

Building Resilience of Smallholder Farmers in Responding to Drought in Indonesia

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INTRODUCTION

Performance of the food and agriculture is influenced by external shocks such as natural disasters (drought and flood), climate change, economic and financial crises, and socio-cultural disturbances. International evidence shows that both intensity and frequency of the shocks are increasing. The shocks may impact the loss or degraded productive assets, infrastructures, food and agricultural production, household income, status of food and nutrition security. Poor household, women, and children are the most vulnerable groups of population and in my experience have the highest impacts. To formulate a sound policy framework in building resilience of smallholder farmers responding to the shocks, we need a comprehensive analysis on the type of shocks, intensity and impacts to the farm household, coping strategy of the local community, and impact of the government intervention policies.

The purpose of this brief is to summarize main results of the empirical study on building resilience of smallholder farmers in responding to drought in Indonesia (Sayaka *et al.*, 2016). The objectives of the study are: (1) to analyze intensity of drought affecting agriculture, particularly food crops; (2) to analyze the impact of drought to food crops sector; (3) to measure farmer's resilience in responding to drought; (4) to analyze various government intervention to overcome drought; and (5) to propose alternative policies in overcoming drought.

CONCEPT OF RESILIENCE AND EMPIRICAL METHOD

Government interventions responding to the shocks are mostly focusing on short-term measures by providing assistance to the population segments experiencing the impacts of the shocks. The assistance usually consists of farm inputs, agricultural equipment, staple food for daily consumption, or cash income. Very little focus on policy measures and capacity building to enable farm household to anticipate, respond, and cope with the impact of the shocks which may be repeated in the future. This is the urgency of building resilience of the farm household confronting to various shocks.

More specifically, Constas *et al.* (2014) defined "resilience as the capacity that ensures adverse stressors and shocks do not have long-lasting development consequences". This concept tries to link short-term humanitarian aid activities with long-term development initiatives and make sure that the long-term development programs take into account short-term vulnerabilities (Fan *et al.*, 2014). Therefore, Fan *et al.* (2014) defined "resilience as the capacity of people, communities, countries, and global institutions to anticipate, prepare for, cope with, and recover from shocks and not only bounce back to where they were before the shocks occurred but become better-off. More specifically, the concept is illustrated in Figure 1, which is modified from DFID (2012).

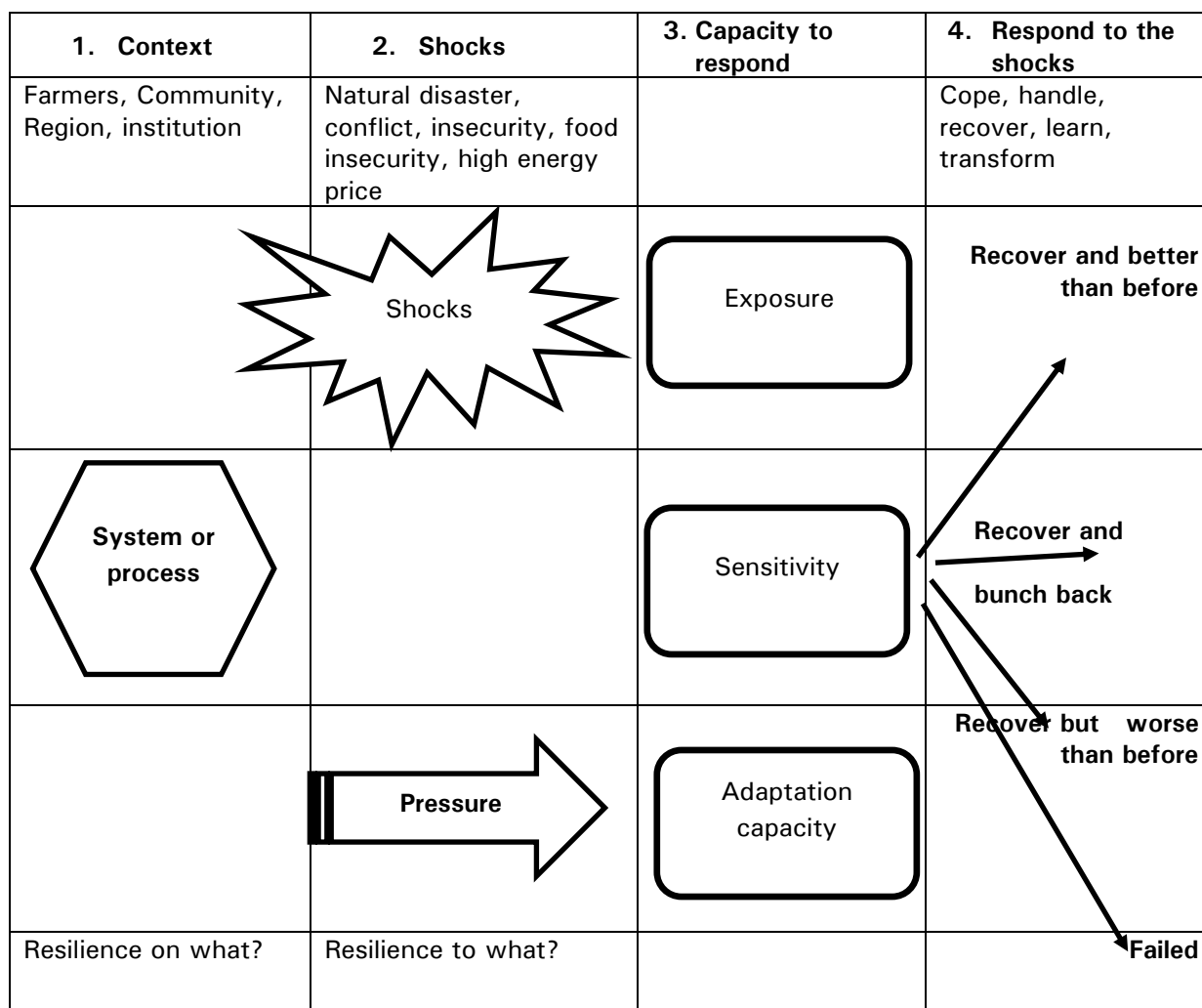


Fig.1. A Framework to analyze resilience

Source: Adapted from DFID (2012)

The study was conducted in the provinces of East Java (EJ) and West Nusa Tenggara (WNT), two major rice producing regions in the country that are seriously exposed to drought. Secondary data pertaining to drought at national and regional levels were collected from various government agencies at the national, provincial, and districts. Primary data were collected from 66 farm households and five farmers' groups in both provinces. The level of resilience was measured by constructing an index representing household asset consist of human resource, social capital, physical capital, natural capital, and financial capital (Sayaka, *et al.*, 2016).

MAIN FINDINGS OF THE STUDY

Drought intensity

As reported in Sayaka *et al.* (2016) during 2013-2015, 4,913 villages (5.98%) out of 82,190 villages in Indonesia were exposed to drought. Coverage of drought exposure were more extensive in East Java (69% out of 8,502 villages), followed by Central Java (64% out of 8,578 villages), and North Sumatera Utara (67% out of 6,104 villages).

Drought directly influences planted areas of various commodities, particularly food crops (rice, maize, and soybean) and vegetables. During 2010-2014, 179,400 hectares of rice (1.3% of total rice area) were affected by drought, of which 32,200 hectares (17.9%) were, totally damaged (Table 1). In 2015, rice area affected by drought increased by 37.8% to 572,900 hectares.

To a lesser extent drought also affected the planted area of maize and soybean. In the case of maize, planted areas exposed to drought were 31.9 thousand hectares/year and 5.3 thousand hectares (16.5%) were totally damage. During the same period, on average 5 thousand hectares of soybean crop were affected by drought, 395 hectares (7.9%) of which were totally damage.

Table 1. Planted areas of rice, maize, and soybean affected by drought, 2010-2014

| Year | Rice | | Maize | | Soybean | |
|-----------|----------|--------------|----------|--------------|----------|--------------|
| | Affected | Totally lost | Affected | Totally lost | Affected | Totally lost |
| 2010 | 96,721 | 20,856 | 82,875 | 20,724 | 5,014 | 643 |
| 2011 | 250,836 | 53,127 | 22,644 | 1,441 | 2,229 | 154 |
| 2012 | 282,795 | 47,573 | 21,686 | 1,508 | 1,546 | 130 |
| 2013 | 50,342 | 4,067 | 11,731 | 365 | 123 | 10 |
| 2014 | 216,345 | 35,423 | 20,581 | 2,306 | 4,969 | 395 |
| Rata-rata | 179,416 | 32,209 | 31,903 | 5,269 | 2,776 | 266 |

Source: Directorate of Crop Protection, Ministry of Agriculture (2015)

According to Directorate of Crop Protection, Ministry of Agriculture (2015), during 2010-2014, there were five provinces which showed the highest percentage of drought, namely Papua (22.8%), Gorontalo (16.9%), Jambi (11.6%), South-East Sulawesi (10.7%), and South Sulawesi (10.2%). There were three provinces that were not exposed to drought at all, namely Northern Kalimantan, Northern Maluku, and Riau Island. Furthermore, there were 10 provinces with drought intensity of less than 1%, among others were East Nusa Tenggara (0.13%), D.I.Yogyakarta (0.24%), and Central Kalimantan (0.33%).

Crop damage intensities due to drought may be classified into four categories, namely: (a) low intensity: up to 25% damage; (b) medium intensity: 25-50% damage; (c) high intensity: 50-80% damage; and totally lost: 80-100% damage. The crops with low intensity damage are usually still able to recover. In 2015, 80,700 hectares out of 572,900 hectares of rice crops exposed to drought were recovered.

Using different criteria, drought intensity in a region could be classified into four groups: highly secure, secure, insecure and highly insecure. According to this concept, 14 provinces are highly insecure to drought, 13 provinces are insecure, five provinces are secure, and only one province is highly secure (Table 2).

With regard to the study sites, East Java is considered as the province highly exposed to drought. During 2012-2015 on average there was 14,100 hectares of rice affected by drought, in which 1,400 hectares (10.2%) experienced total damage (Table 3). In 2015, approximately 1.35% out of 2.2 million hectares of rice area was exposed to drought. Five districts with highest percentage of drought were Bojonegoro, Lamongan, Tuban, Gresik, and Tulung Agung.

Similar to East Java, West Nusa Tenggara was among the provinces that are highly exposed to drought. In 2014, approximately 12,700 hectares of rice area exposed to drought, in which 557 hectares (4.4%) were totally damaged (Table 4). Compared to total rice areas of 433,700 hectares, the areas exposed to drought were approximately 4.4%. Three districts

showed the highest percentage of drought were Central Lombok (45.2%), Dompu (28.6%), and Bima (18.3%).

Impacts of drought to the farm income

Result of the study showed that farm income during drought season were 20-100% lower than that of the normal dry season, depending on the intensity of drought. On average income of rice farmer was lower than that of the chili farmer. Conversely, non-farm income portion of the rice farmer was higher than that of the chili farmer. This implies that rice farmer shows higher resilience when confronted with shocks compared to the chili farmer.

Table 2. Level of drought insecurity by province

| Level of security | Province |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Highly insecure | West Java, Aceh, South Sulawesi, West Nusa Tenggara, Central Java, Lampung, Banten, East Java, North Sumatra, South Sumatra, West Kalimantan, Jambi, South-East Sulawesi, and East Nusa Tenggara. |
| Insecure | South Kalimantan, West Sumatra, Riau, Central Kalimantan, DIY, Gorontalo, Central Sulawesi, East Kalimantan, North Sulawesi, Bali, West Sulawesi, Maluku, and Papua. |
| Secure | Bangka-Belitung Island, West Papua, DKI Jakarta, and North Maluku. |
| Highly secure | Riau Island |

Source: Directorate of Crop Protection, Ministry of Agriculture (2015)

Table 3. Planted area affected by drought in East Java, 2012-2015

| Year | Rice | | Maize | | Soybean | |
|---------|----------|--------------|----------|--------------|----------|--------------|
| | Affected | Totally Lost | Affected | Totally Lost | Affected | Totally Lost |
| 2012 | 16,943 | 1,583 | 1,014 | 107 | 125 | 0 |
| 2013 | 8,701 | 1,776 | 1,247 | 209 | 0 | 0 |
| 2014 | 1,695 | 272 | 693 | 156 | 60 | 0 |
| 2015 | 28,953 | 2,120 | 2,390 | 195 | 263 | 35 |
| Average | 14,073 | 1,438 | 1,336 | 167 | 112 | 9 |

Source: Office of Agriculture Service, East Java (2015)

Farmers' resilience responding to drought

Following Ellis (1999), the degree of resilience is measured by constructing an index representing five types of asset owned by farm household which consist of human resource, social capital, natural capital, physical capital, and financial resources. The analysis based on farm level data in two districts (Kediri and Lamongan) in East Java and two districts in West Nusa Tenggara (Central Lombok and East Lombok).

Based on this framework, chili farmers in East Lombok showed the highest resilience index (67.49), whereas the lowest index was observed for rice farmers in Lamongan district (32.23). The resilience index for the other two districts was 62.86 for chili farmer in Kediri district and 59.28 for rice farmer in Central Lombok district. Comparison of the resilience index in four districts indicates that chili farmers were more resilience to drought compared

the rice farmers. Higher financial resources of the chili farmers enabled them to access more water despite expensive cost of getting the water.

Farmers' effort responding to drought

Some farmers, individually or in group, had adjusted their farming practices to reduce harvest loss. Some of them plant drought resistant crops, delayed planting season until early wet season. In the case of severe and long duration drought, most farmers just left their land fallowed. To compensate for the loss of farm income they work in the non-farm sectors as a laborer or informal business sector such as home industry or petty trade.

Table 4. Planted area of rice affected by drought in West Nusa Tenggara, 2014

| District | Affected (ha) | Totally lost (ha) | Affected (%) | Totally lost (%) |
|-----------------|---------------|-------------------|--------------|------------------|
| West Lombok | 112 | 0 | 0.88 | 0 |
| Central Lombok | 5,746 | 0 | 45.20 | 0 |
| East Lombok | 14 | 0 | 0.11 | 0 |
| Sumbawa | 879 | 193 | 6.92 | 34.65 |
| Dompu | 3,629 | 0 | 28.55 | 0 |
| Bima | 2,331 | 364 | 18.34 | 65.35 |
| West Sumbawa | 0 | 0 | 0 | 0 |
| Northern Lombok | 0 | 0 | 0 | 0 |
| Mataram City | 0 | 0 | 0 | 0 |
| Bima City | 0 | 0 | 0 | 0 |
| Total | 12,711 | 557 | 100 | 100 |

Source: Directorate of Crop Protection, Ministry of Agriculture (2015)

Performance and impact of government policies

On legislation framework the government has launched the Law No.24 in 2007 on coping with disaster, but this framework does not specifically address policy on coping with agricultural disaster. Specific to agriculture, Regulation of the Minister of Agriculture No. 50 in 2007 provides reference on the program to cope with the impacts of agricultural disaster. According to this regulation, coping with the impacts of agricultural disaster are implemented by means of rehabilitation, reconstruction, financing, and management of disaster assistance.

Based on this legislation framework, most common government interventions responding to drought were short-term in nature. For instance, provincial government provided assistance in the form of shallow water pump (15 meters deep) to the targeted farmers' group. Only few farmers' group received this kind of support and the pump was not effective as well due to very deep ground water level or very distance water source during drought. Another program introduced by Directorate General of Horticulture, Ministry of Agriculture, promoted chili farm during dry season which is considered more adapted to drought compared to rice. However, the impact of this program was very limited due to limited area coverage and the introduced technology did not perform well.

The program introduced by the Agency for Meteorology and Geophysics was more in line with the effort to build resilience. The agency implemented farmers' field school on climate to improve understanding and awareness among farmers on the impact of climate change. Through this program the farmers were expected to be able to gradually adapt to the extreme climate, including drought. In addition, the agency also regularly broadcast rainfall data forecast to better anticipate the level of water supply during whole cycle of cropping season, particularly for rainfed rice.

Based on the above-mentioned information, there has been no systematic program related to conservation of water resources in the upstream segment of the river basin. In the long-term confronted with the increasing demand for water in agriculture, industry, residential and other uses, systematic effort must be implemented to explore new sources of water and conserve the existing water sources.

Future policy framework

Based on the available resilience concept and empirical evidence, Sayaka *et al.* (2016) propose more comprehensive policy framework considering both short-term and long-term perspectives as described in the following parts of the brief.

Long-term:

- 1) land conservation in the upper basin to maintain and increase water supply;
- 2) to increase water availability, particularly in the area prone to drought by means of constructing reservoirs, building new irrigation canals, and rehabilitating the existing canals;
- 3) developing market based risk management such as crop insurance;
- 4) increase capacity, effectiveness, and disseminate the early warning system to enable farmers better anticipate drought;
- 5) promote agricultural diversification and income source diversification in both off-farm and non-farm sectors;
- 6) build farmers capacity to comprehend, anticipate, and to respond to drought, for instance through farmers field school on climate and application of technology to cope with drought.

Short-term:

- 1) facilitate more appropriate farm equipment, particularly water pump with medium deep capacity to enable farmers to utilize the available water sources;
- 2) provide assistance on farm supplies (seeds, fertilizers) to enable affected farmers to replant their crops in the same season or in the following season;
- 3) develop cash for work program, particularly focused on rehabilitating public infrastructures such as rural road and irrigation canals;
- 4) cash transfer, targeted directly to farmers experiencing total lost of their crops.

CONCLUSION

Drought is one of the natural disasters affecting agriculture, particularly food crops. The impact of drought is not only on the loss of food production but also source of income, particularly for smallholder farmers. Local communities respond to drought by adjusting crop choice, and planting season. Current government interventions reinforce these initiatives mainly by providing direct assistance to the affected farmers, which in the short-term may help the farmers from experiencing greater lost.

In the long-term the resilience lens must be implemented which focus not only on short-term interventions but also to more systematic long-term policy and capacity building to enable farmers to understand, anticipate, respond to, and cope with the repeated natural disaster events such as drought. Therefore, government policy should be formulated in line with this newly developed concept. This approach not only reduces the risk of natural disaster but also reduces the unnecessary and more costly government interventions because local communities may be able to cope with the problem by their own initiatives.

Furthermore, this framework should be incorporated as an integral part of more comprehensive food production policy.

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