



Multifunctional adaption of farmers as response to urban growth in the Jabodetabek Metropolitan Area, Indonesia



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1. Introduction

Urbanization in Asia is characterized by the rapid agglomeration of people and economic activities in megacities (Douglass, 2013; Swerts and Denis, 2015). This process is accompanied with an expansion of settlement area into the already densely populated agricultural land in the peri-urban, creating a morphological land use structure called “desakota”, consisting of a complex mix of urban and rural land-use types (McGee, 1991; Yokohari et al., 2000).

Jabodetabek Metropolitan Area (JMA) which encompasses Jakarta as the core city surrounded by municipalities and districts of Bogor, Depok, Tangerang, and Bekasi, represents a typical example of this phenomenon. For more than four decades, urban settlement has sprawled into the agricultural hinterland without strong planning control and effective zoning regulations (Pribadi and Pauleit, 2015). This includes low density housing development and large-scale real estate projects and new towns (Winarso et al., 2015). In addition, with rapid rise of land prices and rampant land speculation, agriculture is increasingly under land market pressure, thus many farmers lost their land ownership (Firman, 2009).

However, agricultural activities persist in the peri-urban as farmland in the region has declined by less than 10% from 61% to 52% cover between 1972 and 2012 (Pribadi and Pauleit, 2015). On

the one hand, agriculture itself spreads out into former forest land of the upstream areas, exacerbating flood risks (Pribadi and Vollmer, 2015). On the other hand, there is an increasing share of landless farmers, who are dependent on external land use decisions (Purnomohadi, 2001; Siregar, 2006; Pribadi and Pauleit, 2015). Regional farming activities were further encouraged through rising prices for imported food products due to the economic crisis in JMA in 1998 and 2007 (Purnomohadi, 2001; Pribadi and Pauleit, 2015). During this period, the role of the agricultural sector to provide jobs, income and food security became important again, especially for the underprivileged urban poor (Purnomohadi, 2001; Indraprahasta, 2013). These experiences as well as a series of flooding events have led to enhanced government's efforts to preserve farmland for food production and to curb urban sprawl through spatial planning policy (Agriculture and Forestry Office of Bogor District, 2012; Bekasi District Government, 2011; Tangerang District Government, 2011).

As one of the fastest growing megacities in the world (Cox, 2011; World Bank, 2015), the increase of population in JMA is followed by issues of poverty and food insecurity (Rustiadi et al., 2015). Furthermore, due to rapid urban sprawl, the region is increasingly prone to flood and landslide incidences (Rustiadi et al., 2015; Remondi et al., 2016), rising air temperatures (Effendy, 2009; Tokairin et al., 2010), and a diminishing capability to provide ecosystem services such as fresh water, biodiversity conservation, and recreational areas (Vollmer et al., 2016).

Therefore, the concept of multifunctional agriculture has been proposed as a way to cope with the multiple socio-economic and environmental challenges, demands and requirements to PUA by the nearby urban areas, such as the food and livelihood security (Bryld, 2003; Zezza and Tasciotti, 2010), the provision of ecosystem services (Malaque and Yokohari, 2007; Lee et al., 2015), including micro climate regulation (Lovell, 2010; Ives and Kendal, 2013), management of regional water resources (Haase and Nuissl, 2007), flood protection (Kenyon et al., 2008; Wheeler and Evans, 2009) and prevention of soil erosion (De Graaff et al., 2013; Pribadi and Vollmer, 2015) as well as to regional quality of life and recreation (Yang et al., 2010; Brinkley, 2012; Zasada et al., 2013). In this sense, a

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multifunctional PUA can help to bridge the urban-rural divide, respectively the competition between both and strengthen their interrelationship (Zasada, 2011). Doing so it can contribute in many ways to a sustainable and resilient development of metropolitan regions in general (Aubry et al., 2012; Barthel and Isendahl, 2013) and in developing countries in particular (Lee et al., 2015; De Zeeuw et al., 2011).

Multifunctional PUA in developing countries is particularly expected to alleviate poverty, generate income and employment, enhance food security, manage a landscape, and curb environmental degradation (De Bon et al., 2010; Zezza and Tasciotti, 2010; De Zeeuw et al., 2011; Pribadi and Pauleit, 2016). Achievement of these aims is a challenging task as farming activities in the peri-urban suffers from land conversion and fragmentation (Lee et al., 2015; Pribadi and Pauleit, 2015), soil and water quality degradation (Huang et al., 2006; Vagneron, 2007; Materechera, 2009; Vazhacharickal et al., 2013), insecure land property rights (Siregar, 2006; Bersaglio and Kepe, 2014; Rehman et al., 2013), lack of policy support (Aubry et al., 2012; Robineau, 2015), increasing number of landless farmers and the presence of subsistence agriculture (Rehman et al., 2013; Pribadi and Pauleit, 2015), and high competition of labour due to increasing informal non-agricultural jobs in the peri-urban area (Moench and Gyawali, 2008; Rehman et al., 2013; Hussain and Hanisch, 2014).

Studies from Vagneron (2007), Prändl-Zika (2008), and Aubry et al. (2012) showed that development of multifunctional practices at the farm level is capable to increase the profitability and sustainability of PUA. Economic market incentives; regulatory instruments and land use planning; and decision making processes of different actors have been suggested to influence development of multifunctional agriculture (Renting et al., 2009). Still, whether farming successfully adapts to the urban situation and develops multifunctionality critically depends on farmers' decision making (Wilson, 2009; Aubry et al., 2012). Their lack of adaptation will leave farmers exposed to the prevailing urban land market pressure, thus the preservation of farming and farmland becomes increasingly difficult and land use zoning policies ineffective (Paül and McKenzie, 2013; Rustiadi et al., 2013).

As finding the right path to develop multifunctional PUA in Asian megacities is hampered by the difficult situation at the farm level, studying the multifunctionality potential of different farming practices in JMA will provide a good reference. The objective of our paper is to investigate the adaptation behaviour of farmers in response to urbanization processes in JMA and analyze their capability to provide multifunctional benefits in terms of enhanced livelihood through employment and income generation, commodity production, and improving the environment through their farming practices. In particular, the following questions will be addressed: (1) How do farmers adapt to the urban situation? (2) Does this adaptation promote multifunctional farming? (3) Which factors enhance the development of multifunctional agriculture? Particular emphasis will be placed on (1) response to food market opportunities and urban land pressure; (2) capacity to run the farm business; (3) motivation to continue farming; and (4) access to land as the most competitive resource in the peri-urban area.

2. Conceptual framework

Urbanization in Asia has led to *desakota* regions as a specific feature of peri-urban landscape (McGee, 1991). Here, the city is not really expanding, but rural areas in the suburb are transformed into semi-urban fabric (Meeus and Gulinck, 2008). Some scholars regarded this as a temporary phenomena during the urbanization process (Chan, 1994; Dick and Rimmer, 1998; Hudalah and Firman, 2012), but fragmented farmland in the peri-urban still survives

despite strong pressure of urbanization (Yokohari et al., 2000; Malaque and Yokohari, 2007; Pribadi and Pauleit, 2015). The roles of *desakota* region are even emphasized as farmland in the peri-urban has potentials to provide socioeconomic and ecological services while city development in Asia is increasingly threatened by food insecurity, poverty, and climate change issues (McGee, 2010; Lee et al., 2015). Therefore, Ravetz et al. (2013) have argued that peri-urban can become a new type of multifunctional territory instead of merely an urban-rural transition zone.

In the literature, the persistence of PUA is determined by its capacity to adapt to urban and peri-urban settings (Zasada, 2011; Pribadi and Pauleit, 2015). Particularly, it is related to the diversification of activities, the provision of goods and services which specifically meet the demands of the residents in urban and peri-urban areas (Soy-Massoni et al., 2016). The transition process from rural traditional to multifunctional farming might differ depending on the particular social, economic, and geographical settings (Renting et al., 2009; Van der Ploeg et al., 2009; Moon, 2015), as well as different agricultural types, farming practices, intensity of land use, and farm location (Zasada, 2011; Aubry et al., 2012; Pribadi and Pauleit, 2015).

In order to develop multifunctional PUA, a theory by Wilson (2007, 2008) is useful as he explained the transition of agricultural multifunctionality from weak to strong multifunctionality. Weak multifunctionality refers to food and fibre production, while strong multifunctionality is characterized by: high environmental sustainability; embeddedness into the local and regional economic system (e.g. providing income, employment, and enhancing viability of rural livelihoods); short food supply chains; low farming intensity (e.g. minimizing chemical inputs, avoiding genetically modified crops, etc.); weak integration into the global capitalist market; high degree of diversification; and high degree of rural populations who see agriculture as a process that goes beyond food and fibre production. Wilson pointed out that the ease of transition is influenced by farming types (e.g. large scale or small scale, full-time or part-time occupation, for hobby or economics purposes, etc.) and farming ownership types (e.g. owner-occupied farms, farms in multi-member ownership, tenant farmers).

In developing countries, the prevailing small and economically marginal farms are particularly important to enhance rural livelihoods and local food security (Wilson, 2008; Zezza and Tasciotti, 2010). However, the multifunctional capacity to deliver other benefits, such as environmental or cultural ones is rather limited due to small farm sizes, lack of farm ownership, and low economic turnover (i.e. how farming can generate income in a certain period of time) (Wilson, 2008).

Nevertheless, Pribadi and Pauleit (2015) showed that farm sizes and economic turnover of PUA are different between farming types (e.g. horticultural farms, paddy rice farms, other food crops cultivation, etc.) even under the situation of declining farm ownership in JMA. Wästfelt and Zhang (2016) have argued that the variance of farming types should be considered in developing multifunctional PUA. This leads to the hypothesis that farmers' behaviour has a strong influence on the choice of farming types and it likely depends on their individual characteristics such as age, education, gender, etc. (Burton, 2012; Weltin et al., 2017), experience and motivation to farm (McCracken et al., 2015; Hansson et al., 2013), and type of farm ownership, and hence their strategy to deal with limited access to land (Wilson, 2007, 2008; Wästfelt and Zhang, 2016).

Based on the hypothesis, the field survey was carried out in the catchment area of the Ciliwung watershed as PUA in this area provide more functions than other PUA land in JMA (Pribadi and Pauleit, 2016; Pribadi and Vollmer, 2015; Vollmer et al., 2016). Here, new development of urban settlement has been restricted to

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