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TOWARDS GREEN ECONOMY : THE DEVELOPMENT OF SUSTAINABLE AGRICULTURAL AND RURAL DEVELOPMENT PLANNING, THE CASE ON UPPER CITARUM RIVER BASIN WEST JAVA PROVINCE INDONESIA

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ABSTRACT

Sustainable Agriculture and Rural Development on Upper Citarum River Basin has important role in increasing local economic growth, social equity and environmental quality. It is essential to reduce population pressure on rural resources. A quantitative model on population pressure and its potential for development planning can help to achieve a more holistic regional planning since agricultural development, the creation of employment in the non-agricultural sector and population growth are tied together. By providing local input (resources), agropolitan, training, credit, marketing, ecoretail, ecotourism, bio-energy, bio- industries, and their job & income multiplier effects can be expected to increase value added creating additional income and new employment both on-farm and off-farm as well as non-farm sectors. A model used to develop sustainable agriaquaculture on the following area is agriecobussiness with low external input sustainable agriculture (LEISA) amongs land use patterns covering ricefield, horticulture, fish capture and aquaculture, drawdown area, agroforestry, husbandry, and farm estate management.

Keywords: Upper Citarum Riverbasin, Aquaculture, Agroforestry, Population Pressure, Saguling-Cirata Reservoir.

INTRODUCTION

Citarum River Basin which lie in West Java Province streams from Wayang Windu Montain to Java sea, on the topic is divided into Upper Citarum River Basin and Downstream Citarum River Basin. Environmental Management of PLTA Cirata in 2012/13, Upper Citarum River Basin which on this topic is as planning region, hydrologycally cover Ring I (R-I : Waduk Cirata Reservoir), Ring II (R-II : Cirata Catchment Area), and Ring III (R-III : Saguling Reservoir and Catchment Area). The planning region is divided into sub-catcment area, which on R-I and R-II cover 6 sub-catchment area, ie Cisokan, Cimeta, Cibalagung, and Cikundul, while on R-III consists of 7 catchment area, ie Cikapundung, Cikeruh, Citarik, Cirasea, Cisangkuy, Ciwidey, and Saguling. Hydrologically, regionalization of this planning region could be divided into smallest unit by ordo (primer and scunder). Administratively, R-I and R-II lie in 3 district, ie Bandung Barat, Cianjur and Purwakarta. R-I II for Saguling Reservoir lie in Bandung Barat District, while for Saguling Catcment area lie in 5 district, ie Bandung City, Cimahi City, and districts of Bandung, Bandung Barat and Sumedang (Gambar 1).

Upper Citarum River has important role in regional economic development both West Java Province and others province such as Jakarta Megapolitan and other province in Java. The roles are very complects as kawasan lindung and kawasan budidaya. There are important main activities in this area such as ecotourist, govermental, education, transportation, trade and tourist, settlement, industry, forestry, farm estate management, agriculture of food and horticulture, aquaculture and husbandry, groundwater stock, land and water conservation, electricity, carbon zink/carbon reservoir, water supply for Jakarta City.

After Pasandran[2] spatially Upper Citarum River Basin is towards *the java syndrome* which shows third stage. At the first stage, forest landuse is still dominant which could converted to agricultural land and settlement. At second stage, the landuse of settlement increase continously while ricefield is can not increased, and forest land decrease continously. Finally, at third stage shows *the java syndrome* which indicate the decrease the role of Jawa as food production centre caused by agricultural land convertion to non-agriculture activities. Java Syndrome is not only in Java but also in Out Java (Wikarta et a1, 2010).

Regional economic development quickened to get economic growth without landuse controll and environmental management well such as the case in Upper Citarum River Basin have caused environmental degradation doe to forests and agricultural land convertion to non-agricultural activities, environmental pollution, urbanization, proverty, and high population pressure. The development of Bandung Metropolitan distributed horizontally, industry, unpublic transportation, and also the Java system development of electrical energy such as PLTA Saguling, PLTA Cirata, PLTP Kamojang and PLTP Gunung Wayang Windu development undirectly have role as *"primer mover"* had contributed as the main cause of them.

Increased Economic activities had caused environmental externality. Husen showed it was correlation between economic activities and waste until critical line of carrying capacity. Based on result of the research BPLHD West Java Province (2006) , Parikesit, et al (2006)[6], and Paimin (2007)' the water pollution rate of Upper Citarum River was height with bad water quality status (Wikarta et al, 2010). Wikarta (2011) showed that the productivity and income of floating net cage was significantly different by before and after the polluted reservoir, by the water quality status, and by dry and wet season.

In Upper Citarum River Basin, the development of sustainable agriculture and rural development were very needed to support food security, source of household income and employment, material source of industry, agrotourist, culinary tourist, population pressure controll on resources, and as field laboratorium of research and science development (R&D).

The aim of the writings presented in Sustainability Sciences Symposium is to describe efforts towards green economy through the development of sustainable agricultural and rural development planning. The objectives is to present: (1) Environmental issues on sustainable development; (2) A quantitative model on population pressure and its potential use in the development of sustainable agricultural and rural development planning; (3) Aplication model in the development of sustainable agricultural and rural development planning; (4) Internalize the externality of sustainable agricultural and Rural Development.

[2]Pasandran,E (2002). *"Irigasi Masa Depan Memperjuangkan Ke.sejahteraan Petani dan Ketahanan Pangan"*. JKI Indonesia.

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MATERIALS AND METHODS

The writings based on the case in Upper Citarum River Basin West Java Province Indonesia due to there are the need to integrate sustainable regional development planning using ecosystem approach which sectorally amongs aggriecobusiness, demografi and non-agriculture development; hydrologically between upland and reservoir management; and regionally between rural-urban and inter-out provinces. The writings matterials based on qualitative method through field observation, interview with key informan and study of research result literature.

RESULTS AND DISCUSSIONS

Environmental Issues of Economic Development in Java

Whitten et al (2001) indicated some environmental issues on the economic developments in Java and Bali as folow:

1. The economic developments in Indonesia have led to progress in human economic well being. However, many of the ecological, social and physical impacts resulting from past and present economic developments are now the cause of great concern, to such an extent that it is now questioned weather the available natural resources are able to sustain future economic growth. Especially in Java and Bali are able, of course, to import goods such as basic natural resources, energy and other materials, but the inexorable decline in overall environment quality is still a serious ecological problem, and the issue of sustainable developments need to be addressed seriously very soon.
2. Conventional economic development does not yet have any way of measuring the ecological consequences of development activities and most economist operate without a specific theory of ecological value, relegating ecological impacts to the category of externality. Therefore, exhaustion of non-renewable resources, irreversible damage to renewable resources, pollution, and general degradation of the environment, all of which are ecological concerns, are evaluated arbitrarily in the economic sense so that significant actions to prevent and/or mitigate further ecological deterioration are not accountable.
3. Ignorence of ecology, the failure to comprehend the principles and consequences of ecology has been a major factor in causing the environmental problems, some might say crises, affecting us. Nowadays, the issue of sustainability of our use of natural resources is a major subject on political agendas the world over, it is clear that our understanding of ecology, especially ecosystem and the interaction between organisms and the environment must be improved.
4. Carrying capacity is the maximum size of population that the resources of a given area can just sustain (carry), and at this density the population may cease to grow. More likely, however, is that the population will, for a period, overshoot the carrying capacity of a limiting resource causing a decline in its size do to increased mortality, reduced fecundity and emigration. If this occurs, then it is likely that the excess population will damage the environment and in some way reduce its carrying capacity, a form a negative feedback loop, with the result that the population will fall to a new, lower level until the environment is restored.
5. Population pressure is defined as the force with regulated the farmers/agricultural land ratio to remain unity. When its value larger than 1, there is a force with presses the farmers to either extend the agricultural pressure or to push the farmers to migrate to elsewhere, usually to cities to find new sources of income. Both the extension of land as well as the migration to cities have negative impacts on sustainability and hence efforts should be made to control population pressure.
6. Loss of biological diversity. Biological Diversity is used in difference ways to mean all or any one of: Ecosystem variety, The variety of species, The genetic variation Human cultural variety is a global phenomenon, and the Global Strategy list six fundamental causes (1) the unsustainable high rate of human population growth and natural resource consumption. (2) the steadily narrowing spectrum of traded products from agricultural, forestry, and fisheries. (3) Economic systems and policies that fail to value the environment and its resources. (4) Inequity in the ownership, management, and flow of benefits from both the use and conservation of biological resources. (5) Deficiencies in knowledge and its application; and (6) Legal and institutional systems which promote unsustainable exploitation.
7. Inadequate economic paradigm, the economic system is based on principles that began to be laid down some 300 years ago when no thought was given to the exhaustion of natural resources, to the damage done to human health by industrial wastes, to the loss of biological diversity, or to undesirable social, environmental, and international consequences of gross indebtedness and free trade (George 1992; Daly and Goodland, 1994; Ekins et al 1994; Ropke 1994)*.The conventional view, encouraged by some development banks and national governments, is that the health of a country's economy is best measured by the value of goods and service produce within the country (GDP), and the national income (GNP). This view is ostensibly reasonable, but many or all environmentally-damaging activities increase both measures. It takes no account of depletion of natural resources or of pollution. It means it fails to give any information about efficiency or sustainability (Tinbergen and Hueting , 1992).

A Quantitative Model on Population Pressure and Its Potential Use in Sustainable Agricultural and Rural Development Planning

Reduced population pressure on resources is needed to improve the quality of environment through the development of sustainable agriculture and rural development. Soemarwoto (2008) state that sustainable development should be implemmented with four principles, ie ethics, ecology, social, and economy. Since 1981 until 1985, Prof. Soemarwoto (alm) have developed a quantitative model of population pressure and its potential use in development panning in Indonesia. Based on that formula, population pressure on land could be reduced by a holistic means which involves effort as follow (1) Increase land productivity and on-farm income through the application of bio-technology and integrated fanning, cropping pattern improvement, land structur and textur improvement, the use of high economic value and super variety, the use of organic fertilizer and pesticides, market and transportation improvement, capital access, training and non-formal education continously; (2) Increase farmers income proportion of off-farm and non-farm activities. Increased farmers income is obtained with developing Local Based Agriecobussiness. These activities can create multiplier effect, value added, and strengthen farmers negoisation; (3) Reduce the number of farmers which depend on farmland and they are moved to off-farm and non-farm sector; (4) The reduction of population growth and the increase of the proportion of benefit which can be enjoy by the farmers; and (5) To control agricultural land to non-agricultural.

Wikarta (2012) simplified the model and redefined that the term of population pressure on land was not only used for farmers but also other communities. The formula as follow :

$$RPP = \frac{\sum H_i f_i P_o (1+r)^t}{\sum I_i}$$

In which:

H_i : A perceived level of decent standard of living (Rp/person/year), H_i= f(Cost of living and lifestyle);

f_i : Proportion of labors i in the population;

P_o : Number of population at reference time t, (person);
r : Annual rate of population growth (%/year);
t :Time period of calculation (year);
I_i :The labor income of i cover on-farm, off-farm and non-farm income

The holistic approach can be summarized which mathematically can be presented in the following form (Soemarwoto, 1985) :

$$pp = (1-\alpha)z\frac{fP_o(1+r)^t}{\beta L}$$

In which:
α : Proportion of income from off and non-farm (0<α<1);
z : The minimal hectarage of land required for a perceived level of decent standard of living (ha/person);
f : Proportion of farmers in the population;
P_o : Number of population at reference time t_o (person);
r : Annual rate of population growth (%/year);
t : Time period of calculation (year);
β : Proportion of benefit enjoyed by the people (0<β< l);
L : Total hectarage of agricultural land (ha);

The formula shows that population pressure on resources in rural could be controlled by increase their total income and/or through the decrease of perceived level of adequate standard of living. The value of perceived of adequate standard of living is a function of cost of living and life style, therefore to reduce population pressure both factors should be improved. The main cost of living which must be improved by government cover for food, housing, transportation, health, and education. While to increase the rural households income could are carried out by developing agriecobusiness, ie through the creation of on-farm and off-farm employment. Non-farm employment can help also to increase their households income.

Development program failure due to wrong theory, two ilustration of program failures that keep reappearing in less developed nations highlight the importance of (1) the use of valid economic model, (2) a knowledge of the empirical realities of traditional agriculture; and (3) avoiding incorrect assumptions. False ideas about the economics of agricultural areas in less developed nations continue to be held in both national and international aid and development circles. These wrong mental images lead to the elaboration of many ineffective program and much waste of development recources. In Upper Citarum River Basin by using as average income equivalent to 650 kg of rice/person/year as a basis the population pressuhe re in 1980 was 2,25 and in 2010 was 3,1l (Table 1).

Table 1. Population Pressure in Districts of Upper Citarum River Basin 1980-2015

No		Komponen	Cianjur	Bandung	Sumedang	Purwakarta	West Java
1.	Population	No. (P)	1.387.578	2.669.200	723.627	457.973	25.408.085
		Density (People/km2)	401	878	509	552	665
		Annual growth rate 1971-80 (%/Year)	2.33	3.31	1.40	1.32	2.40
2.	Farmers	No. (F)	921,940	1,215,326	547,510	258,777	14,192,211
		Fraction of Population	0.66	0.47	0.76	0.57	0.59
3.		Farmland (Ha)	155,933	181,513	95,377	53,345	3,532,118
4.		Z-value (ha/person)	0.60	0.56	0.60	0.64	0.54
5.	Population Pressure	1980	2.31	2.44	2.24	2.02	1.90
		2000*)	3.10	3.30	2.75	2.65	2.40
		2015a*)	3.61	3.75	3.10	3.05	2.90

After Soemarwoto (1984) and Projection*).

Application in Development Planning of Upper Citarum River Basin Management

Because of the departementalization of goverments, development planning has been largerly carried out sectorally. Integrated planning is still very difficult, although many efforts have been made to achieve this goal. *The planning region of Upper Citarum River Basin* in West Java will be used as an prototype of green economy for the case in sustainable agriaquaculture development in Indonesia. The high rate of population growth and rising demands or higher living standars act as strong positive feedback signals for more intensive exploitation of our ecosystem. Since population pressure plays an important role in the attainment of sustainability, it is prudent to include it in development planning, such that it will not be increased or where necessary, actually reduced.

The model as shown in equation at Figure I and 2 can help to achieve a more holistic planning since agricultural development, the creation of employment in the non- agricultural sectors and population growth are tied together. The general goal of development is to improve the standard of living of the people on the longterm sustainable basis. Since population pressure plays an important role in the attainment of sustainability, it is prudent to include it in development planning, such that it will not be increased or where necessary, actually reduced.

Population pressure (PP) on land as mirror environmental quality (Q) by scenarios (Soemarwoto, 1984) as presented at Figure 1. Scenario-1, without industrialization population pressure increase and environmental quality decrease exponentially. Scenario-2, scenario with industrialization but caused converted agricultural land, environmental externality and farmers did not enjoyed it that population pressure increase and environmental quality reduce dipped. Scenario-3, with industrialization and farmers get benefit from them that population pressure decrease and environmental quality increase, and finally they will support sustainable region development.

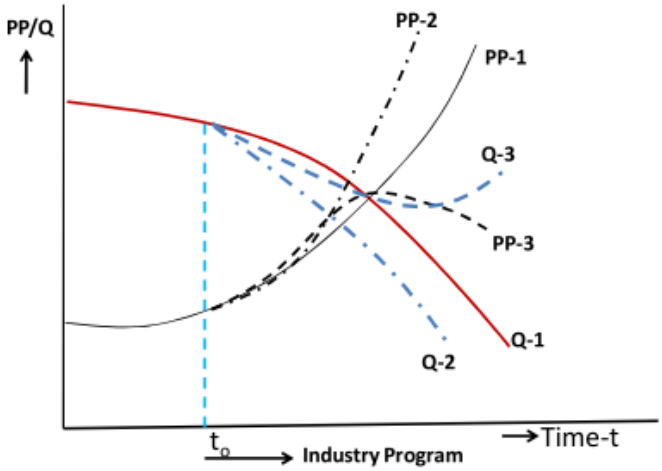

Figure 1. Scenarios of Agrarian Transtition Impact to Industry,Population Pressure on Land as Mirror Environmental Quality (After Soemarwoto. 1984).

Population pressure on land in the case on Upper Citarum River Basin West Java at 1980-2015 is presented in Table 1. By using an average income equivalent to 650 kg of rice/person/year as basis the population pressure on land in districts of West Java on Upper Citarum in 1980 were 2,31 of Cianjur, 2,44 of Bandung, 2,24 of Sumedang, and 2,02 of Purwakarta.

Therefore, agricultural land were converted and polluted that the population pressure on land in 2000 and 2015 be increase. It would also result in hazardous level of population pressure would result in expansion of agricultural land. Since most, if not all, potential agricultural land had already been brought under cultivation, this expansion would occur marginal lands, such as river and ravins banks, and forests; so that the effect would be disastrous. If we wish to reduce them, it is should

be conducted holistically. Based on the model, we should reduce the components of z, f, r, b and increase the components of α and L.

Figure 2 showed Prototype for Towards Green Economy : Sustainable Agriaquaculture Development in Upper Citarum River Basin. There are two aspects in Upper Citarum River Basin Management, ie protected area and cultivated area management. The main goal of protected area management was to protect natural resources and *national vital object* such as to main and increase environmental quality and reducing population pressure on resources. Part of protected area can be managed through *Community Based Ecotourism tCBE),* and its aim to increase ecosystem services covering provisioning services, regulating services, supporting services, and cultural and aesthetical services.

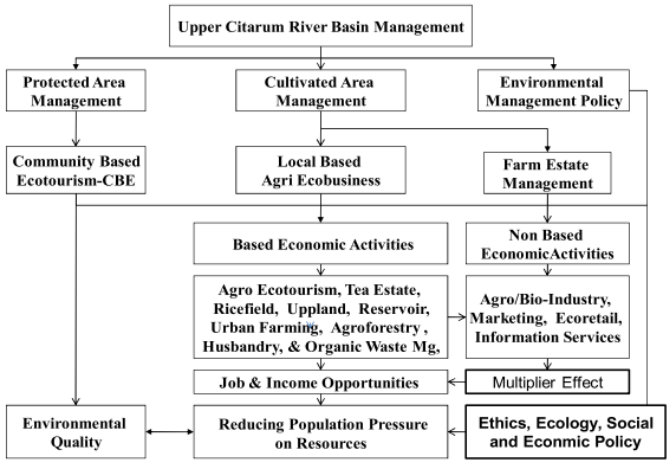

Figure 2. Prototype for Towards Green Economy.

Sustainable agriaquaculture development planning on cultivated area management of Upper Citarum Riverbasin should be developed through local based agriecobusiness management by farmers group and farm estate management by privat. There are two main activities used by regional economics in analysing job and income opportunities of economic activities at the region. The economic activities cover based economic activities and non-based economic activities. Based economic activities cover agroecotourism; tea estate management; farm management of ricefield, upland crops, agroforestry, and animal & husbandry; aquacultur farming of fispond and reservoir; urban farming, and organic waste management. That activities create employment and income multiplier effect of non-based economic activities such as agro-bio industry, marketing, farmers based ecoretail development, extension and information services. These economic activities will increase value added in job and income opportunities that population pressure on resources will be reduced and increase environmental quality automatically.

The implementation of environmental management policy presented in Figure 1 would be needed to support sustainable agricultural and rural development in Upper Citarum River Basin. The main policies as follow :

1. UU RI No. 49/2009 on Protection of Sustainable Food Agricultural Land;
2. UU RI No. 55/2007 on spatial Management;
3. UU RI No. 26/2009 on Environmental Management;
4. UU RI No. 7/2004 on Water Resources Management;
5. Stakeholder participation; internalize development externality; environmental tax (pigovian tax); user tax of natural resources; corporate social responsibility (CSR); micro-finances; marketing & ecoretail development; infrastructurs improvement; waste management through reuse, reduce, recycle (3R); institution development; spatial maving by ordo, and R&D.

Application in Development Planning of Saguling and Cirata Reservoir Management

Based on Environmental Benefit and Risks Assement (EBRA) of PLTA Saguling and PLTA Cirata Development introduced by Soemarwoto in 1981 as be presented also in Figure 3 on Resettlement Scheme of Community Development affected by PLTA Saguling and PLTA Cirata Project, the goals of agricultural development on the upper Citarum riverbasin were to minimize negative impact and to suport sustainable development of the project. In the case to minimize negative impact of the project be recommended mainly through reservoir management which cover agroforestry of greenbelt, agriaquaculture in drowdown area, capture fisheries, aquaculture in reservoir called Floating Net Cage Aquacultur, agro-ecotourism, and agro-bio industry. In supporting sustainable development of the proyek, agricultural development in Upper Citarum River Basin (R-I, R-II, and R- III) should be oriented on development of sustainable agricultural system and local based agriecobusiness.

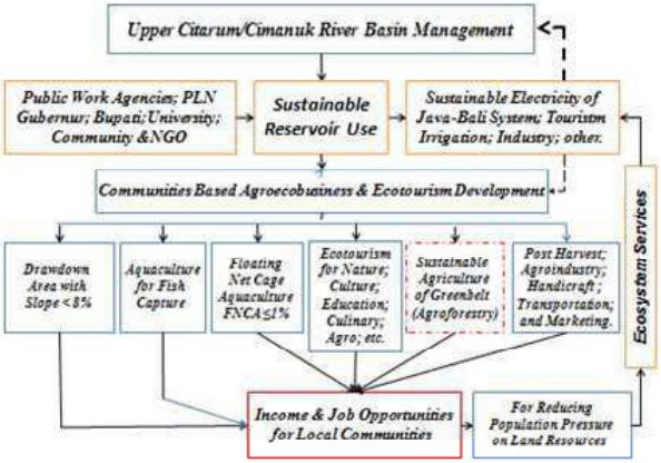

Figure 3. Green Economy Prototype on sustainable reservoir use

The Need to Integrate Conservation of Upper Citarum River Basin and Sustainable Development of Bandung Megapolitan

Kota Bandung at Ring III (R-III) will be megapolitan which the impact area cover Upper Citarum, Upper Cimanuk, and Upper Cipunagara River Basin. Therefore, the need to integrate conservation and development. Figure shows the need upper Citarum riverbasin and sustainable development of Bandung Megapolitan. If Kota Bandung be managed well could role as growth pole in Indonesia and in the world of main service activities such as transportation, education, government trade and tourist, agro or bio industry, and retail development. The activities will employ farmers on services activities, that can reduce proportion of farmers on population (component-fj. By developing agriecobusiness such as cattles with agroindustry of soybean could create new employment in production sector, trade services sector, and the use of biogas and bioslury. Agroindustry of tea and others for food and drinking are also could create job and income multiplier effect. Training, the provision of credit, and the development of markets for products would enamble the farmers to increase their additional income from off-farm and non-farm activities that could also increase farmers income proportion of off-farm and non-farm income (coofecient-o). 0n Urban farming (Figure 4) could be developed the commodities, particularly such as orchids and horticulture which have low values of z. Thus by increasing coofecients o, and lowering the values of z, f, and also r by an intensification of the family planning program, the adverse effects of increasing population pressure would be overcome. By improving life style of people and spatial arrangements such as through transportation and eco-settlement improvement and also market development cost of living would be reduce. By improving household income while cost of living be reduce, population pressure will decrease.

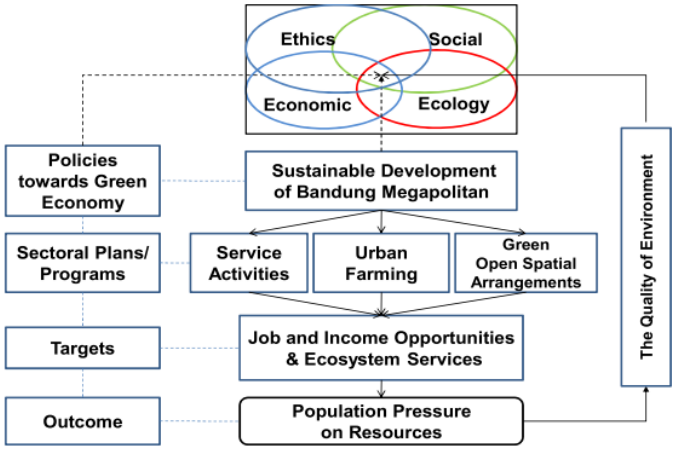

Figure 4. The Need to Integrate Upper Citarum River Basin Conservation and Sustainable Development of Bandung Megapolitan West Java.

By conservation through green open spatial arrangement (Ruang Terbuka Hijau, RTH) could have important role as carbon zink/carbon reservoir, micro climate, flood controll, and water supply that can support services activities and others. Finally, by policies towards green economy through sustainable development of Bandung Megapolitan with emphasize on the main principles ethics, ecology, social, and economy, of course population pressure on resources will be reduce, while the quality of environment will be increase. For that, the master plan for development of sustainable Bandung Megapolitan should be designed optimally, effecient, integrated, and holistically as which be presented in UU RI No /2007 on Spatial Arrangement. That all will controll population pressure on resources in upper Citarum riverbasin. For that, the development of sustainable agricultural development in the area would have important role in regional economic development not only for West Java Province but also for other province indirectly.

Internalize The Externality of Agricultural and Rural Development in Upper Citarum River Basin

In 1920 British economist A.C. Pigou was instrumental in developing the theory of externalities. The theory examines cases where some of the costs or benefits of activities "spill over" on to third parties. When it is a cost that is imposed on third parties, it is called a negative externality. When third parties benefit from an activity in which they are not directly involved, the benefit is called a positive externality. The study of such situations, a part of welfare economics, has been an active area of research since Pigou's efforts early in the twentieth century (Callahan, 2001).

In relation with welfare, Buchanan & Stubblebine (1962) in Randall, A (1981) stated eksternality in a welfare fungtional as follow : U = U(Xi;. Xz;. ..X,j, X), j I k; where X, (i=l,2,...n,m) and activity, j and is individual/community. The fungtional showed that individu/community is not only influenced by the activity of individual/community (Xi,) but also influenced by the external activities, and eksternality could be divided into two types, positive externality or Externality Economy, EE and negative externality or Externality Diseconomy, ED.

In economics, an externality is an impact on any party not directly involved in an economic decision. An externality occurs when an economic activity causes external costs or external benefits to third party stakeholders who did not directly affect the economic transaction. Another term that often replaces externality is spillover. One may see the words "spillover costs" or "spillover benefits"" Although they sound less technical, the two terms are interchangeable for externality. Basically, the producers and consumers in a market either do not bear all of the costs or do not reap all of the benefits of the economic activity. For example, manufacturing that causes air pollution imposes costs on others, while planting forests (rather than other agricultural activities) would improve the water quality of those downstream.

In a competitive market, the existence of externalities would mean that either too much or too little of the good would be produced and consumed in terms of overall cost and benefit to society. If there exist external costs (negative externalities) such as pollution, the good will be overproduced by a competitive market, as the producer does not take into account the external costs when producing the good. If there are external benefits (positive externalities) such as in areas of education or public safety, too little of the good would be produced by private markets as producers and buyers do not take into account the external benefits to others. Here, overall cost and benefit to society is defined as the sum of the economic benefits and costs for all parties involved.

The Positive Externality showed that the welfare of affected people by external activities were increases. In positive externality, the equilibrium price was more higher than internalizing, but output less. The development of sustainable agricultural development in Upper Citarum River Basin would increase on-farm and off-farm income and imployment. In general, we can expect the following relationship to hold. In a situation where a positive externality is present, social benefits Private benefits + External, and benefits External benefits > 0 Social benefits > Private benefits. The need to internalize the positive externality of sustainable agricultural and rural development in uupper Citarum river basin. The issue of external benefits is related to that of public goods, which are goods where it is difficult if not impossible to exclude people from benefits. The production of a public good has beneficial externalities for all, or almost all, of the public. As with external costs, there is a problem here of societal communication and coordination to balance benefits and costs. This also implies that it is not something solved by competitive markets. The government may have to step in with a collective solution, such as subsidizing; implementing land protection policy, environmental and user tax; increasing the use of corporate social responsibily (CSR), training and education, farmers empowerment, etc.

Many negative externalities also called "external costs" or "external diseconomies" are related to the environmental consequences of production and use. The article on environmental economics also addresses externalities and how they may be addressed in the context of environmental issues.

- Water pollution by on-farm and agroindustries activities that adds poisons to the water, which harm plants, animals, and humans
- Industrial farm animal production, on the rise in the 20th century, resulted in farms that were easier to run, with fewer and often less-highly-skilled employees, and a greater output of uniform animal products. However, the externalities with these farms include "contributing to the increase in the pool of antibiotic-resistant bacteria because of the overuse of antibiotics; air quality problems; the contamination of rivers, streams, and coastal waters with concentrated animal waste; animal welfare problems, mainly as a result of the extremely close quarters in which the animals are housed."
- The harvesting by one fishing company in the reservoir depletes the stock of available fish for the other companies and overfishing may result. This is an example of a common property resource, sometimes referred to as the *Tragedy of the commons.*

The need to internalize the negative externality of agricultural and rural development in upper Citarum riverbasin as Figure 5 by ethics development and the use of incentive- disincentive system in natural resources management, such as in optimizing the use of reservoir for floating net cage aquaculture and the use of drawdown area or marginal land; developing sustainable agricultural system such as organic farming, LEISA (Low External Input Sustainable Agriculture), and agroforestry for example homegarden and talun-kebun system on upper Citarum and agrosilvopastural which be developed at Spillway Outlet

PLTA Cirata; and developing R3 (reduce, reuse, and recycle) management.

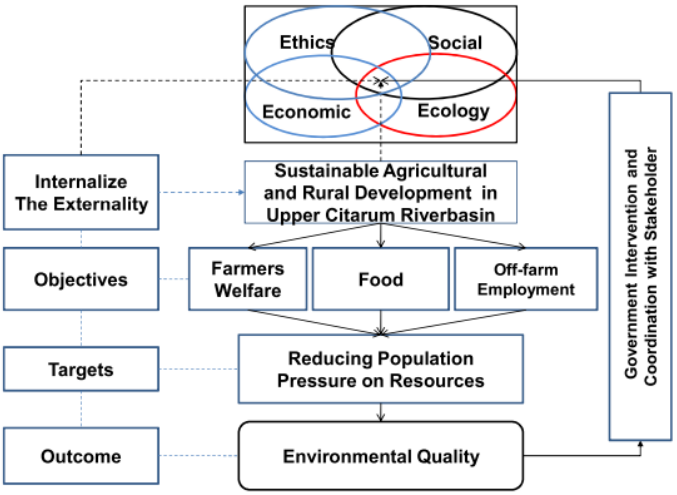

Figure 5. Internalize The Externality of Sustainable Agriculture Development in Upper Citarum Riverbasin West Java.

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