Self-organization and crop insurance to enhance livelihood resilience: A case of rice farmers in Cirebon Regency, Indonesia

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Abstract

Climate variability and change that affects extreme weather events has resulted in long dry season and drought in Indonesia. Farmers become a vulnerable group since drought has damaged rice fields, making them lose their income. Therefore, rice farmers' livelihood resilience needs to be enhanced in order to cope with those impacts. Crop insurance as financial capital could contribute to famers' income stability against drought. Moreover, self-organization helps the farmers understand agricultural risks and increase their adaptive capacity in times of extreme weather events. Accordingly, this paper investigates the impact of drought on rice production and farmers' income, by analyzing the benefits of crop insurance and the support of self-organization to enhance livelihood resilience with a case of Kapetakan Sub-district in Cirebon Regency, Indonesia. The study employed mixed-methods by combining qualitative and quantitative data based on official data from government, in-depth interview, and literature review. The study reveals drought, for instance El Nino's drought in 2015, has resulted in lower rice production and farmers' income compared to 2014. Crop insurance could increase farmers' income as compensation due to drought, yet, there have been many farmers who do not have crop insurance. Moreover, self-organization related to the network capacity of farmers tends to be limited within farmer groups at village level. The government or other stakeholders should assist in expanding the network of farmers to enable them to interact and learn with other organizations outside the region. Thus, knowledge and skills of farmers which include benefits of crop insurance and how to manage it will increase by being able to choose adaptation option. This condition will contribute to the enhancement of farmers' livelihood resilience to recover from extreme weather events.

Keywords: climate change, drought, self-organization, crop insurance, livelihood resilience

1. Introduction

Climate change causes changes to the hydrological cycle and affects the occurrence of extreme weather that results in natural disasters (IPCC, 2012). In Indonesia, more than 78% of natural disasters in 2005-2015 were categorized as climate-related disasters, including drought (BNPB, 2016a). Drought also occurrs because of El Nino, a short-term climate variability that characterized by rising sea surface temperatures along the equatorial Pacific Ocean and its impact affects global circulations patterns (UNDP Indonesia, 2007; Bhuvaneswari et al., 2013; Capa-Morocho et al., 2014). Farmland that is damaged by drought can not be planted with food crops. In Indonesia, many agricultural areas are susceptible and have crop failure due to drought, especially rice crops (BAPPENAS, 2010, Irawan, 2013). For instance, the impact of El Nino on rice crops has caused the average harvested area to decrease by 3.83% and production decrease by 3.99% (Setiyanto dan Irawan, 2013).

Extreme weather events have a negative impact on agricultural productivity and rural livelihoods (Shah et al. 2013; Abid et al., 2016a; Khayyati and Aazami, 2016; Khanal et al.,

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2018). The climate change vulnerability at agricultural level ultimately resulting loss of farmers' income (Abid et al., 2016a; Pratiwi et al., 2016; Rahut and Ali, 2017). The main challenge is that farmers have low adaptive capacity (Abid et al., 2016b; Tripathi and Mishra, 2017), because most of them are small and marginal farmers (Tripathi and Mishra, 2017).

Cirebon Regency is one of the rice barns in West Java Province, thus this region still depends on an agricultural economy. However, climate change impacts could influence the long dry season and resulting in drought events. According to Pratiwi et al. (2016), agricultural land in Cirebon Regency is threatened by drought, which could affect up to 185,075 farmers, including Kapetakan Sub-district. The livelihoods in Kapetakan depend heavily on agricultural land, so any long dry seasons will disrupt the rice planting season and reduce farmers' income. Therefore, rice farmers in this area are a vulnerable group to extreme weather events.

In order to reduce vulnerability of farmers' livelihood, increasing resilience becomes indispensable. Livelihood resilience is a factor and process that keeps livelihood functioning despite changes and increases adaptive capacity to cope with stresses and shocks (Speranza et al., 2014). Furthermore, Speranza et al. (2014) argue that resilience can be maintained if buffer capacity (livelihood assets) is present and does not decrease, self-organization exists and is promoted, and learning takes place. Unfortunately, some farmers in Indonesia do not have sufficient capacity to respond to the impact of drought that causes crop failure and loss of income.

Financial capital becomes one of the buffer capacity that can strengthen resilience, but not easily owned by smallholder farmers. Financial capital is the financial resources that people use to achieve their livelihood goals, including income, savings and access to credit (DFID, 1999; Brocklesby dan Fisher, 2003; Elasha et al., 2005; Reed et al., 2013; Speranza et al., 2014; Keshavarz et al., 2017). Elasha et al. (2005) argue that income stability becomes a reflection to assess community resilience. Regarding to that, crop insurance can be one of the financial capitals to secure the income stability of farmers from extreme weather events. Lunt et al. (2016) argue that crop insurance has a strong position to expand recognition of agricultural climate risks to communities and offer tools to take into account more systematic risks and uncertainties.

Most countries recognize that crop insurance is an important instrument to help farmers manage the financial impact of production risks, mainly because of unpredictable weather, pests and diseases (Dick and Wang, 2010). Application of crop insurance has provided benefits for farmers. In China, crop insurance is considered to have improved the welfare of farmers (Ke et al., 2015). Crop insurance in Philippines also greatly helps vulnerable farmers to reduce financial risk in extreme weather events (Pulhin et al, 2017). In addition, farmers in India argue that agricultural insurance has a positive impact on their livelihoods and is helpful for their recovery from crop losses (Solomon et al., 2017). Furthermore, farmers in Japan also found that crop insurance was useful and beneficial because they received compensation for the recovery from disaster (Nakamura et al., 2017).

Indeed, crop insurance is an important risk mitigation mechanism in agriculture, but its role as revenue security has not been realized by smallholder farmers (Farzaneh et al., 2017). Based on Kapetakan Sub-district officer's explanation, about 60% rice farmers have joined crop insurance in 2017. In order to ensure the benefits of crop insurance on farmers' income security, the condition of self-organization is crucial. Milestad (2003) defines self-organization in agricultural system as the ability of agricultural groups to form flexible

networks and to engage with social, economic and environmental organizations on a scale other than local. Self-organization tends to be robust and can resist disturbance due to its distributed character (Heylighen, 2001), in addition to a flexible and large network. Euler and Heldt (2018) argue that the high degree of self-organization can lead to increased alternative perspectives in dealing with disturbance. Furthermore, farmers with larger networks have more opportunities to assess information and exchange knowledge so that their ability can be more effective (Utaranakorn and Yasunobu, 2016). Hence, strengthening self-organization contributes to improved farmers' knowledge of crop insurance and how to manage it in dealing with drought impacts.

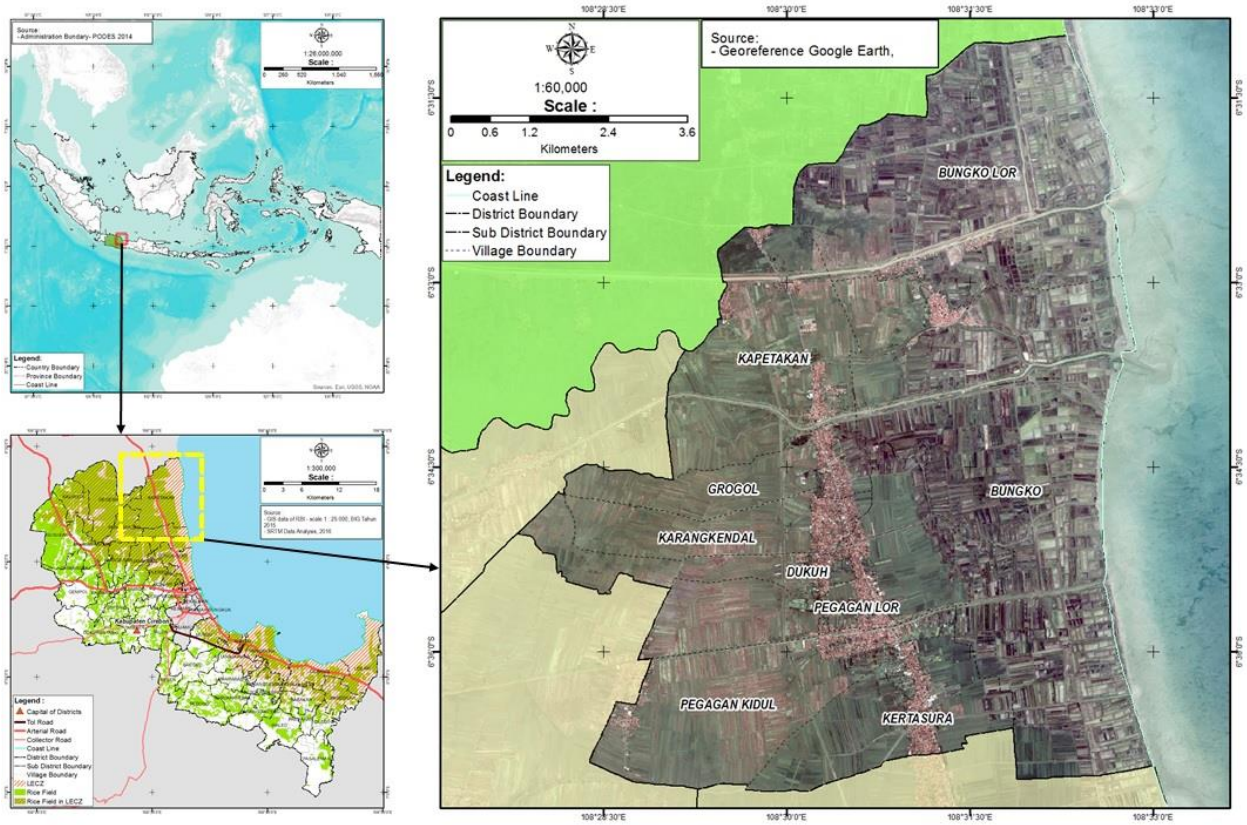
This paper aims to (i) investigate the impact of drought on rice production and farmers' income; (ii) analyze the benefits of crop insurance to enhance livelihood resilience; and (iii) analyze the support of self-organization to enhance livelihood resilience. Cirebon Regency is chosen as the study area because this region has a role as the rice granary of West Java Province but is very vulnerable to extreme weather events, including drought.

2. Method

2.1 The Study Area

This study was conducted in coastal area of Cirebon Regency located in north coast of West Java Province. The coastal area of Cirebon is 50,720 ha (51.2% of the total area of Cirebon) with a rice field area of approximately 32,200 ha (63.5% of the area of coastal area in Cirebon) (Fig. 1). Zikra et al. (2015) argue that the impacts of climate change have a tendency to exacerbate many of the existing problems on the coast. Based on Vulnerability Index Data Information System, the drought risk of Cirebon is at moderate level (KLHK, 2017). Drought has threatened coastal areas of Cirebon and reduced rice production.

Kapetakan Sub-district that located in the coastal area is one of the agriculture contributors to Cirebon nonetheless is included as a drought-affected area. In this study area, there are 3,000 ha of rice fields (50.2% of the total area of Kapetakan) and more than 7,500 farm households (50% of the total of households in Kapetakan) (BPS, 2014). Agricultural activities in this area become the main source of community livelihood. Therefore, the rice farmers' livelihood is vulnerable to drought.



Fg. 1 Orientation of Study Area in Cirebon Regency
Source: modified from BIG (2016)

2.2 Research Method

2.2.1 Data Collection

Mixed-methods by combining qualitative and quantitative data was employed in this study. The data used were official data released by the government as well as supported by literature review as secondary data, and in-depth interviews for primary data. The related variables as a scope of this study to analyze the livelihood of farmers to drought have been developed (Table 1).

Table 1. Research Variables

Variable	Operational Definition of Variables	Data Sources
Rainfall (mm)	The amount of rainwater that falls on the soil surface for a certain period	Meteorological, Climatological, and Geophysical Agency
Rice production (ton)	The amount of rice harvest in the form of dry grain harvest	Statistical Agency
Frequency of harvest	The amount of rice harvest in one year	Interview
Farmers' income	The amount of money generated from agriculture	Statistical Agency and Village Offices in Kapetakan Sub-district

Variable	Operational Definition of Variables	Data Sources
Crop insurance	The number of farmers that join crop insurance	Village Offices in Kapetakan Sub-district
Self-organization	Networking ability of farmers and related stakeholders to be able to determine the option of anticipatory and proactive actions in addressing the impacts of extreme weather event	Interview

The systematic literature review was conducted through reviewing research publications related to livelihood resilience as the basic concept of this study, specifically about crop insurance and self-organization as the scope of this study. The literature review results were further utilized in the analysis for result and discussion in this paper.

Additionally, in-depth interviews were conducted through face-to-face interviews. Informants for interview targets were key stakeholders related to the issues of climate change and its impacts on agriculture. The key stakeholders consisted of (i) local government agencies, including the Agricultural Agency and Kapetakan Sub-district Office; and (ii) local community leaders such as Chairman of the Joint Farmer Group (GAPOKTAN) and agricultural extension workers. The information gathered from each key stakeholder can be seen on the Table 2.

Table 2. Type of Information for Interview

No.	Key Informants	Type of Information
1.	Local government agencies	
1.a	Agricultural Agency	Drought threat for rice farmers, agricultural programs related to livelihood adaptation including crop insurance mechanism.
1.b	Kapetakan Sub-district Office	Drought threat for rice farmers as well as how to respond to those impacts, crop insurance implementation, network development to rice farmers.
2.	Local community leaders	
2.a	Chairman of the Joint Farmer Group (GAPOKTAN)	Rice farmers' respond to crop failure because of drought in order to increase their income, constraint of crop insurance ownership for rice farmers, benefit of farmers join in farmer groups.
2.b	Agricultural extension worker	Benefit of agricultural extension for rice farmers.

2.2.2 Data Analysis

Quantitative method used was descriptive statistics among others to analyze the impact of drought on rice production and farmers' income. Most data for this analysis are secondary data, such as rainfall and rice production, which were then processed with a certain calculation to produce a value expressed with a mean or percentage. Results of data processing are presented in the form of graphs or diagrams. Quantitative method was also

used to assess the intensity of drought under rainfall conditions. Based on Meteorological, Climatological, and Geophysical Agency/ BMKG (2015), the first indication to know the occurrence of drought can be done through the calculation of meteorological drought rate with the intensity of drought (Table 3).

Table 3. Classification of drought intensity

Percentage from normal rainfall condition	Classification
70-85%	Dry
50-70%	Very dry
< 50%	Extremely dry

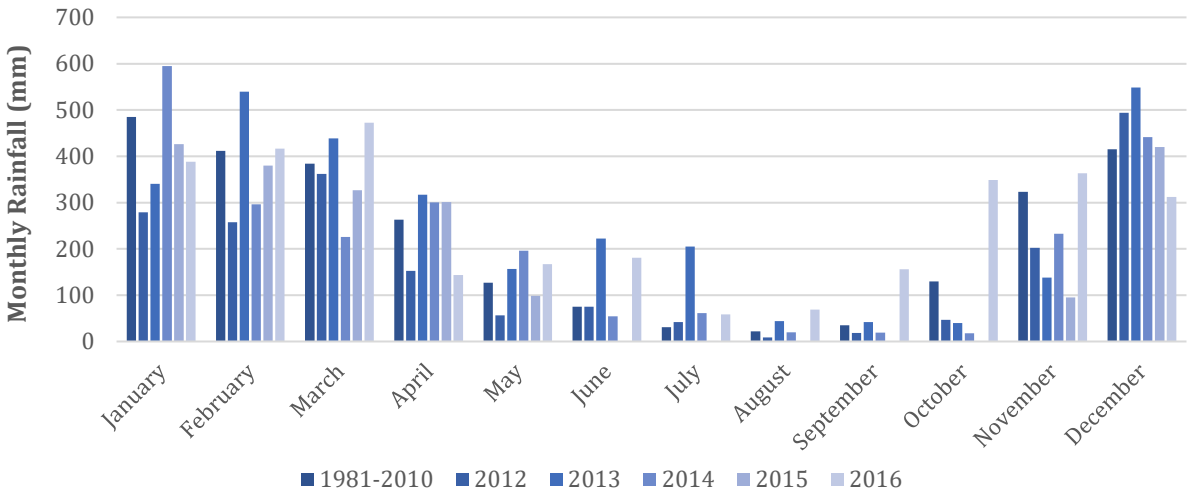
Source: Meteorological, Climatological, and Geophysical Agency (2015)

Meanwhile, qualitative method was used to describe systematically the findings of this study through interpretation of the quantitative data. In addition, this method was also utilized to explore the perception of key stakeholders on management and benefits of crop insurance in order to cope with loss of farmers' income. Obtaining information related to self-organization was also implicitly conducted during the interview. Furthermore, all the interview results were systematically described and compared with previous research derived from the literature review to formulate how self-organization can enhance livelihood resilience through joining crop insurance to reduce financial risk due to extreme weather events. The existence of self-organization could be one method for community engagement to cope with climate change impact.

3. Results and Discussion

3.1 Drought impact on farmers' livelihood

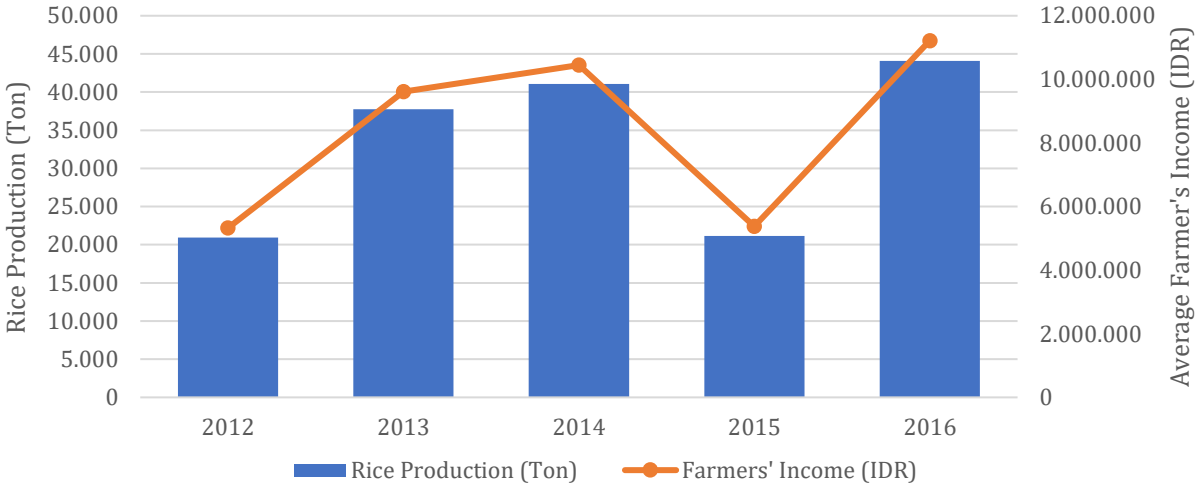
Cirebon has experienced drought among others in 2012 and 2015 (BNPB, 2016b). Drought events can be observed from rainfall conditions that show a decrease (Fg. 2). In 2012, drought occurred in August-October with extremely dry intensity of 30-60% from baseline conditions of 1980-2010. While in 2015, climate anomalies happened from June to November as a result of El Nino. The drought intensity was extremely dry with 0-3.2% in June to October due to no rain and 29.4% on November compared to baseline conditions of 1980-2010. Hereafter, rainfall increased due to La Nina that led to longer rainy season and higher rainfall in 2016.



Fg. 2 Monthly rainfall in Cirebon Regency
Source: Meteorological, Climatological, and Geophysical Agency

The Agricultural Agency of Cirebon explained that drought resulted in approximately 15,000 ha of rice fields (26,7% of the total rice fields) could not be planted due to lack of water supply and implicated crop failure around 7,500 ha of rice fields (13,4% of the total rice fields) (Kabar Cirebon, 2015). This condition among others occurred in Kapetakan. Fg. 3 shows that rice production in Kapetakan decreased about 48% in 2015 compared to 2014. Farmers experienced only one harvest period in March due to El Nino drought in the second cultivation period and significantly reduced their incomes (Pratiwi et al., 2017). At that time, irrigated rice fields in coastal areas did not acquire flow of water from upstream areas. Related to that, Abid et al. (2016a) argue that extreme weather events have a negative effect on agricultural production and rural livelihoods.

Based on interview results with several Chairman of GAPOKTAN, the average income of farmers in Kapetakan is approximately IDR 4.2 million for each cultivation period or IDR 8,4 million per year. However, drought has implications for the loss of farmers' income, whereas farmers still need to cover for their living cost until the next cultivation. Fg. 3 shows that farmers' income decreased almost 50% in 2015 compared to 2014 due to drought. Farmers in Kapetakan depend heavily on agriculture to earn their living. In this regard, Abid et al. (2016a) argue that these conditions may limit the ability of farmers to adapt to climate change. According to Pratiwi et al. (2017), farmers in Kapetakan were only able to find alternative jobs in informal sector to increase their income because it does not require special skills nor higher education. Moreover, crop farmers in Indonesia generally borrow money from middlemen or moneylenders due to crop failure as an impact of extreme weather events (Boer, 2012). According to Shah et al. (2013), extreme weather events can have direct implications for creating unsustainable livelihoods and/or reducing the livelihood options of rural poor.



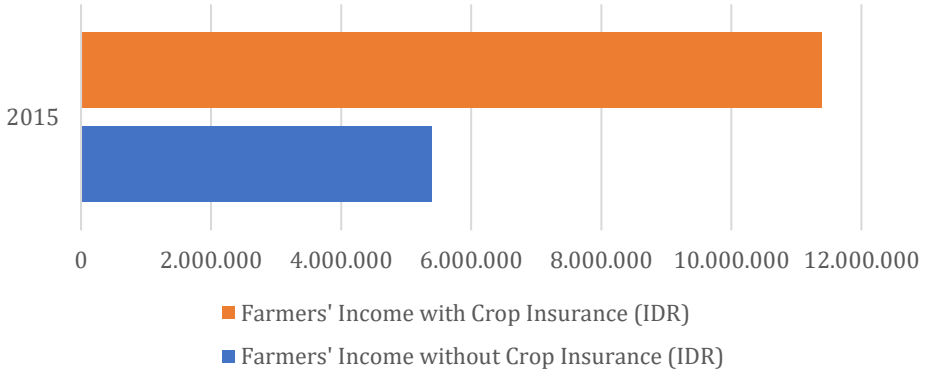
Fg. 3 Annual rice production and farmers' income
Source: modified from Statistical Agency/ BPS of Cirebon Regency (2013 and 2017) and interview results

3.2 Benefits of crop insurance to enhance livelihood resilience

In Indonesia, agricultural insurance program is a mandate from Law No. 19/2013 and has been regulated in Regulation of Minister of Agriculture No. 40/Permentan/SR.230/7/2015. Based on this regulation, agricultural insurance, consisting of crop insurance and livestock insurance, is undertaken to protect farmers from loss of harvest due to natural disasters, attack of plant pest organisms, infectious animal disease epidemic, climate change impacts, and/or other types of risks. Therefore, crop insurance provides guarantees for crop damage due to drought which reduces the level of crop production. Farzaneh et al. (2017) also argue that crop insurance compensates farmers in case of crop failure even if all precautions have been taken by them.

The government also regulates the insurance premium that should be paid by farmers, which is IDR 36,000 per hectare per cultivation period. This premium has already been subsidized by the government as much as IDR 144,000 per hectare per cultivation period. Hence the total of insurance premium is IDR 180,000 calculated from the cost of production for a one-time cultivation. Every member of farmer groups could obtain the premium subsidies. The crop insurance owners will receive compensation with amount of IDR 6 million per hectare per cultivation period in case of crop damage or crop failure.

Fg. 4 illustrates the assumption of Kapetakan farmers' incomes with crop insurance higher than without crop insurance in case of drought. The calculation of potential income obtained from the average income of farmers and crop insurance claim. The crop insurance claim could support farmers to meet their life necessities during drought as well as crop production capital for next cultivation. Dick and Wang (2010) also find that crop insurance can help farmers manage their financial losses from production risks. Thus, the crop insurance is very useful for farmers to cope with the impact of extreme weather events that cannot be predicted.



Fg. 4 Potential income of farmers in drought event, 2015

The farmers' income is actually enough to pay insurance premium since the insurance premium is quite cheap, only about IDR 36,000 per hectare per cultivation period (or 20% of total insurance premiums). However, there are still few farmers who have crop insurance during the El Nino's drought in 2015 as well as currently because the socialization of crop insurance only started from 2016. The Chairman of GAPOKTAN and agricultural extension worker argue that most farmers have not received agricultural insurance information, and farmers also think that it is not worth having insurance because the quality of rice production was not good and they only manage less than one hectare of rice fields. Farzaneh et al. (2017) reveal that farmers often view insurance as an unnecessary cost instead of an investment to reduce future risks, especially given the size of their small holdings of rice fields even though crop insurance can help farmers to stabilize their income (Marza et al., 2015). Sihem (2017) suggests that economic and institutional policies should be integrated with the development of crop insurance, such as agricultural development and crop management policies. For instance, crop insurance owners are encouraged to attempt new cultivation technologies, such as utilizing more dry and higher yielding varieties for farming to ensure the survival of crop although the price is higher (Boer, 2012).

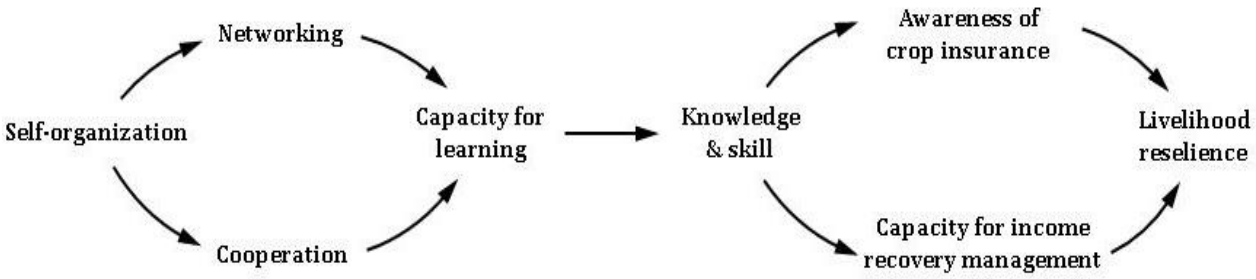
3.3 Self-organization to enhance livelihood resilience

Government has a great role in regulating the development of agricultural system in Indonesia. In terms of agricultural system, crop insurance program contributes to strengthen national food security. Generally, self-organization in agricultural system has been created mandatory and bureaucratically. Besides the government at national to local level, agricultural insurance mechanism also involves some parties, including community and private sector to approach utilization of crop insurance.

Socialization of crop insurance for farmers still continues with the expectation that all farmers have this insurance. Increased awareness about crop insurance should encourage self-organization in each farmer group. In Kapetakan, it is found that farmer groups only interact and cooperate with other farmer groups within one organization called GAPOKTAN at the village level. Through GAPOKTAN, each farmer group can access various agricultural needs, such as seeds, fertilizers, agricultural tools and machinery, market price information, agribusiness training, and also agricultural insurance. While farmers have received a lot of information from the organization, social interactions in this small scope can be categorized

as homogeneous communities that tend to have the same perception and knowledge related to agricultural practices.

The government or other stakeholders need to encourage farmer groups to expand their networks to other areas to improve the learning capacity of agricultural practices, including ownership of crop insurance in the face of extreme weather events. Utaranakorn and Yasunobu (2016) argue that the improvement of farmers' managerial skills can be gained from the learning and sharing of information or ideas among farmers from other groups and/or communities in the wider network. Accordingly, the various benefits of agricultural insurance ownership can be understood from interaction or cooperation within these networks. In addition, the owners of crop insurance can also gain an understanding of financial management in utilizing the insurance claims for household necessities, farm capital, savings, and others. Thus, farmers will have a self-organized manner in managing their finances during extreme weather events. Euler and Heldt (2018) found that self-organization can make individuals have the knowledge, ability, and more competence to create their own living conditions, in this case is farmer financial management.



Fg. 5 Self-organization to encourage the role of crop insurance towards farmers' livelihood resilience

4. Conclusion

Climate variability and change that affect extreme weather events have resulted in more frequent droughts in Indonesia, including Cirebon Regency. The study reveals that El Nino's drought in 2015 reduced rice production and farmers' income more significantly compared to 2014. Based on crop insurance program of the Ministry of Agriculture, farmers with crop insurance are entitled to obtain compensation of IDR 6 million per hectare in case of crop failure for each cultivation period by paying an insurance premium of IDR 36,000 per hectare per cultivation period. In this case, crop insurance can serve as a financial capital that contributes to enhance livelihood resilience as it can stabilize farmers' income during extreme weather events. However, many farmers do not have crop insurance and they can only find other jobs in informal sector or debt during drought to meet their life necessities and next farm production needs. Therefore, they need to gain awareness of the vulnerability and risks of crops to extreme weather events and the benefits of crop insurance.

The crop insurance is important to secure farmers' income so that self-organization needs to be strengthened. Self-organization in crop insurance management that involves government, private and community has been formed mandatorily and bureaucratically by the central government. However, this study finds that self-organization related to the network capacity of farmers needs to be encouraged in order to interact, cooperate, and exchange learning with other organizations outside the region. Thus, the knowledge and skills of farmers on the benefits of crop insurance and how to manage their finances will

increase. This condition will contribute to enhance livelihood resilience of farmers to recover from extreme weather events.

Related to crop insurance development, the government needs to develop index-based climate insurance in order to better protect the livelihood of farmers. Hence, insurance claims will be assessed based on climate index instead of crop failure. It might increase the courage of farmers to use climate-resilient technologies for agricultural since the risk of crops has been covered by insurance.

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