

**FINANCIAL INNOVATIONS FOR BUILDING RESILIENCE TO CLIMATE  
CHANGE-RELATED AND OTHER NATURAL DISASTERS**

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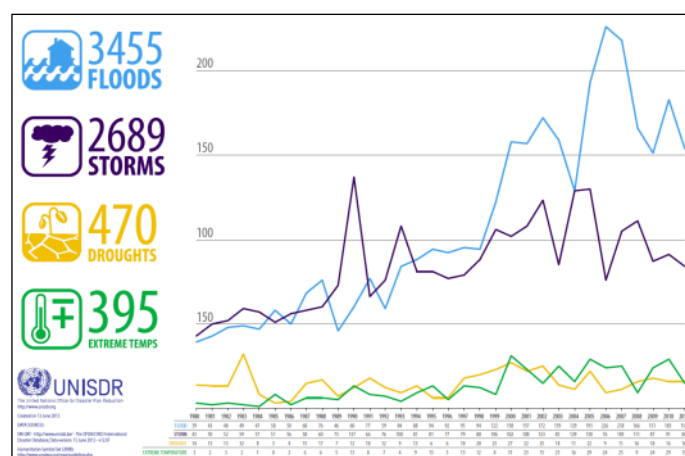
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## 1. INTRODUCTION

The global damages caused by natural disasters have increased rapidly and are projected to continue increasing (Guha-Sapir, Vos, Below, & Ponserre, 2011). Climate change will be one of the drivers responsible for this increase (IPCC, 2007) (Fig. 1). Amongst the most vulnerable groups to climate change related disasters are the rural poor in developing countries. They have few resources to insulate themselves from climate shocks and many live in ecological sensitive areas prone to climate-related natural hazards. However, as the East Japan Great Earthquake and Tsunami (EJGET) of March 2011 reminded us, even technologically advanced countries are vulnerable to natural disasters, and the concept of resilience is equally as important for them as it is for developing countries.

A disaster resilient community can be defined as “the safest possible community that we have the knowledge to design and build in a natural hazard context” (Geis, 2000) “minimizing its vulnerability by maximizing the application of disaster risk reduction measures” (Twigg, 2009). Financial instruments, including loans, savings and insurance, can play a key role in building resilience to enable households, communities and enterprises to withstand and recover from natural disasters. As disasters become more prevalent, adaption of existing financial instruments, new instruments, and better access to financial services will be required.



**Figure 1: Number of climate related disasters around the world (1980 – 2011)  
(UNISDR, 2012)**

The Institute for Global Environmental Strategies (IGES) is implementing 2 research projects that consider the role of financial innovations in building resilience to climate change induced and other natural disasters. One of these considers options for building resilience after the earthquake and tsunami that struck Japan in 2011, reflecting on the evolution of risk transfer mechanisms and other financial innovations delivered through the Internet, and the other research project focuses on the role of microfinance in building resilience to climate change in

developing countries. The 2 research projects were conceived as separate research exercises, but they share a basic conceptual foundation that allows their findings to be compared. This paper first explains the research problem, questions and methodologies, then provides a brief introduction to the national contexts for the research. The initial research findings are then introduced, and the paper concludes with a reflection on these findings.

## 2. CONCEPTUALIZING THE PROBLEM

The conceptual foundation shared by the 2 IGES research projects is illustrated in Figure 2. The first commonality is that in both developing and developed countries, the types of financial instruments that are available have important implications for the resilience of households and enterprises. This concerns not only financial instruments to build resilience before a disaster strikes, but also financial instruments to aid recovery after the disaster. A second commonality is that in developing and developed countries, conventional banking wisdom, which holds that loans must be secured with collateral, will need to be rethought in some circumstances. This rethinking has already taken place in developing countries in the context of poverty alleviation, where alternatives to physical or financial collateral have been found to make small loans (micro-credit) available to millions of households. In developed countries, enterprises can find themselves not only without collateral to secure fresh loans after a disaster has struck, but also in the difficult situation of having to pay existing debts without any form of income. A third commonality is that regardless of whether countries are considered developing or developed, merely to bounce back after a disaster has struck to a similar state of vulnerability before the disaster is not sufficient. Ways, including financial instruments, must be found to construct less vulnerable, more resilient households, communities and enterprises.

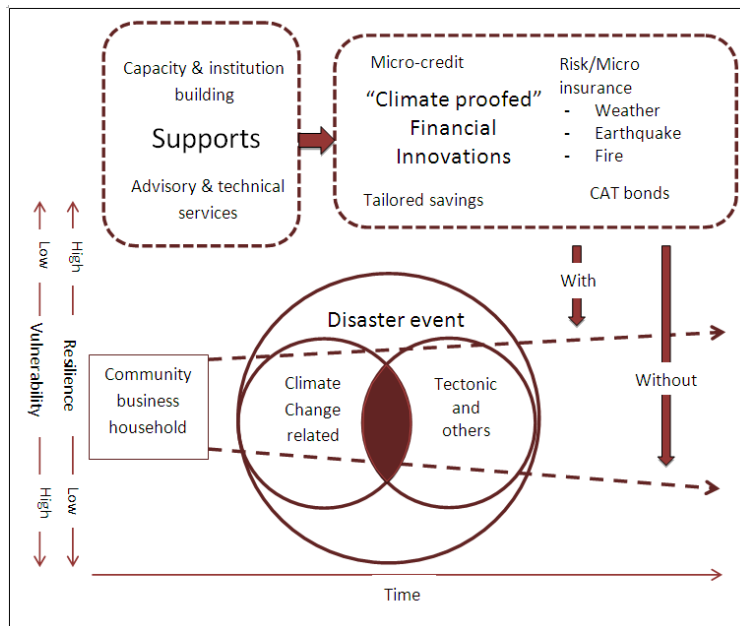
### Box 1: Definitions

**RESILIENCE:** the qualities that enable an individual, community or organization to cope with, adapt to and recover from an event.

**VULNERABILITY:** the relative degree of risk, susceptibility, resistance and resilience to an event.

**ADAPTIVE CAPACITY:** the extent to which a system can modify its circumstances to move to a less vulnerable condition.

*Modified from (Dalziell & McManus, 2004)*



**Figure 2: Financial innovations and disaster resilience - conceptual diagram**

### **3. RESEARCH QUESTIONS AND METHODS**

#### **3.1. RESEARCH ON FINANCIAL INNOVATIONS FOR DISASTER RESILIENCE IN JAPAN**

The need to reconsider financial instruments from the perspective of disaster resilience became especially apparent in Japan after the devastating earthquake and tsunami that struck the country just before 3pm on 11 March 2011. The earthquake, one of the largest since modern recording began, generated a massive tsunami that breached and washed over wave barriers and destroyed entire towns on Japan’s eastern coast (Fig. 3). Magnifying the scale of the disaster, the tsunami also washed over wave defenses protecting the Fukushima I and II Nuclear Power Plants, destroying reactor cooling systems at the No. 1 Plant and triggering a meltdown in three of its reactors. The Government set aside US\$48.5 billion in emergency spending as a first step to aiding the disaster victims. Revitalization of the destroyed local economies is now a high priority.

As part of the reconstruction efforts that are currently under way, new schemes to generate and deliver funds have been established by several innovators to enable small and medium enterprises to rebuild their operations. One IGES research project is studying these new schemes as well as the evolution of risk transfer mechanisms in Japan. The research takes up the following questions:

- How can Japan develop a comprehensive set of risk transfer instruments available to all stakeholders, and thereby strengthen its disaster resilience?

- When disaster-affected businesses lack collateral to access loans for their recovery, and when there are significant constraints on public finances due to large fiscal deficits, how can funds be established and what types of financial products can they provide to most effectively enable the businesses to restart their operations?

In addition to a review of documents and literature, the research methods have included site visits to the affected areas, and key informant interviews with locals, officials, fund managers and financiers.



**Figure 3: Scenes in the aftermath of the EJGET**

### **3.2. RESEARCH ON BUILDING ADAPTIVE CAPACITY AND DISASTER RESILIENCE IN DEVELOPING COUNTRIES THROUGH MICROFINANCE**

The second IGES research project focuses on the links between microfinance and climate change adaptation in three least developed countries that are vulnerable to climate change – Lao PDR, Nepal and Bangladesh. This paper reports only on the research in the first two countries, as the research is yet to be launched in Bangladesh. Theoretically, small, flexible, accessible loans on reasonable terms can enable poor households in these and other countries at a similar stage of economic development to increase and diversify their income sources, making them more resilient to extreme climate events and more capable of adapting their livelihoods to long-term changes in climate variables. When these loans are packaged with other financial instruments, such as flexible savings schemes and micro-insurance and other services such as training on income generating activities, health and education, and disaster preparedness, their potential to contribute to disaster resilience and adaptive capacity may be further enhanced. Conversely, there are risks for households when microfinance schemes are

particularly rigid. When disaster strikes, households that have taken loans from these schemes may be forced to sell off productive assets to meet their repayment obligations, and this could force them into a downward poverty spiral. The research project aims to identify how resilience and adaptive capacity can be incorporated into the poverty alleviation agenda of microfinance.

Another concern is that an increase in the frequency and intensity of natural disasters could threaten the continuation of service delivery by microfinance institutions (MFIs). This situation would arise when member households are unable to meet their loan repayment obligations because of the disasters, and when a MFI has made insufficient provision for overdue loans. MFIs thus need to consider how they can “climate proof” themselves to ensure their continued delivery of services in the face of more frequent and intense extreme climate events. Related to this is the need to engineer microfinance to enable households to build climate resilient livelihoods that increase their disaster resilience, and to cope with and recover from extreme climate events. Both livelihoods and MFIs need to be climate proofed; both these tasks are interdependent

With this understanding, the research project thus takes up the following two questions:

- What innovations are required in micro-finance to build the resilience of rural households to recover from more frequent and extreme climate events, and adapt to long-term climate changes?
- What measures can MFIs take to avoid and/or deal with periods of reduced repayment performance, as could be expected during and after extreme climate events?

The methodology for the research project includes national level reviews of projected climate change impacts, adaptation initiatives, and microfinance policy, regulations and providers; and empirical research of microfinance programs through surveys and/or experimental design. The research in Lao PDR and Nepal has progressed through the national reviews and initial field surveys of microfinance programs, whereas we hope to launch the research in Bangladesh shortly with our national partners.<sup>1</sup>

Field surveys were carried out in Lao PDR in 2010 in districts within the Mekong watershed that are vulnerable to extreme climate events. Some are located in the lowlands vulnerable to flooding (e.g. Sangthong, Thaprabath, Uttapue), and others in the mountainous area vulnerable to drought, pest outbreak, and changes in seasonal and rainfall patterns (e.g. Long, Udomxai, Kham, Phukood). Both villages with and without microfinance services in these districts were selected for the survey.

A checklist of questions was designed to guide semi-structured interviews of key informants. The interviews were carried out in the local language with the assistance of local coordinators (Fig. 4). The features of each microfinance program were obtained from the leader of each organization. In each district, two to three villages were visited (Table 1). Three households in each village were selected for in-depth interviews upon recommendation of the MFI

committees. Households were selected to reflect diversity of loan use and behavior. One non-member household in each village was interviewed to identify barriers to their involvement.



Figure 4: Household surveys in Lao PDR

Table 1: Surveyed villages and characteristics

District	MFI/village	Characteristics	
		Type of MFI / Loan Type	Vulnerability to climate change
Sangthong	Kokpoeng	village microfinance	flood affected area
	Kokhae	village microfinance	flood affected area
	Sanod	village microfinance	flood affected area
Thaprabath	Hadsai	project fund	flood affected area
	Phapong	project fund	flood affected area
	Hadkai	project fund	
	Huayluek	project fund	
Kham	Natoom	village microfinance	storm and drought affected area
	San	Fond Co-operative loan	
Phukood	Pungmun	village microfinance	change of rainfall pattern
	Koeng	village microfinance	
Long	Thad	None	
	Sob Imai	None	
	Jom Jaeng	APB loan, village microfinance	
Viengpooka	Lamon	APB loan	
	Poorad	poverty reduction loan	
	Nam seou	project fund	
	Nam O	project fund	drought and flood affected area
Oudomxai	Chin		
	Lak 10	loan from MFI Pattana Udomxai,	flood affected area,
Hoon	Ponesawang	project fund	drought affected area
	Somxai	in-kind project fund, APB loan, policy bank loan,	drought affected area
Uttapue	Sakae	APB loan	drought and flood affected area
	Wat Tad	village microfinance	storm affected area
	Wat Luang		flood affected area

Note: "Village microfinance" refers to self-organized and self-financed village savings and lending groups, whereas "project funds" are similar, but have received seed funding from external organizations.

The research conducted in Nepal began with key informant interviews in November 2009, followed by the selection of one MFI, Nirdhan Utthan, and one of its branch offices, Mahajidiya



branch in Rupandehi District, for empirical analysis. This was followed up in February 2010 with interviews of Nirdhan Utthan staff, a review of lending portfolios in district and branch offices, and a household survey of clients of Mahajidiya branch (Fig. 5).



Figure 5: Household survey and irrigation by MFI client household member in Nepal

## 4. NATIONAL CONTEXTS

In this section we briefly introduce the national contexts of Japan, Lao PDR and Nepal with respect to disaster vulnerability and financial services. In Japan, we describe the evolution of risk finance, while in Lao PDR and Nepal, we focus on the evolution of microfinance services. This difference in focus reflects the different research questions posed by the 2 IGES research projects.

### 4.1. JAPAN

As a mountainous island nation located on the “Pacific Rim of Fire” in one of the most tectonically active parts of the world, and with a climate that features both typhoons and heavy snowfalls, natural hazards, whether earthquakes, tsunamis, floods, or landslides, are common. Japan has built up a certain degree of resilience to disasters; in fact, people from around the world have travelled to Japan to study the lessons it has learned and its technological advances on disaster preparedness.

As with many other countries, the future for Japan is one of more frequent and more intense climate-change related disasters, and the concept of disaster resilience in Japan needs to be revisited in this light. Settlements, agriculture and industry are founded on a certain consistency in climate variables that are now undergoing long-term changes. These include breaking up of the traditional pattern of monsoonal rainfall, or *tsuyu*, in June and July, followed by the typhoon season in August and September (NPG Natural Asia Pacific, Undated). Greater variability in rainfall is already being experienced, with a long-term increase in intense rainfall events being detected across the country, and changes in snowfall and snow melt patterns in Hokkaido have also been observed (*ibid.*). Drought periods are expected to become more common and longer in the years ahead (*ibid.*).



Financial instruments to deal with weather-related and other disasters in Japan are evolving, but are not as well developed as in some other economically advanced countries. The government's conventional approach to risk finance in Japan is mostly limited to earthquake reinsurance, while it has relied mostly on the issuance of reconstruction bonds to finance rebuilding after disasters strike.

In Japan, risk insurance is largely viewed as earthquake insurance. Earthquake insurance issued by private insurance companies is intended to provide financial support for earthquake victims; therefore, its scope is limited to residential houses and personal property. Although the Government, through Japan Earthquake Reinsurance Co. Ltd., acts as a reinsurer, earthquake insurance was not popular until after the 1995 Hanshin-Awaji earthquake, because it is incidental to fire insurance and limited to 30-50% coverage in present value of the insured asset, with an upper limit of 50 million yen, and as premiums are high. After the 1995 Hanshin-Awaji earthquake, the proportion of insured households grew steadily to 23.7% in 2010. Nevertheless, earthquake reinsurance, as a risk mitigation tool, is constrained by the fact that it exposes government to a large fiscal risk when a catastrophic earthquake strikes (General Insurance Association of Japan, 2011).

To generate the necessary public finances for rebuilding after disasters have struck, National and Prefectural governments usually issue disaster bonds. However, looking beyond disaster bonds is now necessary as Japan's heavy public debt, largely a result of pump-priming during the 1990s, the so called "lost decade", and worsened by the EJGET, makes this instrument difficult to sustain (OECD, 2011).

The situation is changing through the evolution of market-oriented risk management schemes. Although at 1,450 trillion yen (Bank of Japan, 2012) total private financial assets, consisting of bonds and bank deposits, in Japan are larger than any other country, risk assets account for little of this. Despite their relatively minor role, market-oriented risk management schemes, such as equity and mutual funds, do exist and are needed to grow to replace some of the public financing.

Table 2 lists various risk insurance initiatives in Japan. Currently, alternative risk transfer mechanisms in the Japanese market consist of CAT bonds, captive insurance, finite risk insurance, and weather derivatives (METI, 2006). CAT bonds, captive insurance, and finite risk insurance are the main risk transfer schemes used by large companies and benefit associations such as *Zenkyoren*, the National Mutual Insurance Federation of Agricultural Cooperatives. Munich Re has issued CAT bonds called *Muteki*, which covers *Zenkyoren's* earthquake risk and transfers it to the capital market (Munich Re Group Risk Trading Unit, 2011). *Midori*, a 5-year CAT bond designed for JR East, the largest railway company in Japan, is expected to cover loss of public transportation services and infrastructure when a significant earthquake is centered within a 70km radius of the Tokyo area. Large corporations can create Special Purpose Vehicles (SPV) for captive insurance and they can afford to accumulate sufficient funds for finite risk

insurance. However, these financial risk transfer mechanisms require large portfolio volumes and are thus not suited to small businesses.

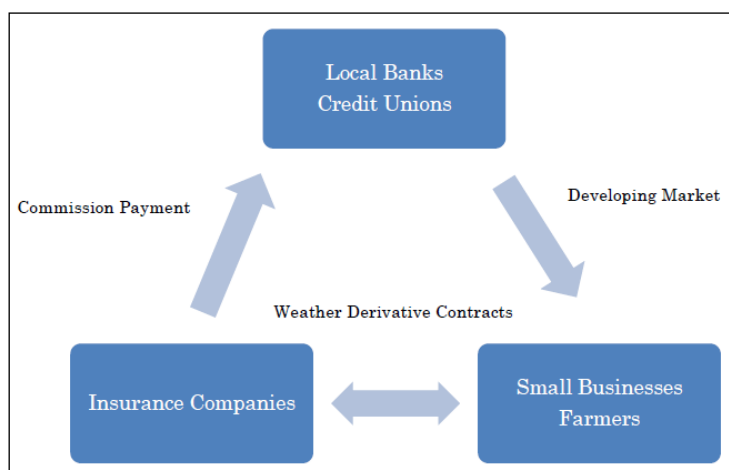
**Table 2: Examples of risk insurance initiatives in Japan**

No	Case	Geographical coverage	Hazards covered	Direct benefactor	Payment trigger	Benefits accrued
1	Muteki Ltd (CAT Bond)	National	Earthquake	<i>Zenkyoren</i>	Richter scale	Investors
2	Midori Ltd (CAT Bond)	National	Earthquake	JR East	Richter scale	Investors
3	Typhoon Derivative (Tokio Marine Co.)	National	Typhoon	Farmers Union, Hotels, Leisure industry,	Number of typhoon passed	None
4	Warm Winter Derivative (Sompo Japan)	National	Climate	Farmers Union, Energy retailers, Fashion Industry	Temperature	None
5	Winter Preparation aka <i>Fuyu no Sonae</i> (Aioi Insurance)	National	Climate	Farmers Union, Energy retailers, Fashion Industry, Hotels	Temperature, Rainfall, Snowfall	None

Source: (Aioi Nissey Dowa Insurance Co., 2011); (Sompo Japan Insurance Inc., 2012); (Munich Re Group Risk Trading Unit, 2011); (Tokio Marine and Nichido Fire Insurance Co., 2011).

Some risk mitigation financial options now exist in Japan that are suited to small businesses and households. Weather derivatives (see initiatives 3 to 5 in Table 2) are a good example. Strong demand from businesses and industries affected by weather has encouraged insurance companies to develop small to large-scale weather derivatives. Although weather derivatives do not fully cover disaster damages, they can provide immediate relief.

Weather derivatives are over-the-counter products designed for specific clients and are not publicly offered; therefore, until recently, the premiums, usually over 1 million yen, were too high for individuals and small businesses. The weather derivatives sold by Japanese insurance companies are only intended for corporate bodies and unions, as selling financial products to individual can be a violation of the Consumer Contract Act (Itabashi et al., 2007). However, individuals, mostly farmers, are able to purchase the derivatives through local agricultural associations. Weather derivative sales have been increasing significantly (Yamada, 2010) through local banks and credit unions that will even provide farmers and business owners with a loan for the derivative (Fig. 6). The growing number of sales of weather derivatives has helped reduce premiums. Each derivative has a different trigger for the payment and hence it is not rare for an individual or business to purchase multiple financial products.



**Figure 6: Weather derivative sales scheme through local financial institutions**

Although the weather derivatives market is growing, the volume is much smaller than in the U.S. Unlike the U.S. derivative market, risk derivatives in Japan are only traded over-the-counter, as, under the Commodity Exchange Act, the market can trade only ‘tangible objects’ (METI, 1950). This is another reason why Japan’s risk is not widely shared. Another reason why trading of weather derivatives would be difficult is that the currently traded derivatives in Japan use a wide variety of indices, such as average temperature and rainfall in major cities, that are not well standardized. In order for derivatives to be traded in Japan, there is also a need to increase derivative volume.

#### **4.2. LAO PDR**

The landscape of Lao PDR ranges from rugged mountains in the northern and eastern parts of the country to the lowlands of the Mekong River in the western part. A tropical monsoon climate combined with this varied geomorphology supports rich biodiversity, but also makes Lao PDR vulnerable to climate change, particularly through increased flooding in the west, where it borders Thailand, and increased drought in the east, where it borders Viet Nam.

Lao PDR is a least developed country. In 2000, 39% of population fell under the extreme poverty line. The Government aimed to reduce the numbers of the extreme poor to 19.5% of the population by 2005, and 0% by 2010 (Darachanthra, 2006), but these targets were not achieved.

The Government has identified microfinance as a tool for poverty reduction, with the belief that microfinance gives poor people important access to financial services (National Economic Research Institute, 2007). MFIs in Lao PDR exist in the formal sector (e.g. Agricultural Promotion Bank), semi-formal sector (e.g. credit unions, Village Development Fund and International Non-Governmental Organization (INGO) projects) and informal sector (e.g. moneylenders, friends) (BWTP, 2004; Coleman & Wynne-Williams, 2006; Darachanthra, 2006). In practice, microfinance is mainly delivered through community-based models, or what we

refer to in this paper as “village microfinance”, due to the low population density and the poor accessibility to remote areas (BWTP, 2004; Darachanthra, 2006).

The National Economic Research Institute (NERI) surveyed microfinance in 17 provinces in 2006, finding 190 MFIs and a growing trend in the number of microfinance service providers, especially in the northern region (due to greater poverty) and the central region (due to high demand for business investment) (National Economic Research Institute, 2007). The microfinance services covered 4,664 villages (46.5% of the total), an increase of 3.9% over 2005, but the number of clients was only 6.5% of the total population (ibid.).

Loans from informal sources account for about 55% of the total loan amount for rural households (Coleman & Wynne-Williams, 2006). Most of the informal lending takes the form of cash, though in-kind transactions (e.g. rice grains and buffalo) also exist (ibid.). In-kind savings (e.g. livestock, precious metals, jewellery, housing materials) are preferred over cash savings in banks, including MFIs (ibid.).

The MFIs generally direct microfinance at income generation, food security and women’s development, while some target poverty alleviation, rural or community development and health. In 2003, the credit portfolios of the semi-formal sector indicated that most borrowers intended to use credit for livestock raising, crop production, handicrafts and trading (Coleman & Wynne-Williams, 2006). The 2006 NERI review found that 70% of borrowers used loans for agriculture, livestock and fisheries, 18% for trade and small shops, 7% for handicraft and weaving, and 5% for other activities (National Economic Research Institute, 2007). The wide variety of uses registered also included services, food processing, health, education, recovery from accidents, and social occasions such as weddings and cultural festivals (ibid.).

Most MFIs encourage their clients to save and require them to make monthly deposits. About 80% of MFIs offer dividends on savings that are higher than a fix interest rate (ibid.), making them more lucrative for savings than regular banks. Many MFI clients who do not take loans may well benefit from the returns on their savings (Darachanthra, 2006). Women make up 61% of the people with savings in MFIs and their average savings is almost twice that of men (National Economic Research Institute, 2007). This reflects the efforts of the Lao Women’s Union to empower women and a more favorable attitude amongst women towards savings for income generation.

Repayment performance appears to be variable. For example, records of the Microfinance Office in Sayabouly Province show that in 2003 the repayment rate was 82%, but fell to 73% and 67% in 2004 and 2005, respectively, due to an economic crisis (Soukhamthat, 2006).

### **4.3. NEPAL**

Modelling of climate change in the Himalayan region predicts increased temperatures and unusual patterns of precipitation, longer and more intense droughts, forest fires, more extreme weather events resulting in natural disasters such as flooding and landslides, drying up of springs, and reduced flow of local streams (Parry, Canziani, Palutikof, van der Linden, &

Hanson, 2007). Adaption to climate change will require a combination of strategies at different scales.

Poverty remains one of the country's major challenges with about 31% of the population living below the poverty line (United Nations Development Program, 2006, p. 230). Microfinance has been one of the major strategic instruments for poverty reduction in Nepal for the past three decades. The National Microfinance Policy from 2008 aims to improve the flow of funds to the poorest segment of the rural population.

Amongst the rural population, more than 1.6 million people have access to microfinance services. This represents approximately 8% of the total population and approximately 26% of the population living below the poverty line (Centre for Microfinance Nepal, 2010). MFIs mostly operate in the Terai region (plains), where population density is greatest and the road and market infrastructure most developed.

The microfinance market in Nepal can be divided into formal and informal sectors (Table 3).

**Table 3: Microfinance institutions in Nepal**

			Number	Poor clients served (Dec. 2007)
Formal Sector	Providing directly to the poor	Microfinance development banks	13 (2009)	289,018
		Saving and Credit Co-operatives (SCCs)	2,692 (2007)	358,212
		Small Farmers Co-operatives Limited (SFCLs)	219 (2007)	129,000
		Financial intermediary NGOs (FINGOs)	47 (2009)	257,956
	Banks and finance companies/co-operatives	Commercial banks	16 (2009)	No direct services
		Development banks	58 (2007)	
		Finance companies	70 (2009)	
		Financial co-operatives (Limited Banking Licenses)	16 (2009)	
	Wholesale MFIs	a) Rural Microfinance Development Centre (RMDC)	3 (2009)	
		b) Sana Kisan Vikas Bank		
c) Rural Self-Reliance Fund				
Informal Sector		Self-help groups	Above 20,000	
		Rotating savings and credit associations (ROSCAs)		
		Others: moneylenders, traders, friends and relatives		

Source: Developed from (Rural Microfinance Development Centre Ltd., 2009) and (Majorano, 2007).

The major mechanisms for microfinance delivery include the Grameen Bank model and co-operative models used by Saving and Credit Co-operatives (SCCs) and Small Farmers Co-operatives Limited (SFCLs). Since its introduction in the country in the early 1990s, a large number of MFIs have adopted the Grameen Bank model, including most of the microfinance development banks, financial intermediary NGOs (FINGOs) and some microfinance co-operatives.

Informal microfinance sources include over 20,000 informal community-based organisations, such as self-help groups and rotating savings and credit associations (ROSCAs), but also moneylenders, traders, friends and relatives. Together, they provide nearly 75% of all rural credit (Majorano, 2007).

## 5. PRELIMINARY RESEARCH FINDINGS

### 5.1. JAPAN

In the section on National Context, we discussed conventional ways of insuring against disaster and of financing disaster recovery in Japan. In this section we discuss our preliminary observations of reconstruction financing, including several financial innovations that emerged after the EJGET to assist the recovery of disaster-affected, small-medium enterprises.

In the disaster-affected area, small and medium enterprises (SMEs) have played a major role in sustaining the local economy. They include enterprises involved in primary industries, such as fisheries and agriculture, and retailers, sake and soy sauce brewers, pastry shops, and others. The challenges the affected SMEs faced immediately after the EJGET included loss of income because of the destruction of their production facilities, lack of collateral to secure new loans to rebuild their operations, and the servicing requirements of their existing debts. Businesses and households wanting to take new loans to reconstruct their facilities and dwellings would end up having multiple debts (or *nijyu saimu*). After disasters, financiers tend not to provide loans to businesses with multiple debts, even for projects with attractive net present value (Myers, 1977).

One recent study analyzed the impact of multiple debts in the area affected by the EJGET by comparing ex ante corporate financial indicators in the affected area, previous disaster areas (Hanshin-Awaji 1995 and Niigata 2004), and throughout Japan (Uchida, Uesugi, Ono, Hosono, & Miyakawa, 2011). Based upon capital adequacy ratios and operating margins, the financial position of firms in the affected area is fragile compared to other parts of Japan, and it seems that the multiple debt problems are more significant than for previous major earthquakes. Uchida et al. (2011) also analyzed the soundness of regional banks and credit unions in the affected area. In the region, more than 90% of local companies have business transactions with regional banks and credit unions, and more than 80-90% of them chose local institutes as their major financial partner. Amongst *Chigin* (first-tier regional banks), a decline of capital adequacy ratio was observed at the end of the month the disaster occurred for 77Bank, Tohoku Bank, and Sendai Bank. Consequently, the Ministry of Finance provided financial support to Chigins for them to settle debts, as Chigins needed to forgive loans taken by victims of the EJGET. Daini Chigin (second-tier regional banks) and Shinyo Kinko (credit unions) are relatively small in the region and could not withstand the financial shocks caused by the disaster, despite their management being mostly sound before the EJGET (Weekly Toyo Keizai 2011).

In these circumstances, ways to reduce existing debt must be found. The Iwate Industry Reconstruction Corporation was established in October 2011 after the EJGET to provide part of the solution. Jointly established by the Iwate Prefectural Government, regional financial institutions and the Organization for Small and Medium Enterprises and Regional Innovation, Japan (SMEJ), Iwate Industry Reconstruction Corporation can purchase pre-EJGET debts from local business owners. The East Japan Great Earthquake Industry Reconstruction Corporation supported by Reconstruction Agency of Japan, which began operation on 05 March 2012, also has this function. The Bank of Japan has provided funds for supporting regional financial institutions in the affected area from the end of April 2011. This has enabled regional banks and credit unions to supply funds through the East Japan Great Earthquake Industry Reconstruction Corporation for debt purchase. For individuals, the Japanese Bankers Association (*Zenginkyo*) collaborated with lawyers to establish the Management Committee of Individual Debtor Guidelines for out-of-court workouts for debt adjustment.

With lenders reluctant to provide fresh loans, new ways of providing small-scale financing to assist the recovery of SMEs in the EJGET-affected area were required. Using the Internet, fund innovators developed new quasi-investment, fund-raising schemes for local SMEs. The schemes have a number of common features. They use the Internet to attract funds from individuals and organizations interested in assisting the recovery; they share a common understanding that the process of recovery will be long and uncertain; and they prefer share purchases over donations, with the understanding that this provides the share owners with a long-term interest in the affected people and the recovery of the area.

The Save Sanriku Oysters Scheme (<http://sanriku-oysters.com/>) was established by Japan's largest oyster online shopping site, which sources oysters from production areas around Japan, to provide finance to oyster growers in the Sanriku coastal area whose assets (oyster rafts, work facilities, ships, oysters in oyster culture beds and houses) were destroyed by the EJGET. Save Sanriku Oysters enables any interested person or group to purchase shares at 10,000 yen each, through the Internet or the Post Office. The shares entitle the owners to receive scheme updates and a delivery of about 20 oysters per share once the oyster production has recovered sufficiently (expected to be within 3 – 5 years).

Site visits, interviews with affected oyster producers, and the Schemes micro-investments to assist the producers in rebuilding their operations, are reported on the Scheme's website. As of 10 July 2012, 20,858 investors had purchased shares equivalent to 3.41 million USD ("Save Sanriku Oysters," 12 July 2012). The web page is frequently updated to report progress, including the allocation of the collected funds to individual oyster farmers.

The Fund to Support Disaster Affected Areas set up by Securite (<http://oen.securite.jp/>) functions in a similar manner. The Fund sells shares through the Internet at the same price as the Save Sanriku Oysters shares, with an additional 5% charged for administration costs. Enterprises that are seeking investment register their interest and are provided guidance in developing recovery plans. Once the plans are approved by the Fund, it makes a public offer



through its website, providing information on the investment amount targeted, monthly sales, and dividends. Full information disclosure ensures accountability and builds trust between business owners and investors. Any interested individual or group purchases a share/s, half of which is provided to the enterprise as a donation and half as an investment, with the owner of the share deciding which enterprise the money should go to. The share owner receives a dividend in kind after the business has restarted production. The in-kind payment symbolizes the success of the enterprise in restarting its operations.

11 enterprises were registered for the 1<sup>st</sup> public tender offer, with individual fund targets ranging from 97 – 607,000 USD. 24 enterprises participated in the 2<sup>nd</sup> public tender offer. As of 10 July 2012, the Fund had collected 1,029 million yen, of which over 75% had been disbursed with 22,607 people registered as clients ("Securite Fund to Support Disaster Affected Areas ", 10 July 2012).

The concept and mechanisms used by Securite are similar to those of Kiva.org (<http://www.kiva.org/>), a non-profit organization established in 2005 that uses the Internet to enable individuals to lend small amounts of money (micro-credit) for poverty alleviation around the world. Figure 7 provides an illustration of how the Securite Fund works using Yagisawa Corporation as a case study.

The SME Infrastructure Development Agency of Japan launched another type of support to assist the recovery of disaster-affected SMEs called "Temporary Facility Development". This program provides funds for the construction of temporary facilities for SMEs that have lost their business facilities and intend to restore their business. Land is provided to the businesses free of the rent. The facilities made are made available to SMEs free of charge for 1 year, and later will be donated to the local government, which will determine further support. This program is unique in that a national agency sets up the foundation for the business facility with cooperation of local government.

Other schemes to support farmers and fishermen are more conventional and appear somewhat stalled. The national government has announced programs to support farmers and fishermen who have lost their production facilities and equipment. For the farmers, funding can be made available only to associations and not individuals, and the need to build consensus has created a stumbling block. Further, the funding can cover up to around 85% of the cost to procure agricultural machines such as tractors and combines, but, as the total cost of the procurement can exceed 40 million yen, farmers, who have lost everything but their lives and struggle to survive in the temporary shelters away from their original homes, are unable to afford the remainder. Fishing communities face similar problems.

*Background: Over two-hundred year history of making soy sauce using traditional methods*  
*Disaster impacts: All production facilities lost*  
*Plans: Eventually recover its production, by starting first with stock liquid sauces*  
*Challenges: Carrying excessive debt due to the damages incurred*  
*Targeted finance: 25,000,000 JPY, 1<sup>st</sup> round; 100,000,000 JPY, 2<sup>nd</sup> round*  
*Product: Soya Sauce, Miso*  
*Dividend: None for 1<sup>st</sup> 36 months; 1% thereafter, until end of accounting period (70 months)*  
*Recovery: Restored its sales from 15 per cent of the previous year in May 2011 to 70 per cent in November 2011*



*Production at Yagisawa's Plant, March 2012*

Source:  
<http://www.musicsecurities.com/communityfund/details.php?st=a&fid=167>.

**Figure 7: Yagisawa Corporation case study**

## **5.2. LAO PDR**

Our subject matter now turns from funding recovery in the aftermath of the EJGET to building household resilience in Lao PDR and Nepal through microfinance.

Our survey in Lao PDR found various financing institutions operating at village level, including banks, MFIs, co-operatives (Seno Saving and Credit Union), village microfinance, project funds, Chinese investors, and informal sources (Table 4).

In the surveyed villages, most formal microfinance providers require borrowers to form groups before they apply for loans. Collective risk-sharing within the group provides a form of social collateral, which makes microfinance accessible to low income groups who cannot offer property as security. Most of the lending is for cultivation, particularly rice and corn. Other common uses are the buying and selling of non-timber forest products and agricultural produce, handicraft making, education and medical care.

While the linkages between climate change adaptation and microfinance require further study, microfinance does appear to be contributing to household resilience through savings. For example, Kokpoeng Village has a population of 1,256 and is located in Sangthong, a poor

district on a tributary of the Mekong River. It has medium-high vulnerability to climate change, especially from flooding. In Kokpoeng, the Village Savings Group started in February 2004 with 35 members and with savings of 66 USD, and by 2009 had increased its membership to 357 and savings to 93,021 USD. The Village Savings Group was so successful that an upper limit of 1,241 USD per month was set in 2010 to avoid investment from outsiders, especially from Thailand, who put their savings through their relatives.

Village microfinance organised by self-managed and often self-funded local savings groups has proved more popular than lending from microfinance banks. Village microfinance has succeeded in motivating/enabling members to save cash, invest, allow their children to attend school, and recover from floods. All interviewees who had borrowed from MFIs explained that they appreciated the village microfinance because (i) it is always available, which means it can be used for emergencies, such as sickness and death, avoiding the need for asset sales, (ii) compared to banks, which are normally far from the village, there are no travelling costs, (iii) procedures for lending are simple, (iv) existing deposits can be used to secure the loan, meaning a guarantor is not necessary, and (v) it can be used to finance recovery after floods or droughts, and to pay for the higher education of their children. Other benefits of village microfinance that were noted are (i) improved relationships between villagers, due to the monthly group meetings and the large annual meetings, (ii) availability of funds for public purposes (some of the interest is retained for local development activities, such as road construction), (iii) provides a secure way to save money for future use, (iv) resorting to informal lenders who demand high interest rates of 20% per month is no longer necessary, (v) eliminates the practice of “green rice selling” when farmers sell their expected rice crop before cultivation at low prices to moneylenders to secure finance, (vi) strong local acceptance, as committee members are from the village, and (vii) flexible responses through democratic decision-making for trustworthy poor members experiencing repayment difficulties because of disasters, including postponing the repayment without additional charges and providing new loans. Table 4 summarizes the features of village and bank microfinance.

One concern is that the poorest villagers do not join the village development funds as they fear that they will not be able to make the regular deposits.

**Table 4: Village microfinance compared with microfinance banks**

Features	Village microfinance	Microfinance banks
Accessibility	Easy (located in the village, no guarantor required, quick to release funds)	Difficult (far, guarantor required, time required for processing)
Interest on loans	3% per month	1% per month
Interest on savings	Based on income from loan interest; normally higher than rate offered by banks	0.5% per month
Monthly saving requirement	0.62 USD	None
Emergency loan (sickness, death)	Yes, with low interest (1%)	None, or, if any, guarantor required
Social welfare (e.g. small gift or event for childbirths or contribution for funerals)	Yes	No
Village development fund	Yes	No
Disaster relief	Following national bank regulation and agreement within the group	Following national bank regulation, upon request and evidence from borrowers
Management	Self	Bank
Administrative cost	Low (voluntary and elected positions with small remuneration)	High (salary)

### **5.3. NEPAL**

A number of studies on the impacts of microfinance on poverty reduction in Nepal have been conducted, with no clear picture emerging. The Centre for Policy Studies and Rural Development (CPSRD) found that the impact of microfinance programmes on reducing the poverty levels of their clients was low, with only 24.4% of interviewed households reporting an improvement in their socio-economic conditions (CPSRD, 2004). In contrast, a study conducted by the International Network of Alternative Financial Institutions (INAFI) and the South Asia Partnership – Nepal (SAP-Nepal) found that microfinance had enabled most clients to increase their income, promoted micro-enterprise activities and improved nutrition, clothing and housing conditions (INAFI-SAP-Nepal, 2005). A study by the Rural Microfinance Development Centre Ltd. (RMDC) on clients of its partner organisations reported that participation for three or more years had led to an increase of household income by 250% and of savings by 286%, while reliance on moneylenders and relatives had decreased by 68% and 65%, respectively (RMDC, 2009).

For our programmatic and site-specific survey, we focused on the Nirdhan Utthan, an MFI that uses the Grameen model, and its Mahajidiya branch, located in Rupandehi District. Nirdhan Utthan targets women, hence all of the 33 clients interviewed were women, and most were from ethnic minorities with their own language. We found that all of their households are poor, lacking access to health and education services. Sanitation is a problem with most

households not having pit latrines. The main occupation of most households is farming, followed by wage labour.

The farmer clients use microfinance for a variety of purposes (Table 5). Most invest in cash crops such as off-season vegetables (cauliflower, cabbage, mustard, lentils, beans, etc.) and some in livestock. Many farmers take loans to purchase seeds, irrigation and/or fertilizer for rice and wheat cultivation in the summer.

**Table 5: Branch clients and their investments by sector (January 2010)**

Sector	Total no. of borrowers	Total amount (NPR)
Agriculture sector	702	5,386,536
Cottage industry	38	462,192
Social or Consumption	8	37,161
Services	406	5,481,923
Others	5	56,654
Total	1,159	11,424,466

Note: 1 USD = 82 NPR.

We found positive impacts for some households in terms of income, savings and capacity building. About 30% of the interviewed clients stated that they had increased their income significantly after joining Nirdhan Utthan, especially those who invested in buffalo husbandry, rice and vegetables, earning on average NPR 10,000- 40,000 per year.

All of the interviewed clients have savings with Nirdhan Utthan, and none save with conventional banks as these are far from their settlements and they believe that the administrative procedures are difficult. Regular personal and group savings are compulsory. Clients are allowed to withdraw personal savings at any time but the withdrawal of group savings is limited. Clients save to purchase clothes, medicine and food, for emergencies and loan repayment, and in some cases, for dowry.

Capacity building training and workshops are occasionally conducted by Nirdhan Utthan field officers. The training is mostly on sanitation, health, education, HIV and women's empowerment, but also on loan issues such as repayment, interest, making instalments, signing of documents and investment decisions. A few clients participated in a tour to learn from experienced groups elsewhere in the country, and found this to be more useful than the regular training they receive from their field officer.

The survey also identified several problems. First, roughly two thirds of the clients reported that their average monthly income was only NPR 3,000-4,000 and that they did not perceive any changes in their income before and after joining Nirdhan Utthan. For most of them, the establishment and operational costs of most of their micro-enterprises exceeded the loans they had taken. Out of 33 clients, 12 faced losses in their investments. As the income from their microenterprises is either insufficient or they desire additional income, all interviewed clients have other sources of income. They commonly work as wage labourers in brick and

cement factories and in agriculture; some go to India for seasonal work. Second, interviewees complained about the treatment of poor clients by field officers, i.e. the scolding of clients who did not make repayments. Third, some are also dissatisfied with the group liability mechanism, which was part of the original Grameen model.

The relevance of microfinance to climate change is suggested by several observations. First, a possible climate change impact on the area is greater water scarcity, which traditional strategies may not be able to cope with. In the survey area, households can irrigate their fields by paying NPR 50 per hour to a large irrigation project. However, most clients do not use this service because they cannot afford the fee or face social discrimination. More than 60% of clients irrigate their fields using pump sets, and a lesser number use tube wells. Less than half of the clients used loans from the MFI to finance their irrigation. As the maximum agricultural loan from Nirdhan Utthan is NPR 5,000, some clients have taken general loans of up to NPR 40,000 to invest in irrigation equipment. Irrigation has led to an increase in productivity of up to 200% for rice but also other agricultural products like vegetables.

Second, about 30% of the interviewed clients have incurred losses from drought, 18% from floods, and 15% from both floods and droughts. Nirdhan Utthan offers an “emergency loan” for clients who are affected by natural calamities, with a maximum amount of NPR 10,000, 10% interest, and a maximum 2 year grace period. However, 70% of the clients responded that they were unaware of the emergency loan system, and only 2 of the 4 interviewed clients who had applied for emergency loans actually received them.

Third, Nirdhan Utthan offers life insurance, livestock insurance and loan insurance schemes, and plans to develop a crop insurance scheme, which could become increasingly important as climate change impacts are felt. In the survey area, clients have only made use of the loan insurance, which only partly covers the loan amount.

## 6. DISCUSSION

The two IGES research projects reported on in this discussion paper are at an early stage of development. While they were conceived as separate research exercises, their subject matter shares some commonalities and encourage us to look at potential for lesson learning between developed and developing countries in the field of financing for climate change and disaster resilience.

### 6.1. JAPAN

Our analysis leads to the following observations: a) to create disaster resilient societies, we need to look beyond conventional “hard” risk mitigation mechanisms, e.g. disaster protection works such as concrete wave barriers, to “soft” flexible mechanisms, including risk transfer instruments and more effective responses to deliver finance to aid reconstruction after a disaster has struck; b) there is huge potential in Japan to increase the use of risk insurance at all scales, from individuals through to corporations, and for specific natural hazards, such as

earthquakes, tsunami and floods; c) the role of financial markets in disaster resilience can further be strengthened by linking the domestic risk insurance market with that of the regional and international financial markets; and d) the role of government (national and prefectural) in promoting risk insurance is declining, but it has an important role to play in establishing the future generic risk finance market.

Our analysis of the risk finance market in Japan shows that the market is segmented and should be consolidated to accommodate the needs of households and industry. One reason why the market cannot respond to the growing need for risk finance is the immaturity of Japan's capital market infrastructure in terms of the capability of domestic financial institutions. The existence of few Japanese reinsurance companies with small gross billings compared to top reinsurers elsewhere is indicative of the problem. Portfolio funds flow to Europe, the U.S., Bermuda, etc. as the Japanese market cannot offer attractive financial options to meet investor demand. Sound capital and reinsurance markets supported by domestic agents are needed for Japan to utilize private funds for risk reduction.

Turning to the financing of reconstruction, we found that the recovery of the oyster farmers supported by Save Sanriku Oysters and the SMEs supported by Securite is important for the disaster-affected region. Despite their strong business foundations, which include a clientele across Japan, the SMEs had no way of securing sufficient loans from conventional sources for their recovery. Fund innovators who understood that the recovery of SMEs was critical to the recovery of the whole disaster-affected region, and who recognized the strong business foundations of the SMEs, stepped forward to fill some of the financing gaps.

Use of the Internet was key to generating the funds. Images are provided to enable potential investors understand how the funds help local businesses. Securite targeted the types of SMEs that most people are familiar with, such as retailers, foodstuff producers, restaurants, shipbuilders, farmers, and fishermen, and that can offer attractive in-kind dividends. Other SMEs that are less easy to "sell" to potential investors, for example machine part manufacturers, may be less suited to the Securite type model. In this light, there is a need for a more comprehensive assessment of disaster-affected SME financing needs and gaps, and to consider other models to generate and deliver finance.

The approaches used by Save Sanriku Oysters and the Fund to Support Disaster Affected Areas can be built into a comprehensive framework for disaster resilience. These models can be established quickly after a disaster strikes to expediently generate and deliver finance to disaster-affected SMEs. This experience is now being shared within Japan to consider the application of these models for future mitigation.

## **6.2. LAO PDR AND NEPAL**

The exploratory surveys in Lao PDR and Nepal provide important information for the research assumption, i.e. that microfinance services can contribute to community-based adaptation to climate change. Geographic factors, features of the schemes and the way they are



implemented have implications for the assumption. The role of microfinance in adaptation may be less in areas with low population density, poor accessibility and weak market development, though the research in Lao PDR suggests that village microfinance, rather than microfinance banks, can still play an important role under these conditions.

Microfinance and savings opportunities provided by village savings and loan schemes were found to have a number of perceived advantages over banks. Of these, flexibility can be highlighted. Microfinance schemes that are rigid are likely to be less useful, and in fact can be damaging, to households that need to respond to unforeseen events. Ready access to small loans on reasonable and flexible terms to cope with and recover from climate-related disasters could be key to household adaptive capacity. Flexibility also means a learning-by-doing approach from the MFIs. Rather than merely replicating microfinance models developed by other organisations, MFIs need to monitor and evaluate the acceptance and social and economic impacts of these models on their members. Where problems are identified, the MFIs need to be sufficiently flexible to make the necessary changes. For example, the survey of one MFI in Nepal found dissatisfaction amongst clients with the joint-liability model, which other MFIs have found not to be necessary. Also, clients were dissatisfied with the interest rates, instalment requirements, training, which they found ineffective, and lack of support for investment in agriculture. Targeted livelihoods training for the poorest households who lack formal education and marketing to ensure good prices for produce and better methods to support women's empowerment, would increase the effectiveness of the program.

From the survey sites, a clear picture that microfinance contributes to household resilience by increasing household income has not emerged. There is clearly large variation in the performance of household investments and the questions of why some households have done well and others poorly require further analysis. Other indicators relevant to resilience are household assets, including savings. Here, we see a more consistent image emerging with the surveyed households having cash savings that are earning interest and having used microfinance or their savings to avoid emergency asset sales, e.g. the practice of "green rice selling" reported from Lao PDR. The surveys also reveal that "resilience" is a complex phenomenon that needs to be teased out to understand all of its contributing factors. For example, that village microfinance group members in Lao PDR have been able to send their children on to higher education could mean a significant increase in household income at some time in the future. The social capital that has been built from regular meetings of the village microfinance groups may also contribute to resilience.

Regarding the first research question – What innovations are required in micro-finance to build the resilience of rural households to recover from more frequent and extreme climate events, and adapt to long-term climate changes? – our exploratory survey suggests areas where further research is required. It is now common for microfinance programs targeting the rural sector to include emergency funds. Quantitative analysis that sheds light on the significance of these funds for household coping strategies during crisis periods is required. Loan forgiveness, postponements on repayments, reduced interest rates, and fresh loans on especially soft

terms, are other examples used to help borrowers through difficult times, and these too need further review from an adaptation perspective. Examples of micro-insurance were reported from Nepal and these should be investigated in terms of design, relevance and uptake.

Not so much light was shed on the second research question – What steps can MFIs take to avoid and/or deal with periods of reduced repayment performance? Resorting to the practice of scolding or public shaming to force clients to make repayments, as was reported at the survey site in Nepal, is certainly not one of the answers.

### **6.3. COMPARISONS**

Given the largely different socio-economic contexts of Japan as a developed country, on the one hand, and Lao PDR and Nepal as developing countries on the other, it might be expected that there are few similarities to allow for meaningful lesson sharing between them on climate change and disaster resilience, especially in the field of finance. Indeed, there are differences, but there are also some similarities.

Just as new risk transfer mechanisms are evolving in Japan, they are now being piloted in various forms in developing countries, where traditional crop insurance has been limited and not so successful (Pierro & Desai, 2008). Several organisations are field-testing new types of micro-insurance products as specific tools for adaptation to climate change in developing countries. These products, known as weather (based) index insurance (WII), have been developed with support from the World Bank (World Bank 2012), the World Food Programme (IFAD 2011) and a number of donor agencies. The essential feature of WII is that the insurance contract responds to an objective parameter (e.g. measurement of rainfall or temperature) at a defined weather station during an agreed time period. The parameters of the contract are set so as to correlate, to the extent possible, with potential future losses of a specific crop type suffered by the policyholder. Policyholders within a defined geographic area are subject to the same contract conditions and measurements at the same station (ibid).

Experience of implementing a number of pilots and research activities allows for some reflections. The IFAD study concluded that WII is best suited to weather hazards that are well-correlated over a widespread area and where there is a close relationship between weather and crop yield. This correlation is typically highest for a single crop, a marked rainy season and no irrigation. Most WII efforts have focused on the risk of drought. The scaling up and further development of WII faces a number of constraints related to a lack of technical capacity in the insurance sectors of most developing countries. WII requires a high degree of technical and financial knowledge, awareness, and capacity at all stages including its design, monitoring and adaptation to new data and crops (World Bank 2012).

The main similarities we have found concern the “lending” models. As with microfinance in Nepal, Lao PDR and other developing countries, the quasi-investment, fund-raising schemes that evolved to assist SMEs destroyed by the EJGET understood that collateral could not be provided to secure loans. Save Sanriku Oysters and Securite recognise the SMEs as credit

worthy because of their strong business foundations. Similarly, the origins of microfinance in developing countries in the 1970s and 1980s were rooted in the belief that, contrary to the conventional banking wisdom of the time, poor people without collateral are credit worthy and will work hard to repay their loans.

A second similarity is a philosophy that even when households and enterprises find themselves in difficult circumstances, charity alone is not the solution. The schemes reviewed in Lao PDR, Nepal and Japan all recognize the importance of loans tailored to the circumstances that households and enterprises find themselves in, and the opportunities available to them, whether the context is rural poverty or disaster reconstruction.

The differences between the schemes in Japan and microfinance models in developing countries, on the other hand, start with their origins and objectives. In Lao PDR and Nepal, the evolution of financial services to the poor has been a gradual process. The objective has been poverty alleviation, especially in rural areas. Thus, in the context of climate change, the challenge is to ensure the continued delivery of effective microfinance services in the face of more frequent and extreme climate events, and to marry microfinance with other services that build household resilience and capacity to adapt to long-term changes in climate variables. In contrast, the two schemes we reviewed in Japan originated in reaction to a specific disaster, and their value to resilience is in disaster recovery.

This explains two other major differences, namely the source of funds and the process of fund raising. In Lao PDR and Nepal, many microfinance institutions have started as grassroots, local organizations and have grown gradually, mainly based on the savings and interest paid by their clients. In contrast, after the EJGET fund innovators came forward with the idea of using the Internet to sell shares to individuals and organizations who wanted to contribute to the recovery efforts.

## **7. CONCLUSION**

For both developed and developing countries, new financial instruments and modification of existing instruments are needed to build resilience to climate change induced and other natural disasters. This applies to resilience building prior to a disaster event, coping during the period of disaster, and recovery and reconstruction after the disaster. In Japan, we see a much greater role for risk transfer instruments to build the resilience of SMEs prior to a disaster, whereas microfinance (including microcredit, micro-savings and micro-insurance) could play this role for rural households in developing countries such as Lao PDR and Nepal. During the period of the disaster and in its immediate aftermath, financing of immediate survival needs becomes the priority. For long-term reconstruction, Save Sanriku Oysters and Securite suggest some innovative solutions for Japan and other developed countries, while MFIs in developing countries have experimented with a variety of responses to support livelihood generation in the post-disaster period. In both developed and developing countries, there is a need for further experimentation.

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<sup>i</sup> IGES and its partners (Institute of Microfinance, Bangladesh Institute for International and Strategic Studies, Institute for Disaster Management and Vulnerabilities Studies, Unnayan Shamannay, Bangladesh Centre for Advanced Studies) have developed a multi-component research project for Bangladesh with the following elements: Literature review and key informant interviews to identify the covariate climate change shocks to microfinance; Construction of a special Social Accounting Matrix (SAM) for Bangladesh to track the potential implications of climate change on microfinance; Development of a recursive dynamic Computable General Equilibrium (CGE) model for Bangladesh to investigate the increasing influence of climate change on economic activities, etc.; Econometric analysis to better understand how exposed microfinance institutions are to climate change risks; Quasi-experimental design to assess microfinance performance before, during and after climate events; Study of financing options for adaptation technologies; Experimental design of microfinance products for climate change-affected clients.