QUARTERLY INTERNATIONAL JOURNAL

ECOLOGY

ENVIRONMENT & CONSERVATION

ISSN 0971—765 X

Vol. 23
No. (1)
2017

EM INTERNATIONAL

Quarterly International Journal

Ecology, Environment and Conservation

ISSN 0972-3005

Editor: Dr. R.K.Trivedy, Pune, India

EDITORIAL ADVISORY BOARD

Ecology, Environment and Conservation is Abstracted in -

- Chemical Abstracts, U.S.A.
- Ecological Abstracts, U.S.A.
- Cambridge Science Abstracts, U.S.A.
- Ecodisc-CD-Rom, Netherlands
- Geological Abstract, Netherlands
- Pollution Abstract, U.S.A.
- International Dev. Abstracts, U.S.A.
- Paryavaram Abstracts, India
- Current Awareness in Biological Scienenc, Elsevier
- World Textiles Abstracts, Netherlands
- Fluid Abstracts, Netherlands
- Environmental Abstracts, India
- Indian Science Abstracts, India
- Cambridge Science Abstracts

Impact Rating 3.5 (NAAS 2011)

The journal figures in Uhlrich International Periodicals Directory, U.K., Gale Directory, U.K. & SAARC Directory of periodicals.

SUBSCRIPTION RATES

	INDIA	OVERSEAS
Individuals	Rs : 1000.00	US$: 150.00
Institutional	Rs : 2000.00	US$: 600.00

Note : All payments in favour of EM INTERNATIONAL (Postage included in Subscription)

Publishers : **EM INTERNATIONAL,** Prakriti, Balewadi, Baner 411 045, M.S., India

☎(91-2164- 220369; 20- 46745119; E-mail : rktem@pn3.vsnl.net.in

ECOLOGY, ENVIRONMENT AND CONSERVATION

VOL. 23 (1) : 2017

CONTENTS

Eco. Env. & Cons. 23 (1) : 2017; pp. (63-70)
Copyright@ EM International
ISSN 0971–765X

Design of integrated infrastructure development in Poncokusumo Agropolitan Region-Malang, Indonesia

A. Tutut Subadyo and Dina Poerwoningsih

Department of Architecture, Engineering Faculty, University of Merdeka Malang, Indonesia

ABSTRACT

Integrated infrastructure development in the agropolitan region plays very important role in promoting economic growth of the region. Poncokusumo Agropolitan Region (PAR) Malang based on agro and eco-tourism is one of 11 (eleven) agropolitan in East Java Province of Indonesia. This study aimed to develop an integrated infrastructure development design direction to support the development of PAR. In this study the performance of PAR were analyzed by several methods: situational analysis, potential matrix, LAP (Land Allocations Percentages), Bayes-LQ (Location Questions), VA (Value Added), BCG (Boston Consulting Group), CF (Coumpounding Factor), and ISM (Interpretative Structural Model); independence level was analyzed with Multi Dimensional Scaling (MDS), and AHP (Analytical Hierarchy Process). The results showed that: (1) Development of PAR on post facilitation shows that positively impact performance: (2) Independence of the PAR on post facilitation still need to improve some aspects; and (3) development of infrastructure should be driving and leverage other sectors in the development of PAR independently which is reflected in the implementation of environmental management systems, sustainability of economic activities, social and cultural stability and preservation of the environment. The simulation results show the expected major infrastructure is roads, irrigation, drainage and building to support agribusiness. Infrastructure development optimistic scenario would be the best option because it provides a broad impact on the increassing of the total economic value of PAR. Model of Integrated Infrastructure (IT) development prioritized the infrastructure for agro-industries to encourage industrialization in PAR, both in household and industrial scale, which should meet the rules of norms, standards, guidelines and manuals in accordance with minimum service standards. IT development model in this PAR can be an agropolitan prototype development in Indonesia.

Key words *: Agropolitan, Integrated infrastructure, Infrastructure development, Poncokusumo,*

Introduction

National development in Indonesia preferred more to put economic growth in urban, so rural position is on conditions of stagnation, and continue to lag behind. Urban areas as engines of growth (city as an engine of development) trigger agglomeration development activities on a large scale, and increase heavy migration to urban areas (speed up processes), primarily to medium-sized cities (secondary city) (Sitorus, 2010). Strategy of rural areas development by agropolitan concept is expected to balance the development of urban areas and rural areas. Agropolitan which focuses on the development of agribusiness and infrastructure towns of farmer (agropolitan) in rural areas of potential can only be done in a sustainable if the infrastructure available can stimulate and encourage the activity of production and markets in rural areas (Pradhan, 2003). Therefore, the availability of infrastructure (infrastructure) is critical to the development of the agropolitan (Heeres *et al.*, 2012).

The agropolitan concept seen most ideal to be developed in rural areas, particularly with the "research rural base" possession that turned out to be "robust" against the problems of economic crisis, It is because agricultural products produced by the Indonesian have a high value to market export abroad (Sitorus, 2010; Fatkhiati *et al.*, 2015). Poncokusumo Agropolitan Region (PAR) is one of the agropolitan developed in Indonesia, which has the leading commodity horticulture plateau (Farhanah and Prajanti, 2015).

Poncokusumo Agropolitan Region (PAR) Malang is one of 11 (eleven) agropolitan in East Java-based on horticulture and ecotourism. There were problems during the stages of the PAR development activities. Those problems were related to the development of human resources, capital, institutions, natural resources, artificial resources, layout, technology, and infrastructure. In the development of PAR, integrated infrastructure (IT) development is essential to support all the activities in it (Heeres *et al.*, 2012). PAR was developed through government facilities with aspects developed include natural resources, human resources, spatial , farming, housing, infrastructure, technology, capital, and institutional.

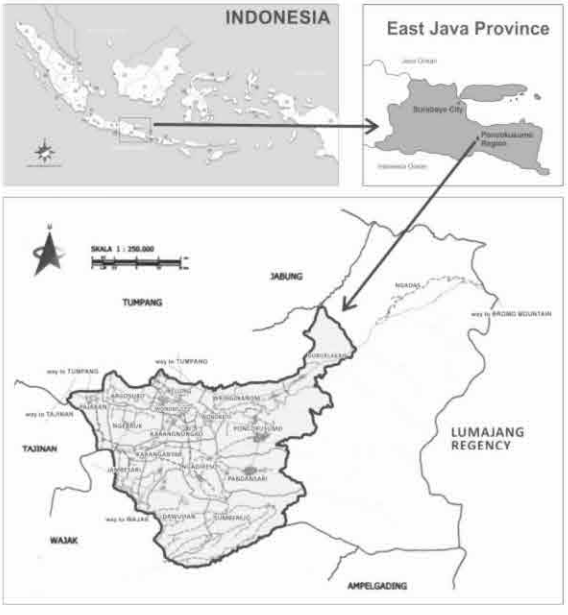

Fig. 1. Map of Poncokusumo Agropolitan Region

PAR performance is assumed to rise, after receiving support from the government stimulant and is projected to become independent. The availability of a sustainable integrated infrastructure is a prerequisite to supporting the development of independent agropolitan. Based on those background, we conducted the research regarding the performance of PAR post facilitation, PAR level of independence, and formulate an sustainable integrated infrastructure design.

As a system consisting of many components, the planning and design of PAR infrastructure should pay a ention to the linkages and interdependencies between components, and their impacts. Planning and design of the infrastructure is a process with high complexity, multi-disciplinary, multi-sector and multi-user. So that the planning and design of infrastructure should not be sectoral, but also can not be too global. If the planning and design too specific (sectoral) regardless of other components, it will conflict with other components. Conversely, if too global, the result will not be effective (Grigg, 1988; Suripin, 2003; Conine *et al.*, 2004; Sitorus, 2010; Subadyo, 2012)

PAR is a system, which contains a plurality of high, multi-sector, multi finance, multi-disciplinary science. As a system agropolitan comprised of subsystem sub-system development, among others: (a) sub-system of human resource development, (b) sub-system of natural resources development, (c) sub-system of spatial development, (d) sub-system of se lement development, (e) sub-system of agribusiness development, (f) sub-system of infrastructure development, (g) sub-system of and information and technology development, (h) sub-system of capital development, and (i) sub-system of institutional development (Estrada-Carmona *et al.*, 2014; Rosdiana *et al.*, 2014; Kumar and Devadas, 2016).

This research aimed to develop models of integrated infrastructure (IT) development to support

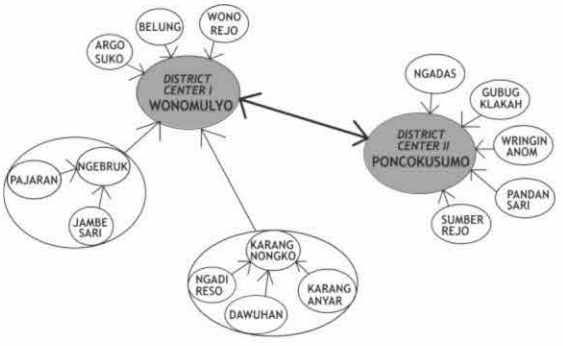

Fig. 2. Spatial Structure and Hierarchi of PAR Based on Agropolitan Districts

the agropolitan development in Poncokusumo Agropolitan Region. Thus the research questions to be answered are: (1) How is the performance of PAR; (2) How is the level of PAR independence after facilitated by the government; (3) How is the formulation on model design of sustainable integrated infrastructure development to support the PAR ?; and (4) How is the development policy direction of PAR?

Method

This research was conducted in Poncokusumo Agropolitan Region, Malang, East Java, Indonesia. The analysis performed include:

1. Analysis of the PAR performance: (a) to determine the general description of the study area, covering natural resources, human resources, housing, infrastructure, technology by was using situational analysis methods: (b) to determine the performance of PAR post facilitation by using matrix analysis methods of agriculture potential cumulative index (APCI) to determine the primary agricultural commodities featured in PAR, matrix analysis of public facilities cumulative index (PFCI) to determine agropolis in PAR, matrix analysis of demand agriculture potencial cumulative index (DAPCI) to determine the final market towns (outlet) PAR, land allocations percentages (LAP) analysis to determine the land use paern, Bayes analysis, LQ, R/C ratio, added value, BCG (Boston Consulting Group) analysis for farming, processing and marketing, analysis of compounding factors for capital and analysis of interpretative structural modeling (ISM) for the institution.
2. Analysis of PAR independence level: to determine the value of the independence agropolitan index level based on the dimensions of farming, agro-industry. Marketing, individual infrastructure and superstructure was by using analysis method of multi-dimensional scaling (MDS), a modification of Rapfish called Rap-Agro
3. Designing a model of an integrated infrastructure (IT) development in PAR: to determine the linkages between sub-sub models of infrastructure development and major infrastructure required by PAR as well as to predict what might happen in the future in accordance to the achieved objectives that are prepared in the pessimistic moderate and optimistic scenario. The analytical method used: dynamic systems analysis, design criteria analysis and financial analysis
4. Formulation of an integrated infrastructure (IT) development policy direction: to determine the priority of policy alternatives in PAR infrastructure development was by using AHP (Analytical Hierarchy Process)

Results and Discussion

Performance and Level of Poncokusumo Agropolitan Region Independence

The results showed that PAR performance on post government facilitation (2013) has increased significantly. This increase is characterized by indicators of success: increasing the level of education, public awareness about the preservation of natural resources and the environment, the application of agricultural technology, the feasibility of the se lements, improving the quality and quantity of infrastructure, as well as the institutional role. The increase in revenue earned through the expertise in selecting the type of commodities that were financially viable and the added value were gained

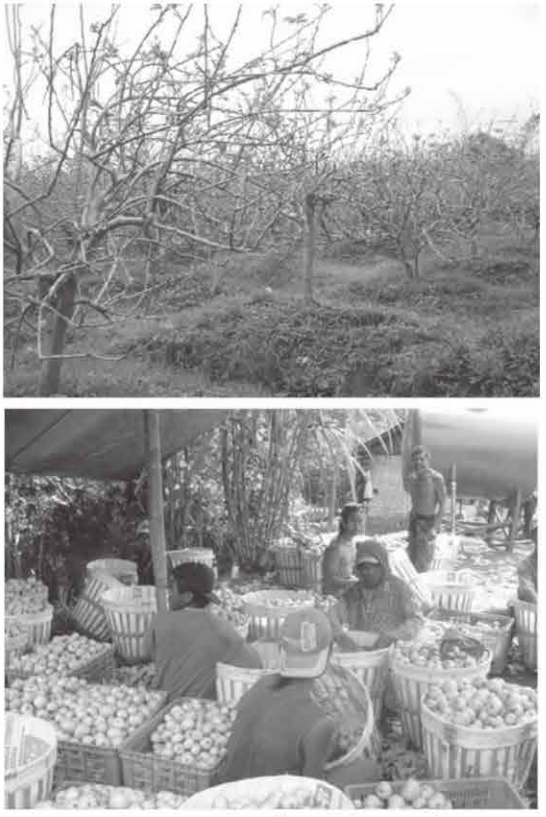

Fig. 3. Fruit Plantation and Apple Production in Poncokusumo

through the final processing and marketing system to bring the production to the final consumer.

PAR independence degree from the analysis on the dimensions of farming, agro-industry, marketing, infrastructure and superstructure showed that the index value is good enough (60.11) which means that PAR is in the category "agropolitan" though not independent. To enhance the PAR independence, the most important dimension is the agro-industry, and then followed by improved marketing dimensions and superstructure dimension.

Agro-industry developed creatively and cleaner production is an innovation in the region toward an independent agropolitan. Porter *et al.*, (1999) and Sitorus (2010) argues that welfare must begin with improvements in productivity and increasing value added through quality and competitiveness processing. The higher the productivity, the be er the competitiveness of the business, and the more creative in the production processing , the higher added value to be obtained. The added value will also be higher if there is net production of hazardous materials, pollutants, or contaminants that is wasted through sewerage or released into the environment before being recycled, treated or disposed of. Clean production does not involve the production process but also involves the management of the entire production cycle, starting from raw material procurement, processes and operations, and waste production, to distribution and consumption. Innovation through the development of creative industries and clean production is an important node that can improve productivity, simplify process steps as well as improve the appearance and taste, will ultimately improve the economic value in PAR towards independence.

PAR independence will be more quickly achieved if development is carried out in partnership between the relevant stakeholders It will be able to create profits together with the principle of mutual need, raising, developing as well as an equal partnership between stakeholders. The partnership principle can generally be identified consists of three basic principles that can be used as a strong starting point for all stakeholders to work together, namely equality, transparency, beneficial and mutual for all stakeholders (Hafsah, 1999; Subadyo, 2012; Kumar & Devadas, 2016) .

The results of the simulation model of the integrated infrastructure development in PAR shows that the main infrastructure for the agropolitan base

Fig. 4. Post-Harvest Conditions in the Absence of Temporary Shelter Production (TSP)

on commodities horticulture, among others, are: road (farm roads, village access roads, and the roads between villages and towns), water infrastructure (water irrigation and water supply), drainage network and building support (sub terminal agribusiness, packing house and cold storage) (Heeres *et al.*, 2012). The road network, especially axis road and farm roads, support the improvement of farming by increasing the number of production facilities capable of being transported to the land, and crops are being transported to the collectors and market. Irrigation facilities can improve farming through the addition of raw water availability for agriculture so that the planting frequency can be increased in the dry season.

Development scenario of integrated infrastructure (IT) in PAR that have been chosen through alternative optimistic scenario is to improve the condition be er for all the variables, through the development of infrastructure to support farming, marketing and post harvest processing. Through the optimistic scenario, it is expected to have a wide impact on the improvement of the economic value

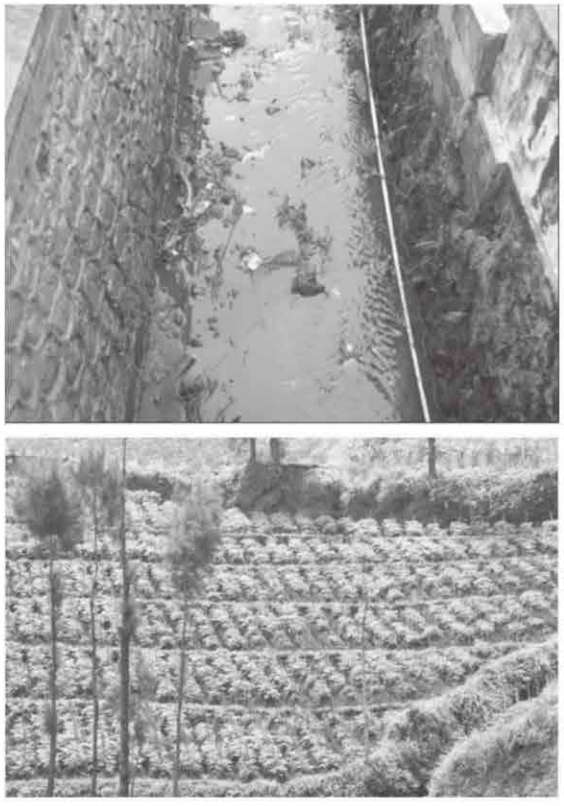

Fig. 5. The Availability of Irrigation Channels that Support the Agricultural System in PAR

of the total area and decrease the unemployment rate, which will be implemented gradually over the long term. Through the optimistic scenario, the value of an integrated infrastructure development interventions in the early years of the simulation (2014) and the end of the simulation (2039) are predicted to increase the economic value of the total area amounting to Rp.75 billion in the beginning of the simulation (2014) and Rp.125 billion in the end of the simulation (2039).

Policy priority of integrated infrastructure development in PAR is the infrastructure development to support agro-industry in order to encourage industrialization in the agropolitan both in the household scale and large-scale industry through the development of facilities home industry, industrial processing factory facilities, cold storage, packing house, and village access roads. The next policy is to expedite the marketing of agricultural products to the market towns final (outlet) through the development of agribusiness terminal (AT) and the roads between villages and towns. Specific policy of infrastructure development in PAR should meet NSGM rules (norms, standards, guidelines, manuals) and meet the MSS (minimum service standards).

Simulation model of infrastructure development in PAR was built through the logic of the relationship and interaction between submodel related, includes sub-models: population growth, land use, production/processing/ marketing of agriculture, infrastructure to support farming, infrastructure for processing, and infrastructure to support marketing, the economic value of regional products and employment. Sub-model simulation results illustrate that the population likely to be positive population growth (positive growth) rose following an exponential curve until the year 2039. This is due to the pace of birth rate greater than the rate of mortality. While the land use sub-model simulation results indicate the change of land use horticultural land into land selements are expected to average area of 4.3 ha/year.

The simulation sub-model results of farming, processing, and marketing, showed a tendency to decrease the production rate, as a result of a decrease in horticultural land area, whereas the one hand the increase in population occurred significantly. Conditions such as these will be very pos-

Fig. 6. Road Infrastructure Condition that Support PAR

sible shortages of horticulture if it is not maintained the balance between supply and demand. Submodel simulation infrastructure for farming, processing, and marketing shows that the availability of irrigation and farm roads will support the increase of the farm production rate. Availability of agro subterminal and village roads access will expedite agricultural products marketing as they will be able to bring products closer to market, while the availability of traditional markets and roads between villages and cities will be able to bring the production to the final consumer.

Furthermore, the sub-economic simulation model showed a significant prediction that until the year 2039 the economic of PAR are affected by proceeds from the sale of horticultural production in fresh form plus the proceeds from the sale of the processing and marketing that are directly sold to wholesalers/distributors in the sub-terminal agribusiness which is already in region. The whole process bring added value that are economically profitable. Meanwhile for the results of the labor simulation submodel obtained significant results that employment is high enough. This is because of the multiplier effect influence on agribusiness that developed include horticultural production, post harvest processing in the domestic scale, as well as the transactions that occur directly between farmers and traders in sub -terminal agribusiness.

Infrastructure Development Scenario of Agropolitan

Integrated infrastructure (IT) development scenario on PAR can be done through the intervention of the variable infrastructure for farming, processing, and marketing in which its regional development progress indicators are region's economic value and the number of unemployed.

Selection of sustainable integrated infrastructure development in PAR is done with the optimistic scenario approach, by intervention in the construction of roads, irrigation, AST (Agro Sub Terminal), household and industrial facilities processing minced chili powder. This optimistic scenario through sustainable integrated infrastructure development in PAR can increase the total economic value of the region significantly until the year 2039, and to reduce the unemployment rate to the level of 10.04% in 2039.

Infrastructure Development Model

Based on the analysis of Analytical Hierarchy Process (AHP), it can be formulated development strategies integrated infrastructure in agropolitan PAR, which factors are most important to the least important are (1) land suitability (0.412), (2) region accessibility (0.236), (3) human resources (0.174), (4) technology and energy (0.119), and (5) financing (0.059).

Land suitability factors play an important role in the development of integrated infrastructure in PAR, as it will determine the effectiveness and efficiency of infrastructure development. The effectiveness and efficiency of land is determined by the role of stakeholder Stakeholders or actors are most important to the least important, namely (1) the government (0.401), (2) the farmer (0.259), (3) entrepreneurs (0,199), (3) co (0.110), and (5) banking (0,031). The government's role is highly expected as a motivator and facilitator in the development of infrastructure PAR, especially Malang Regency Government that should act as a major stakeholder.

The result of this study showed the order of strategic priority in PAR development as follows: (1) the increasing of income (0.324), (2) the expansion of employment (0.298), (3) the expansion of the market (0.237), (4) the increasing of competitiveness (0.091), and (5) regional development (0.051). Interest of income increasing is prioritized by considering that the income of farmers has always been very inadequate and often lose money, whereas the core activity of agribusiness development in PAR is farming as a major community activities

The result of this study also showed the order of priority in the decision-making process of integrated infrastructure development that is sustainable in PAR as follows: (1) the construction of supporting infrastructure agoindustri amounted to 0.333, (2) development of infrastructure to support marketing (0.285), (3) development of infrastructure supporting farming (0.246), and (4) development of supporting infrastructure for se lement (0.134). Development of agro-industries supporting infrastructure is needed because it could lead to a multiplier effect on PAR mainly in improving the region's Gross Domestic Product.

Conclusion

The conclusion that can be drawn from the results of this study are as follows: Infrastructure development in PAR into propulsion, thrusters, and levers, other sectors, which significantly impacted performance improvement PAR, such as:

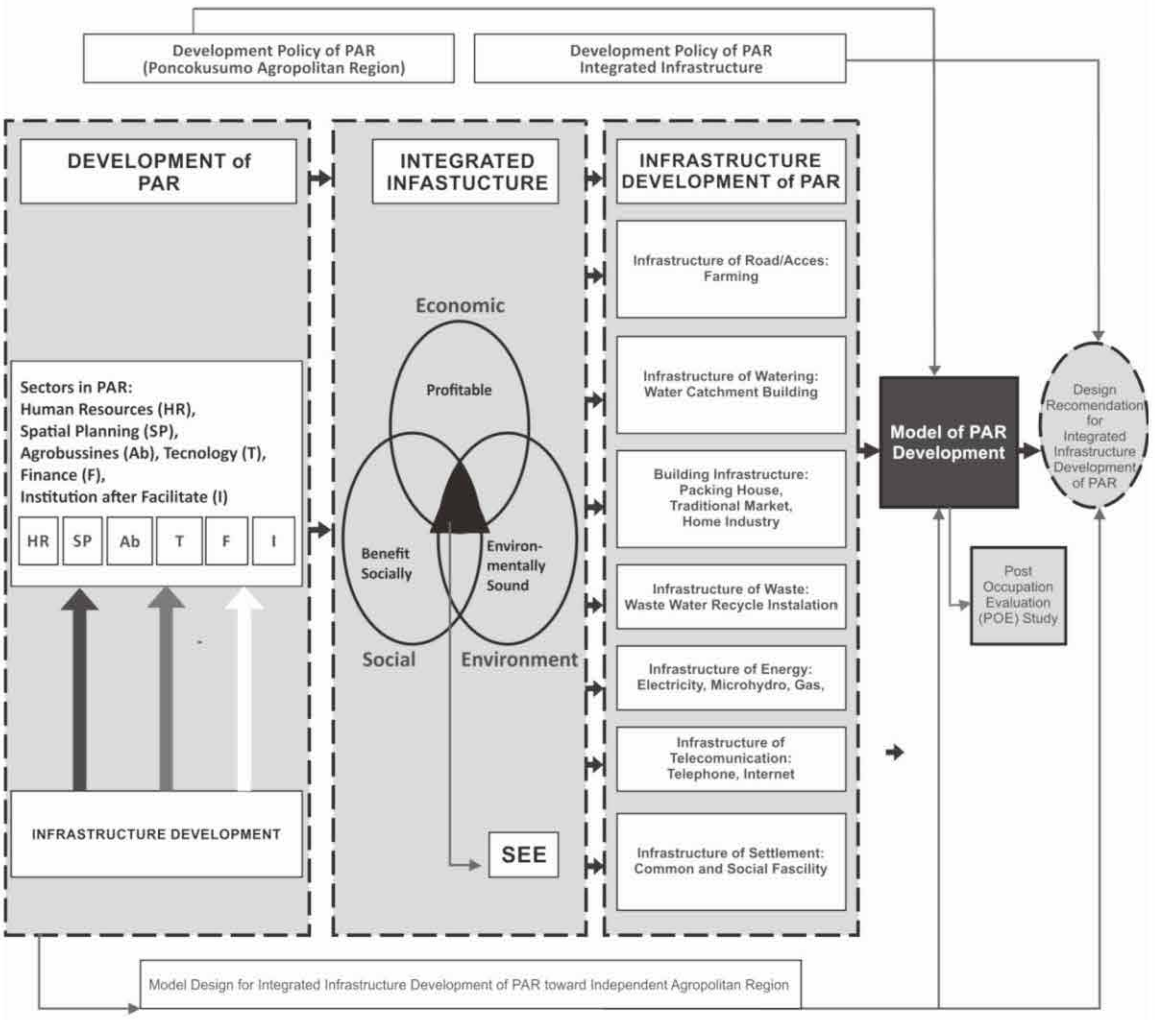

Fig. 7. The Conceptual Model of Integrated Infrastructure Development in Poncokusumo Agropolitan Region

1. Paerns of thorough development of the production centers area to the processing centers on the agropolis), will encourage the spread of population evenly.
2. The development of agricultural technology in PAR especially for manufacturing industries based on agricultural commodities in the household (home industry), will encourage the management of the original PAR conventional to semi modern.
3. The paern of residential development which still retains the traditional paern of beautiful and rural in character, with a building density is low, will be a regional power that is important to be maintained.
4. The existence of the Poncokusumo village and the Wonomulyo village which will be the new farm town/Agropolis can serve as agropolitan development centers, distribution and services centers, trade and service centers of agro-industry, housing and selement development centers, public facilities as well as service centers and social facilities.

Related to the above conclusions, the formulation of the design concept of infrastructure development in PAR should be based on:

1. The environmental management system (EMS), that takes into account to aspects of environmental sustainability (ecology), the economic activity sustainability and social culture stability.
2. Infrastructure development scenario in PAR is directed to the optimistic scenario, with interventions through improve the conditions of all

variables in the infrastructure construction to support farming, marketing and processing.

3. The concept of infrastructure development policy in PAR, directed (a) to push the speed and independence PAR, (b) to encourage local economic growth in PAR through the development of the system and based agribusiness commodity that competitive, (c) to encourage the formation of farmers' towns/agropolis in Poncokusumo and Wonomulyo which serves as a service center and distribution of goods and services center in PAR and (d) to prioritize the development of supporting agoindustry infrastructure, followed by marketing infrastructure, farming and selement.

In line with the infrastructure development policy above, this paper proposes the following facilities:

1. Infrastructure facilities for supporting agroindustrial that are most needed are the packing house, the unloading field, cold storage, clean water supply, sewage and waste water facilities, telecommunications networks, and the manager secretariat office.
2. Infrastructure facilities for supporting marketing that are most needed are a wholesale market/agribusiness terminal (AT) and the traditional markets in the cities of the marketing end (outlet).
3. Infrastructure facility for supporting farming that is most needed is a secondary farm roads that can be passed four-wheeled pickup vehicles.
4. Infrastructure facilities for supporting se lements that are most needed are public facilities and social amenities in PAR that is equivalent with the urban, so it can withstand the pace of migration to the cities.

Design of infrastructure development in PAR is directed to encourage the development of systems and agribusiness completely and thoroughly from upstream to downstream. The integrated infrastructure development that is designed in PAR is also encouraged to play a role as a leverage and the prime mover to the other relevant sectors in the agropolitan.

Acknowledgment

This paper is a part of our process during research funded by research scheme of "Penelitian Hibah Bersaing", so the authors would like to thank General Directorate of Research Strengthening and Development, Ministry of Research, Technology and Higher Education, Indonesia.

References

Conine, A., Xiang, W. N., Young, J. and Whitley, D. 2004. Planning for multi-purpose greenways in Concord, North Carolina. *Landsc. Urban Plan.* 68 : 271–287.

Dardak, AH. 2002. *Pembangunan prasarana dan sarana khususnya jaringan jalan mendukung agropolitan.* Depkimpraswil Jakarta.

Estrada-Carmona, N., Hart, A.K., DeClerck, F.A.J., Harvey, C.A. and Milder, J.C. 2014. Integrated landscape management for agriculture, rural livelihoods, and ecosystem conservation: An assessment of experience from Latin America and the Caribbean. Landsc. *Urban Plan.* 129 : 1–11.

Farhanah, L. and Prajanti, S.D.W. 2015. Strategies in Developing Agropolitan Areas in Indonesia. J. Ekon. Pembang. *Kaji. Masal. Ekon. Dan Pembang.* 16: 158–165.

Fatkhiati, S., Tjiptoherijanto, P., Rustiadi, E. and Thayib, M.H. 2015. Sustainable Agropolitan Management Model in the Highland of Tropical Rainforest Ecosystem: The Case of Selupu Rejang Agropolitan Area, Indonesia. *Procedia Environ. Sci.* 28 : 613–622.

Heeres, N., Tillema, T. and Arts, J. 2012. Functional-Spatial Sustainability Potentials of Integrated Infrastructure Planning. *Procedia-Soc. Behav. Sci.* 48: 2533–2544.

Kumar, S. and Devadas, V. 2016. Integrated Planning for Sustainable Development of Ku anad Wetland Region, Kerala State. *Procedia Technol.* 24 : 1660–1667.

Pradhan, P.K. 2003. *Manual for urban rural linkage and rural development analysis*. New Hira Books Enterprise. Nepal.

Rosdiana, H. and Inayati, Murwendah, 2014. Evaluation of Fiscal Policy on Agropolitan Development to Raise Sustainable Food Security (A Study Case in Bangli Regency, Kuningan Regency and Batu Municipality, Indonesia). *Procedia Environ. Sci.* 20: 563–572.

Sitorus. 2010. Model kebijakan pembangunan infrastruktur berkelanjutan dalam mendukung pengembangan kawasan agropolitan. SP PSL IPB Bogor.

Subadyo, AT. 2012. *Desain Pembangunan Infrastruktur Terpadu yang Sustainabel dalam Pengembangan Poncokusumo Agropolitan Region.* Laporan Penelitian Hibah Bersaing, Tahun Pertama. DP2M Dikti, Depdiknas.

Suripin. 2003. Sistem drainase perkotaan yang sustainable. Jakarta.