BUILDING RESILIENCE THROUGH SOCIAL CAPITAL AS A COUNTER-MEASURE TO NATURAL DISASTERS IN AFRICA: A CASE STUDY FROM A PROJECT IN PASTORALIST AND AGRO-PASTORALIST COMMUNITIES IN BORENA, IN THE OROMIA REGION OF ETHIOPIA

Go SHIMADA
School of International Relations, University of Shizuoka
Miki MOTOMURA
Rural Development Department, Japan International Cooperation Agency (JICA)

ABSTRACT Since the 1990s, the number of natural disasters has been rapidly increasing. So far, little quantitative analysis has been carried out on the economic impact of natural disasters in Africa. This paper finds the following: (1) the number of natural disasters in Africa has rapidly increased since the 1990s; (2) East Africa has been hit hardest by natural disasters—of these, drought is the most serious; (3) natural disasters have expanded agricultural land; (4) natural disasters have decreased forested areas; (5) natural disasters have decreased the number of cattle, buffalo, chicken, sheep, goats, and horses. These results indicate that pastoralists have been hit particularly hard by natural disasters. As natural disasters are no longer rare in Africa, it is necessary to consider their impact. This paper examines a JICA project in Borena, in the Oromia Region of Ethiopia, which set out to explore options for building resilience as a counter measure. Our findings indicate that regions at risk from natural disasters need to build resilience through social capital.

Key Words: Social capital; Natural disasters; Pastoralist; Agro-pastoralist; Official development assistance.

INTRODUCTION

Recently, Africa has suffered from frequent natural disasters, which have increased very rapidly since the 1990s because of climate change. What impacts will the increasing number of natural disasters have on Africa in terms of its agriculture, livestock, and the people's lives? How can the international community address the issue of increasing natural disasters by creating more resilient societies? These are the questions that this paper will address. The first section of this paper analyzes the correlation between natural disasters and peoples' lives. The second section uses, as a case study, a Japan International Cooperation Agency (JICA) project in Ethiopia to propose potential counter measures that can build resilience.

THE IMPACT OF CLIMATE CHANGE AND NATURAL DISASTERS

I. The Rising Trend of Climate-Related Natural Disasters

Natural disasters have increased globally since the 1990s (Shimada, 2015a). What is the situation in Africa? Using the EM-DAT database, Fig. 1 shows that this is a clear trend in Africa. The EM-DAT was put together by the Center for Research on the Epidemiology of Disasters (CRED), Université Catholique de Louvain in Belgium. The EM-DAT contains disaster data on the occurrence and effects of over 22,000 mass disasters in the world, from 1900 until today. In Africa, natural disasters gradually increased in the 1990s, becoming even more frequent between the 2000s and the present day. This rising trend indicates that all plans to implement policies should take the increased likelihood of natural disasters into account. In the past, natural disasters have been rare; Table 1 shows that they have now become much more commonplace. If this is true, why have they been increasing particularly in Africa?

To answer this question, it is necessary to examine this trend in more detail. What type of natural disasters does Africa typically endure? In Japan, most major disasters are either earthquakes or typhoons. In Africa, as Fig. 2 shows, drought and flooding are the most common and severe types. In some parts of Africa, it rains too little; in others, it rains too much. Both are climate-related disasters. In other words, the core reason for this increase is probably climate change, by which Africa has been severely affected. It continues to have a serious impact on people's lives and causes great suffering.

Fig. 3 presents the regional distribution of natural disasters. Eastern Africa suf-

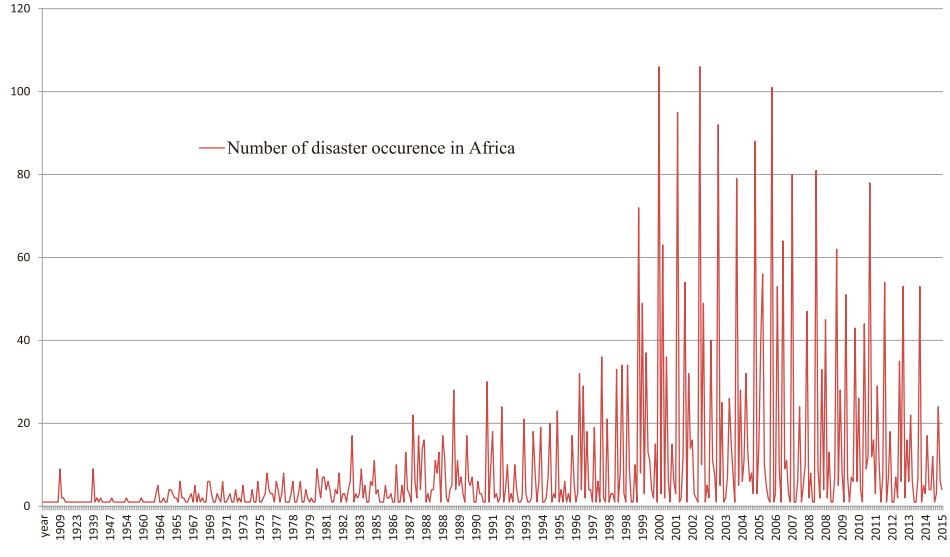

Fig. 1. Disaster occurrence in Africa
Source: Author, based on EM-DAT database

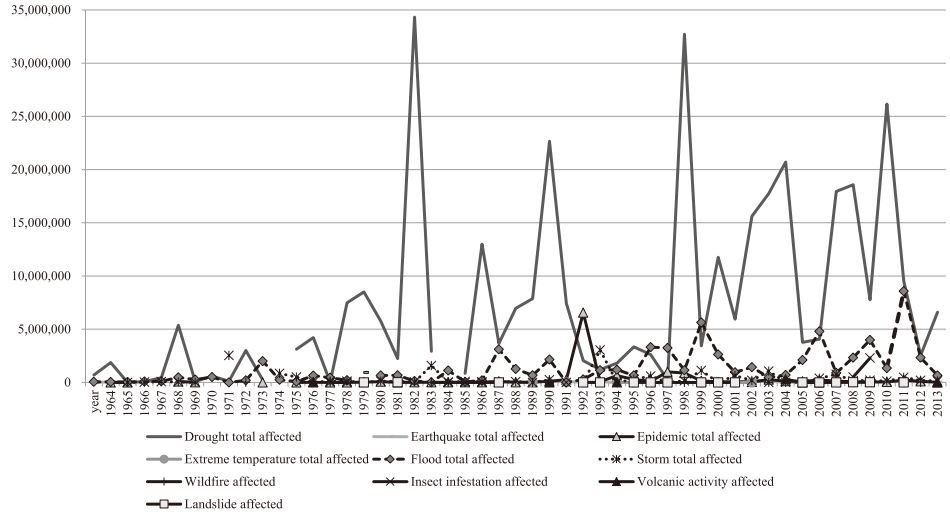

Fig. 2. Types of natural disasters in Africa (total number of affected persons)
Source: Author, based on EM-DAT database

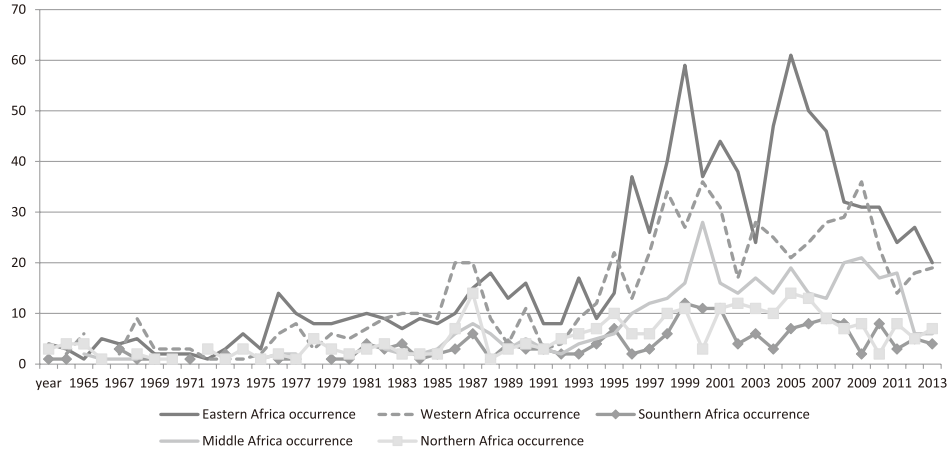

Fig. 3. Number of natural disasters by region in Africa
Source: Author, based on the EM-DAT database

fers the most, followed by Western Africa and Southern Africa. On the other hand, the situation in Northern and Middle Africa has been relatively stable, in comparison with the rest of the continent.

As Africa has experienced various different types of disasters, their impacts have been heterogeneous, not homogeneous. There are also regional variations. The following questions are raised: how do natural disasters affect agriculture, livestock, and people's living conditions in Africa? And have pastoralists also suf-

fered from other natural disasters apart from drought? These will be discussed in the next section.

II. Natural Disasters Involving Agriculture, Livestock, and Households

Little research has been carried out on the impact of climate change on agriculture and people's livelihoods. Recently, Lesk, Rowhani, and Ramankutty (2016) studied the influence of extreme weather disasters on global crop production.(1) This paper focuses only on Africa. Our study uses long-term trends to study the correlation between natural disasters and agriculture, livestock, and household expenditure, all of which are influenced by long-term trends. To analyze the correlation, this paper has used the autoregressive model, which controls for long-term trends (Beck & Katz, 2004).

We have used existing data from the World Bank (2016) and the Food and Agriculture Organization (FAO, 2016). Our macro-economic data is derived from the Africa Development Indicators available from the World Bank. For agriculture and livestock data, this paper has used the FAOSTAT, available from the FAO. Table 1 shows descriptive statistics; as the standard deviation of most variables is large, for those variables, we will take the log; in other words, most of the equations are in double-log format.

Tables 2, 3 and 4 show the regression results. As this paper used panel data, pooling and both random effect (RE) and fixed effect (FE) analysis are implemented. Of these three methods, this paper has reported the results of the FE analysis, as our test results showed that this produced the best estimates. The tests carried out were the F-test, the Hausman test, the Breusch and Pagan Lagrangian multiplier test, and the Suest test.

Table 2 presents a correlation between natural disasters and GDP per capita, household final consumption expenditure per capita growth, and the agricultural production index. Models (1) to (3) analyze the correlation between natural disasters and variables in the same year. The results of models (4) to (6) show correlation one year (lagged) after the natural disasters. As Table 2 shows, all of the lagged dependent variables became statistically significant, meaning that the long-term trend mattered and was controlled in our model. In a year when there was a natural disaster, only the agricultural production index became statistically significant; GDP per capita and household expenditure were not. However, in the year following a natural disaster, household expenditure became significant. The agricultural production index is a composite index by price and production quantity. We cannot disaggregate these factors. It is very likely that increased prices, rather than increased production caused by the natural disasters, made this variable positive and statistically significant. As for expenditure, this variable is a proxy for people's standard of living. The fact that this variable became negative after one year shows that people's standard of living decreased one year after the disaster, demonstrating that the impact of a natural disaster can last for a long time.

Table 3 shows that, as natural disasters occur, agricultural land expands, not only during the year of the natural disaster, but also in the following year. The

Table 1. Descriptive statistics of the panel data (57 Countries, 1961–2015)

Variable	Obs	Mean	Std. Dev.	Min	Max
Household final consumption expenditure per capita growth (annual %)	1,363	1.861	11.856	–45.363	219.142
GDP per capita growth (annual %)	2,164	1.384	6.671	–50.29	92.586
Agriculture production index (2004–2006=100)	2,536	71.881	28.41	14.23	192.72
Disaster occurrence	2,824	0.867	1.403	0	12
Total deaths	2,824	320.613	6,874	0	300,000
Agricultural land (% of land area)	2,567	44.146	21.498	2.456	91.16
Forest area (% of land area)	1,163	28.477	23.618	0.044	88.478
Land under cereal production (hectares)	2,450	1,580,696	2,523,846	2	19,400,000
Land under maize production (hectares)	2,352	468,564.60	822,798.10	2	6,008,470
Asses (head)	2,345	317,253	771,643	5	7,428,037
Cattle and baffaloes	2,986	3,565,560	6,386,310	0	56,700,000
Chickens (1,000 head)	2,883	16,293	27,707	7	200,000
Sheep and goat (head)	2,991	7,153,798	13,000,000	1,700	112,000,000
Horses (head)	2,064	113,937	295,361	0	2,750,000
Pigs (head)	2,641	325,418	685,080	333	7,471,730

Source: Author, based on the following data: macro-economic data from the Africa Development Indicators, World Bank; agriculture and livestock data from FAOSTAT; disaster data from EM-DAT. CRED

coefficient is very large, indicating the magnitude of this impact. These results imply that farmers expand their agricultural land to be resilient, and to cope with the natural disaster. Almost 50 thousand ha of new agricultural land is added every time a natural disaster occurs. These results are confirmed by Models 11–14, which analyzed crops. If natural forest is converted to agricultural land in order to expand it, then the forest is destroyed by the natural disaster in two ways, natural and man-made (Models 9 and 10).

How do natural disasters affect pastoralists? Table 4 examined the correlation between natural disasters and livestock (cattle, buffalo, chicken, sheep, goats, horses, and pigs). Except for pigs, all livestock become negatively statistically significant—both in the year of the disaster and during the following year. Livestock favored by pastoralists (cattle, buffalo, sheep, goats, and horses) are all hit

Table 2. Correlation between natural disasters and key variables

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables	GDP per capita growth (log)	Household final consumption expenditure per capita growth (log)	Agricultural Production Index (log)	GDP per capita growth (log)	Household final consumption expenditure per capita growth (log)	Agricultural Production Index (log)
GDP per capita growth (log) (lagged)	0.163 [5.05]***			0.164 [5.07]***		
Consumption (log) (lagged)		0.124 [2.75]***			0.123 [2.73]***	
Agricultural Production Index (log) (lagged)			0.963 [167.00]***			0.962 [166.10]***
Disaster occurrence	–0.006 [–0.22]	–0.049 [–1.56]	0.007 [4.50]***			
Disaster occurrence (lagged)				0.005 [0.21]	–0.068 [–2.25]**	0.008 [4.73]***
Constant	0.868 [15.36]***	1.189 [14.53]***	0.170 [7.22]***	0.856 [15.37]***	1.213 [14.87]***	0.174 [7.33]***
N	983	570	2483	983	570	2,483

* p<0.1, ** p<0.05, *** p<0.01
t-value in parentheses

by the direct and indirect impacts of natural disasters. The direct impact is that the natural disaster itself kills livestock. The indirect impact reflects the fact that livestock are sold and consumed when a disaster occurs, because there is a shortage of food.

If this increasing trend in natural disasters continues in Africa, then already scarce resources such as pasture and water will become even more scarce. Given this situation, what measures can the international community take to counter this situation?

A COUNTER MEASURE: BUILDING RESILIENCE BY ENHANCING SOCIAL CAPITAL

One important measure is to tackle climate change. However, it will take time to reach a global consensus, and even more time for such measures to take effect. Another important initiative is to build resilient communities. If resilient commu-

Table 3. Correlation between natural disasters and land use

	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Dependent Variables	Agricultural land (ha.)		Forest area (% of land area) (log)		Land under cereal production (ha.) (log)		Land under maize production (ha.) (log)	
Disaster occurrence (log)	493,992.920 [2.65]***		–0.034 [–4.98]***		0.146 [7.87]***		0.156 [5.20]***	
Disaster occurrence (log) (lagged)		597,036.602 [3.15]***		–0.039 [–5.36]***		0.140 [7.26]***		0.158 [5.13]***
Constant	27,447,489.5 [203.71]***	27,325,322 [200.69]***	2.666 [478.83]***	2.663 [448.31]***	13.456 [996.18]***	13.444 [968.93]***	11.745 [534.67]***	11.733 [522.16]***
N	1,093	1,060	720	713	1,084	1,052	1,056	1,024

Table 4. Correlation between natural disasters and livestock

	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Dependent Variables	Cattle and Buffaloes (head) (log)		Chicken (1,000 head) (log)		Sheep and Goat (head) (log)		Horse (head) (log)		Pig (head) (log)	
Disaster occurrence (log)	–0.013 [–2.36]**		–0.016 [–1.66]*		–0.014 [–1.73]*		–0.027 [–2.68]***		–0.012 [–1.11]	
Disaster occurrence (lagged) (log)		–0.013 [–2.36]**		–0.018 [–1.88]*		–0.017 [–2.21]**		–0.031 [–3.07]***		–0.017 [–1.57]
Constant	14.723 [631.95]***	14.738 [627.71]***	9.619 [231.17]***	9.639 [230.97]***	15.481 [455.67]***	15.517 [459.76]***	9.934 [227.20]***	9.943 [227.33]***	12.051 [260.75]***	12.089 [261.20]***
N	886	865	878	857	886	865	652	637	824	804

* p<0.1, ** p<0.05, *** p<0.01
t-value in parentheses

nities can be built, then these communities can cope with natural disasters. How can resilient communities be built in Africa, at a time of increasing natural disasters? Recent studies have explored the role of social capital as a factor in building resilience after natural disasters (Aldrich, 2012; Shimada, 2014; 2015a; 2015b; 2015c; 2015d). These studies have focused mainly on cases in developed, rather than developing countries. The literature includes very few cases studies in Africa. This section will ask whether social capital could work to enhance resilience in Africa.

I. The Roles of Social Capital in Building Resilience

There are various definitions of resilience (See Shimada, 2015a for a detailed discussion of these definitions). This paper defines resilience as follows: resilience is the capacity of a society to mitigate disasters, implement recovery activities, and prevent future disasters. Why is social capital an important factor in building resilience? There are three reasons for this. First, natural disasters destroy social capital, killing people's relatives, and forcing them to migrate and live among strangers in unfamiliar places (sometimes even falling into conflict with those strangers). This kind of situation makes life extremely difficult, especially when there is less trust in the community. Promoting social capital involves recreating social capital after a natural disaster.

Second, social capital provides "informal insurance" during a natural disaster. Households and people who have endured a natural disaster have a diverse range of different needs, depending on their specific situations. In addition, these needs have arisen either during or soon after the natural disaster. In most cases, it is difficult for local authorities to respond such diverse needs on a huge scale, especially when they all arise at almost the same time. Furthermore, it is difficult to locate vulnerable people in a stricken area. Neighbors know the people who live nearby, but outsiders do not. For this reason, the first responders after a disaster are usually neighbors, not the local government.

Third, in the recovery phase, collective action is, in many cases, required to recover social function, and social capital makes collective action possible. Social capital has, therefore, three important functions: "recreating social ties"; "acting as informal insurance"; and "promoting collective action." These make up the basic foundation of a resilient community.

II. The Project and its Area

As drought is the most frequent disaster, and East Africa has been hit the hardest, this paper chose to study a project supported by JICA on building resilience against drought in the Borena zone, in the southern part of the Oromia Region of Ethiopia (Fig. 4). This project emphasized the importance of social capital in building resilience. The JICA project was entitled, the "Rural Resilience Enhancement Project (RREP)," and was implemented from 2012–2015. There were several components of the project, including weather index insurance. This paper focused only on community-based projects, whose main objective was to

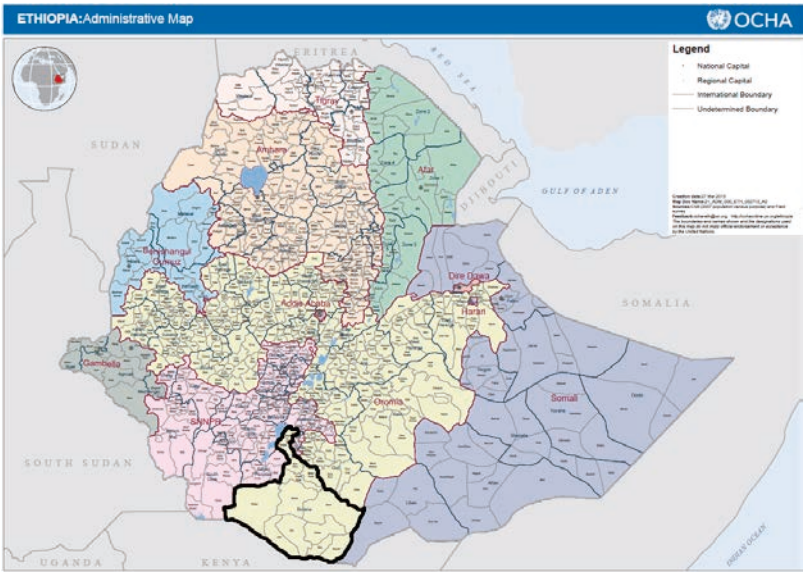

Fig. 4. Location of the Borena zone
Source: Modified by authors, based on OCHA (2013)

improve access to water during a time of drought.

The population of the Borena zone is 1,113,538, occupying around 45,435 sq. km of land (CSA, 2011; 2012). In the Borena zone, the various ethnic groups (such as Guji and Konso ethnic groups) immigrated from the highland areas and began farming in the 1970s. They were forced to start farming to cope with rising number of droughts affecting the region. In terms of climate, the Borena zone is one of the most vulnerable areas in Ethiopia; it has been severely affected by droughts in recent years (see detailed climatic data for JICA, 2016). Pasture and forage yield are greatly affected by rainfall. To cope with this, communities in Borena often manage by moving their livestock to ensure the availability of pastures and forage. However, there is never enough rain, and cultivation frequently fails. According to the Borena Zone Pastoral Development Office, during the 2010/11 droughts, around 131,000 cattle died; this was approximately 13% of the total number of cattle in the area (JICA, 2013).

The core of the JICA project in Ethiopia was social capital. Based on local community ties, the project aimed to build resilience in the face of drought, both by enhancing prevention (the power to survive during the drought), and recovery (the ability to recuperate and regain strength after the drought). For example, one of the project components was designed to improve the water-related infrastructure (e.g., ponds, rangeland). These improvements were carried out using local ties. As mentioned earlier, the project focused on social capital because it seemed the best way to foster a network of resilience. The project also adopted an approach designed to improve (and repair) the infrastructure by fostering social capital, as detailed below.

III. Project Activities

The Borena zone has a system called the Borena *Gada* system, which is guided by traditional rules and regulations, embedded in time and rituals. It has specific laws to manage resources such as pasture, water, and livestock (Hallpike, 1976; Oba, 2014).(2) As Legesse (1973: 179) pointed out, *Gada* contains the community's social memories of the past. This historical memory is crucial for communities recovering from natural disasters. In this region, people attach a particular *Gada* leader's name to every major event. This enables them to remember historical events such as natural disasters (e.g., damage to livestock, wells, or people). In other words, livestock, wells, and human beings are interlinked through social memory (Tiki et al., 2013). In his interview with a Boranan oral historian about the history of community disasters since the 1530s, Oba (2014) discussed the fact that *Gada* and its rituals can be used to reconstruct societies damaged after natural disasters. The essential characteristic of a natural disaster is that it destroys the social capital of the community and its people. For this reason, social ties, such as the Borena *Gada* system, are important in restoring the society's sense of time and history.

This project aimed to enhance community resilience by improving infrastructure; in launching the project, JICA conducted a social survey to find out the best way to implement improvements. This survey revealed that the Borana *Gada* system not only manages resources such as land, but also encourages people to help each other within the *Mona* (a unit for cattle)/*Olla* (natural settlement) by sharing food. The government administrative unit and traditional social structure (or natural village) of Borana are shown in Table 5. As this table makes clear, neither *Mona* nor *Olla* are government administrative divisions; rather, they are traditional social structures. *Mona* are cattle enclosures, and *Olla* is a village consisting of several *Mona*. The *Mona* is run by a larger family unit, which is called a *Warra*. The government administrative division is made up of *Woreda* (third-level), *PA (Peasant Association)/Kebele* (fourth-level) and *Gare* (fifth-level). *Gare* is an administrative hamlet introduced by the government, and generally made up of one or several *Ollas*. In Ethiopia, a government administrative unit and a natural village are sometimes the same thing. However, sometimes they are completely different from each other. When considering the resilience of a community, this difference needs to be taken into consideration (Tiki et al., 2013).

It has furthermore been found that, at a time of natural disasters, people share food within the *Mona* and *Olla.* If the natural disaster, such as a drought, is very severe, members of the *Mona* or *Olla*, being in the same situation, will try to get support from *Gosa* (the primary sub-clan) and from relatives outside the *PA*/*Kebele*. In other words, if the impacts of a natural disaster are huge, people draw on larger social ties within the society. As we have seen, social capital works in the Borana zone to mitigate the damage caused by natural disasters, promoting mutual help. This is why JICA has adopted a strategy that not only enhances the government administration's capacity to rebuild, but also strengthens social ties in order to build resilience in both the hard and soft infrastructure.

What exactly does the JICA project do? Most of the time, international donors

Table 5. Government administrative divisions and the traditional social structure of borana

Government Administrative Divisions (and Traditional Social Structure)	Description of the Structure
1st-level administrative division: *Region*	
2nd-level administrative division: *zone*	
3rd-level administrative division: *Woreda*	*A Woreda* is a sub-division of an Ethiopian *zone* (population around 30,000 to 100,000).
(*Gosa*)	There are 18 *Gosa*, which are sub-clans of Borena.
4th-level administrative division: *PA (Peasant Association)/Kebele*	An administrative village in a *Woreda* (district)
(*Zonii*)	There are 3 *Zonii* under *PA*.
(*Rera*)	A unit of communal pastureland: a *Zonii* is made up of between one and several *Reras*.
5th-level administrative divisions: *Gare*	An administrative hamlet introduced by the Government to settle *Olla*. A *Gare* is usually made up of between one and several *Ollas*; however, sometimes an *Olla* is bigger than a *Gare*.
(*Olla*)	A natural hamlet of the Borena tribe, usually made up of between 10 and 29 households (between 100 and 500 people) living in an *Olla*, surrounded by a fence. Traditionally, an *Olla* moves to a different *Rera* every 10–15 years.
(*Mona*)	Where villagers keep their cattle together during the night; a *Mona* is run by a larger family unit called a *Warra*.
(Individuals)	With relatives and close friends.

Source: Modified by authors, based on JICA, 2016 II-3-14

employ "cash for work" to build or repair elements of the infrastructure, such as ponds. The cash for work program provides temporary employment opportunities for unskilled workers. This project has not adopted this conventional approach. Instead, it employs an unconventional approach (which JICA calls "RREP: the Rural Resilience Enhancement Project approach"). Unlike the cash for work approach, RREP does not pay compensation; instead, it follows the decisions made by villagers using the Borena *Gada* system. This approach enabled JICA to support activities that the community would normally be able to manage, during times when there was no severe drought. The project provided only technical assistance and necessary tools (e.g., shovels, pickaxes, hand carts, axes), instead of cash.

In managing resources under the Borena *Gada* system, villagers in the Borena zone rehabilitate or construct the infrastructure elements, such as ponds and wells, when the need arises. They decide what to build by themselves, as well as when and how to do it. This illustrates one characteristic of the Borena *Gada* system:

it is governed through the active participation of members, who are accountable for their decisions. The RREP approach supports the villagers' existing ordinal communal activities rather than their temporal ones. Projects have no set targets to restrict the activities of the community. It is also up to the community to set its own targets. In other words, project operations are very flexible. If a donor pays wages, then monetary incentives could degrade (or crowd out) existing communal activities. This could result in weakening, rather than strengthening, social ties.

To motivate the villagers, the project organized 14 types of workshop and study tours for key stakeholders (in total, 3,011 persons participated), including community members and extension officers known as DAs (Development Agents). In those workshops and study tours, participants joined to analyze the present state and problems of the zone, *Woreda*, PA, *Gare*, and natural villages. The project then organized several workshops with the DA to further discuss project activities. This process was an important way to generate a common understanding among stakeholders, especially among the villagers. It also played an important role in motivating them to participate in project activities. In other words, through these discussions, participants not only recognized their issues, but also found ways to solve them in workshops.

IV. The Results of the RREP Approach

Was JICA's unconventional approach effective? This section looks into the project results, and their consequences. This project supported 734 communities (21,311 households in *Gares/Ollas* level), providing them with necessary skills and advice, as well as with 41,960 tools (e.g., shovels, pickaxes, hand carts, axes). To utilize and strengthen the existing traditional social structure, the project distributed the tools to each *Gares/Ollas*). The project explained that participants would receive no reward beyond tools and expertise. Even before the project began, almost all of the activities were being carried out without tools, which was very hard work. The villagers used to carry away all excavated soil so that they could dig deeper. The activities that communities chose and implemented included the following: rehabilitation and the construction of a pond for people (*haro*); a well for livestock (*ella*); rangeland management (building fences and rehabilitating the rangeland); infrastructure (building roads and bridges); and construction of key buildings (such as schools, health posts, and veterinary offices).

Regarding water access, the *ella* is a traditional well and the main water source for pastoralists. Whereas the *haro* dries up during the dry season, the *ella* can be used throughout the year. For this reason, people tend to use the *ella* during the dry season. According to the JICA study team, at the start of the project, 47% of *ellas* had been damaged by the flood, landslide, and sediment deposit. Improving these wells was a hugely important task, in helping communities cope with drought.

During the course of this project, 400 activities designed to improve and repair the infrastructure were continuously conducted in 32 peasant associations (PAs). How was this achieved? The key to the success of this project was the partici-

pation of the local community. Fig. 5 compares community participation before and after the project. It is easily observed that participation increased in every PA. The average of 1.7 MD (man-days) per household per month before the project (Mar. 2012–June 2013) increased to 3.0 person-days per household per month after the project (Mar. 2013–June 2016), which is equivalent to a 170% increase. In other words, people were motivated without a monetary reward.

In supporting these activities, the project distributed necessary tools not just to individuals, but also at the *Gare/Olla* level, to promote collaboration among communities. If tools are kept at the *Gare/Olla* level, villagers can use them as the need arises for different activities at different levels, involving different types of collaboration (including PA, *Rera*, and *Olla*).

Table 6 shows how users extended their participation after the project in three areas: (1) the farming and agro-pastoralist area; (2) the transition area (from pas-

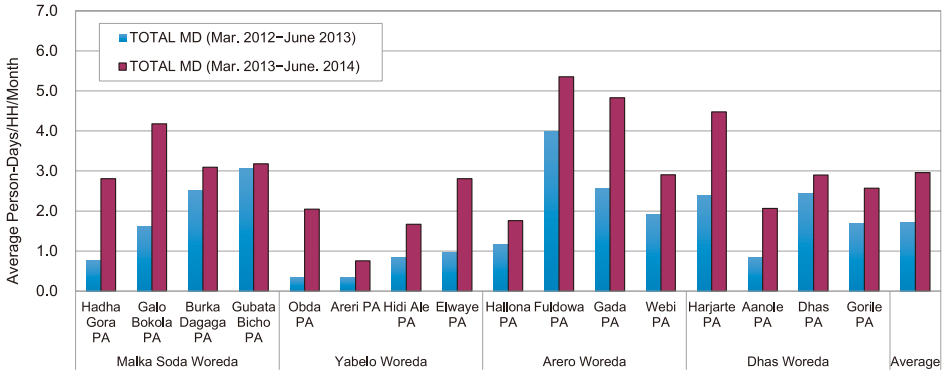

Fig. 5. Comparison of participation rates before and after the project
Source: Modified by authors, based on JICA, 2016: II-4-9

Table 6. Broadening users and participation using the RREP approach by area

Group	Community Activities		The Levels of Social Ties: *Olla / Gare*	*Ollas / Gares*	*Rera* / PA zone	PA	*Gosa*	Change in Levels	Reasons
Group I: Farmers and Agro-Pastoralists Area (Malka Soda Woreda, Bule Dambi PA and Bule Korma PA of Teltele Woreda)	1. *Haro* for Human Beings	Before	←						More community participation at PA zone both on *haro* and *kalo* to improve water and pasture shortage in the dry season. More community attention to road to connect PA zones and to create market access for their products.
		After	←				→	+3	
	2. *Kalo* (Rangeland Management)	Before	←						
		After	←			→		+2	
	6. Construction (Road / Bridge)	Before	←						
		After	←				→	+3	
Group II: Transition Area (Arero Woreda and Yabelo Woreda except Chari PA)	1. *Haro* for Human Beings	Before	←						Very serious shortage of water forced the communities to work hard on *haro* and *ella*. As *haro* becomes bigger, it tends to be get focus by *gosa* as well.
		After	←				→	+4	
	2. *Kalo* (Rangeland Management)	Before		←					
		After		←		→		+1	
	3. Borena *Ella*	Before	←						
		After	←				→	+4	
Group III: Pastoralists Area (Dillo Woreda, Dhas Woreda, Chari PA of Yabelo Woreda, and Dibe Gaya PA and Marmaro PA of Teltele Woreda)	1. *Haro* for Human Beings	Before	←						More participation, care and management of *haro* at *rera* / PA zone because it is at the center of the PA. More attention is given for *kalo* at PA-level as bush encroachment is an acute issue. As *ella* activities require very huge labor and money, it is usually done at PA- and *gosa* -level.
		After	←			→		+2	
	2. *Kalo* (Rangeland Management)	Before	←						
		After	←				→	+3	
	3. Borena *Ella*	Before				↔			
		After				↔		+1	

Source: Modified by authors, based on JICA, 2016: II-4-14

toralists to farmers); and (3) the pastoralists area. As is shown, more people are making use of the common facilities according to the increase of the participation, and improvement of the accessibility to the tools; for example, the top line shows that the *haro* (pond for people) was only used by members of the same *Olla* (natural village) and *Gare* (community) before the project. After the project, one *haro* was being used by several *Ollas* and *Gares*, and even by people at the PA level (it could be argued that the social network able to use the *haro* had been enlarged for the third level). This remarkable change can be seen both in relation to the *haro* and to the *ella* in Group II (the transition area), which enlarged for the fourth level, and was used by those in the *Gosa* level. As for *Kalo* (rangeland management), it is traditionally placed and utilized by *Rera/PA zone*, but currently been used by *Olla* because of the limitation of participation and tools. Since the participation and accessibility to the tools been improved through the project, it becomes to be used by *Rera/PA zone*. As this management is based on the traditional *gada* system, there is no conflict among users.

These changes indicate that the project enhanced the bridging type of social capital. As is well known, there are two types of social capital: "bonding" and "bridging" (Narayan, 1999). Bonding creates an inward type of network, such as a family, or a neighborhood. Bridging creates an outward type of network, and networks that link bonding networks (for instance, a network between communities).

As mentioned above, communities in the Borena zone have a culture of supporting each other when difficulties arise. It could be argued that enlarging participation and the number of users provided an opportunity for the Borena people to get to know each other in a wider context. This should increase choice and options for increasing reliance, and requesting support when difficulties arise. It can confidently be predicted that this will enhance the community's general resilience in the face of drought.

Compared to the RREP approach, one needs to be careful not to destroy or disrupt these social ties when employing people on a "cash for work" basis. The target of such "cash for work" activities (that is, what to do, when to do it, and how to do it) is generally decided and initiated by the person or organization who pays the workers. "Cash for work" also tends to provide temporary employment opportunities for particularly vulnerable people. When employing people on a "cash for work" basis, it is necessary to be aware that selecting certain people can segmentalize existing social ties, which would otherwise be effective in dealing with difficulties.

When projects introduce cash into conventional development activities such as the rehabilitation of *haros* or rangeland, they select and pay vulnerable individuals, rather than traditional groups. This leads to an exclusion of some community members from traditional development activities. Even worse, it can undermine the social ties that once existed between participants and non-participants. In addition, communities in the Borena zone traditionally have their own regulations for maintaining communal assets, such as rangeland, or ponds. The cash-for-work targeting of particular groups disrupts such traditional norms, leading to a loss of social ties in or between communities.

This result is in line with the recent findings of behavioral economics. Ariely (2010) found that people do not necessarily work harder under the market norm for cash. In fact, people tend to work harder under voluntary social norms, when no money is involved (e.g., friendship). He argues that cash, which is not always efficient and in many cases is inappropriate, brings market norms into the social norms. Market norms can ruin social norms. For instance, if one asks a volunteer: "how much do I owe you?"—this question will undermine his/her commitment to volunteering. It is possible that he or she will never volunteer again. In other words, people may work harder and more efficiently without money. A traditional culture and society like those in the Borena *Gada* system, which social norms plays a greater role, is not suitable for a "cash for work" type of intervention. In the case of the RREP approach, the project was implemented based on the Borena *Gada* system. Throughout the project, people decided their own activities by themselves, and it created sense of ownership among people in the community toward the project. Thus, once again, it is necessary to consider carefully how to best enhance the resilience of communities, not only physically, but also socially.

CONCLUSION

As we have seen in this paper, climate change disproportionately affects Africa, rapidly increasing the frequency of climatic natural disasters. In a disaster, already scarce resources such as water and land become even scarcer. As this paper saw in the case of JICA's project in Ethiopia, JICA's unconventional approach focusing on social capital is more effective than a conventional monetary incentive-based approach would have been. This project shows that people are motivated by causes based on social capital, not by monetary incentives. JICA's approach makes more significant improvements both to the physical infrastructure, and to the community's social ties.

Of course, interventions differ in accordance with their objectives, target population, and activities. However, it is important for international donors to align their projects in a way that respects and preserves the context of social ties that people have accumulated over a long history.

This paper has limitations as well. First, on the use of social capital proxy, it is standard to employ "trust game" and "dictator game," among others, which are based on the game theory, to study quality of participation objectively. This paper could not afford to use those games. For future studies, it would be advisable to collect data using those methods now available. Second, this study was made soon after the end of project, so sustainability needs to be monitored.

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and inputs. It goes without saying that any errors or inaccuracies are solely the responsibility of the authors.

NOTES

(1) They discovered the following five factors: (1) national cereal production fell by 9–10% globally, due to extreme weather (drought and extreme heat) between 1964–2007; (2) no impact was found relating to floods or extreme cold; (3) drought reduces both harvested areas and yields; (4) extreme heat decreased cereal yields; and (5) developing countries suffered greater damage than developed countries.

(2) The *Gada* is generation-grading system different from true age-grading systems, which can be found in only a few Cushitic-speaking societies of Ethiopia and northern Kenya. Under the *Gada* system, true age does not matter; what matters is a series of fixed length grades at single fixed intervals. In other words, under this system different generations of people, ranging from young boys to mature men, share the same level and come together (Hallpike, 1976; Oba, 2014).

REFERENCES

Aldrich, D.P. 2012. *Building Resilience—Social Capital in Post-disaster Recovery*. The University of Chicago Press, Chicago.

Ariely, D. 2010. *Predictably Irrational: The Hidden Forces That Shape Our Decisions*. Harper Perennial, Kindle edition.

Beck, N. & J.N. Katz 2004. Time-series-cross-section issues: dynamics 2004. *Working Paper*. The Society for Political Methodology. Online. http://polmeth.wustl.edu/media/Paper/beckkatz.pdf (Accessed January 18, 2014).

Central Statistics Agency (CSA) 2011. *Statistical Data Set*. Central Statistics Agency, Addis Ababa.

———— 2012. *Statistical Data Set*. Central Statistics Agency, Addis Ababa.

FAO 2016. *FAOSTAT*. FAO, Rome. Online. http://www.fao.org/faostat/en/ (Accessed July 14, 2016).

Hallpike, C.R. 1976. Review: The origins of the Borana *Gada* system. *Journal of the International African Institute*, 46(1): 48–56.

JICA 2016. *Final Report of the RREP (Rural Resilience Enhancement Project) in Ethiopia*. JICA, Tokyo.

———— 2013. *Completion Report of the First Year of RREP (Rural Resilience Enhancement Project) in Ethiopia* (in Japanese). JICA, Tokyo.

Legesse, A. 1973. *Gada: Three Approaches to the Study of African Society*. Free Press, New York.

Lesk, C., P. Rowhani & N. Ramankutty 2016. Influence of extreme weather disasters on global crop production. *Nature*, 529: 84–87.

Narayan, D. 1999. *Bonds and Bridges: Social Capital and Poverty*, Poverty Groups. PREM, World Bank, Washington, D.C.

Oba, G. 2014. *Climate Change Adaptation in Africa: A Historical Ecology*. Routledge, London.

OCHA 2013. *Map of Ethiopia*. Online. https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/21_ADM_000_ETH_032713_A0.pdf (Accessed September 14, 2016).

Shimada, G. 2014. A quantitative study of social capital in the tertiary sector of Kobe: Has

social capital promoted economic reconstruction since the great Hanshin Awaji earthquake? *JICA Research Institute Working Paper. No. 68*. JICA Research Institute, Tokyo.

———— 2015a. Toward community resilience: The role of social capital after disasters. In (L.H. Chandy, H. Kato & H. Kharas, eds.) *The Last Mile in Ending Extreme Poverty*, pp. 369–297. Brookings Institution Press, Washington D.C.

———— 2015b. The role of social capital after disasters: An empirical study of Japan based on time-series-cross-section (TSCS) data from 1981 to 2012. *International Journal of Disaster Risk Reduction*, 14: 388–394.

———— 2015c. What are the macroeconomic impacts of natural disasters?—The impacts of natural disasters on the growth rate of gross prefectural domestic product in Japan. In (L. Haddad, H. Kato & N. Meisel, eds.) *Growth is Dead, Long Live Growth The Quality of Economic Growth and Why it Matters*, pp. 243–264. JICA Research Institute, Tokyo.

———— 2015d. Twenty years after the great Hanshin-Awaji earthquake and the great East Japan earthquake: From the perspective of resilience and social capital. In (Waseda University "After 3.11 disaster" Editorial Committee, eds.) *After 3.11: Waseda's 92 Analysis and Suggestions* (In Japanese), pp. 376–385. Waseda University Press, Tokyo.

Tiki, W., G. Oba & T. Tved 2013. An indigenous time-related framework for reconstructing the impact of disasters on ancient water systems in southern Ethiopia, 1560–1950. *Journal of Historical Geography*, 41: 33–43.

World Bank 2016. *Africa Development Indicators*. World Bank, Washington D.C. Online. http://data.worldbank.org/ (Accessed July 14, 2016).

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Authors' Names and Addresses: Go SHIMADA, *School of International Relations, University of Shizuoka, 52-1, Yada, Suruga, Shizuoka 422-8526, JAPAN*.

E-mail: go.shimada [at] u-shizuoka-ken.ac.jp

Miki MOTOMURA, *Japan International Cooperation Agency, Nibancho Center Building 5-25, Niban-cho, Chiyoda-ku, Tokyo 102-8012, JAPAN*.

E-mail: Motomura.Miki [at] jica.go.jp