried work, international migration as well as seasonal and permanent businesses. All common livelihood activities involve use of credit. For instance, most agricultural inputs are purchased on credit and debts traditionally repaid post-harvest at a festival known as Halkhata.

Riverine flooding, which affects much of south-west Bangladesh, is a key hazard in Noapara village (MoEF, 2008). Over-

flowing of the Kobadak River banks directly causes the flooding. It in turn has been linked to earlier top-down flood management programs, such as the Coastal Embankment Project (see Wesselink *et al.*, 2015) which have induced subsidence in surrounding lands and focused sedimentation in rivers inadvertently elevating them above the floodplain. There is some evidence that flooding hazards in Bangladesh are increasing due to climate change (e.g., Kundzewicz *et al.*, 2014). Our interviews suggest that the intensity and frequency of flooding has increased substantially, major events occurring in 2008 and 2011. Flooding occurs from June to October and lasts 2–3 months due to poor drainage. A local councilor commented that in 2011 flooding lasted for 8 months. Survey results indicate that most households have been significantly affected 3–5 times in the past decade.

Flooding severely disrupts the livelihoods of the inhabitants of Noapara. Many households have abandoned cash-crop cultivation, a vital activity linked to savings, debt repayment and investment. Local demand for agricultural laborers has declined, forcing many to migrate for longer periods. Income earned from wages does not offset the income earned through cash-crop cultivation. In related studies, agricultural wages in migration destinations have been shown to be low due to excess supply and low demand (L. Banerjee, 2007). Natural assets such as trees are sensitive to flooding and have mostly perished. Businesses are also sensitive to flooding due to damage to premises and stock, and low demand for goods and services.

Financial institutions serving Noapara households include externally established and managed institutions (banks and NGOs) regulated by government; and community-initiated and managed semi-formal institutions (SCOs), which are not regulated by the government (see Table 1). NGOs, SCOs, and some banks are privately owned. The important banks are government-owned and controlled. Banks and NGOs provide external funds – typically from the government – whereas SCOs circulate community resources. All financial institutions use a mixture of individual lending and liability mechanisms, although NGOs still bundle borrowers into groups for mutual support.

Banks are traditional providers of financial services that have minimum credit limits, complex procedures, and formalized repayment structures. NGOs and SCOs (both considered MFIs) have maximum credit limits, simplified procedures, and formalized repayment structures. Informal credit is also available from market stalls, friends, and extended family. Informal credit is characterized by idiosyncratic credit limits and lack of formal procedures and repayment structures. Credit from market stalls is relatively inexpensive compared to formal institutions. Credit from friends and family is interest free due to Islamic principles.

About half (55.01%) of outstanding loans in Noapara are provided by MFIs (see Table 1). Interviews indicated preference for MFI loans because of accessibility, convenience, and trusted procedures. MFIs providing non-financial benefits such as aid during floods were preferred. Informal sources accounted for much of outstanding credit (39.28%). Interviews suggest the preference for informal credit is due to greater flexibility and low costs. Banks provided few loans (5.72%) despite their relative accessibility and low interest rates. Interviews suggest bank loans are not preferred due to lengthy and complex application procedures, inability to obtain required documentation, inconvenience of traveling to branches, and a belief that bribes are required.

Formalized saving in banks, NGOs, and SCOs is common among households. But only socioeconomically advantaged

Table 1. *Breakdown of financial providers by breadth of outreach*

	Traditional providers	MFIs		Informal Providers			
	Bank	NGOs	SCOs	Friends	Family	Shop	Money-lender
Number of institutions	7	15	9	N/A	N/A	N/A	N/A
Total loans issued	36	215	131	82	98	63	4
% households with loans	12.78%	53.00%	35.71%	30.83%	36.84%	23.60%	1.50%
% of total loans	5.72%	34.18%	20.83%	13.04%	15.58%	10.02%	0.64%
Average loan size	43,611	22,116	13,996	30,948	12,026	14,757	6,500
Total credit issued	1,570,000	4,755,000	1,833,500	2,537,700	1,178,500	929,660	26,000
% of credit issued	12.24%	37.06	14.29%	19.78%	9.19%	7.25%	0.20%

Average loan size and total credit offered reported in local currency, Bangladesh Taka, (BDT).

households have bank deposit accounts. They are particularly important for households that have family members working overseas, as they enable remittance transfers. Many NGOs require clients (typically female) to open a savings account, though saving is subsequently voluntary. Savings are formalized and their use by NGOs is regulated by the government. SCOs enable members to save but access is inflexible. Members can only save a fixed amount, equal to other members, during the initial capital accumulation phase to ensure equal ownership.

5. RESULTS

In this section we first report the results regarding microfinance and coping and then discuss the results regarding microfinance and adaptation. In the end we discuss results regarding microfinance and maladaptation.

(a) *Microfinance and coping*

The survey elicited the main purposes for which credit was obtained, although attributing credit for different activities is not straightforward because of the fungibility problem: credit is often not used as originally indicated to the lender (Hulme, 2000). Households also face the recall problem: they do not remember exactly how they spent credit. We focus on the main purposes for which households obtained credit as a proxy for how credit was used.

Table 2 summarizes the number of times different purposes were listed as reasons for obtaining loans by each source of loan. Specific purposes are aggregated to three categories: *consumption*, the use of credit to maintain current wellbeing; *investment*, the use of credit for future wellbeing; and *repayment*, the use of credit to repay existing debt obligations. Investment was the most commonly cited reason for obtaining loans (45.86%) but consumption (34.22%) and repayment (19.91%) were also common reasons. The majority of loans for investment and repayment were obtained from MFIs as expected, as they are the largest providers of loans. However, consumption loans were most often obtained from informal sources.

Consumption loans were used for purchasing food (65%) or medicine (30%) at times of livelihood shocks. Therefore, they are a suitable proxy for loans obtained by households to cope with livelihood shocks. This means that informal sources of credit are more important than MFIs for coping with livelihood shocks. To explore this connection in more detail we disaggregated loans into those obtained during months when flooding commonly occurs (henceforth 'flooding months'),

and those obtained during months when flooding does not usually occur (henceforth 'non-flooding months'). Consumption loans obtained during flooding months can be used as proxy for obtaining loans to cope with flooding. We found that consumption becomes a three times more common reason (8.14 vs 25; see Table 3) for obtaining loans during flood months.

To understand why obtaining credit during flooding months is so important we asked households how they respond to livelihood deficits in each month. Few households used savings as a coping response, which was surprising as many households do have savings. Interviews suggest members of SCOs have very limited access to their savings because SCOs do not hold reserve capital and all of their capital is used to disburse new loans. The problem is compounded when households are temporarily unable to repay their loans during and after flooding. Additionally, withdrawal of savings results in membership cancellation: this deters households from withdrawals as membership ensures priority for future loans. Furthermore, many households felt that governing bodies of SCOs would not allow them to withdraw savings and did not try to do so. Finally, many households do not know how much savings they have: many interviewees felt that governing bodies of SCOs withheld this information from them. Many households have also savings with NGOs that they should be able to withdraw when in need. However, households also reported difficulty withdrawing funds from NGOs, claiming that NGO field officers steer members to keep savings for future emergencies. NGOs denied that this is the case.

Field research indicated that accessing credit was the most important way to cope with flooding. Credit is important because few alternative responses are available during flood months. Traditional coping responses, such as finding agricultural wage labor opportunities, are in short supply due to the abandonment of cash-crop cultivation. Credit is so important for coping because its availability is uncorrelated with the occurrence of flooding. In contrast, traditional coping responses are built around traditional livelihood practices that are inversely correlated with flooding. For instance, access to agricultural labor opportunities depends on the existence of local agricultural activity, but when flooding occurs, agricultural activities and thus many traditional coping responses are limited. The problem is compounded by the covariate nature of flooding which affects large areas rather than isolated farms.

During flood months, consumption loans are most often obtained from informal sources, and informal loans account for half of all loans obtained for consumption during flood months. Consumption becomes four times a more common reason for obtaining informal loans in flood months compared to non-flood months. MFIs provide most of the remaining loans for consumption. Similarly, loans obtained from MFIs

Table 2. Breakdown of purposes to obtain loans

General Purpose	Specific Purpose	Financial provider approached				MFIs				Informal				Specific Total		General Total	
		Bank	Bank	Bank	Bank	Cite count	% of all related specific cite counts	% of all purposes of loans from provider type	Cite count	% of all related specific cite counts	% of all purposes of loans from provider type	Cite count	% of all related specific cite counts	% of all purposes of loans from provider type	Cite count	% of all specific purposes	Cite count
Consumption purposes	Purchase food	4	2.33%	9.76%	30.81%	53	13.38%	115	66.86%	41.67%	172	66.86%	41.67%	244	24.12%	34.22%	
	Purchase medicine	1	1.79%	2.44%	53.57%	30	7.58%	25	44.64%	9.06%	56	44.64%	9.06%	7.85%	7.85%		
	Wedding costs	1	6.25%	2.44%	68.75%	4	2.78%	4	25.00%	1.45%	16	25.00%	1.45%	327	2.24%	45.86%	
	Purchase agricultural inputs	6	6.59%	14.63%	56.04%	11	12.88%	34	37.36%	12.32%	91	37.36%	12.32%	19	12.76%	2.66%	
Investment purposes	Purchase equipment	4	21.05%	9.76%	63.16%	12	3.03%	3	15.79%	1.09%	19	15.79%	1.09%	12	1.68%	1.68%	
	Purchase aquaculture inputs	3	25.00%	7.32%	58.33%	7	1.77%	2	16.67%	0.72%	30	16.67%	0.72%	30	4.21%	4.21%	
	Purchase livestock inputs	2	6.67%	4.88%	73.33%	22	5.66%	6	22.08%	2.17%	77	22.08%	2.17%	26	10.80%	10.80%	
	Purchase business inputs	2	2.60%	4.88%	75.32%	58	14.65%	17	34.62%	6.16%	26	34.62%	6.16%	54	3.65%	3.65%	
Repayment	Education costs	3	11.54%	7.32%	53.85%	14	3.54%	9	27.78%	5.43%	12	27.78%	5.43%	12	1.68%	1.68%	
	Build or repair homestead	3	5.56%	7.32%	66.67%	36	9.09%	15	33.33%	1.45%	1	33.33%	1.45%	5	0.70%	0.70%	
	Build shop	1	8.33%	0.00%	0.00%	7	0.00%	4	100.00%	0.36%	1	100.00%	0.36%	142	19.92%	19.92%	
	For a job	0	0.00%	0.00%	20.00%	1	2.25%	4	80.00%	1.45%	142	80.00%	1.45%	142	19.92%	19.92%	
	Take credit to go broad	0	0.00%	26.83%	94	66.20%	37	23.74%	13.41%	142	26.06%	13.41%	142	19.92%	19.92%		
	Repay existing loan	11	7.75%	26.83%	94	66.20%	37	23.74%	13.41%	142	26.06%	13.41%	142	19.92%	19.92%		

for consumption almost double compared to non-flood months.

NGOs and SCOs have less important role as providers of consumption loans during flood months, although their consumption loans also increase in flood months by 20% and 90%, respectively. That SCOs and informal providers play a bigger role than NGOs during flood months for consumption loans is unexpected, because the covariate risk of flooding should reduce the ability of localized financial institutions to provide support, as well as the ability of social support networks to provide mutual support (Bhattachamishra & Barrett, 2010). There can be several reasons for our unexpected finding. First, NGOs often provide food and blankets to members as substitutes to credit during flooding. Second, government regulations discourage provision of loans for consumption purposes (see Microcredit Regulatory Authority Rules, 2011). Third, NGOs often provide only one loan to a household; borrowers with outstanding loans would need to obtain additional loans from alternative lenders. SCOs and informal providers are the most obvious sources as unlike with NGOs, prior membership is not necessary.

(b) Microfinance and adaptation

Household interviews found no autonomous agricultural adaptations to flooding. A few households tried flood-resistant crop varieties but they were not workable. No agricultural adaptation options existed due to limits imposed by the severity and duration of the hazard and the sensitivity of livelihoods to the hazard. Microfinance did not enable households to overcome limits as they were biophysical, not financial (see Klein *et al.*, 2014). The implication is that microfinance can only facilitate adaptation when feasible options exist. Also, microfinance facilitates adaptation only when financial services can help overcome barriers and limits. In the absence of agricultural adaptation options, households either migrated or converted land for aquaculture. We will discuss the links between these adaptations and microfinance below.

Domestic and international migrations are adaptations that help to retreat from flooding (see Dronkers *et al.*, 1990). They are adaptations because they consist of livelihood changes to reduce long-term vulnerability. Both are transformational as they involve abandonment of traditional cash-crop cultivation (see Fenton *et al.*, 2016). Many male members of households migrate domestically to find agricultural employment from elsewhere. Migration is a low-cost adaptation that mainly entails expenditure for transport and accommodation. Remittance services enable migrants to regularly and securely send earnings to local household members. Male members of households also migrate overseas to work. International migration is available only to socioeconomically advantaged households due to its high cost. Access to bank deposit services, remittance services, and substantial amounts of credit are needed.

SCOs and informal providers are key sources of credit for international migration, as banks and NGOs will not fund this activity. One NGO branch manager noted: "if the member migrates after the loan distribution then how can I recover this loan?" International migration takes place because flooding suppresses the local economy and prevents livelihood diversification. One household interviewee noted: "I can start a business; however, the interest charged would be more than the profit. If I go [abroad], that amount of money I would be able to make will be sufficient to repay loans." Credit enables the financial barriers to international migration to be overcome.

Table 3. *Different types of loans by flood and non-flooding months*

	Banks	MFIs		Informal	Total
		NGO	SCO		
<i>Across the year</i>					
Amount of times consumption purposes listed as a major reason for obtaining a loan	6	52	42	82	182
Amount of times investment purposes listed as a major reason for obtaining a loan	24	133	75	95	327
Amount of times repayment purposes listed as a major reason for obtaining a loan	11	58	36	37	142
Average number of times per month consumption purposes listed as a major reason for obtaining a loan	0.50	4.33	3.50	6.83	15.17
Average number of times per month investment purposes listed as a major reason for obtaining a loan.	2.00	11.08	6.25	7.92	27.25
Average number of times per month repayment purposes listed as a major reason for obtaining a loan.	0.92	4.83	3.00	3.08	11.83
<i>During flooding months</i>					
Amount of times consumption purposes listed as a major reason for obtaining a loan	2	26	33	64	125
Amount of times investment purposes listed as a major reason for obtaining a loan	9	38	28	52	127
Amount of times repayment purposes listed as a major reason for obtaining a loan	3	16	18	12	49
Average number of times per month consumption purposes listed as a major reason for obtaining a loan	0.40	5.20	6.60	12.80	25.00
Average number of times per month investment purposes listed as a major reason for obtaining a loan	1.80	7.60	5.60	10.40	25.40
Average number of times per month repayment purposes listed as a major reason for obtaining a loan	0.60	3.20	3.60	2.40	9.80
Proportion of times consumption purposes listed as a major reason for obtaining a loan during flooding months	1.60%	20.80%	26.40%	51.20%	
<i>During non-flooding months</i>					
Amount of times consumption purposes listed as a major reason for obtaining a loan	4	26	9	18	57
Amount of times investment purposes listed as a major reason for obtaining a loan	15	95	47	43	200
Amount of times repayment purposes listed as a major reason for obtaining a loan	8	42	18	25	93
Average number of times per month consumption purposes listed as a major reason for obtaining a loan	0.57	3.71	1.29	2.57	8.14
Average number of times per month investment purposes listed as a major reason for obtaining a loan	2.14	13.57	6.71	6.14	28.57
Average number of times per month repayment purposes listed as a major reason for obtaining a loan	1.14	6.00	2.57	3.57	13.29
Proportion of times consumption purposes listed as a major reason for obtaining a loan during non-flooding months	7.02%	45.61%	15.79%	31.58%	

However, credit limits and usage restrictions imposed by banks and NGOs make them less useful source of credit. Use of credit imposes the challenge for households of obtaining financial benefits greater than the cost of capital to overcome financial barriers. Formal financial institutions may also be unwilling to provide credit for migration due to governance and institutional constraints.

While many households migrated some remained and converted agricultural land for freshwater fish and prawn aquaculture. This is an adaptation because it changes a livelihood to reduce long-term vulnerability. This often involved renting flood-prone land from other households. The function of this adaptation was to accommodate flooding and was exclusive to socioeconomically advantaged households due to the relatively large financial resources required. It is also transformational because it is original to the village and enables house-

holds to overcome the limits associated with agriculture and flooding (see [Fenton et al., 2016](#)). Credit is vital due to large upfront costs of converting land and purchasing aquaculture inputs. Households obtained credit from banks as the needed amounts exceeded credit limits of MFIs. Here credit enables the financial barriers of adaptation to be overcome. Not only are MFIs less able than banks to support this adaptation due to their credit limits, bank credit can also actually be obtained at lower cost.

All households have faced the decision of whether to rebuild higher traditional earth homesteads or build improved brick and mortar homesteads. They are adaptations because they seek to reduce long-term vulnerability. Improved homesteads are widespread but can be considered transformational as for many households this is a new way of construction with new materials and skilled labor (see [Fenton et al., 2016](#)). It

is an adaptation to accommodate flooding and to enable male household members to migrate for longer periods of time without a fear that the homestead will collapse on family members. Homestead reconstruction requires relatively large financial resources. Many households have adopted this adaptation despite its cost as it is considered an adaptation priority. Its widespread adoption depended on access to credit, which many households do by securing loans from multiple credit providers. Credit enables the financial barriers of homestead improvement to be overcome. However, the ability of MFIs to support adaptation is restricted due to their credit limitations, and new specialized products would need to be developed to foster adaptation.

(c) *Microfinance and maladaptation*

While microfinance can facilitate adaptation by enhancing coping and adaptive capacity as evidenced above, sometimes it has unintended consequences which increase vulnerability via over-indebtedness. Over-indebtedness results from the use of credit to cope with flooding. Coping with credit does not produce income streams, which would assist households to repay loans. The abandonment of cash-crop cultivation and migration reduce income and thus ability to repay debts. Yet households prefer over-indebtedness to the sale of assets such as land. Over-indebtedness caused by the use of credit to cope can increase future vulnerability when further credit is needed to repay debts, because this prevents the use of credit for coping with hazards or for adapting. External intervention is needed to reduce the frequency at which hazards occur, as reliance on credit to cope with frequent severe climate hazards may contribute to over-indebtedness and greater vulnerability.

Over-indebtedness is also linked to the financing of adaptation options with credit, particularly of homestead improvement, which yields no income. One over-indebted household noted “to build this house we took loans, and to repay the loans we borrowed money from another place, and to repay the second loan we borrow money from yet another place”. Such accounts were common because the numerous lenders are unaware that they are lending to the same household (called overlapping). Financing adaptations that do not produce income streams with credit can increase future vulnerability if households are unable to meet repayments and consequently become over-indebted. Such adaptation options would require new products to facilitate adoption without the risk of over-indebtedness. Additionally, adaptation planners cannot rely on autonomous adoption, as there remains a danger of increased vulnerability because of over-indebtedness.

6. DISCUSSION

The aim of this research was to empirically assess previously proposed linkages between microfinance and coping, adaptation, and maladaptation. We now discuss our research findings in relation to these proposed linkages in order before drawing conclusions.

(a) *Microfinance and coping*

The findings show that credit acts as an ex-post source of capital when environmental and climate hazards occur. This finding resonates with previous studies suggesting such a link (e.g., [Heltberg et al., 2009](#)); and resonates with arguments of the microfinance literature according to which credit is an important coping mechanism more generally (e.g., [Banerjee,](#)

[Karlan, & Zinman, 2015](#); [Collins, Morduch, Rutherford, & Ruthven, 2009](#); [Osbaahr, Twyman, Adger, & Thomas, 2008](#)).

In addition, the findings highlight the important role of both informal and formal credit in coping with environmental and climate hazards. The role of informal credit is an important finding considering the high number of financial institutions serving the village (effectively 1 per 11 households). Traditional theory suggests that formal credit replaces informal credit ([de Aghion & Morduch, 2005](#); [Ledgerwood, 1999](#)). However, this was not the case in Noapara. Existing microfinance-adaptation literature has hitherto not sufficiently acknowledged the role of informal credit in supporting livelihoods and coping capacity.

Furthermore, the results highlight the role of social support networks in coping with environmental and climate hazards, and shows that resources flow through these networks despite covariate risks. Easy access, flexibility, and low costs were key reasons why informal credit is popular during flood months. The implication is that formal credit products may need to be made more flexible, cheaper, and be easier to access during times of flooding to meet household needs.

This research distinguished between two forms of MFIs which support coping capacity, externally managed NGOs and community initiated and managed SCOs. In many studies SCOs are not considered MFIs and their role in supporting coping capacity has not been sufficiently acknowledged in existing literature. NGOs were found to play a smaller role than previously assumed, accounting for only approximately 25% of consumption loans during flooding months, further downplaying the role of formalized credit in coping with environmental and climate hazards. Government regulation regarding credit usage, number of loans per borrower, and limits on the number of institutions borrowers can obtain credit from, as well as NGO preferences for providing other forms of support during flooding, could explain why NGOs have a smaller than expected role in supporting coping capacity.

(b) *Microfinance and adaptation*

The results partly corroborate existing literature, which has suggested that microfinance can support adaptation by enhancing adaptive capacity through the accumulation of assets and diversification of livelihoods ([Agrawala & Carraro, 2010](#); [Hammill et al., 2008](#); [Heltberg et al., 2009](#)). However, whether this necessarily leads to vulnerability reduction depends on how adaptation is both conceptualized and operationalized. Much of the existing literature implicitly adopts an ‘adaptation as development’ perspective (e.g., [Hammill et al., 2008](#)). Within this approach the accumulation and diversification of assets and livelihoods is interpreted as vulnerability reduction. However, from an ‘adaptation plus development’ perspective the accumulation and diversification of assets and livelihoods only reduces vulnerability if it directly confronts or manages climate risk (see [Ayers & Dodman, 2010](#); [McGray, Hammill, Bradley, Schipper, & Parry, 2007](#)).

We adopted the latter perspective and found fewer examples of credit facilitating adaptation. For instance, household livelihood diversification into business does not reduce vulnerability, as businesses are also sensitive to flooding. Most businesses stop operating during flooding due to inundation, risk of damage to stock, and low demand for goods. Many food shops have closed due to the need to sell much of their goods on credit. A former shop owner commented: “I had to always give credit, so I couldn’t make profit and I decided to stop the business”. Only when assets accumulated or diver-

sified livelihoods reduce exposure or sensitivity can they result in vulnerability reduction. When this occurs the result could be described as 'climate-resilient' or 'climate compatible' microfinance (Fenton *et al.*, 2015).

Moreover, microfinance cannot always facilitate adaptation through livelihood diversification because there may not be feasible activities into which households can diversify, especially when training is not coupled into financial services (Caretta, 2014). In Noapara the most widespread adaptation was seasonal migration due to lack of viable in-situ alternatives. Migration has proved less lucrative than cash crop cultivation according to households and it appears that if they could cultivate cash crops then they would adapt back into this activity. If microfinance could be relied upon to enable adaptation through livelihood diversification, then lower levels of migration would have occurred.

Even when adaptation options exist, they may not reduce vulnerability. For instance, credit was used for rearing ducks instead of chickens to reduce sensitivity to floods. However, the reduction in vulnerability was not sufficient to offset the ongoing effects of flooding on their homesteads and agricultural land, the most important livelihood assets.

Also, when adaptation options do exist, credit limits of MFIs may not enable financial adaptation barriers to be overcome. For instance a major barrier to the adoption of aquaculture is the inability to acquire sufficient capital to construct necessary embankments and purchase necessary aquaculture inputs. Although households could access credit from MFIs, credit limits prevented them from acquiring sufficient capital to adapt into aquaculture. Thus this adaptation option was only feasible to socioeconomically advantaged households which could access bank credit. Furthermore, the terms and conditions associated with credit may prevent financial barriers associated with adaptation options from being overcome. Banks and NGOs did not finance overseas migration as they feared not being able to collect repayments. The cost of credit may also act as a financial barrier, making adaptation options economically unviable. It was commented by some households that it was not possible to profit from livestock purchased using credit due to the costs of meeting loan repayments.

(c) *Microfinance and maladaptation*

Our results corroborate earlier microfinance-adaptation literature which proposed microfinance may increase vulnerability and lead to maladaptive outcomes (Hammill *et al.*, 2008). The most evident example of microfinance causing maladaptation is through a reduction of adaptive capacity. Almost one-fifth of all loans in the village were obtained for repayment of existing loans. We interpret this as over-indebtedness, although no authoritative definition of it exists in the literature (Schicks, 2013). Over-indebtedness refers to an inability to meet repayment deadlines, which results in costly actions and increased indebtedness.

To date there has been little research on the impact of climate change on the drivers of over-indebtedness. Drivers for over-indebtedness have been grouped into external factors, lender behavior, and borrower behavior (Schicks, 2013). However, very little has been said about the relative importance of these drivers, or the relative influence of environmental and climate hazards upon them. Much of the emerging literature focuses on borrower behavior, such as the use of credit for non-productive purposes or activities with low financial returns (e.g., Schicks, 2014; Taylor, 2012). However, this research highlights that climate change can also potentially contribute

to over-indebtedness by exacerbating external factors such as flooding, altering borrower behavior, and limiting the ability of households to build up assets. Historical accounts of village life indicate that earlier flooding was less significant and more infrequent, allowing household livelihoods to recover. Households reported that flooding is now much more frequent and severe, frustrating livelihood recovery. Borrower behavior has changed, as households have been forced to invest in activities that do not produce a financial return. Households also reported abandoning cash-crop cultivation due to risk of harvest loss. This reduces their ability to generate income, accumulate assets, save, and repay debts; and gradually erodes their asset base and leads to over-indebtedness.

The over-indebtedness and its links to credit use for coping and adapting can be said to present a Faustian bargain. This evocative term have been used in other studies such as Wood (2003), who uses it to describe the actions by poor households for the pursuit of short-term security at the cost of longer term prospects for livelihood improvement. The phenomenon was manifest in our case study in the form of use of credit to cope with livelihood shocks caused by climatic hazards and the use multiple microfinance loans to finance homestead improvements. Current loan products are ill-designed for these purposes: they are short-term products with short-repayment schedules which do not work well with adaptations that do not generate income in the short term. Households know this yet are pushed into such arrangements due to the need for secure shelter. This has contributed toward many households becoming over-indebted. One respondent crystallized this problem when commenting: "If you can use it in a productive way then it is helpful. As we cannot use it in a productive way it is not helpful, even sometimes it is a burden".

The research also highlights that accumulation of assets can increase vulnerability by increasing exposure and sensitivity when assets are not resilient to or do not reduce sensitivity to environmental and climate hazards. An example is households using credit to convert agricultural land for aquaculture. The accumulation of flood-prone landholdings increases exposure. Sensitivity does not necessarily decrease. If embankments are inadequate flooding can overwhelm embankments and lead to loss of fish stock. Some households lost income and became over-indebted in this way, and one household was taken to court for unpaid debts. Risk-transfer mechanisms (e.g., insurance) may be required to reduce risks associated with certain adaptation options.

(d) *Insights from an equity perspective*

In order to address the restricted ability of the risk-hazard approach to incorporate equity considerations, we integrate equity considerations into the discussion. From an equity perspective, our survey data demonstrate how poorer households are much less able to cope with flooding than more advantaged households with access to traditional banks. Very few bank loans were obtained for consumption by wealthier households. Household interviews indicated that this may be the case because wealthier households had greater access to bank loans or government extension services that enabled them to transform their income-generating activities to deal with flooding. Hence they have less need to obtain loans to maintain consumption during flooding months. The use of credit to cope with flooding can be seen as an extra burden for poorer households, leading to a vicious cycle where it is even harder for them to adapt because they need to use limited resources to pay off existing debt.

An equity perspective highlights the inequity of adaptation outcomes, notably due to international migration and conversion of agricultural land for aquaculture. These were the main transformational adaptations to flooding risk undertaken only by socioeconomically advantaged households. These households were able to obtain significant amounts of credit from SCOs to migrate overseas because of their higher social status, whereas socioeconomically disadvantaged households obtained credit from SCOs mainly to cope with flooding. The ability of socioeconomically advantaged households to access credit from banks enabled them to take advantage of aquaculture. This occurred at the direct expense of socioeconomically disadvantaged households who, without access to sufficient levels of credit, were forced to rent land and migrate in search of agricultural wage labor. Therefore despite the evident benefits of microfinance services, if socioeconomically disadvantaged households cannot gain access to credit services similar to socioeconomically advantaged households, there is a danger of two-tier adaptation outcome, where those unable to access larger amount of credit are disadvantaged.

7. CONCLUSION

Our article examined the role of microfinance in climate change adaptation in Noapara village, situated in Satkhira District, Southwest Bangladesh. We adopted a risk-hazard approach to the study of vulnerability, focusing on the role of microfinance in coping capacity and adaptive capacity. To compensate for its weakness regarding equity, we integrated equity concerns from the political-ecology approach.

Our results indicate that credit can play an important role in improving coping capacity, reducing ex-post sensitivity to flooding, corroborating existing literature. Credit was found to be especially important because its availability is less correlated to the occurrence of flooding, unlike many other traditional coping responses. While many previous studies have downplayed the role of informal credit, this research found that both informal and formal credit are important for coping. Easy access, flexibility, and very low costs are key factors explaining why informal credit is particularly important to coping with flooding.

With regard to adaptive capacity, our results indicate that credit can improve adaptive capacity reducing ex-ante sensitivity to flooding, corroborating existing literature. However, caution is needed regarding the ability of microfinance to facilitate adaptation. It can only do so when feasible adaptation options exist. Adaptation options must also reduce vulnerability to environmental and climate hazards. For instance, there

is much enthusiasm for microfinance to facilitate adaptation by instigating livelihood diversification, such as microenterprise. However, we found enterprises were also sensitive to flooding. Only when livelihood diversification reduces exposure and sensitivity to environmental and climate hazards will it reduce vulnerability. Also, microfinance facilitates adaptation only when access to financial services can help overcome barriers and limits associated with potential adaptation options. Even if it does facilitate adaptation, credit limits imposed by MFIs may limit its role to incremental adaptations. Incremental adaptations facilitated by access to microfinance were not sufficient to offset the ongoing effects of flooding on agriculture, the most important household income generating activity.

Also, lack of access to credit is not in itself an adaptation barrier: lack of financial resources is. Credit and appropriately designed loan products are simply ways to gain access to financial resources. There is a need to distinguish between access to 'credit' and 'microcredit' when referring to lack of financial resources as a barrier to adaptation. The conversion of agricultural land for aquaculture was only feasible for those households who could access credit from banks. We found transformational adaptations often require access to substantial amounts of credit, significantly more than MFIs are willing to lend. If credit limits continue and socioeconomically disadvantaged households cannot gain access to government extension programmes and banks, there is a risk of a two-tier adaptation scenario in which the poorest will continue to be disadvantaged in terms of not being able to effectively adapt and being financially penalized by having to obtain loans to cope.

Our results indicate that credit can lead to maladaptation through over-indebtedness. Almost one-fifth of all loans were obtained for repaying existing loans. Climate change can contribute to over-indebtedness by exacerbating external factors such as flooding, altering borrower behavior, and limiting the ability of households to build up assets. We found over-indebtedness to be linked to both the use of credit as a coping response and its use in financing adaptation options. This was due to the use of credit to finance activities which did not produce income streams which assist households to repay associated costs.

To conclude our study found empirical evidence to both corroborate and contradict proposed linkages between microfinance and adaptation. While our article has made a start in filling a n evidence gap, there is a need to re-orientate the discussion to better understanding the contexts within which microfinance supports autonomous household adaptation, as well as leads to maladaptation to be able to better inform adaptation planning and policy.

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