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Concept of Carrying Capacity: Challenges in Spatial Planning
(Case Study of East Java Province, Indonesia)

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Abstract

East Java as a province which has strategic role at national scale has a real consequences of the population and natural resource consumption rising. The regional economic growth has not given significant contribution to the environmental sustainability issue. Hence, development should take carrying capacity into account in which population dwelled so that the concept of sustainability could be implemented.

Masterplan as product of a spatial planning should consider various strategic issues which among of them are the environmental sustainability issue. Policies, plans and programs in masterplan should consider the environment carrying capacity through SEA (Strategic Environment Assessment). Using comparative analysis, SEA in masterplan of East Java Province has not fully described how the environmental capacity could accommodate spatial activities. The concept of carrying capacity through the implementation of SEA is not easily integrated in spatial planning, considering challenges faced are the difficulty of the integration and synchronization between SEA and spatial plan substance; studies focus on the environment which do not consider the social and economic objectives; and the longer formulation process on policies, plans, and programs of spatial plan

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1. Introduction

There are two laws that expressly puts the values of the carrying capacity on development planning, namely Act No. 32 year 2009 on the Environmental Protection and Management and Act No. 26 Year 2007 on Spatial Planning. Environmental carrying capacity is a measure of the environmental ability to support humans life, other living beings, and the balance among both of it and a measure the environmental ability to absorb energy and / or other components that come incorporated into it (Rees and Wackernagel, 1996). Environmental Carrying capacity aims to preserve the environmental functions and public safety, in the Act stated that any spatial planning document shall be based on strategic environmental assessment (Strategic Environmental Assessment) - is a series of systematic analysis, holistic, and participatory, to ensure that principles of sustainable development has become a basic and integrated on the development of an area and / or policies, plans and / or programs (Retnowati, 2013).

Economic growth in East Java province which has increased in recent years and shows that the performance of physical development and economic performance increasingly stretched. On the other hand, the activities of the construction and development of the region which is grow intensively still not consider the principles of sustainable development. While the development of the residents and their needs for access to resources is increasing, the declining of environmental conditions which is shown by the phenomenon of degradation and decline in the quantity and quality of natural resources and supporting means which become the needs of the population dwindling due to the limited existence. The result is some of the issues raised as the external issues of East Java Province, which are the increasing ratio of residents number in urban areas (migration), the rapid development of the cities so that they appear more megacities, global warming issues, the restructing of the core city functions resulting in urban spatial spillovers that occur agricultural land use changes in a large scale, technological developments which melt the physical boundaries between regions so that more and more cities have broad dimensions (globalization). While the internal issues in East Java Province covers issues of population, the availability of infrastructure and socio-economic facilities, the gap of development concentration, food security, Sidoarjo mudflow, and the increasing conversion of forest and environmental damage that resulted in the escalation of disaster.

Thus, the growth conditions of East Java development is supposed to accommodate elements of the carrying capacity of the environment in accordance with the mandate of spatial policy and the environment both at the planning and implementation so that the carrying capacity of the environment could support the development continuously. But in reality the issue of environmental degradation cannot be avoided in East Java. To help toward improving the quality of spatial plans, the presence of a Strategic Environmental Assessment (SEA) is mandatory as a tool for spatial planning framework to address the environmental problem -based environmental carrying capacity. This paper aims to identify how the challenges of SEA implementation in spatial planning, particularly in East Java.

2. Methods

The method used in this research is descriptive comparative method. Comparative method is defined as the ratio between the substance of the research objectives with the concept or theory (Mill, 1872). In addition, a comparison technique is also the conclusion of two or more theories as a matter of clarification or clarifies a point (Ragin, 2005). In this research, comparative method was used to compare the concept of environmental capacity based on SEA instruments with the carrying capacity basic principles which is contained in the provincial spatial plan of East Java.

The first step is to conduct a literature review on the concept of carrying capacity through the instrument of SEA. Furthermore, a review of the product of spatial plans of East Java Province regarding plans, policies and programs that impact on the environment, as well as how the SEA implemented for the Spatial Plan East Java Province.

3. RESULTS AND DISCUSSION

3.1. Carrying Capacity Concept

Carrying capacity (carrying capacity) is defined as the maximum population that can be supported by a particular habitat indefinitely without damaging the productivity of the habitat permanently (Rees and Wackernagel, 1996).
The definition of the concept of carrying capacity according to the Malthusian theory is contentious because it is close to understanding the context of the "war" with the human population so that an increase in the environmental carrying capacity leads to the suppression efforts of the human population. While Catton, 1986 (in Rees and Wackernagel, 1996) simply defines the environmental carrying capacity as the maximum carrying capacity continuously. That is, the human factors technology could pursue the use of natural resources remain within the limits of a maximum carrying capacity of the environment. Thus, the concept of Carrying Capacity is not solely related to how many maximum population, but instead related to capacity / maximum capacity entropy) environment that can be utilized by humans. So that in practice, the concept of carrying capacity is associated with the critical question of how productive land area required to support human needs (Rees, 1992; Rees and Wackernagel, 1994), hereinafter termed the palm of ecological (ecological footprint).

The concept of carrying capacity (Carrying Capacity) is naturally not a relationship that is fixed, static, and simple. This concept is closely related to technology, preferences, as well as the structure of production and consumption. This concept is also related to the interaction between the physical and biotic environment (Arrow et al., 1995). Rees and Wackernagel, 1996 illustrates the concept of carrying capacity in city environments where the metabolism of a city analogous to human metabolism, where the city consumes natural resources from the environment and produce waste are then released into the environment again. So the concept of carrying capacity is closely related to two things (Khanna, 1999), ie the capacity support of natural resources (supportive capacity) of a city neighborhood with a capacity of waste/residues (assimilative capacity). Conceptually, the concept of carrying capacity is very clear but very difficult to estimate.

3.2. SEA (Strategic Environmental Assessment) as the Implementation of Carrying Capacity Concept

The concept of carrying capacity is to be implemented through development policies oriented at carrying capacity of the environment. SEA is an instrument developed for the purpose of management and environmental protection in Indonesia. SEA aims to assist in managing and protecting the environment and promoting sustainability. SEA is defined as follows:

"SEA is a systematic process for evaluating the environmental Consequences of proposed policy, plan or program initiatives in order to Ensure they are fully included and appropriately addressed at the earliest stage of NAMAs decision making on par with economic and social considerations." (Sadler and Verheem, 1996 in Therivel, 2004.)

Another definition of the SEA should be also related to the principle of policy integration and sustainable development plans and programs in accordance with the environmental carrying capacity (Deputy Sustainable Environment, Indonesia Ministry of Environment, 2007). Some principles of SEA are (Therivel, 2004):

- SEA is a tool to increase the strategic action.
- SEA should promote the participation of other stakeholders in the decision-making process.
- SEA should focus on environmental constraints /key sustainability, thresholds and limits on the appropriate level of plan-making.
- SEA should help identify the best options for strategic action.
- SEA should aim to minimize the negative impacts, optimize positive, and compensate for the loss of valuable benefits.
- The SEA must ensure that the strategic actions do not exceed the limits of the impact that permanent damage may occur.

Spatial planning in Indonesia produces planning products containing formal spatial policies, plans and programs. Policies, plans and programs are aimed to create a better spatial planning quality. However, environmental issues are still going on and the indication of a decrease in environmental quality and carrying capacity. Therefore, in the preparation of spatial planning should take the environmental carrying capacity into
SEA approach to spatial planning in Indonesia is divided into four, namely:

- **SEA as a basic framework of the EIA (Environmental Impact Assessment)**
  This approach has a procedure similar to the EIA (Environmental Impact Assessment) to examine the effects and impacts of spatial plans posed to environmental quality.
- **SEA studies assessing environmental sustainability (Environmental Appraisal)**
  This approach did a review of the policies contained in the Spatial planning with the specific environmental point of view.
- **SEA as an integrated assessment / environmental sustainability assessment (Integrated Assessment / Sustainability Appraisal)**
  This approach did a review of the policies contained in the spatial plan with a holistic perspective, from the standpoint of social, economic and environmental.
- **SEA as an approach to sustainable natural resource management (Sustainable Natural Resource Management)**
  This approach was applied by emphasizing natural resource considerations as substance in Spatial plan, and as an affirmation of spatial plan as the reference rule of resource utilization and protection of natural reserves.

SEA has a different role according to the level of the spatial plan product hierarchy. At the level of the provincial spatial plan, the SEA is transformative, which means that the results of the SEA works to improve the quality and substance of the Spatial Plan formulation process, as well as facilitating the process of decision making in the planning process in order to balance environmental objectives with social and economic objectives. Studies on SEA minimum load:

- the carrying capacity and environmental capacity for development
- An assessment of environmental impacts and risks
- Performance of service / ecosystem services
- Efficient use of natural resources
- The level of vulnerability and adaptive capacity to climate change
- The level of resistance and the potential for biodiversity

### 3.3. SEA in East Java Provincial Spatial Plan Year 2011-2031

The East Java Provincial Spatial Plan 2011-2031 compiled to provide an operational reference for the sectoral development implementation. It is designed by considering all aspects including environmental capacity in order to achieve harmony between the natural environment and artificial environment. East Java economic growth which increasing continuously need to be contained in the spatial plan so that in the document said that the development of the East Java Province is directed to support and realize the commercial services sector to deal with the dynamics of globalization and free trade, so as to bring the various sectors in East Java become more valuable and encouraging regional economic growth.

On the other hand, the growth of the region should not neglect the aspects of sustainable development, which directly or indirectly will remain a major bearing capacity of all activities. Sustainable development is a conscious and planned effort that combines aspects of environmental, social, and economic to the development strategies to ensure the integrity of the environment as well as safety, capability, welfare, and quality of life of the present generation and future generations.

Therefore, this document is drawn up through a series of stages and assessment to the condition of East Java Province plans so that drawn up plan can accommodate all aspects and full of harmony. Some of the strategic issues that underlie the preparation of spatial planning documents include:

- The issue of land capability and land conversion
The issue of economic inequality, infrastructure and human resources
The issue of natural disasters and vulnerability
Lapindo Sidoarjo mud disaster issues and economic implications
The issue of conversion of protected forest and paddy farming
The issue of disintegration agricultural sectors and not optimal increase in value-added agricultural production.
The issue of urban growth that leads to urban sprawl
The issue of food security
The issue of the development of strategic infrastructure such as transportation, energy and telecommunications.

In relation to the extent to which the concept of carrying capacity was adopted in The East Java province spatial plan is then necessary to review how the framework of SEA is implemented in the preparation of policies, plans, and programs. Policies, plans and programs in East Java province studied their effects on the environment are as follows:

Table 1. Effects of Policy, Plan and Program of The East Java Provincial Spatial Plan to The Environment

| No. | Policies                        | Plans and Programs                                                                 | Effects                                                                                     |
|-----|--------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1.  | Controlling City System Policy | The development of urban centers which hierarchical one to another and are associated with rural systems create a system that supports the growth and spread of various activities | • The negative impact is expected to come from the effects of rapid urban development on agricultural land availability, environmental disturbances and the like. It is given, that in urban centers has meant agricultural land reserve wetland which is high enough.  
• The development of new urban centers which is close to forests and conservation feared the emerge of conflicting land use. |
|     | Regional Infrastructure Policy | Southern Cross Road Network Development as the development plan of the National Strategic Road Network (still not connected yet)   | • The opening of the new road will affect the trend of the development of aquaculture activities, especially in protected areas, forests and conservation through JLS.  
• The opening of roads and improvement of the quality of the road and its grade at country area will also trigger a land use change of agricultural land into non-agricultural land so as to reduce the agricultural land reserve (food security). |
| 2.  | Expansion of Tanjung Peark Port due to its current capacity already saturated by the increasing demand and regional economic growth | Adding the burden of the environment (land) which already exist, such as, floods etc. Susceptible to environmental conditions such as the disruption of port activities that will be developed |

Source: Adopted from SEA Proceeding, 2011

The policies, plans, and programs effect study contained in the Provincial Spatial Plan towards environmental strategy just had been conducted on issues related to disparities and development facilities and regional infrastructure. SEA in this context is only executed on a qualitative study on how much the influence of policies plans and programs will be developed will affect to the environment. However, the results of this study may not fully represent that space utilization is well within the carrying capacity of East Java province. Therefore, SEA to support environmental capacity of East Java region needs to be internalized in spatial plan product. The internalization of SEA in East Java spatial plan can be made through integration of SEA with Spatial plan content. However, this integration process becomes not easy because the analysis stage in the SEA is difficult to be synchronized with the formulation stage of policies, plans and programs in East Java spatial plan. In the formulation of policies, plans and programs of East Java spatial plan have considered several principles which is related to environmental sustainability, such as efforts related to conservation of protected areas. SEA towards East Java spatial plan is still not done yet thoroughly and systematically on various strategic issues.
4. Conclusion

Management efforts and environmental protection done through one of the study on carrying capacity. SEA as one instrument of carrying capacity should be included in spatial plan. SEA in spatial plan is transformative which give improved quality on the substance formulation process, and can facilitate decision-making in the planning process in order to balance between environmental, economic, and social objectives. However, SEA which contains environmental carrying capacity study having a procedures and steps which are difficult to be implemented in the spatial planning process.

Some of the challenges to implement the SEA into spatial plan are:

- Difficulties on the integration and synchronization of SEA substance with the spatial plan substance.
- SEA focus on environmental viewpoint which do not accommodate the social and economic goals such as on policies, plans and programs in Spatial plan.
- SEA provide a thorough environmental assessment over territorial strategic issues that impact on the longer formulation process for policies, plans, and programs of spatial plan.

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