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An Appropriate Strategy to Anticipate Fringe-Settlements Development in the Rural-Urban Fringe Area

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ABSTRACT

This paper is concerned with characteristic changes of rural-urban fringe area and an appropriate strategy to anticipate fringe-settlements development in the rural-urban fringe area. It is used a combination model by the proportion of urban land use functions, residential properties and the proportion of agricultural land use. It was also calculated based on the square grid and the distance bands. The objective of this research is to improve the policy of fringe-settlements development in the rural-urban fringe area. This study demonstrates that: (1) There has been a conversion of productive agricultural-land into residential-land especially fringe-settlements. (2) For the establishment of new fringe-settlements should be established in the inner fringe, and that is not the area of agriculture. The outer fringe area should be keep for agricultural-land. Thus, there is a balance in the rural-urban fringe area between inner fringe and outer fringe. (3) An appropriate strategy for rural-urban fringe area is: Tax Defferal and Abatement Laws is suitable to be applied in the inner fringe area because the majority of the population in no longer committed to preserve agricultural land and agricultural-activities. Utility Extension Policy and Police Power Mechanism are suitable to be applied in the outer fringe area because the availability of agricultural land is still a lot and the farmer committed to agricultural land and agricultural activities.
Keywords: fringe-settlement; characteristic-changes; rural-urban fringe.

INTRODUCTION

The rural–urban fringe is the landscape located just outside of established cities and towns, where the countryside begins. The fringe characterized by diversity in land uses, with many areas in continuous transition [1][2].

Land conversion has both of direct and indirect consequences. The direct impacts include loss of prime agricultural-land, loss of agricultural jobs, loss of investment in the area of irrigation infrastructure, natural landscape destruction, and excessive exploitation of groundwater [2] [3]. Land conversion in Indonesia has occurred at a large scale. Hence it could greatly affect the production of foodstuffs, as well as waste investment in irrigation of agricultural-lands, notably the paddy fields. There is no evidence that any country has been able to limit agricultural-land conversion successfully without causing high pressure on land prices for other purposes [2]. There is a relationship between land use changes and the LOS of the road [4].

Attention balanced and proportionate course required in the development of rural-urban fringe area. It is related to the growing land conversion in the rural-urban fringe area. Urban development is necessary for the growth of regional and national economy while the character development of provincial resources aimed at saving food and the importance of environmental balance. Then the objective of expansion which rural characteristic is balancing environment. It is difficult to implement this development orientation because of many experts think that in reality the interests of their respective opposites. Thats why many experts emphasized the problems of unmanaged land use controls and high conversion rate in the rural-urban fringe area.

Land use as a human activity product on the earth's surface shows a large variation, within both local and regional cities. An understanding of land use forms that characterise the built-up area, urban-rural transition area, and the countryside itself, is a matter of principle to do its spatial structure differentiation. An understanding of "urban" and "rural" also needs attention - especially "urban" related to urban life and "rural" associated with countryside life. Aspects of life itself consist of urban and countryside aspects: political, social, economic, cultural, psychological, technological, and physical. In discussing this morphological approach, someone insisted on the physical aspect, one of which is land use. There are many studies about the location of rural-urban fringe such as rural-urban land use triangle, urban-rural land use, and spatial structure. They have the different part of rural-urban fringe [5][6][7]. It also several studies on rural-settlement such as Everson and Fitzgerald did a detailed study of the services provided by both rural and urban settlements in part of East Anglia, using a very wide range of data resources [8]. Carter carried out a detailed analysis of settlements in Pembrokeshire in SW Wales using data from what was then the Dyfed Country Council [9]. Schoenauer places

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rural settlements and house types into six different categories as being like an evolutionary hierarchy of dwelling types of dwellings from the most mobile shelters to the most permanent of buildings [10]. Rural settlement is that which is located in the countryside as opposed to a broadly urbanized area [11]. This research make analysis about 'fringe-settlements'. This is slightly different from 'rural-settlements'. Fringe-settlements are located in the rural-urban fringe area and it was built by housing-developers.

This research is concerned with characteristic changes of rural-urban fringe area and an appropriate strategy to anticipate urban development in the rural-urban fringe area. The rural-urban fringe area is the most important area in the city because if city centre is insufficient, the target of urban development will move to the rural-urban fringe area. In fact, it is difficult to trace boundaries of the rural-urban fringe area clearly because of the mixing of urban and provincial properties in an area once. This research investigates this problem by combination model using GIS function. The main purpose of this study is to improve the policy of rural-urban planning related to 'fringe-settlements' development in the rural-urban fringe area. Firstly we analyse characteristic changes of the rural-urban fringe area for 1990 to 2010. Secondly, we make an appropriate strategy to anticipate fringe-settlements development in the rural-urban fringe area. Then, the outcome of this study can be used by city government to creating a new policy for the sustainability of rural-urban fringe in the future.

MATERIALS AND METHODS

The location of the study is the rural-urban fringe in the city of Malang, Indonesia. The present study selected four sub-districts and 23 villages, which have a total area of about 8164.33 hectare. In 2010, there were 816,637 inhabitants (Statistic of Malang City, 2010). The study area located between 112.06° to 112.07º (East longitude) and 7.06°- 8.02º (South latitude). The study area has a topography that is most flat (96.3%) with slope 0 per cent to 15 per cent and a height of 380 meters to 667 meters above sea level (Fig. 1).

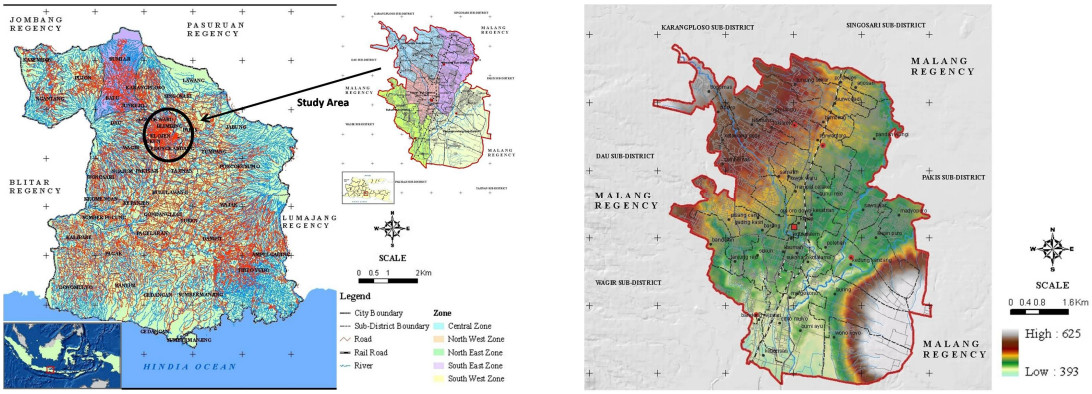

Fig. 1. *The location of the study area and Digital elevation model of the study area*

In this research, we used combination model to identify location of rural-urban fringe area clearly. This model is determined by the proportion of urban land-use functions and residential properties, the proportion of agricultural land-use, distance bands and square grid [12]. The basic research division of rural-urban fringe area location is divided into two sub-zones. The first is inner fringe, in which non-agriculture land began to be dominant. The built-up environment and the natural environment are balanced (40 per cent to 60 per cent of agricultural and conservation areas). It covers an area of around 2 kilometres from the city centre. The second sub-zone is the outer fringe, in which land use is dominated by provincial features (60 per cent to 90 per cent of agricultural and conservation areas). It covers an area from more than 2 kilometres and up to 5 kilometres (Fig. 2). Measurement of the distance bands of each sub-zone calculated from the total radius of the city

Data regarding farmer, housing acquisition, farmer's commitment to agricultural-land and farmer's commitment to agricultural activities have been collected using a questionnaire that was distributed in September 2009 and July 2010. The region of population sample was taken in the rural-urban fringe area which has been determined using the technique of Non-probability Sampling. Respondents were selected using purposive sampling method where respondents are not determined in advance. The population in the study is farmer and come-in population in the area of rural-urban fringe. Then, the number of samples was determined after the discovery of the location of rural-urban fringe area. This research collected 184 farmers and 184 come-in populations that were required to fill in the questionnaire.

The questionnaire is divided into two parts. The front page of this questionnaire is the introduction to the respondent that explains the purpose, the person in charge, and the contact address. The first part for farmers asks their commitment to their agricultural-land and agricultural-activities. It consists of 10 general questions.

The second part for come-in population asks their job and their reason come to the rural-urban fringe area. It consists of 15 general questions.

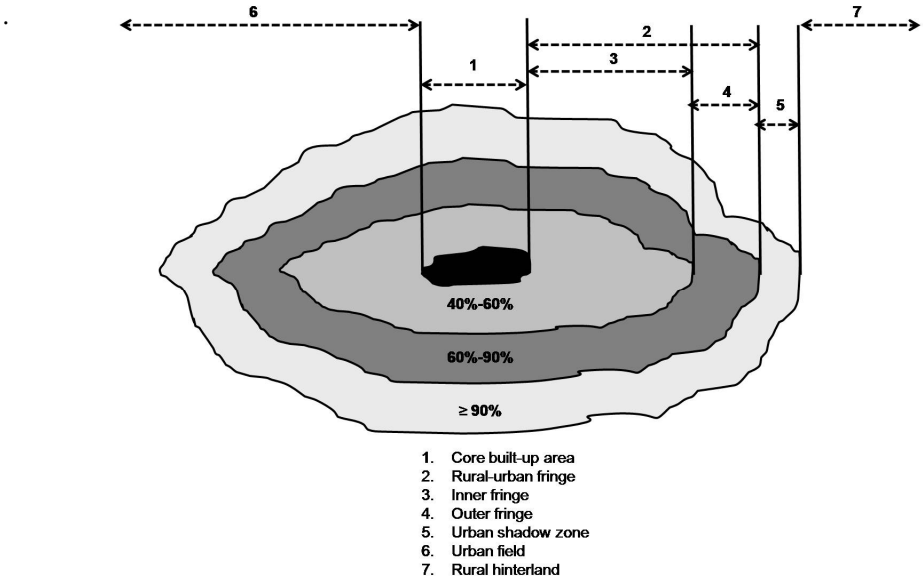

Fig. 2. *Combination model [1]*

The data collection was conducted in September 2009 and July 2010. Ten surveyors (including one coordinator of surveyors) distributed the questionnaire directly to farmer's house and come-in population's house, the surveyors approached the farmers and come-in population personally to kindly ask him/her to fill in the questionnaire. The surveyors assisted/accompanied by one of the village officers. In this case, we co-operate the office of the local village because it is easier for surveyor to guide the respondent when completing the questionnaire. Sometimes the surveyor is reading out the question to the respondent in case the respondent could not read it, up to translating the questionnaire into a local language (*Bahasa Jawa*) if the respondent was not able/understand the national language (*Bahasa Indonesia*), especially for farmers who have a slightly different character and a low level of formal education, since the questionnaire was written in Indonesian. On average, the success rate of gathering respondents willing to complete the questionnaire was quite high. It was known by making a note of the number of respondents that filled in the questionnaire.

In this study, we used several analytical techniques. It can be seen in Table 1, and developed our research design as shown in Fig. 3.

Table 1. Analytical techniques of the study

No	Analytical techniques	Equations
1	Agricultural-land reduction	$P_{elp}/\text{year} = \frac{L_{lp}(t_1) - L_{lp}(t_2)}{d}$
2	Additional of residential-land	$P_{nlp}/\text{year} = \frac{\lvert L_{lnp}(t_1) - L_{lnp}(t_2)\rvert}{d}$
3	Additional of non-agriculture land and residential-land	$P_{nlnp}/\text{year} = \frac{\lvert L_{lnpn}(t_1) - L_{lnpn}(t_2)\rvert}{d}$
4	Acceleration of urban sprawl	$A_{hlp}/\text{year} = \frac{L_{lp}(t_2)}{\frac{L_{lp}(t_1) - L_{lp}(t_2)}{d}}$
5	Population growth	-
6	SWOT	-

where P_{elp} means agricultural-land reduction (ha/year), L_{lp} means agricultural-land area (ha), P_{nlp} means additional of residential-land (ha/year), L_{lnp} means residential-land area (ha), P_{nlnp} means additional of non-

agriculture land and residential-land (ha/year), L_{lnpn} means non-agriculture land and residential-land area (ha), A_{hlp} means acceleration of urban sprawl index, t means time (year), and d means difference in time (year).

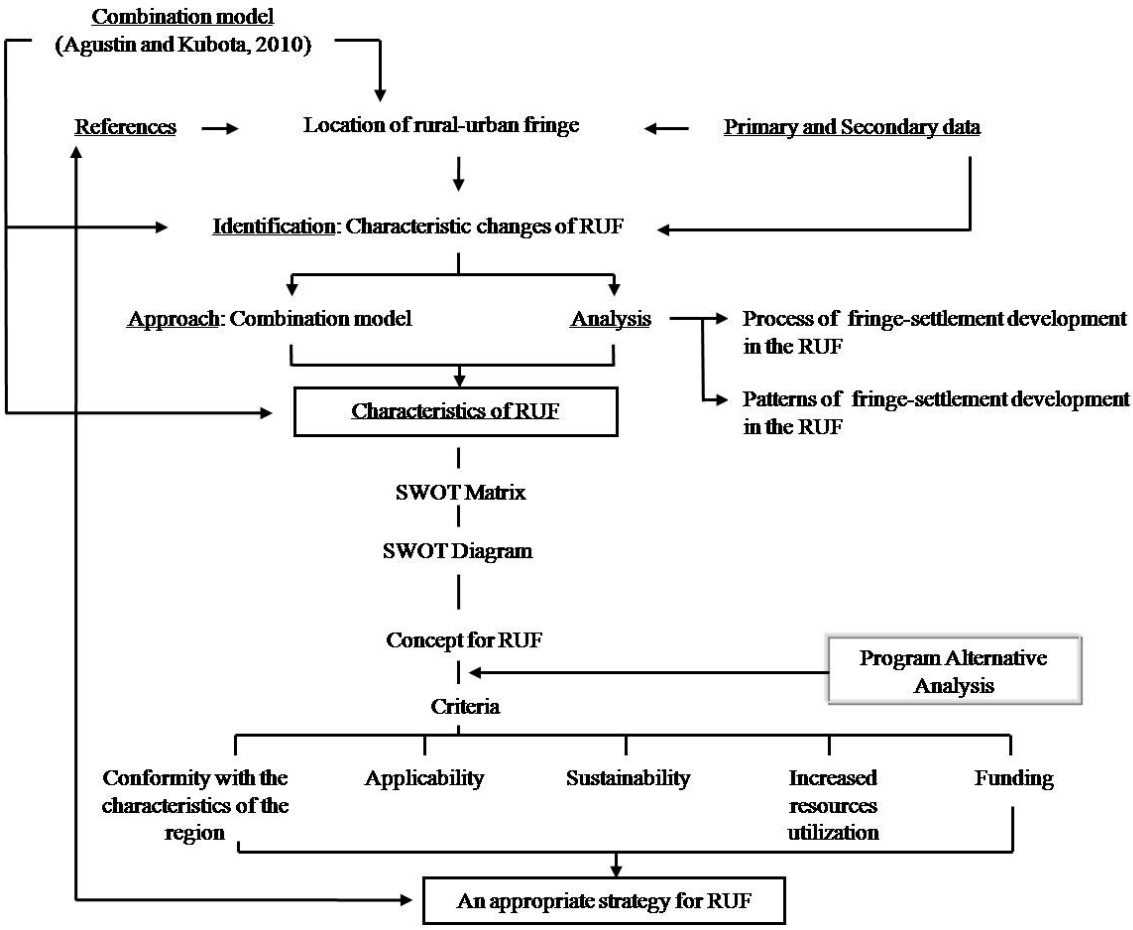

Fig. 3. *Research design*

RESULTS AND DISCUSSION

The result of analysis has been conducted on land-use change in the region around the 'fringe-settlements': it is known that the area of paddy field, moor and vacant land is designated for 3040.89 hectare in 1990, and was reduced by 2215.98 hectare in 2000. Furthermore, it reduced again by 1482.71 hectare in 2010. While, the area of 'fringe-settlements' in the rural-urban fringe area increased from 2621.36 hectare in 1990 to 2947.16 hectare in 2000 and it increased to 3344.36 hectare in 2010 (Table 2).

Table 2. Land use type in the study area around the fringe-settlements

Function	Area (Ha)		
	1990	2000	2010
1. Paddy-field	1001.05	838.89	526.86
2. Moor	1532.74	1057.89	773.45
3. Dwellings	2621.36	2947.16	3344.36
4. Vacant-land	507.10	319.20	182.40

Changes in land use of paddy fields, moor, and the vacant land designated on the map of land use change look of the largest in the Bandulan village and Pandanwangi village particularly in 'Kampung Jambangan' and 'Kampung Senokembang' directly adjacent by Griya Asri Pandanwangi as 'fringe-settlements'. For more details see Fig. 4.

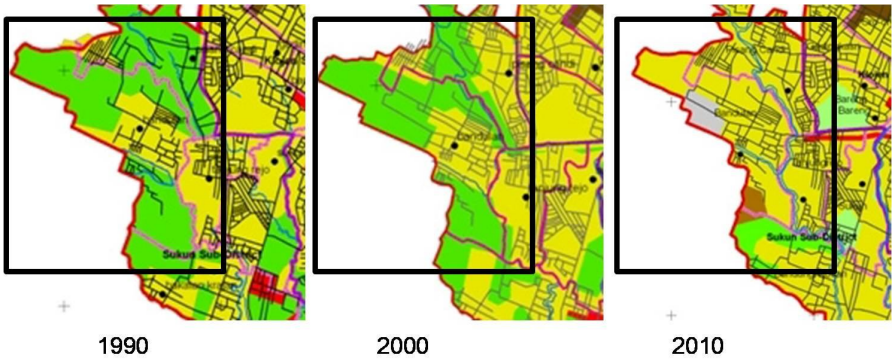

Fig. 4. *Land use changes in the study area*

Land conversion from agricultural-land to non-agriculture land determined by farmer's commitment to their agricultural-land. High motivation of farmers to maintain agricultural-land, it will cause lowest conversion rate of agricultural-land in rural-urban fringe areas. Conversely, if the motivation of farmers is low, the conversion rate of agricultural-land will become easier. The majority of farmers in the inner fringe area do not want to keep their farm. While, many farmer in the outer fringe area who still wants to maintain their agricultural land in the amount of 56.31 per cent (Fig.5). Land conversion in the study areas influenced many things. One of them is the commitment of farmers to their agricultural activities. One of the impacts occur when farmers are not motivated to start their agricultural activities are farmers going to change the use of agricultural-land. They think that it is no longer perceived earning their living. When this happens, it will be easier to land conversion in the study areas.

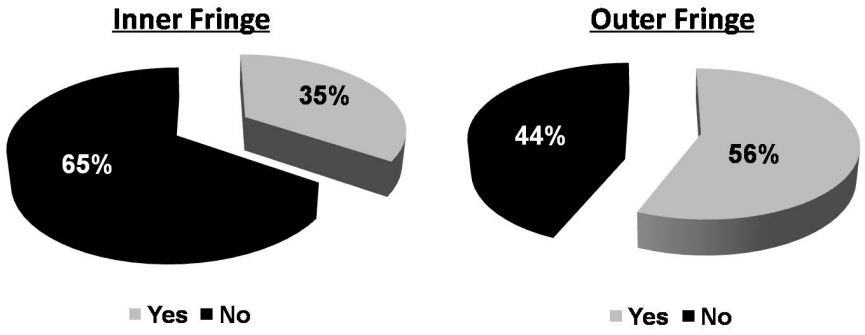

Fig. 5. *Farmer's commitment to their agricultural-land*

Majority of farmers in the inner fringe area do not want to maintain their agricultural activities. While, many farmers in the outer fringe area who still wants to maintain their agricultural activities is 63 per cent (Fig. 6).

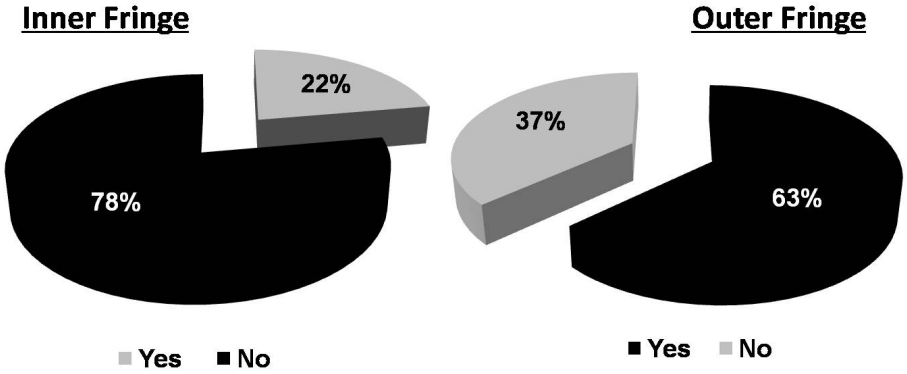

Fig. 6. *Farmer's commitment to their agricultural-land activities*

The strategy can be proposed are as follows:

(1) Utilization of agricultural lands in rural-urban fringe areas as food providers at the same time balancing the ecological city to support the provision of food in the study area.
(2) Development of the study area should be consider which land can be converted into built-up, and The existence of the agricultural areas in accordance with the City Plan maintained and controlled as reserve-land development through the means of prevention of land conversion.
(3) Improved quality control mechanism for conversion of agricultural land, especially in the rural-urban fringe to keep the existence of agricultural-land in the study area.
(4) Need for 'Local Regulation' in the imposition of sanctions for perpetrators of violations of land conversion.

The concept can be proposed are as follows:

(1) An appropriate concept for the inner fringe area is Tax Defferal and Abatement Laws. Applying a tax on those areas of land on the basis of 'use value' despite having a high sale, as long as the owner retains the form of land use (agriculture), this concept can be done. This concept is suitable to be applied to the inner fringe area because the majority of the population in no longer committed to preserve agricultural land and agricultural-activities.
(2) An appropriate concept for the outer fringe area is Utility Extension Policy and Police Power Mechanism. This concept is suitable to be applied to the outer fringe area because the availability of agricultural land is still a lot and the farmers are still committed to agricultural land and agricultural activities.

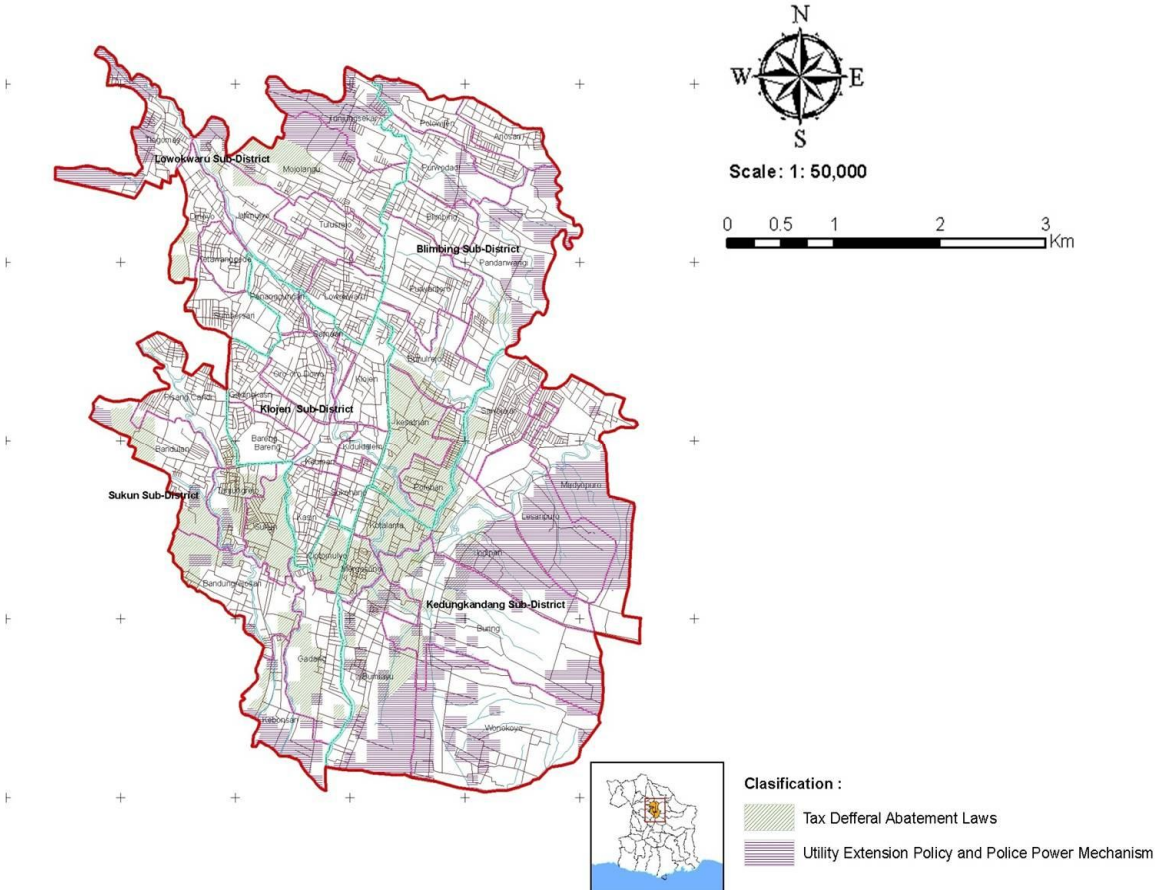

Fig. 7. *Appropriate concept for rural-urban fringe*

An appropriate concept for the inner fringe area and the outer fringe area can be seen in Fig. 7. Tax Defferal and Abatement Laws is suitable to be applied to the inner fringe area because the majority of the population in no longer committed to preserve agricultural land and agricultural-activities. Utility Extension Policy and Police Power Mechanism is suitable to be applied to the outer fringe area because the availability of agricultural land is still a lot and the farmers are still committed to agricultural land and agricultural activities.

The detail of recapitulation of characteristic changes in the rural-urban fringe area can be seen in the Table 3.

Table 3. Recapitulation of characteristic changes in the rural-urban fringe area

No.	Indicators	Changes	Causative Factor
1	Population growth	Population growth in the rural-urban fringe area is higher (5.38%) considering the average of population growth in the total of the city is only of 1.17.	This is probably due to the inner fringe is the area directly adjacent to urban areas.
2	Come-in population	The largest arrival rate of development is owned by the outer fringe area for 1.56 %	A large area and fringe-settlements were built in the outer fringe area.
3	Farmer population	The total of farmer in the rural-urban fringe area is decline.	Agricultural-land conversion because of fringe-settlements
4	Agricultural-land reduction	The biggest agricultural-land reduction in the outer fringe for 20 years is 19.45 ha/year.	There is no other option for farmer than selling their agricultural-land to developers
5	Additional of residential-land	It concentrated in the inner fringe area of 25 ha/year	This is probably due to the inner fringe is the area directly adjacent to urban areas.
6	Additional of non-agriculture land and residential-land	It concentrated in the outer fringe area (8.50 ha/year)	Still have a large area with a good environment
7	Acceleration urban sprawl	The calculation of urban sprawl acceleration shows that the urban process in the inner fringe area is faster than the outer fringe	Additional of residential-land concentrated in the inner fringe and also the centre of urban area
8	Housing acquisition	The inner fringe area changes by individuals in large numbers	Because of the many migrants and housing development
9	Farmer's commitment to agricultural-land	The majority of farmers in the inner fringe area didn't want to keep their farm. While, many farmer in the outer fringe area who still wants to maintain their agricultural land in the amount of 56%	High motivation of farmers to maintain agricultural-land will cause lowest conversion rate of agricultural-land in the rural-urban fringe area.
10	Farmer's commitment to agricultural activities	The majority of farmers in the inner fringe area didn't want to maintain their agricultural activities. While, many farmers in the outer fringe area who still wants to maintain their agricultural activities in the amount of 63%	The majority of farmers want to maintain their job as farmer because they just have one occupational activity as farmer.

CONCLUSIONS

In the planning of the rural-urban-fringe, we should consider the potential area to be developed to keep track of fringe-settlement as a home-business site. So, in the future designation of an area will be in accordance with the needs of the region. In addition, it is importantly to consider the possibility of increasing infrastructure in the area of fringe-settlements. For the establishment of new fringe-settlements should be established in areas that still have a large area especially in the inner fringe, and that is not the area of agriculture. This is because the existence of the fringe-settlements will influence the development of the rural-urban fringe area. If the fringe settlements built in the agricultural area especially in the outer fringe, it would have caused many problems especially in terms of land use. Outer fringe area should be keep for agricultural-land. So, there is a balance in the rural-urban fringe area between the inner fringe and the outer fringe. In fact, the development of 'fringe-settlements' gives considerable influence on the characteristic changes in the rural-urban fringe area and the social-economical society. This proves that the 'fringe-settlements' is the trigger new growth of a city/region. For that reason, there needs to be a strictly regulation of the 'fringe-settlements' and home-business to being focused and organized. During this time, Cities in Indonesia has not had a planning guidelines as a guide in the establishment permissions, the establishment 'Pajak Bumi Bangunan' (The Land and Building Tax), control of land price, site selection, the establishment of the minimum wide block environment, direction of development of infrastructure and references to the price of the house. So hopefully, this policy could reduce the gray area that can be pushed around by the developers as well as providing clarity regarding the direction of regional development, especially in the rural-urban fringe area.

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