Farmers' resilience towards land use change case study in Padang City, West Sumatra, Indonesia)

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Abstract. Farmers in Padang City, West Sumatra Province, Indonesia face a dilemma of choices to change in land use due to urban development and population growth in the city. However, some farmers still survive and keep their land for agricultural farming purposes. This research aims to analyze farmers' resilience factors for coping and adaptation towards land us change. This study used a survey method and selected; 3 sub-districts in Padang Cityhave the largest irrigated agriculture land area and have a tendency of high land conversion. One hundred and two rice farmers were selected as respondents with a criterion of having land close to the main road access, arterial roads, and residential roads and in an area with a high land convention tendency. Primary data were collected using a structured questionnaire, which then analyzed using descriptive qualitative analysis. The results show that internal factors and external factorsinternal factors influenced farmers' resilience and external factors influenced farmers' resilience, internal factors and external factors influenced farmers' re-silience,internal factors, and external factors influenced farmers' resilience. Internal factors include land ownership, farm income, farming experience, and the nature of farming activity where farming is a transfer of strong knowledge and understanding between parents and their children in farming, thus strengthening farmers to continue their farming. The external factor that affects farmers to survive is the ownership system of communal land (*ulayat land)* as a Minangkabau cultural heritage. This forces farmers to keep working on their land. By considering these factors, the government policy should be concerned about the social system in Minangkabau society as a baseline policy to maintain agricultural land.

Keywords: Resilience, Land use change, West Sumatra

1. Introduction

The land is a critical asset fundamental to all human activity, and, at a global scale, net sequestration by the land-use sector is vital to keep temperature rise to 1.5°C. A future vision should address the role of land use in adapting to climate change impacts and delivering the wider set of outcomes outlined in the government's 25-year environment plan, including restoring nature and supporting a resilient food sector that operates within environmental constraints and delivers health-promoting food. Finally, the land is a limited resource, constrained not only spatially but also by natural processes. Its capabilities and value to local communities will also vary across the country. Gaining a better understanding of the land system will help to identify the positive synergies of different land uses as well as to prevent or manage potential conflicts [1].

The majority of Indonesia's population works in the agricultural sector. With the total area of 5,070,606 sq km, the total land area is 1,904,443 sq km (Indonesia Country Report, 2017). According to [2] studies, Indonesia's population is recorded as a farmer reaching 45 million people, and most of them are fishermen, farm laborers, and farmers who own less than 0.3 ha of land. Nature is unpredictable and tends to be erratic. The existence of climate change is also very influential for agricultural productivity. Even under normal conditions (without disasters) farming is a vulnerable business, especially with the addition of a disaster that aggravates the situation. This resulted in the lives of farmers far from being well off. Natural conditions, as described previously, require farmers to adapt and make certain patterns to maintain their lives. Although farmers have a high vulnerability to natural instability, farmers also have high resilience which is manifested as a livelihood strategy by farm households. Livelihood strategies mean it is not limited to livelihoods, but rather to livelihood strategies [3].

Resilience is the opposite of vulnerability, where the two concepts are like two sides of a coin. The concept of resilience is a broad concept, including the capacity and ability to respond in crisis/emergency situations. Resilience is the ability to survive and return to its original state in the event of a disaster [4]. Resilience is a dynamic process that includes positive adaptation in the event of a disaster. Resilience is included in the strengthening system, building defenses, and implementing back-up systems, and reducing losses [5].

Agricultural land conversion is not beneficial for the growth of the agricultural sector because it reduce the production capacity and absorption of labor, which in turn decreases food production which further affects the welfare of the community. Agricultural land conversion is a change in the function of agricultural land to non-agriculture uses. Many factors have led to the conversion of agricultural land, one of which is the increase in population. Especially for urban areas, urbanization is one of the causes of population growth besides being caused by birth rates. The population increases in an area will increase demand for settlements land and will increase demand for other public facilities. Land availability, on the other hand, will not increase, as a consequences land conversion cannot be avoided. The land conversion can be driven by social, economic and government policies.

The rapid development of Padang City in West Sumatra, Indonesia, is marked by the increasing development and growth and dynamics of ongoing socio-economic activities, such as the increasing number of service centers, the economic, industrial, transportation, education, tourism, and are supported by increasingly improved road access (Padang City Spatial Plan 2004-2013). This development is a response to the increasing annual population. In the year 2003, the number of population was 765,450 (Statistics of Padang City in 2003) and increased to 846,731 people in 2011 (Statistics of Padang City in 2011). The population of Padang City continue to growth, it reached 927.168 in 2019 [6].

Padang City is also an area prone to natural disasters, especially earthquakes that have the potential to cause a tsunami. This result in city residents choosing residential areas away from the coast to reduce the risk of natural disasters. This choice reduces the size of agricultural land. Of the total area of Padang City, the majority or 52.52 percent are nature reserve protected by the government, buildings and fields covering 9.01 percent or 62.63 km2 while those used for paddy fields only cover 7.52 percent or 5225 ha. The topographical condition of Padang varies widely, between 0-1,853 m above sea level and the highest area is Lubuk Kilangan District [7].

Land-use conversion is a change in the function of part or all of the land area from its original function (as planned) to other functions that have a negative impact (problem) on the environment and the potential of the land. Land conversion is the conversion of agricultural land to non-agricultural use or from non-agricultural land to agricultural land [7]. From the data on agricultural land conversion (paddy) in Padang City in 2017 on agricultural land statistics, the area of Padang City's paddy fields continued to decline due to the large number of land use change of paddy fields. Changes that occurred in 2012 with an area of 6,587 Ha of paddy fields decreased to 6,574 Ha in 2013. This data continues to decline in 2014, 2015 and 2016 to 6,570 Ha, 6,474 Ha and 6,418 Ha [6]. Based on these data, this research is important to analyse how the resilience of paddy rice farmers in Padang City in

defending their land with research questions is: What are the factors that influence farmers' resilience in the land conversion.

2. The Concept

Vulnerability is a condition of a community that leads to or causes inability to deal with threats and dangers. The level of vulnerability is an important factors that influence the occurrence of a disaster, because the disaster will only occur if the danger occurs in vulnerable conditions. The level of vulnerability can be viewed from physical or infrastructure, social demographic and economic vulnerabilities. Physical vulnerability is a condition that describes a physical condition that is prone to certain hazard factors, where it can be seen from a variety of indicators, namely: 1) the percentage of built area; 2) Building density; 3) percentage of emergency construction buildings; 4) ratio of road length; 5) telecommunications networks; 6) PDAM network; 7) railroad [8].

Social population vulnerability is a condition that describes the level of social fragility in the face of danger. When a social condition is vulnerable, in the event of a disaster it can be ascertained that this will cause a large loss. Several indicators of social vulnerability are; 1) population density; 2) population growth rate; 3) the percentage of population under five to old age. Economic vulnerability is a condition that describes the level of economic fragility in the face of danger. Some indicators of economic vulnerability, namely: 1) the percentage of households working in vulnerable sectors or those who are vulnerable to termination of employment; and 2) the percentage of poor households [8].

In language, resilience is a term derived from English from the word resilience which means spring, resilience, or excitement [8]. The term resilience was first formulated by Block (Klohnen, 1996) with the name ego-resilience which is defined as a general ability that involves high and flexible adaptability when faced with internal and external pressures. According to R-G Reed. Resilience as the capacity or ability to adapt positively to overcoming significant life problems [9]. Resilience is a psychological construct proposed by behavioral experts to find out, define, and measure an individual's capacity to survive and develop under adverse conditions and to determine an individual's ability to recover from a state of pressure [10].

Resilience as trait. This trait is a hidden capacity that appears to fight individual destruction and protect individuals from all obstacles to life. Individuals who have good intelligence, adaptability, social temperament, and interesting personality have finally contributed consistently to respect for themselves, competence and the feeling that they are lucky [11]. These individuals are resilient individuals. Analogies resilience with flexibility in metals [12]. For example, printed iron that contains a lot of carbon is very hard but brittle or easily broken (not resilient) while wrought iron contains less carbon so it is soft and easily formed according to needs (resilience). The parable can be applied to distinguish individuals who have endurance and those who are not when faced with psychological stresses that are associated with negative experiences.

The Intergovernmental Panel on Climate Change (IPCC) defines vulnerability as a function of sensitivity, exposure, and adaptive capacity. Sensitivity is defined to what extent a system will respond to changes that occur as a result of climate change, including beneficial effects or adverse effects. Exposure (exposure) to climate change is defined to the level of climate stress in a particular unit of analysis and can be represented as a long-term change in climatic conditions or changes in climate variability including the magnitude and frequency of extreme events [13]. The vulnerability analysis with the Livelihood Vulnerability Index (LVI) using several indicators to assess exposure to natural disasters, household socioeconomic characteristics that affect adaptive capacity and current health, food and water resources characteristics that determine household sensitivity to climate change [14].

3. Research Method

This study was conducted in Padang City, West Sumatra Province, Indonesia. The city of Padang was chosen intentionally (purposive) based on specific objectives by the research objectives. Padang City has considerable potential for the conversion of agricultural land to non-agricultural land.

The method used in this research was survey method. The population in this study was rice farmers in Padang City. The sample was selected in a non-probability sampling method because the population of rice farmers was not known with certainty. The sample requirements are rice farmers who have land close to settlements or housing, close to highways, arterial roads, and village roads. Sampling was derived intentionally on 102 paddy rice farmers in Kuranji and Pauh Subdistrict, Padang City. The sub-districts, Koto Tangah, Kuranji, and Pauh were chosen because the area still had a small population density based on Padang welfare indicator data 2016. Thus these areas also have a high potential for land conversion. Data collected from respondents including their profile and information about their farmland.

A structure and semi-structure interviews were conducted to gain primary data. A direct interview with respondents were conducted by using a structured questionnaire. The interviews were documented and transcribed. The data was analyzed using qualitative descriptive analysis. The variable of the second objectives of this research including; a). Demography factor, b). Economy factor, c). Socio-culture factor, d). Government Regulation [15].

4. Results and Discussion

4.1. General Description of Padang City

Padang is the capital city of West Sumatera Province, Indonesia. It is located in the West Coast of Sumatera Island. It consists of 11 sub-districts with a total area of 694, 96 km2. Sub district with the largest area is Koto Tangah District (232.25 km2) or one-third of the total area of Padang City and the smallest area is the District of Padang Barat (7 km2) (Figure 1). Geographically the area of Padang City is between 00º44'00"- 01º08'35"LS and 100º05'05"-100º34'09"BT with an area of 694.96 km² with the following boundaries: 1) North : District Padang Pariaman; 2) South : South Pesisir Regency; 3) East : Mentawai Strait and 4) West : Solok Regency.

Districts with a high average population density, namely Padang Timur Subdistrict, Padang Barat, Padang Utara, have relatively sloping topography, are not steep and there are many public and social facilities, supporting infrastructure such as road infrastructure, sanitation, drainage, electricity, telecommunications and others which support the overall economic growth of Padang City, while areas with low population density are areas with hilly, steep terrain and lack of supporting infrastructure.

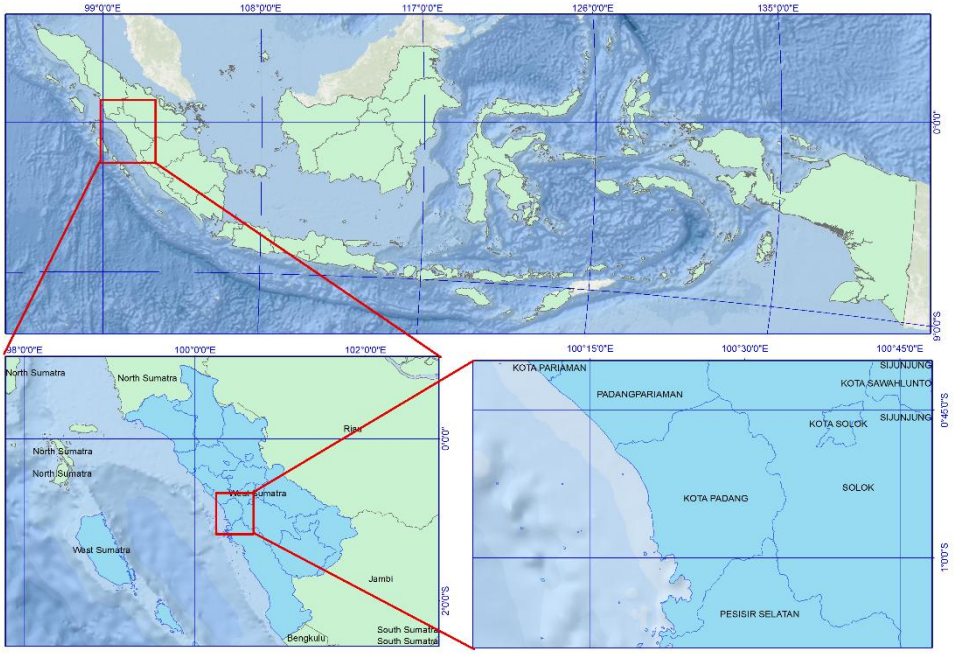

Fig.1 Maps of Padang City

4.2. Characteristics of Respondents

The characteristics of respondents in the three sub-districts in Koto Tangah, Kuranji and Pauh are based on data processed from survey. Fifty two percent of the respondents are male while forty eight percent of the respondents are female. FAO (2011) reported that women in Asia play an important role in agricultural labor force [16]. West Sumatra is known as matrilineal society where the land is inherited by women. Male usually migrate to other cities looking for a better job. The women who stay home mostly do job as farmer, seller or full time housework. Moreover, most of respondents are in productive age, which is between 15 years to 55 years, as many as 62%, while 38% of respondents have an age over 55 years (Figure 2).

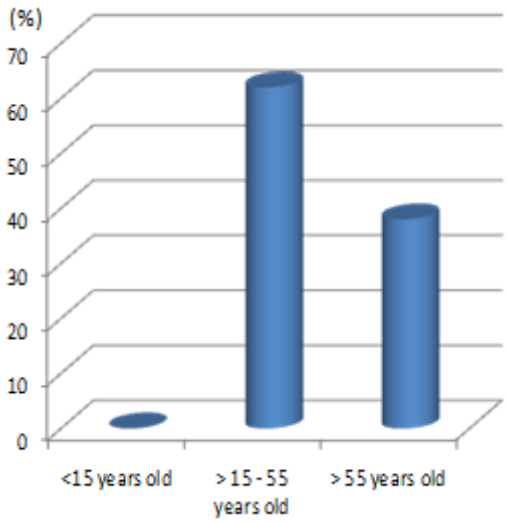

Figure 2. Distribution of respondent by age

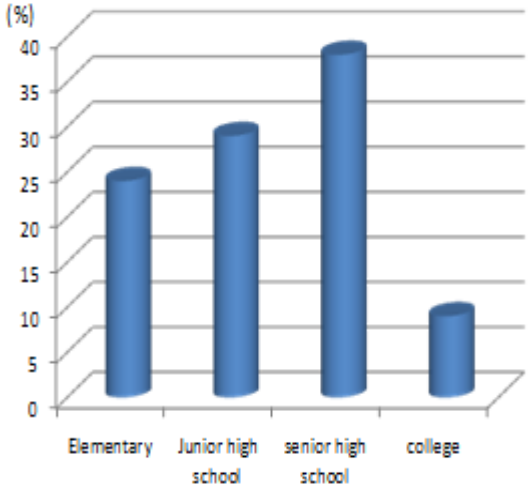

Figure 3. Distribution of respondent by educational background

It was found that respondents educational background are vary. The fact that 24% of respondents are only graduated from elementary school makes that some respondents are not good in writing and reading. Twenty nine percent of respondents graduated from junior high school and 38% of respondents finished their study from high school. They could not continue their study to higher degree. Become a farmer is the only choice for them. Only 9% of respondent got bachelor degree. They choose to be farmer because they do not have any other choices to get other job than famer (Figure 3). Sixty percent of respondents have more than 2 people of their family members. The number of household member related to household rice consumption of the family. This is one reason why respondents keep their paddy land. It is important for them to assure that they can feed their family member. They believe that as long as they still have rice farming, they are in a save place. Most of the respondents (100%) in Pauh planting paddy as the main planted plant, while the second one is maize with the percentage of only 2%.

4.3. Factors of farmers' resilience towards land-use change in Padang City

4.3.1. Demography factor in Meso Level

Padang city is one of the cities with high level of population density. From 2003 as many as 765,450 (Statistics of Padang City in 2003) and increased to 846,731 people in 2011 (Statistics of Padang City in 2011). The population of Padang City is increasing until 2016 to 914,968 people. Despite the increasing of population in Padang city, the research result shows that it does not affect farmer to converse their land. This finding is contradictive with Edwards-Jones study [17], focused upon factors affecting farmers' decision-making characterized into five main categories, they consists of: the socio-demographic and psychological characteristics of the farmer themselves, characteristics of the farm

household, structure of the farm business itself, the structure of social milieu and the characteristics of the policy or product that the farmer is deciding upon.

4.3.2 Economy factor

Economy factor is the main factor of farmer to preserve their land. The average income of the farmer in the research area is 2,545,196 IDR/capita (or equal to 185.62 USD). It means that these farmers income is higher than the poverty line in Padang City which is 453,612 IDR/capita (or equal to 33.08 USD). Most of the respondents (70% of them) own their land, which most of the land are communal land. Only 30% of respondents rent their land for cultivating paddy (Figure 4). It shows that the farmer generates full income from their rice farm. Farmers stated that their income from paddy farming is higher than other income. The average income of rice farming is Rp. 8.924.425/ha/planting season (or equal to 650.85 USD). Moreover, the total labor in the farm is sufficient to continue producing rice. It can be concluded that the farmland is one of the important income source for the family, with land size varies from 0.25 to 1 ha per household.

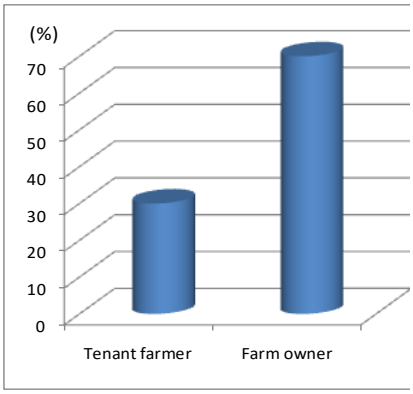

Figure 4. Distribution of farmers by land ownership

4.3.3 Socio-culture factor

More than half of the respondents (64%) are having rice cultivating area from 0.25 to 1 ha. This small size of farmland has to be preserved by the farmer because this farm is the main income of the farmer. It was found that about twenty six percent of respondents have less than 0.25 ha for rice-growing land. Only ten percent of respondents have rice cultivating area of 1 -2 ha. The small scale of paddy yield has resulted in a low average of paddy production. But it does not mean that farmers prefer to sell their land area to get cash money. With a number of limited cultivation area and a large number of family members, they maintain the paddy production to fulfill household consumption. Farming experience is also one of the factors that contribute to preserve the land. Half of respondents in research area are having farming experience between 15 to 30 years. Thirty percent of respondents have been doing as paddy farmers for more than 30 years. The other factor is land ownership which seventy nine percent of the status of land ownership is clan (***ulayat)*** which is belong to the tribe. In *Minangkabau* matrilineal system, the communal land, family high heritage wealth (***Pusako Tinggi***) is belong to woman in the family. It is handed to women from generation to generation. In other word, the land cannot be sold.

4.3.4 Government Regulation.

The government regulation does not contribute to farmers' resilience in Padang city. Ninety-one percent of respondents do not know anything about any spatial policy related to land-use change. Only nine percent of respondents know about land-use change policy. However, the role of government to preserve agricultural land is very important. Other report [18], stated that the attributes of governance function in society to enhance the capacity to manage resilience are: (1) participation builds trust, and deliberation leads to the shared understanding needed to mobilize and self-organize; (2) polycentric and multi-layered institutions improve the fit between knowledge, action, and social-ecological contexts in ways that allow societies to respond more adaptively at appropriate levels; and (3) accountable authorities that also pursue just distributions of benefits and involuntary risks enhance the adaptive capacity of vulnerable groups and society as a whole.

5. Conclusion

This study concluds that the resilience of farmers is influenced by internal factors which are land ownership, farm income, farming experiences, farming is inherited farming that characterizes the transfer of strong knowledge and understanding between parents and their children in farming, thus strengthening farmers to continue their farming. The external factors that affects farmers to survive is the ownership system of ***ulayat land*** as a Minangkabau cultural heritage. This forces farmers to keep working on their land. It is suggested that to sustain farmers' resilience towards land-use change, it is important to maintain agricultural lands by preserve ***Minangkabau*** culture, namely communal land and also maintaining the process of inheriting farming knowledge which has been carried out from generation to generation.

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