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Regional Sustainable Development in Bali: The Role of Indigeneous Institution of Subak in Retarding Farm Land Conversion

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Abstract

Spatial planning processes are often faced with problems no matter how good and perfect the spatial plans are, but to make it happen there are always be the selection of priority operational steps. Many factors must be considered integrally and synergistically in spatial use, for example, components of natural resources, artificial resources, the environment, and the technical components and forming the other regions. The use of dynamic systems in developing regions has several advantages, including the improvement of the territorial dimension, facilitated of participatory process, anticipatory networks of future scenarios, and innovation in public policy arrangement. A model of sustainable tourism in Tabanan showed that local institutional aspects (Subak) became one of the driving force key in reducing land conversion. It is necessary to do the expansion of the indigenous institutional aspects, especially in the aspect of granting autonomy for Subak in spatial planning and evaluation in the tourism area which became a shelter for the local institutions, includes not only the autonomy management of water irrigation.

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By entering those elements, new models in the dynamic system will be obtained and it concluded that indigenous institution is an aspect that should be taken into the modeling of spatial planning in a region or area so that the problems of food security, land conversion can be eliminated as early as possible and obtainable alternatives policies could be taken by policy makers for each region.

Keywords: indigenous institution; land conversion; food security; sustainable development; Subak, Bali.

1. Introduction

The current development paradigm has been applying the concepts of local based development, but still using common institutional forms that have limited size of physical (material) and economy indicators and also easily to measure and observe. In fact there are locality institutions and people who have social needs that can not be measured in financial and economic ways. Noer [9] explained that the strategy of territorial planning has not accommodated the social dimension (social relationships) and politics (authority) of local culture into the decision-making process. Resource allocation is still planned by the economic principles (rationality of the market) and state law, but in some areas the resources are in joint ownership, which is more social (social rationality), and regarded as a cultural heritage. This situation shows the lack of regional planning to realize the concept of local-based development that grows from the bottom.

Systems approach is needed in region development, particularly in determining the analyzed components. Sherman et al. [19] explained that the thought of using systems approach means that there has been a process of comprehensive and integrated thinking to provide an overview of a whole issue of the task that need to be resolved and simplify the complex issue by selecting a few dominant components without losing the essence or the main elements of the object that being studied. The rapid growth of the tourism sector turns out to bring negative impact on spatial planning in Bali, including land conversion. Bali provincial government then planning the sustainable development of rural tourism as a measure to overcome the land conversion from agricultural to non-agricultural. The supply of and demand for ecotourism have grown significantly. At the same time, ecotourism has, as a particular form of tourism development, become increasingly recognised and legitimised as a means of achieving sustainable development in destination areas [16]. Rural tourism development must involve the management of natural resources in order to maintain the original conditions of the local communities [13,21]. The study reflected that rural tourism should promote the development of education and create the awareness for maintaining regional ecosystems not only exploit the economic growth. Management of rural tourism should involve the local communities in the development process, especially in transferring culture. Shikida *et al.* [17] explained that the tourism village in Japan was not only nature-based, but also includes local lifestyles, learning about the culture and history of the place, and to support local based industries. According to Scheyvens [14], a tourism village would succeed if local communities have some measure to control over it and if they obtain the benefits arising from such activities equitably. According to Coria and Enrique [3], the need for a better approach to enhance the indigenous communities' livelihood possibilities coming from ecotourism, as well as to promote land tenure and communities' empowerment. Jones [8] also explained that the development of environment-based tourism village (ecotourism) should include elements of social capital from the local community. Social capital has been contributed in the establishment of

tourism villages and improve the environment because social capital is also the driving force of an area.

Subak is an indigenous people that own religious-socio agrarian characteristic, also an association of farmers who manage the irrigation water, has an important role in the tourism villages management along with the traditional village (Pakraman). Indigenous villages (Pakraman) represents the unity of indigenous people in Bali which possess the whole traditions and manners of Hindu communities for generations in bonds of Goda Three or Goda village that has a specific area and their own property and entitled to manage their own household.

2. Research Methodology

2.1. Location and Data Analysis

This research was conducted for one year (January 2013-January 2014) in Tabanan, Bali. The selection of sites in Tabanan was because this district is the granary of Bali where 70 percent of the region is rural areas that have experienced the conversion of agricultural land (paddy). The analysis was performed by qualitative and quantitative methods. Qualitative analysis was aimed at policy makers (stakeholders) in Tabanan, including local institutions in the district (the village offices, village customs, and Subak). The qualitative data related to spatial management.

System dynamics was performed as an approach to quantitative analysis. The use of that kind of analysis was to create a structuring model of sustainable tourism villages and local institutions through simulation-based model of the physical subsystem (land and water), economic subsystem, social and institutional local subsystem (Subak, Pakraman, and village offices). Data used in this research was time series data over five-year (2009-2013). Data collected was based on the implementation of the new tourism village program began in early 2009. The data was simulated for 21 years (2009-2030 years) in accordance with the Tabanan Spatial Planning.

2.2. Model Approach

This study used a physical, economic, social and institutional subsystem. Physical subsystem consists land and water. Land subsystem covering wetlands, accessibility road to the paddy fields, land settlement, green space area, sacred area, land area of other buildings, and the ratio of developed and undeveloped land in Tabanan. Water subsystem in debit form was derived from dams and rivers that managed by the Department of Public Works in Tabanan and from water debit that consumed by the local environment. Economic subsystem consists of the GDP, government support, land rent, LPD, tourists visit, educational facilities, and local incomes. Social and institutional subsystems consist of population, labor force, employment in agricultural and tourism sector, the growth in both sectors, the number of unemployed, the number of poor, the effectiveness level of Subak, Pakraman, village services and tourism infrastructure.

Optimization models will be simulated with Powersim Studio 10. The dynamic program is modeling software based on flow charts and an approach to multi-level hierarchical environment, both for developing the model and interact with the model [7].

System dynamic is a representation of system behavior which has the interdependence relationships and changes

through time. It can be said that system dynamic is a feedback (feedback structure) that interrelated each other and equilibrium [18].

2.3. Model Validation

Validating the modeling of systems dynamic can be performed in several ways including the direct structure test without operating (running) the model, the structural test of model behavior (structure-oriented behavior tests) by operating the model and comparing the model behavior with real systems (quantitative behavior pattern comparison). AME (Mean Absolute Error) and AVE (Variation Absolute Error) were used in this study. AME is a deviation (difference) between the average value (mean) results of a simulation of the actual value. AVE is a deviation value variation (variance) of the actual simulation. Limits of acceptable deviation is between 1-10 percent [4].

$$AME = [(S_i - A_i) / A_i] \tag{1}$$

$$S_i = S_i N, S = \text{simulation value} \tag{2}$$

$$A_i = A_i N, A = \text{actual value} \dots \dots \dots \tag{3}$$

N = time interval of observation

$$AVE = [(S_s - S_a) / S_a] \dots \dots \dots \tag{4}$$

$$S_s = [(S_i - S_i)^2 N] = \text{the deviation of simulation value} \dots \dots \dots \tag{5}$$

$$S_a = [(A_i - A_i)^2 N] = \text{the deviation of actual value} \dots \dots \dots \tag{6}$$

3. Results and Discussion

3.1. Physical Subsystem

The demand for land is generally affected by two types of demand, direct demand and derived demand. Direct demand has meant that the land serves as consumption goods or housing. This direct demand can directly gives benefit. In derived demand, the increasing of population growth will lead to a high demand for land as a place to produce goods and services or economic activities [1].

The increase on land use for settlement has reached over 100 percent, from 2009 to 2030. Similar conditions also occurred on land for another building by 63.54 percent from 2009 to 2030. The use of land for residential and other buildings will lead to decline the wetlands from 21744.29 ha to 22 465 ha by the end of 2030, or by 3.21 percent. The decline in the sacred area at the end of 2030 is in minor changes, which is at 1.26 percent (Figure 1). Sanctum zone is an area around the temple that needs to be maintained within a certain radius according to sanctity temple status as set out in Purity Bhisama Hindu Dharma Indonesia Pura Parisadha Centre (PHDIP) of 1994. The people of Bali in general and Tabanan in particular are very maintaining the sanctity and sustainability of the land so that the sacred area will only have minor reduction. The loss of sacred area was

normally used for the expansion of rural infrastructure, such as roads, community halls, or Subak halls.

The formulation of physical subsystem models (land) are:

a. Land_area = land area in Tabanan = 83 933 Ha

b. Paddy_field_area = 22 465 Ha

c. Settlement_area = 6047 Ha

d. RTH_area = 12 582 Ha

e. Sacred_area = 4,603 Ha

e. Other_buildings_area = 18.440 Ha

f. The_total_area_of_paddy_field_use=

Paddy_field_area+Settlement_area+RTH_area+Sacred_area+Other_buildings_area

g. Area_that_can_be_used =

Land_area-The_total_of_land_use

h. Land_use_fraction

Area_that_can_be_used/land_area

i. Ratio_of_developed_land =

(Other_buildings_area+Sacred_area+Settlement_area).

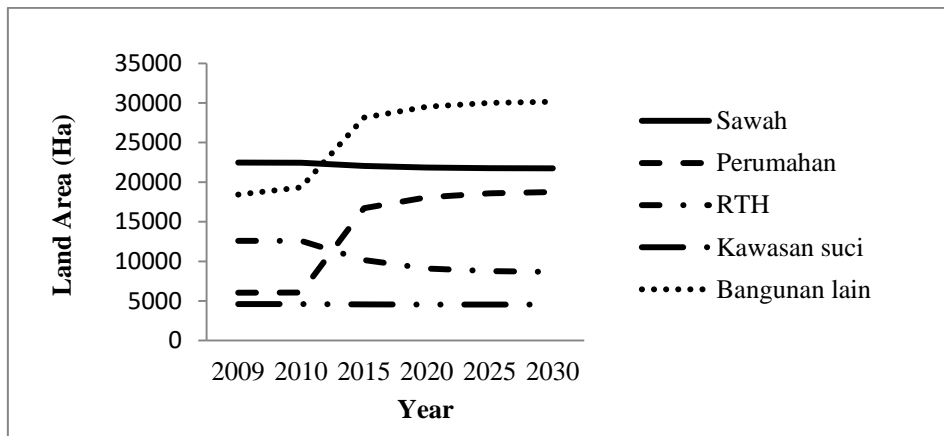


Figure 1: Results Chart of The Land Use Simulation in Tabanan

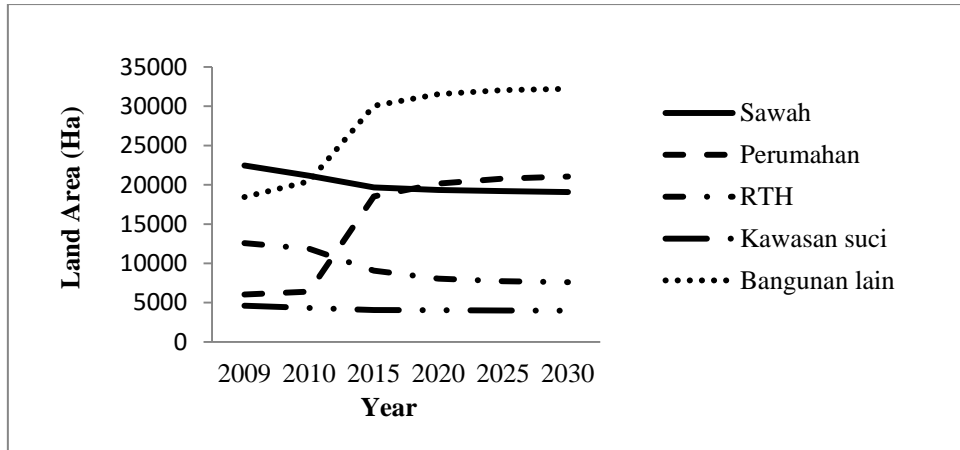


Figure 2: Results chart of the land use simulation in Tabanan without incorporating the elements of local institutions.

This simulation will be different in condition if excluded the elements of local institutions, such as Subak and Pakraman. Wetland/paddy field conditions will decline above 10 percent or 15.09 percent from 2009 until 2030 (Figure 2). The slowing of land conversion might not be happening without the involvement of local institutions. The decline of wetlands was caused by urgency demand of lands for housing and other buildings, especially to support the tourism sector.

Boettke *et al.* [2] affirmed that institutions have roles to derived from subjective perception to an option. The role of institutions, particularly local institutions can eliminate the uncertain elements and defused environment so that it could be more easily connected between options and results.

Research conducted by Dharmawan *et al.* [5] explained that the conversion of agricultural land has implications for changes on agrarian structure. These changes will result in imbalances of agrarian land. The changes will include in land ownership patterns, subsistence patterns, and the patterns of production.

Land conversion can be dynamic. The change of land conversion are likely to lead to the land use that surplus the higher land [11]. Land conversion is a serious threat to food security because the impact of land conversion is permanent. The most influential impact as a result of land conversion is the decrease in water debit.

Simulation models showed that water debit in Tabanan will be reduced to 55.78 percent or 39,692,696 m³ from 2009 to 2030 (Figure 3). The reduction in water debit caused by the high ratio of developed land was above 60 percent. The lack of green area (RTH) due to settlement land or other property/building will cause a reduction in water debit in district area.

The limited of water debit was affecting the cropping pattern in Tabanan. Rice planting season is done only twice a year, in contrast from the previous period that conducted three times a year. Housing and other buildings even PDAM (Regional Water Company) are also using the same water source to their irrigation network. This will cause the greater of water run-off as a shaper of the debit value than the water debit over the years. Social

and environmental functions of water have changed its position into economic functions.

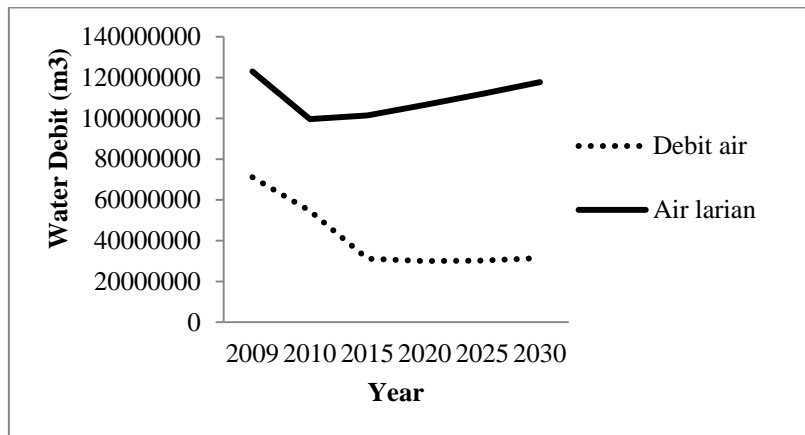


Figure 3: Simulation results chart of water debit in Tabanan.

The economic function through privatization and commercialization of water have caused the excessive exploitation of water, decrease waters for agriculture, changes in cropping patterns, decrease the cropping intensity, reduction of land area for rice cultivation, the expansion of fallow land. Subsequently, conversion of agricultural lands will lower the rice production and farmers' income. Privatization and commercialization of water have caused changes in institutional forms include the decay of spatial space, the values of autonomy and social attachment, governance, leadership, and the power and authority of Subak [20].

Based on characteristics of resources, water resources and all aspects of its utilization is a shared resource (common pool resource) and polycentric [10]. Those characters are making it more difficult to restrict the exploitation, the cost of its boundary (exclusion cost) becomes so high, taking a resource unit will reduce the willingness of others to use it (substractibility or rivalry). As a result, every individual wants to be a free rider, utilizing the resources without contributing to its provision, or the preservation and vulnerable to overexploitation or damage resources. This condition is introduced as the tragedy of the commons by Garrett Harding [15]. This tragedy can happen if there is no restriction rules in exploiting resources so that the water is an open access.

3.2. Economic subsystem

The simulation model results of the economic subsystem to the GDP showed an increase. The value of GDP currently stands at Rp 6.5 trillion. If seen from the simulation results, the value of GDP the Tabanan regency in 2030 will be Rp 8.8 trillion (Figure 4). The average annual rate increase of more than one trillion. This condition was due to an increase in people's income every year in line with the development of tourism villages.

The formulation of economic subsystem models are:

a. $Land_rent_growth = Paddy_field_area / Settlement_area$

b. $Paddy_field_Land_rent = F_Paddy_field_land_rent * Ratio_of_developed_area$

c. $LPD = 273 \text{ unit}$

d. $Supporting_tourism_facilities = Supporting_facilities_fraction * LPD$

e. $Total\ Tourists = Paddy_field_area * Tourists_fraction * Supporting_facilities$

f. $PDRB (Tourists/Land_rent_growth) * (Population/Local_income) * Growth_fraction_PDRB$

g. $Educational\ facilities = PDRB / Educational_facilities_fraction$

h. $Local_income = (Tourism_labor + Agriculture_labor) * Local_income_fraction$

The development of sustainable tourism village certainly has the support from LPD (Local Credit Institutions). LPD is a local financial institutions managed by the local indigenous villages. LPD management is democratically controlled by the local community. Convenience provided by LPD will encourage local communities to create employment opportunities to support tourism sector.

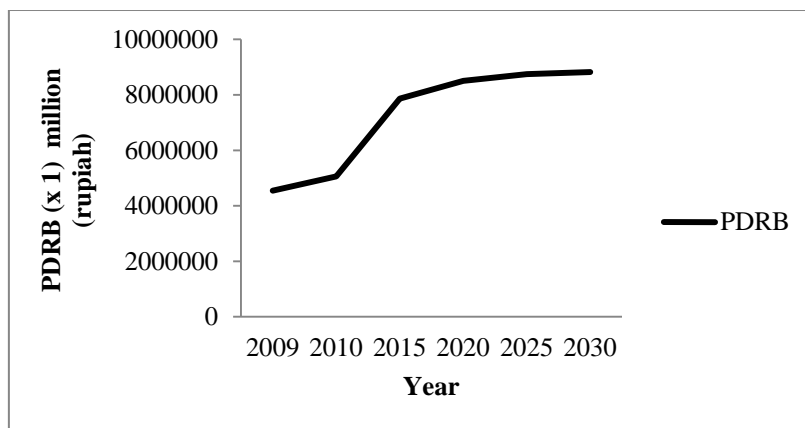


Figure 4: Simulation results chart of GRDP in Tabanan.

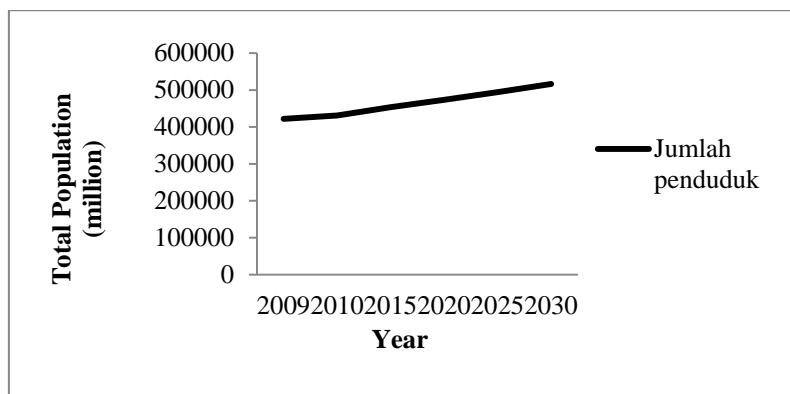


Figure 5: Simulation results chart of total population in Tabanan

3.3. Social and Institutional Subsystem

The simulation results of local resident in Tabanan showed an increase of 22.44 percent from 2009 to 2030 (Figure 5). The population increase in this district was driven by lack of settlement area in Badung and Denpasar and also because the high cost of living in both regions.

The population will be related to labor conditions in agricultural and tourism sector. The simulation results in Figure 6 showed that there is a fluctuation in the labor force in this district. The labor force in agricultural sector has decreased from 2011. The decrease was at 27.82 percent from 2009 to 2011. As seen on Figure 1, the designation of wetland has decreased from 22 465 ha in 2009 to 22456.11 ha in 2010. Despite the decrease of 0.04 percent, reduction in wetland has impacted the decline of employment in agricultural sector in the next year. Different conditions occurred in tourism sector. The rapid growth occurred in 2012 at 26.57 percent compared to 2009 (Figure 6). Declaration of Tabanan as sustainable tourism villages have influenced the shift of labor from agriculture to tourism.

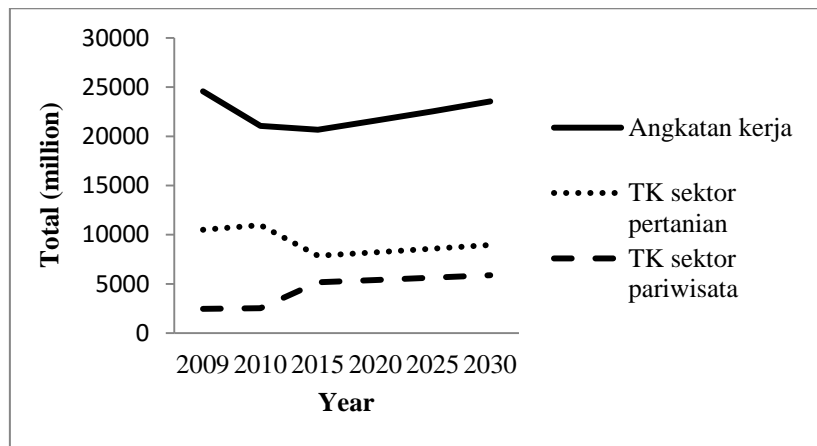


Figure 6: Simulation results chart of labor force in agricultural and tourism sector Tabanan

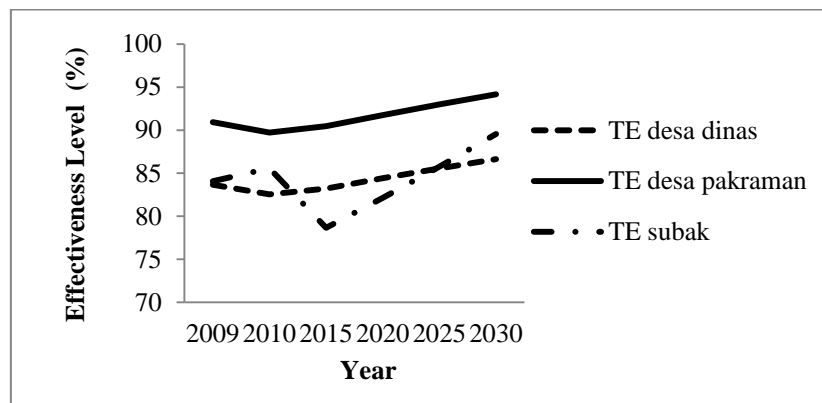


Figure 7: Simulation results chart of effectiveness level in Subak, Pakraman, and Jatiluwih

The formulation of social subsystem models are:

- a. Total = Total Population in Tabanan = 421.843 people
- b. Birth= Total_population*Birth_rate
- c. Death= Total_population*Death_rate
- d. Labor_force= Birth*Labor_force_fraction
- e. Agriculture_labor_force= Labor_force*Agriculture_labor_force_fraction
- f. Tourism_labor_force= Labor_force*Tourism_labor_force_fraction
- g. Education_level= Educational_facilities/Education_level_fraction
- h. Unemployment= (Labor_force*unemployment_rate_fraction)/Education level
- i. Poor people= Poor_people_fraction*unemployment

- j. The effectiveness of Subak = The growth of agricultural labor*Fraction level of effectiveness Subak*workforce

- k. The effectiveness of Pakraman = Growth of tourism labor*Fraction level of Pakraman effectiveness *The labor force

- l. The effectiveness of village = level of Pakraman effectiveness*Fraction level of effectiveness village.

The condition of the labor force associated with the effectiveness of an institutional level. An institution will be considered as effective if it has the right capabilities in selecting the achieved goals and useful tools, so that the desired goals can be achieved with excellent results [12].

Reduced wetland in 2011 was followed by reduction of the labor force in agricultural sector. This condition had caused decrease levels of Subak effectiveness during the year. The effectiveness of water control system and the level of village effectiveness in performing the duties do not differ much. The effectiveness of Pakraman seemed to look higher. Sample level of effectiveness in this study was taken in Jatiluwih. The level of effectiveness in Jatiluwih is classified as very effective. This condition illustrates that the high level of effectiveness in Subak, Pakraman, and other village are still able to control the deceleration of agricultural land conversion to non-agricultural land (Figure 7). Reduced wetland due to the transfer function of only 3.21 percent.

The high level of effectiveness in those villages was caused by the relationships of the three local institutions. The governance in villages (include service village and Pakraman) indicated that Subak position is not under the authority of the service village and Pakraman. Subak is an autonomous institution that has a similar position with the service village and government agencies in Pakraman. The relationship has a coordination character between those three institutions. Coordination between Subak and Pakraman can be seen from the organization of ceremonies or other religious ceremonies, for example when carrying out a temple ceremony in Subak.

4. Referral Policy in Spatial Planning of Sustainable Tourism Village with Local-Based Institution.

Related to spatial planning, model scenarios are necessary to reduce the impact of the agricultural land conversion. Based on the scenario of sustainable tourism villages spatial model and perform the institution-based simulation model of the important factors and systems that affect the agricultural land conversion.

Figure 8 Scenario structuring models of sustainable tourism villages and local institutional-based. Referral policy in this model is divided into three scenarios:

1. The existing scenario (scenario I) is the scenario of the actual conditions in which variable road accessibility to the fields was at 70 percent, government assistance 5 percent, infrastructure 85 percent.
2. The optimistic scenario (scenario II) is the scenario expected to reach the target goal in reducing or lowering the agricultural land conversion to non-agricultural land in realizing sustainable tourism villages, where the variable of road accessibility to the fields was at 90 percent, government assistance 6 percent, facilities and infrastructure 90 percent.
3. Moderate scenario (scenario III) is a middle way scenario if the optimistic scenario could not achieved. Variable of road accessibility to the fields was at 80 percent, government assistance 5.5 percent, infrastructure 88 percent.

Scenario I (road accessibility to the fields at 70 percent, 5 percent to government assistance, 85 percent to facilities and infrastructure) which is better to choose. Slowing the decline of wetland on the first scenario was smaller in 2009-2030 (3.21 percent) compared to scenario II (3.65 percent) and scenario III (3.43 percent) (Figure 9).

As seen on the GDP, second scenario should be selected (variable road accessibility to the fields at 90 percent, 6 percent to government assistance, 90 percent to facilities and infrastructure). Changes in the GDP growth will affect local's income per capita (Figure 10).

The scenario above need to be strengthened by the provision of incentives and disincentives for local institutions and local governments. The farmers who preserve the fields should get incentives such as tax reduction, crop farmers are required to be purchased by the owner of the village, hotel, restaurant and local governments, subsidizing inputs, provision of agricultural credit, or by providing replacement land with other productive land so that agricultural activities can still possible to performed.

Subak has a clear legal rules to running the organization. The rule of law is used as a basic guideline for water control system consists of two kinds, the written and unwritten law. The rules are written in the form of awig awig, perarem and pasuara. The unwritten law is in norms of living in society of Subak. Although almost all indigenous people in Bali were assumed perarem and pasuara as an unwritten rule of law, but in Subak most perarem and pasuara have been recorded so it is considered as written rules of Subak. Within these laws contained various of provisions that binding on all members of Subak, so that everyone in Subak members

shall comply with all legal provisions contained in the rules. In relation to the concept of Tri Hita Karana mainly on the palemahan concept related to the land use, awig awig Subak stated that:

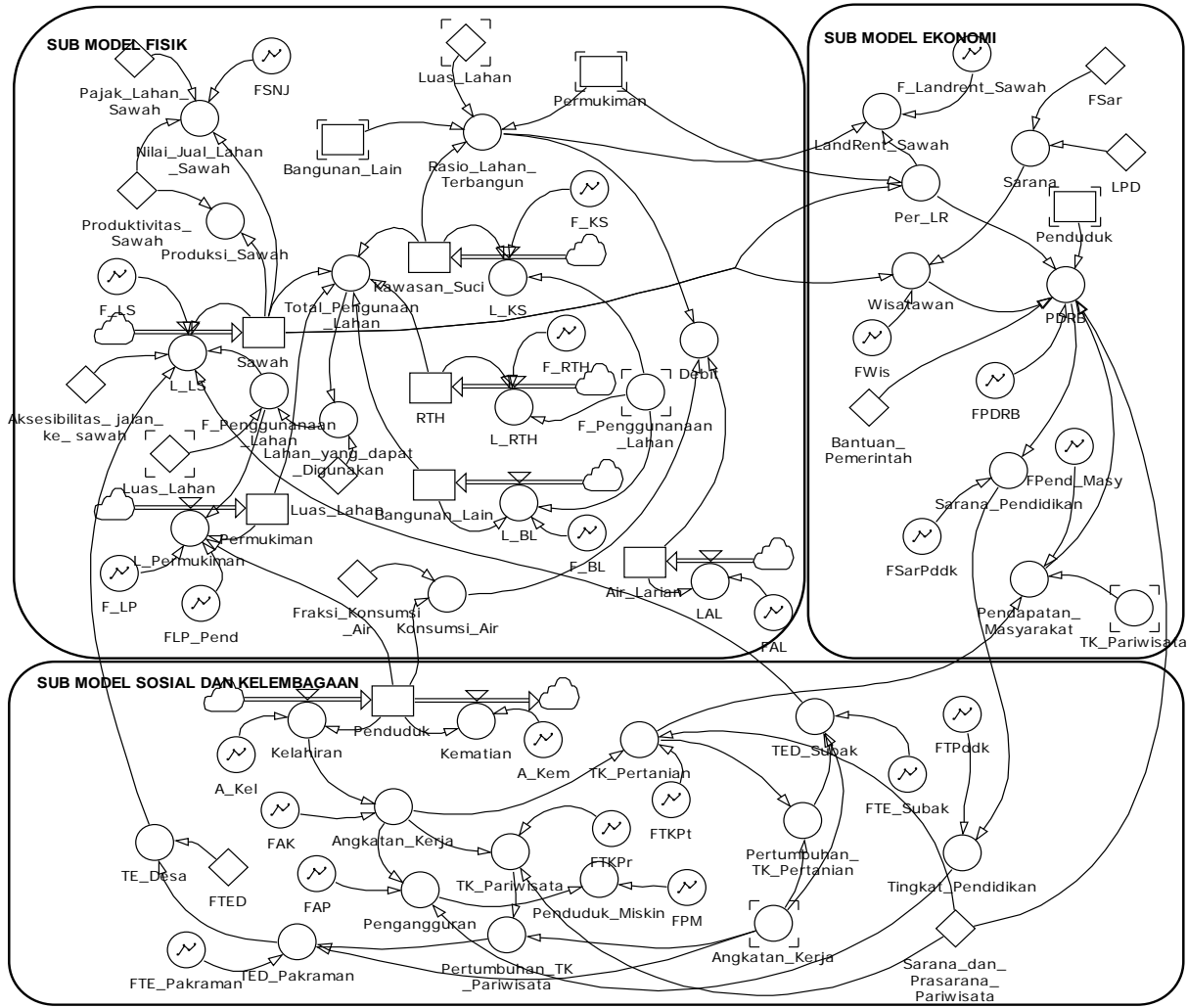


Figure 8: Structuring models scenario of sustainable tourism villages and local-based institution.

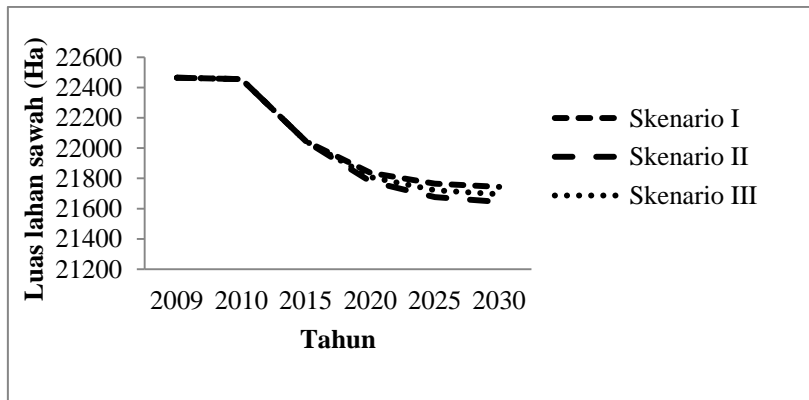


Figure 9: Scenario I, II, III of wetland/paddy fields

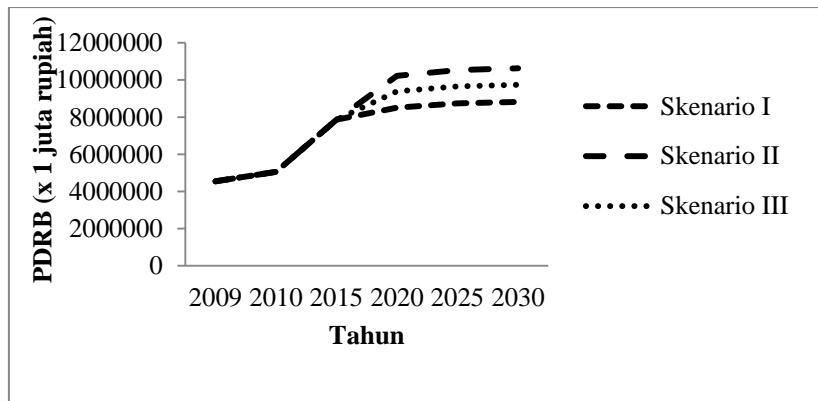


Figure 10: Scenario I, II, III for Tabanan GDP

Sape sire sane ngadol utawi numbas carik ring wewidangan subak patut: (1). Mesadok ring prajuru subak utawi Pekaseh Gede; (2). Patut nginutin sepopa-pali pemargin subak gede sane sampun memargi; (3). Yening wenten salah sinungil carik krama subak gede magentos wiguna ayahan lan pola-pali ring kahyangan mangda kasungkemin

Meaning:

Anyone who sell or buy paddy fields in Subak shall: (1). Reporting to prajuru (caretaker) or pekaseh (chairman) gede; (2). Shall comply with the rules that have been agreed by Subak Gede; (3). To be agreed, if there is one of the krama fields (member) of Subak Gede who converse the function associated with the obligations and rules in Khayangan (temple or shrine).

From the quote above shows that prajuru big Subak and pekaseh Subak gede have an important role in response to the land conversion in Subak. Each krama Subak should do the reporting mechanism if they want to sell their farm. This rule also applies to people outside Subak who will converse their farm into non-agricultural land. This mechanism should be based on certain conditions, especially in the ayah-ayahan (liabilities) that must be executed, as in the procurement of Subak buildings, the implementation of religious ceremonies and other obligations. Besides these rules, prajuru Subak also provide intensive instructions to krama Subak to maintain their farmland. But to create a situation of legal order in society, public acceptance of the law itself is very necessary. The krama Subak found that their fields are family heritage (penglingsir). They feel guilty if they ignore this legacy let alone to sell it. They will manage their wetland/paddy field as good as possible for the sake of the family, sekala, and niscala.

5. Conclusions and Recommendations

5.1. Conclusion

Structuring sustainable tourism village in Tabanan requires the involvement of local institutions, such as Subak, Pakraman, and service village. Overall, reduction in wetland and labor in agricultural sector did not reduce the effectiveness of Subak, Pakraman, and service village. This condition was caused by the pattern of Tabanan tradition which divided into three norms, norms of relationship with God, relationship with human being, and

relationship with surroundings. The third norm is called the Tri Hita Karana.

Structuring models scenario of sustainable tourism villages and local-based institution was aimed to reducing the road accessibility to the paddy fields, government assistance, tourism facilities and infrastructure.

The descriptive of referral policy was to provide incentives and disincentives for the governments, local institutions, and local communities. No local institutions need to be preserved and given incentives. Sale and purchase transaction of agricultural land should be regulated in awig awig and local regulations.

5.2. Recommendations

The model scenario found that the conversion of paddy fields still occur even in a small percentage. This condition was caused by a high effectiveness in local institutions in Tabanan. More analysis needed to make the model scenarios. This model scenarios will also be enriched with analysis to include other local institutions outside Bali so that the appropriate model scenario can be obtained. Future studies should be aimed also to the positive and negative effects on the development of sustainable tourism villages and local-based institution.

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