



## LAND USE EFFICIENCY IN SOUTHERN PHILIPPINE PROVINCES

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**Abstract:** The global economic crisis and the environmental sustainability issues have identified clear imperatives that need to be addressed at specific governance levels to be more effective and direct, rather than continuing to be engulfed under a cloud of general policy assumptions. Policies on decoupling environmental impacts from economic activities have been suggested with models derived from developed countries where the impacts have been observed to be more significant and direct. In the Asia Pacific, many countries have already implemented national assessments and environmental accounting to manage sustainability.

Land is one of the key natural resources that drive economic growth. Land use patterns and trends of land use efficiency in the country are evaluated to determine the key drivers and implications of land use changes, baseline land use efficiency and evaluate the impacts to the provision of ecosystem services.

**Key Words:** Environmental Policy Issues; Land Use Efficiency; Sub-national Governance

### I. Introduction

It is increasingly recognized that a serious response to environmental sustainability issues will require a much greater attention to biophysical processes and the changes in human activities that underpin all economic development efforts. These are all manifested in different levels of physical aggregation – at the city and municipal levels in one extreme, to the regional and national levels at the more aggregated end. The implications, however, are more profound than what have been debated as the development agenda in the past. The responses of developing countries, however, have been very clear.

In the UNEP assessments such as the Millennium Ecosystem Assessment, Green Economy, Green Growth, Green Industry, Green Economy, Resource Efficiency: Economics and Outlook in the Asia Pacific, the gap in fundamental understanding is even more alarming as information on specific countries, such as the Philippines, are not readily available. For example, national level policies are least understood when viewed at highly aggregated levels. Imbalance in development agenda leads to an alarmingly improper utilization of available resources, resulting in service and product scarcity.

In the Asia Pacific, many countries have already implemented national assessments and environmental accounting to manage sustainability. The Philippines is also highly encouraged towards this direction. Land is one of the key natural resources that drive economic growth. This research aims to assess the land use patterns and trends of the regions in the country, determine the key drivers and implications of land use changes, measure land use efficiency and evaluate the impacts to the provision of ecosystem services.

To assess land use efficiency in the Philippines, this study made use of indicators based on eco-efficiency. In the 1990s, Schaltegger and Sturm (1994) introduced eco-efficiency as a “business link to sustainable development”. It was then popularized by the World Business Council for Sustainable Development (WBCSD) for the business sector in the course of the United Nations Conference on Environment and Development (UNCED) in 1992.

Targeting the improvement of eco-efficiency is good for environmental sustainability of society. It is important to apply eco-efficiency concept to a macro level and economy wide level rather than in specific production process or individual products as application to these specific areas only implicate a rebound effect to the social demands of goods and services.

Eco-efficiency indicators focus on practices of resource-use attaining economic and environmental progress through more efficient uses of resources and lower pollution. Eco-efficiency is a more general expression of the concept of resource efficiency – minimizing the resources used in producing a unit of output – and resource productivity – the efficiency of economic activities in generating added value from the use of resources. The same concept of eco-efficiency, however, can be applied to economic activities, in terms of local and national scope, hence improving the overall functioning of the economy. Most indicators focus on the consumption of energy, materials and water and the emission of greenhouse gases, wastewater and pollution emission.

## II. Philippines an overview

### a. International Comparison of Descriptive

Asia attained the highest population among its peer regions (See Figure 1). All regions experienced an annual rate of increase corresponding to the percentages presented in Table 1 with Africa being the region which had experienced the highest increase from 2000 – 2005.

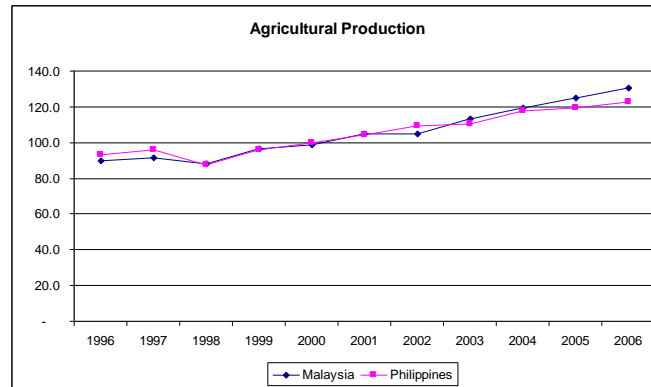
Computed density for 2005 showed that Asia is the densest among its peer regions. The calculation of density refers to the population per square kilometer of surface area. Density figures are merely the quotients of population divided by surface area and are not to be considered either as reflecting density in urban sense or as indicating the supporting power of a territory’s land and resources. Thus, it makes sense that Asia is the densest since it has the highest population and surface area.

Looking closely in Asia, for years 1970 up to 1990, Eastern Asia has the highest population however for years 2000 up to 2005 Southern Central Asia overtakes it. Countries and territories included in Eastern Asia are Taiwan, South Korea, North Korea, Mongolia, Macau, Japan, Hongkong, and People’s Republic of China. In terms of land use, Indonesia has the highest available land which is approximately 182,000,000 hectares among the Southeast Asian countries and which is six times as big as the Philippines ( $\approx 30,000,000$  hectares).

For the Philippines, of the 30 million hectares available land, 5,700 are considered as arable land – a land that can be used for growing crops; 5,000 are for permanent crops, and 7,162 are for forest cover.

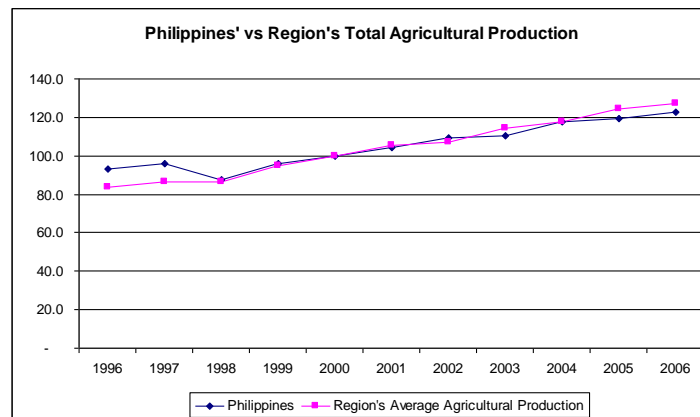
The agricultural production of the Philippines is similar to neighbouring countries in Southeast Asia. Comparing it to neighbouring Malaysia, it is similar in

terms of behaviour. From 1996 the total agricultural production index averages at 94 and rose up to 123 in 2006.



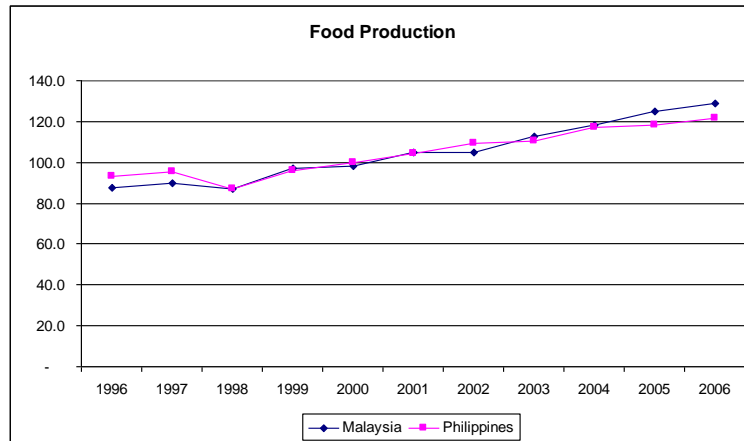
**Figure 3: Agricultural Production Index of Malaysia and Philippines, 1996 – 2006**

When the total agricultural production index of the country is compared to the average index of the Southeast Asian region it shows that relatively the Philippines agricultural production is at par with the average of what the other Southeast Asian countries are producing.



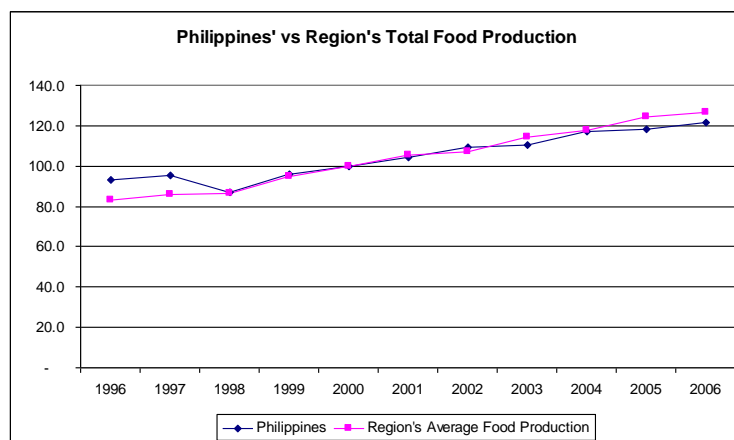
**Figure 4: Agricultural Production Index Comparison, 1996 – 2006**

Similarly in food production, the Philippines is similar with its neighbouring countries. Comparing to Malaysia, similar patterns can be observed in terms of behaviour. From 1996 the total food production index averages at 93 and rose up to 122 in 2006.



**Figure 5: Food Production Index of Malaysia and Philippines, 1996 – 2006**

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**Figure 6: Food Production Index Comparison, 1996 – 2006**

**b. Philippines Regional Descriptive**

As of June 2008, the Philippines have a population of over 88 Million with a land area of 343,448 square kilometres (See Table 3). Population density is about 258 persons per square kilometre. Philippines consist of 16 regions. However, among these 16 regions a large concentration of people can be located in the National Capital Region (NCR), where population density exceeds the national average by almost 70 times. NCR has a population density of 18,648 persons/ sq km. The least dense among the region would be the Cordillera Administrative Region (CAR), with only 78 persons/ sq km.

There is an uneven distribution of population, where high concentration areas can be located in economically thriving areas such as NCR, Central Luzon, Central



Visayas, and Western Visayas. Looking into Gross Domestic Regional Product or GRDP (see figure below), GRDP are highest also among the high population density areas. Highest observed GRDP are in the regions of NCR, Central Luzon, Central Visayas and Western Visayas. While low GRDPs can also be observed in less populous areas such as CAR, CARAGA and ARMM.

There is a total of 42,008 barangays in the Philippines as of June 2008. NCR alone comprises of 1,705 barangays. Region XIII (Eastern Visayas) has the highest count of number of barangays. While, CAR (Cordillera Administrative Program) has the least with 1,176 barangays.

### III. METHODOLOGY

Eco-efficiency indicators focus on practices of resource-use attaining economic and environmental progress through more efficient uses of resources and lower pollution. Eco-efficiency is a more general expression of the concept of resource efficiency – minimizing the resources used in producing a unit of output – and resource productivity – the efficiency of economic activities in generating added value from the use of resources. The same concept of eco-efficiency, however, can be applied to economic activities, in terms of local and national scope, hence improving the overall functioning of the economy. Most indicators focus on the consumption of energy, materials and water and the emission of greenhouse gases, wastewater and pollution emission.

Another technique that will be used in assessing land use efficiency analysis would be Data Envelopment Analysis. Data Envelopment Analysis was first developed by Charnes, Cooper and Rhodes (Charnes, Cooper, & Rhodes, 1981). They proposed a model that could take multiple inputs and multiple outputs and determine a single efficiency score. DEA determines an efficiency score relative to the performance of regions in converting resources to outputs. DEA can make simultaneous comparisons of multiple dependent performance measures and can provide a scalar measure of best overall practice. DEA shall be used to compare the relative efficiency of regions in converting land resources to economic outputs.

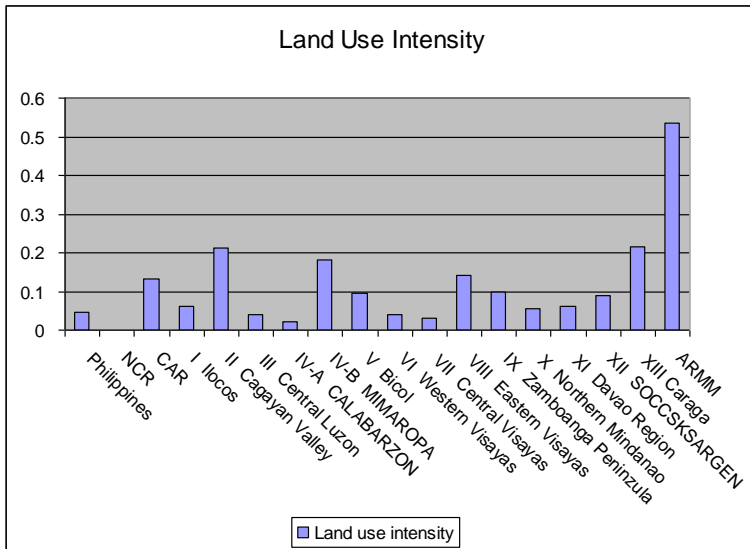
In using DEA, NCR was excluded in analysis as NCR is an outlier among regions. Including NCR in analysis would result to a lopsided comparison among regions as it would indicate that NCR is the only efficient region. And also since NCR has a unique economic structure (it has a concentrated economic zone) compared to other regions it is seemingly that NCR is not homogenous to the other regions and thus not comparable. In this manner more insights among regions can be further gathered.

### IV. RESULTS AND DISCUSSION

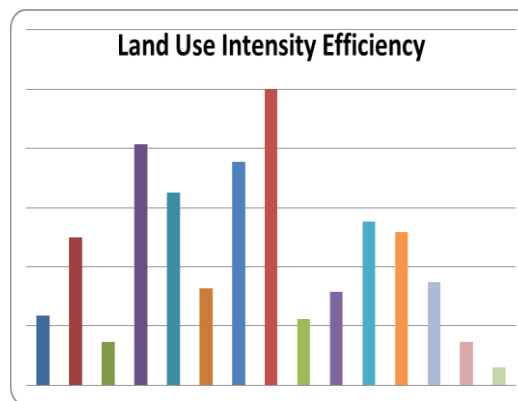
#### Land Use Intensity (sq.km/GDP)

This indicator shows how much land is used per unit GDP produced. In terms of land use intensity it can be seen that the least efficient in using land resources is

ARMM with a land use intensity of 0.53. ARMM has one of the larger regional land areas. However, produces only 0.84% of the country's GDP.

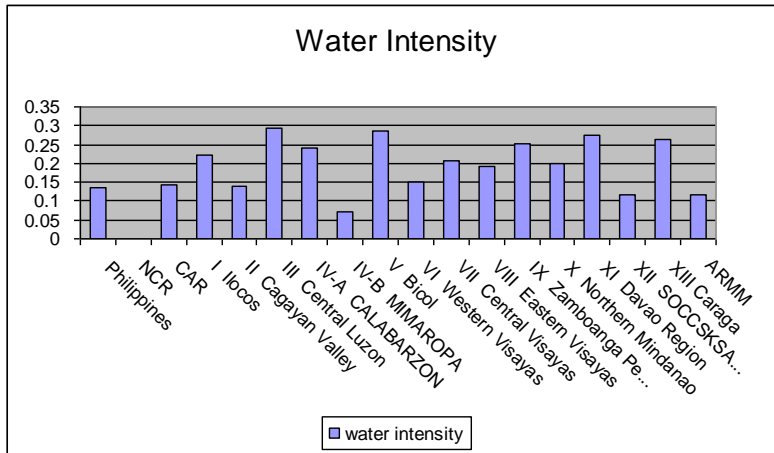


Excluding NCR in analysis, comparatively in land use intensity, Central Luzon and Central Visayas are more effective in using land resources in converting to GRDP. Whereas comparatively less efficient are ARMM and Cagayan Valley.

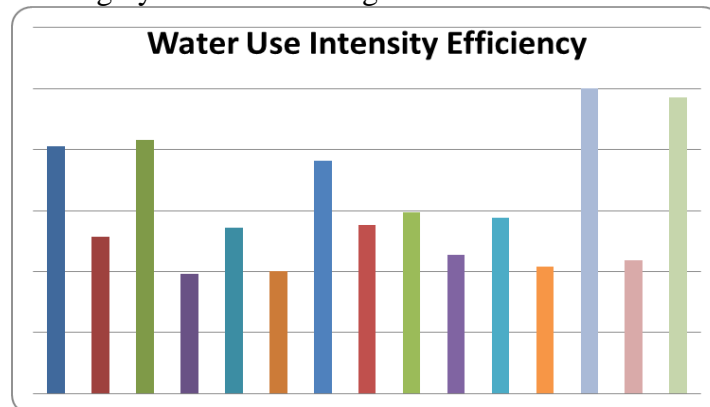


Water Intensity (cu.m/GRDP)

This indicator shows how much water was produced per unit GDP produced. High water intensities are in Region 5 in Southern Tagalog, as well as Region 3 in Central Luzon, and Region 11 or in Davao region. It can be observed that high water intensity areas are the areas where water is abundantly produced.

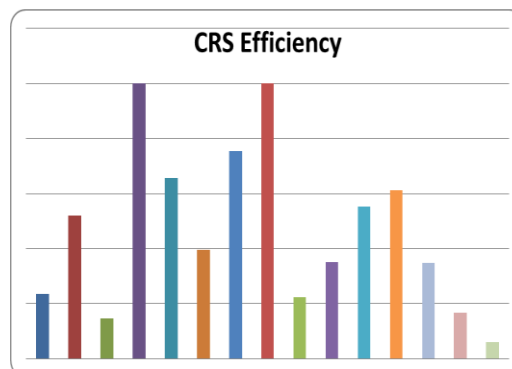


In terms of water intensity efficiency it would seem that SOCCSKRAGEN and ARMM are highly efficient in using water to convert to GRDP.

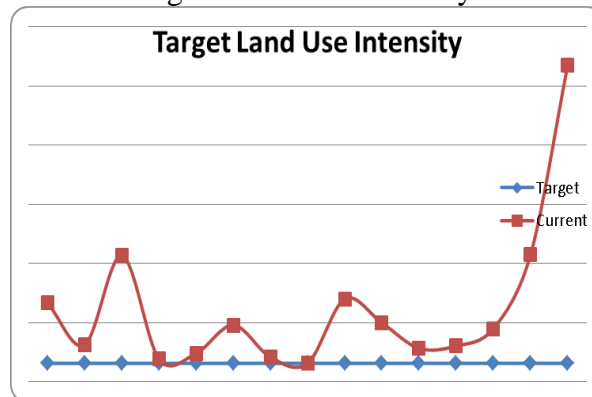


DEA efficiency (inputs: land area, output: water produced, GRDP)

In terms of converting land resource to outputs such as water produced and GRDP, it can be seen in computing DEA CRS efficiency that Central Visayas and Central Luzon are the most efficient ones, whereas Cagayan Valley and ARMM are the least efficient.



Benchmarking from Central Visayas, land use intensity should be at 0.31 sq.km/GRDP. The graph below shows the current performance of regions as compared the benchmark target of land use intensity.



## V. Conclusion and Recommendation

The Philippines has a highly uneven distribution of population where larger populations are located in more economically thriving areas. It can also be observed that high efficiency in terms of land use intensity is among areas where economic developments are observed such as NCR, Central Luzon and Central Visayas. Mindanao is observed to have relatively low GRDP as compared to Visayas and Luzon. In Mindanao high efficiency in land use is observed also in more developed areas such as in Davao Region and Northern Mindanao; whereas lowest efficiency can be observed in troubled areas of ARMM. Further analyses can be done to compare the commonalities of efficient areas and inefficient areas. (e.g., peace and order status, economic developments, etc). Focus should also be put on decentralizing population densities by decentralizing economic developments.

## VI. ACKNOWLEDGEMENTS

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