Econutrition: An Integrated Approach of Safe, Sustainable, and Environmentally Friendly Food Supply to Improve Economic and Health Status in Indonesia

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INTRODUCTION

Today more than 6.3 billion humans inhabit our planet. Based on current rates of increase, the world population is projected to double to more than 12 billion in less than 50 years (PRB 2003). At a time when the world population continues to expand at rate of 1.3% per year, adding more than a quarter million people daily, providing adequate food becomes an increasingly severe problem. Conceivably, the number of malnourished will reach 5 billion in future decades (Pimentel 2004).

Food security depends on abundance of food, an even distribution, and an ability to purchase food, as well as political stability. Reports from the FAO of United Nations and numerous other international organization, further confirm the serious nature of the global supply. For example, the per capita availability of world cereal grains, which make up 80% of the world's food supply, has been declining for nearly two decades. These shortages are not reflected in the price of cereal grains, because the poor people cannot afford to purchase grains despite the fact that prices are relatively low (Pimentel and Pimentel 1996).

Malnourished people are more susceptible to chronic diseases and public health problem related to chronic diseases like malaria, tuberculosis, schistosomiasis, and AIDS. The World Health Organization reports that in 2001, chronic diseases contributed approximately 60% of the 56.5 million total reported deaths in the world and approximately 46% of the global burden of disease (WHO 2002). The proportion of the burden of NCDs is expected to increase to 57% by 2020. Almost half of the total chronic disease deaths are attributable to cardiovascular diseases; obesity and diabetes are also showing worrying trends, not only because they already affect a large proportion of the population, but also because they have started to appear earlier in life (WHO 2003). However, World Health Organization also reports for public health problem related to chronic diseases that more than 2.4 billion people are infected with malaria, 2 billion are infected with tuberculosis, 600 million are infected with schistomiasis, and 40 million are infected with AIDS (NIAID 2002).

Thus as the world population continues to expand, greater pressure than ever before is being placed on all basic resources that are essential for food production and protection from diseases. Unfortunately, while the human population grows exponentially, food production only increases linearly. Furthermore, degradation of land, water, energy, and biological resources vital to agricultural sustainability continues unabated (Pimentel and Pimentel 2003).

As developing country, Indonesia with total population over than 214.6 million on 2004 also suffered from multi complexities problems on agriculture and biological resources, nutritional and health status, water, energy, and also environment. Therefore, implementation of econutrition as an integrated approach of save and sustainable food supply should be met to improve health status and sustain the whole national, regional, family, and individually food security in Indonesia.

MATERIAL(S) AND METHOD(S)

This paper made using a literature review which came from different sources consist of the scientific books review, current journal review, internet and scientific magazine. Those sources analysed leads to 'main idea' based on the exposition method. Discussion of this paper consist of 3 subtitles. On the first subtitle, explaining about the recent situation of agriculture in Indonesia; the second subtitle explaining more about the spectrum of malnutrition in Indonesia; then the third subtitle talk about the econutrition concept as integrated approach of save and sustainable food supply, in this subtitle will be discussed three important aspects (agricultural and environmentally sustainable aspect,

nutritional and health aspect) as a basic fondation for econutrition and its potential to implementing in Indonesia.

RESULTS AND DISCUSSION

Recent Situation of Agriculture in Indonesia

Like most other countries in the region of South-East Asia, Indonesia started out as a predominantly agrarian economy, with agriculture contributing the largest share to gross domestic product (GDP), employment, and export earnings. Unstable export prices and the inability to produce enough food for the population were the major challenges of the government in the agriculture sector. Not surprisingly, food (predominantly rice) self-sufficiency became a key national policy goal.

To achieve the self-sufficiency policy goal, highly successful agricultural development initiatives and new technologies were launched in the 1970s and 1980s. Agricultural GDP grew by more than 3% per year, compared with population growth of 2.3% in the 1970s and 2.0% in the 1980s. During this period, 9.3% of the public budget was allocated to agriculture—higher than the 7.5% allocated to the sector, on average, by 40 other developing countries. In addition to government initiatives, other factors like breakthroughs in technology (notably the Green Revolution), expansion of the agricultural resource base, and human resources development contributed to success in the sector. As a result, the value of agricultural exports grew by 11% yearly, accounting for 23% of total Indonesian exports. In 1984, Indonesia temporarily achieved rice self-sufficiency. Rural poverty was reduced from 40.0% in 1976 to 21.2% in 1987. During 1984–1996, agricultural GDP grew by 3.2% per year; and rural poverty declined by 4.5% per year, reaching a low of 12.3% in 1996, but could not be fully eliminated (Irawan and Romdiati 2000).

Although Indonesian agriculture continued to grow throughout 1970–2002, its share in the overall economy declined from 41.0% in 1970 to 15.4% in 1996, before increasing slightly to 17.5% in 2002 as a consequence of the Asian financial and economic crisis. Nowadays, agriculture remained the largest sector in the economy in terms of employment, with almost 40 million people, or 44% of the labour force (Central Statistics Agency 2002). However, despite the significant structural change in Indonesian agriculture and the relative decline in the contribution of agricultural value added to GDP, agricultural value added per worker increased from about $450 in 1970 to $610 in 1980 and $688 in 1990 (at 1995 prices). Before the crisis, agricultural value added per labourer stood at $750—relatively high when compared with the value for other Asian countries, in the People's Republic of China, for example, agricultural value added per labourer was $298 in 1996 (World Bank 2003).

However, agriculture is still an important sector for Indonesian economic growth, especially for rural communities enhancing the economic and health status. Unfortunately, over three decades implementing the Green Revolution of Indonesian agriculture practices brought a several effect to Indonesian agriculture like dependency on pesticide, degradation of land quality, over using of chemical fertilizer so that affect to the balancing of ecology. Therefore, an integrated strategy is needed on maximizing the agricultural production to enhance the economic and health status of rural communities, in other way the technology used still on the way of sustaining the ecology.

Table 1. Trend in Prevalence of Underweight in Indonesia 1989–2003
(Weight for age < -2 SD, and < -3SD)

Indicator	1989	1992	1995	1998	1999	2000	2001	2002	2003

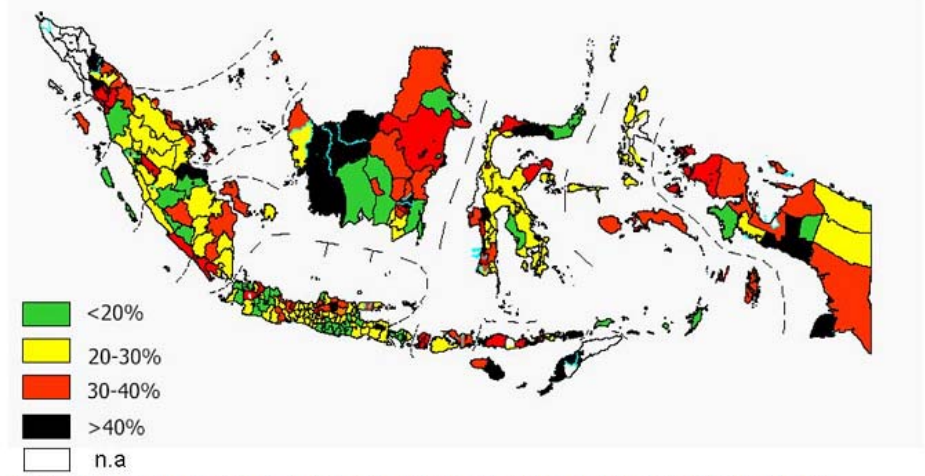

Figure 1. The Prevalence of Underweight among Pre-school Children in Indonesia, 2003
Source: SUSENAS Data sets, Nutritional Status Component, 2003

The Spectrum of Malnutrition in Indonesia

Hunger and malnutrition remain the most devastating problems facing the majority of the Indonesian, especially for the poor. Inabilities to access a good and nutritious food lead to malnutrition. Malnutrition affects all age groups across the entire lifespan. At present, malnutrition includes a spectrum of nutrient-related disorders, deficiencies and conditions creating major public health problems: intra-uterine growth retardation, protein energy malnutrition, iodine deficiency disorders, vitamin A deficiency, iron-deficiency anemia, obesity and other diet-related non-communicable diseases. Other specific nutritional deficiencies also start exposing Indonesian such as: folate deficiency, zinc deficiency, calcium deficiency and osteoporosis (Atmarita 2005).

Despite the energetic effort of the program to empower communities, and ensure that the country had sufficient energy available for consumption, the weight of pre-school children remained below the international reference standard as can be seen in Table 1. While the rates of moderate malnutrition (underweight children) decreased through the 1990's, the prevalence of severely underweight children increased. Overall, efforts over the last 14 years have reduced the proportion of underweight of pre-school children by about only 10 percentage points: 37.5% (1989) to 27.5% (2003) or with average rate of reduction less than 1% per year (Atmarita 2005).

With a diverse population of 210 million, underweight rates vary across districts. Figure 1 showed the prevalence differences between districts that estimate the proportion of preschool children were moderately or severely underweight range from under 20% to over 40%. The district differences in underweight are reflecting wide variation in the IMR between different parts of the country. Even though the national figure for IMR was 35 per 1000 live births, there were 24% of total districts of Indonesia with the rate of above 50 per 1000 live births. These regional differences reflect the broad diversity of Indonesia's society and conditions.

The trend data on stunting among pre-school children also show no changes over time. The prevalence even has been increasing to over than 40% since the 1990's. The higher rate is observed not only on underweight and stunting but also wasting. This implies that nutrition problem in young and school children are still a serious public health problem. Considering that this problem has implication on the children educability, the seriousness of nutrition problem should also be considered as an education problem.

Econutrition as Integrated Approach of Save and Sustainable Food Supply

Concept and Rationale

The dictionary definitions of ecology as "the interrelationship of organisms in their environment" and nutrition as "the act or process of being nourished" are commonly known. However, no dictionary definition can be found for "econutrition." Thus, the concept of integrating the terms of ecology and nutrition into econutrition is relatively recent. For the framework of this paper, refer to Deckelbaum *et al.* (2006) econutrition will be defined in terms of the interrelationships among nutrition and human health, agriculture and food production, environmental health, and economic development (Figure 2). As Alexander von Humboldt said, "*In the great chain of cause and effects, no thing and no activity should be regarded in isolation*," and this is particularly true of econutrition. Figure 3 illustrates how adverse interactions among health, agriculture, and environment are critical contributors to poverty. The vicious cycles that lead to loss of nutrients, soil erosion, and decreasing biodiversity link into environmental degradation that results in decreased food production. Lack of food is associated with malnutrition and illness and especially with declining labour productivity, which exacerbates poor agricultural management (Deckelbaum *et al.* 2006).

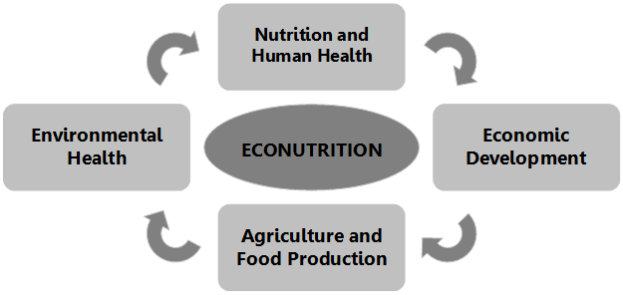

Figure 2. Interrelationships among nutrition and human health, agriculture and food production, environmental health, and economic development.

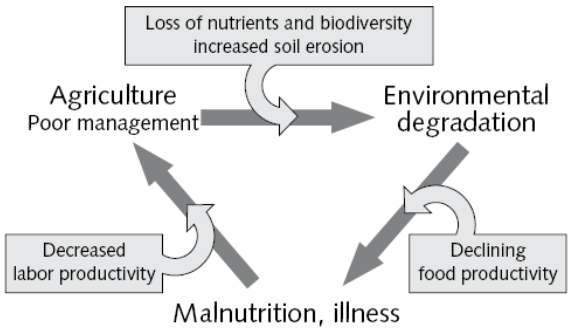

Figure 3. The Cycles of Agricultural Mismanagement, Agricultural Degradation, and Malnutrition (Deckelbaum *et al.* 2006).

In econutrition, sustainability aspect is the key role integrating with other components. The use of nitrogen-fixing plants in agricultural systems provides an example understood by all disciplines. Nutritionists and vegetarians know that peanuts, tofu, and beans are important sources of protein that can replace animal sources. This comes as no surprise to agronomists or ecologists, who recognize that all three of these foods come from a unique plant family, the legume family, or *Fabacaeae,* which are major drivers of nitrogen cycling in terrestrial ecosystems and are tied to increased productivity in natural systems (Tilman *et al.* 2001).

A unique association with bacteria found in the roots of most legumes allows the plant to convert atmospheric nitrogen into ammonium, a form usable by plants. This ability to capture and convert atmospheric nitrogen (N_2) to ammonium (NH_4^+), the foundation of amino acids and thus of proteins, is what makes legumes desirable from a nutritional perspective, as well as from the agricultural and ecological perspectives. The incorporation of legumes into agricultural systems can add up to 200 kg of nitrogen per hectare, restoring nutrients to depleted soils, boosting agricultural productivity, and providing human populations with plant based protein (Deckelbaum *et al.* 2006).

Agricultural and Environmentally Sustainable Aspect

The nutrition system influences the environment (Carlson-Kanyama 1998), which in turn determines the quality of food. The environmental impact of food production is determined by the agricultural method used. Conventional farming methods rely on extensive use of natural resources and result in higher levels of food contamination. In contrast, the environmental impact of organic farming is lower. Organic farming practices include controlling pests naturally, rotating crops, and applying legume plants as manure, in contrast to the use of synthetic pesticides and fertilizers in conventional farming. In integrated farming, organic and conventional methods are combined, resulting in an intermediate environmental impact (Reganold *et al.* 2001).

To reduce the environmental impact of the conventionally farming which depends on externalities, organic farming needs to be supported globally. IFOAM (International Federation of

Organic Agriculture Movement) & FiBL (2006) observe an organic boom is taking place in Indonesia. This includes an increase of organic food imports in the major cities. Specialty health food stores can be found in larger cities in Indonesia, catering mostly to an expatriate population and the increasingly aware educated Indonesians with strong interest in organic food.

Indonesia with 141.493.000 ha agricultural land has a big potential to develop more environmentally friendly organic farming. Although no official government programme is implemented in support of organic farming in Indonesia, many NGOs like Pesticides Action Network (PAN) Indonesia, SPTN-HPS, ELSPPAT (Bogor), BITRA, and Sintesa in North Sumatra are trying to promote the debate about agriculture in public whilst organizing practical projects with farmers' groups. These NGOs are members of the national network of organic farmers (Jaringan Kerja Pertanian Organik), which includes both NGOs and farmers' groups. Although not a member of IFOAM, the national network, works together with IFOAM on some activities. The Indonesian Organic Alliance (an alliance of 41 members) has set up a national certification centre called BIOCert (Board of Indonesian Organic Certification). Certified organic produce from Indonesia includes: palm oil, coconuts, coffee, cocoa beans, rice, vegetables, red ginger, mushrooms, cinnamon, pepper, honey, cashew nuts, pineapple and shrimps. Most of the products are sold in semi-processed or raw forms. Organic farms produce mainly for the international markets. Therefore, by implementing organic farming hoped contributing enhancing farmers' economic status.

Addressing to issues of livestock and the environment, there are several negative impact. Livestock interact on a global scale with land, water, air, plant, and animal biodiversity. About 34 million square kilometers, or 26 percent of the world's land area are used for grazing livestock. In addition, 3 million kilometers, or about 21 percent of the world arable area, are used for cereal production for livestock feed. Livestock produce 13 billion tons of waste a year. A large part of this is recycled, but where animal concentrations are high, waste poses an enormous environmental hazard. Livestock and livestock waste causes gaseous emissions such as ammonia, carbon dioxide, methane, ozone, and nitrous oxide, affect the world's atmosphere, by causing global warming or global climate change (Steinfeld *et al.* 1998). Livestock is responsible for 64% of ammonia emissions, which contributes significantly to acid rain (Pachauri 2008).

Freshwater resources are the pillar sustaining development and maintaining food security, livelihoods, industrial growth, and environmental sustainability throughout the world (Turner *et al.* 2004). Water is important resource for drinking, irrigation, industrial, and services such power for hydroelectricity generation and support of recreational activities (Dompka *et al.* 2002). Since water is very limited state and only 2.5 percent of all water resources are fresh water (70 percent of fresh water resources are locked up in the glaciers, permanent snow, and the atmosphere), the water usage should be well managed. Water is needed to produce fodder and feed concentrate, to provide drinking water for animals, and to drain surplus waste and chemicals (Steinfeld *et al.* 1998). As comparison of water need with the amount product yielded, to get 1 kg beef the amount 15500 L water needed, as comparison 1 kg maize (900 L), 1 kg rice (3000 L), 1 kg chicken (3900) and 1 kg pork (4900) (Pachauri 2008).

In other hand, livestock also play an important role in the overall pressure of demand for fish. It is estimated that in 2004, 24.2 percent of world fishery production was used for fishmeal and fish oil for feed (Vannuccini 2004). Therefore, the livestock industries should be reduce and need to be well managed to minimize its several negative impacts into environment. However, there are also feed-food controversy related to livestock and human consumption. One-third of the world's grain harvest ends up in the digestive tracts of livestock, where the conversion of vegetable protein into animal protein is incurring losses of 60 to 90 percent of edible protein. This fact concerns large parts of the public. Among the 996 million tons of concentrates used in 1994 (FAO 1996), all cereals, roots and tubers, pulses, and some feedstuffs of animal origin (milk powder) can be classified as edible. Edible feedstuffs provide livestock with 74 million tons of protein. In the same year and by contrast, livestock produce 199 million tons of meat, 532 tons of milk, and 45 million tons of eggs, altogether yielding 53 million tons of protein. Leaving aside the differences in nutritional value, the world's livestock sector consumes more edible protein than it produces.

The alternative way is to integrate the livestock with the crop as intensification of food production system. Mixed farming provides farmers with an opportunity to diversify risk from single-crop or livestock production, to use labor more efficiently, to have a source of cash, and to add value to low-value or surplus feed. To varying extents, mixed farming systems allow the waste products of one enterprise (crop by product, manure) to be used as inputs to the other enterprise (as feed or fertilizer). Mixed farming is, in principle, beneficial for land quality because it helps to maintain soil fertility. In addition, the use of rotations between various crops and forage legumes replenishes soil nutrients and reduces soil erosion (Thomas and Barton 1995).

As policy maker, the Indonesian government should create a pro-farmers sustainable agriculture strategy (organic agriculture) through several policies:

Encourage resource-conserving technologies and practices

1. Establish a national strategy for integrated pest management.
2. Prioritize research into sustainable agriculture.
3. Promote farmer to farmer exchange.
4. Provide better information for consumers and the public.

Support local groups for community action

1. Encourage formation of local groups.
2. Foster rural partnership.
3. Support training and field schools for farmer.
4. Provide incentives for on-farm employment.
5. Permit groups to have access to credit.

Reform external institutions and professional approaches

1. Foster stronger NGO-government partnership.
2. Develop capacity in planning for conflict resolution and mediation.

Nutritional and Health Aspect

During the past decade, rapid expansion in a number of relevant scientific fields and, in particular, in the amount of population-based epidemiological evidence has helped to clarify the role of diet in preventing and controlling morbidity and premature mortality resulting from noncommunicable diseases (NCDs). Some of the specific dietary components that increase the probability of occurrence of these diseases in individuals, and interventions to modify their impact, have also been identified (WHO 2003).

Furthermore, rapid changes in diets and lifestyles that have occurred with industriali-zation, urbanization, economic development and market globalization have accelerated over the past decade. This is having a significant impact on the health and nutritional status of populations, particularly in developing countries and in countries in transition. While standards of living have improved, food availability has expanded and become more diversified, and access to services has increased, there have also been significant negative consequences in terms of inappropriate dietary patterns, decreased physical activities and increased tobacco use, and a corresponding increase in diet-related chronic diseases, especially among poor people (WHO 2003).

The recent situation of food availability in Indonesia, for calorie availability reaching 3000 kcal/cap/day while for protein 75.5-80.5 gram/cap/day (as the recommendation of WKNPG require 2200 kcal/cap/day for energy and 57 gram/cap/gay for protein). The trend of food demand increase by years both in rural and urban area. Therefore, to maintain or retain good health, the consumption of an individually optimal diet is recommended. The term *preventative diet* has been used recently to underline the possibility of avoiding nutrition-based diseases (Krauss *et al.* 2000). The aggregate of most studies suggests that the consumption of plant-derived foods (grains, vegetables, fruits, legumes, nuts) should be increased and that the intake of animal-derived foods (meat products, dairy products, and eggs) should be reduced. This principle applies particularly to sedentary individuals. Plant foods should be consumed when they are as fresh as possible, should be minimally processed, and should be eaten partly as raw food (Leitzmann and Hahn 1996).

From a nutritional point of view, sustainability also deals with the fair distribution of food through ecologic and preventive eating behaviour. To achieve sustainability, a comprehensive

rethinking of common values is needed to attain a new understanding of the quality of life. The question as to the adequate amount of food needs to be addressed at all social levels with the goal of achieving nutrition security for all. To fulfill the demands concerning ecologic, economic, social, and health compatibility, the following 7 principles have been formulated:

1. Food should be predominantly plant derived (decrease on meat consumption, or replace protein sources from meat to legume and fisheries product).
2. Food should originate from organic farming;
3. Food should be produced regionally and seasonally.
4. Food should be minimally processed.
5. Food should be ecologically packaged.
6. Food trade should be fair.
7. Food should be tastefully prepared.

A diet based on these principles has a scientific basis, is socially acceptable, is economically feasible, is culturally desired, is practicable, and has a high degree of sustainability.

CONCLUSION(S)

The econutrition has the goal of attaining sustainability of food and nutrition security worldwide and it practicable in Indonesia to achieve food security and sovereignty in each person. To achieve this goal, government, professionals involved in the nutrition system must inform the public about the principles of econutrition and implementing the strategy pro-farmer sustainable agriculture through several policies. In this manner, people can be motivated to practice sustainable eating behaviour. Interested and well-informed consumers will be able to weigh the arguments and make the necessary decisions. The vision of a sustainable future depends upon individuals who feel responsible for the environment and health. One of the most effective ways to achieve the goals of econutrition, including healthy and sustainable food choices, is by consuming food originating from organic farming, predominantly plant derived (decrease meat consumption to avoid the further impact on NCDs), food should be produced regionally and seasonally, minimally processed, food trade should be fair, and tastefully prepared.

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