# Research Agenda *for* Food Sector 2009-2012

Bogor Agricultural University

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# Foreword

Indonesia is still facing numerous problems regarding the closely linked sectors of food, energy and environment. These problems have indirect impacts on the economic, socio-cultural and political conditions in Indonesia. The considerable environmental degradation and natural resources depletion that are occurring are due to natural resources utilization such as forest, sea, agricultural lands, minerals and water that overlooked ecological sustainability, production sustainability and social impacts. To overcome these problems, Bogor Agricultural University (IPB) offers new perspectives for agricultural-based national development in a broader term that are based on sovereignty, impartiality and sustainability principles.

Within the food sector, Indonesia requires a new paradigm to ensure bigger control of natural resources by the people. Resource control at local scale, *i.e.*, the household unit, has higher potential to produce food than control at higher scale. This condition will boost the production and diversification of food at local level that corresponds with local ecosystem and culture. On the other hand, bigger resource control by the people will improve people's welfare which in turn will impact the purchasing power of the people themselves. In general, these situations will push food sovereignty and security at local and national levels.

In accordance to the task that the Indonesian President, Dr. Susilo Bambang Yudhoyono, gave during his Scientific Oration at the 45th IPB Dies Natalis on 4th of November 2008, IPB must become the front liner for national food security movement. As an academic institution with competence in agricultural development research, IPB should always enhance food production increase in Indonesia, that requires systematic concrete steps. Through many discussions, seminars and workshops, IPB has formulated a Strategic Research Agenda in relation to food problems.

This Strategic Research Agenda (ARS) is organized with the objectives to: 1) provide direction for optional policies that should be taken by IPB and 2) provide bases for compilations of research programmes that are realistic and inspiring for stakeholders. We hope that this Research Agenda for Food Sector can be use as guidelines for all IPB's academic society and other institutions in carrying out future research activities within food sector.

Bogor, March 2009

Rector,

Prof. Dr. Herry Suhardiyanto

# I Introduction

## 1.1. Background

One serious threat facing Indonesia in the future is the inability to fulfil food requirements, especially rice and other strategic commodities due to low food production and productivity. On the other hand, data shows that domestic food requirements tend to increase year by year due to high population growth and increased welfare as well as shift in food consumption pattern, including non domestic production food that have high volume and export values (flour, milk, soy bean, sugar).

Bogor Agricultural University (IPB) as the front liner in agricultural development has a significant role in overcoming food scarcity in Indonesia. As an academic institution that develops research in agriculture, it is expected that activities conducted by IPB should produce impacts in the form of increased food production in Indonesia. Responding to the occurring national and global problems, there need to be some systematic concrete steps. One important step that should be taken by IPB is to formulate Strategic Research Agenda in relation to food problems.

## 1.2. Objectives of Formulation of Research Agenda

This Strategic Research Agenda is expected to provide strategic framework to:

1) stimulate investment in research,
2) provide direction for policy options that should be taken by IPB,
3) direct the formulation of realistic and inspiring research programmes that will be able to mobilize stakeholders, and
4) ensure IPB with its competence to be the trendsetter in Indonesia's agriculture.

# II Indonesian Food Situation in The Middle of Global Agricultural Glomeration

## 2.1. National Food Situation

As human basic necessities, sufficiency of food amount and quality should be the right of every Indonesian to achieve quality human resources to carry out development. Currently, national food situation is experiencing scarcity due to the effects of internal and external factors that cause national food market price to increase far compare to that in 2007.

Causes of the external factors are : 1) the rise of food price in world market, 2) reduction of global food production due to climate change especially related to drought that is occurring in major producer countries (Argentina and Brazil for soy bean) as well as the reduced total harvesting area in America (it is estimated that the total harvest area of global soy bean will decrease to 6.5 percent in 2008), 3) effect of increased price of oil that resulted in production costs increase, 4) global climate change and conversion of food commodities to bio-fuel, 5) control of seed trading by several multi-national corporations, and 6) involvement of investors in commodity stock exchange.

Causes of internal factors are: 1) conversion of paddy fields for settlements and industries, 2) slight change (about 1.4 % in 2008) of total harvest area, 3) relatively stable productivity, 4) low food crops margin received by farmers compare to horticultural commodities, and 5) relatively low price of food crops commodities.

Changes that are experienced by rice-producing countries will affect global rice availability. Ten biggest rice producing countries are: China (127.8 MT), India (93.35 MT), Indonesia (33.3 MT), Vietnam (22.89 MT), Thailand (18.25 MT), Myanmar (10.60), Filipina (10.09 MT), Japan (7.79 MT), Brazil (7.70 MT) and United States of America (6.24 MT) (WAOB, 2008). Global climate change that caused tropical storm in Myanmar in early May 2008 was one of the factors that cause international market price of rice to increase.

Currently, at national and international levels, trade has become the policy determinant for agriculture and food. As a result, food producers such as small scale farmers loose their control over productive resources, such as land, seed, water, sustainable and eco-agriculture knowledge and other biodiversity aspects.

Meanwhile, hunger and malnutrition in Asia are increasing. FAO (2008) estimates that more than 500 million out of a total of 800 million people in the world who are experiencing hunger and malnutrition live in Asia. Ironically, most of whom are actually food producers, in other words, people who produce food are not able to meet their own need of food. Beside food vulnerability due to lack of macro nutrition (carbohydrate and protein) which manifested as "hunger" (lack of energy and protein), more than 100 million Indonesians are currently experiencing what is

called 'hidden hunger'. Hidden hunger is basically a lack of micro nutrition, especially lack of zinc that resulted in zinc anaemic, lack of iodine that cause GAKI (Disturbances Caused by the Deficiency of Iodine), and KVA (Vitamin A Deficiency) that can cause blindness and low immunity (Depkes, 2007).
Conversion of 3,099,000 ha of paddy field (42.4 %) (BPN) into settlements and industries has great impacts on national food availability. Where fertile fields with irrigation channels are converted to other functions, more lands are often required to replace the converted lands due to the less fertile available lands.

Indonesian total population in 2007 has reached 224,904,900 people with growth rate of 1.36 percent during 2005-2007, where together with food consumption pattern per capita will greatly affect the national food requirements. The annual food consumption per capita in Indonesia for rice, corn, soybean, sugar, poultry, meat, fish and milk are 130-139 kg, 6 2.0 kg, 9.10 kg, 15.6 kg, 4.5 kg, 3.5 kg, 7.10 kg, 21.8 kg, and 8 litres respectively.

Indonesia still needs to import some food commodities to fulfil the needs. During 2004-2006, the import figures for rice, soybean, corn, sugar, milk and beef were 0.74 percent, 60-65 percent, 10.9 percent, 19.7 percent, 92.0 percent and 4.1 percent respectively out of the total national requirements, and 3.5-5 million tonnes/year for wheat. These suggest that national food requirements is still dependent on imports which indicates weak food sovereignty.

Rice import in 2005/2006 was 0.54 MT, in 2006/2007 was 1.9 MT (WAOB, 2008) and in 2007 was 1.3 million tonnes (Bulog). In 2007 the total harvest area was 12,124,727 ha, with productivity of 4,705 tonnes

GKG/ha, thus the obtained total production was 57,051,679 tonnes GKG or equal to 34,231,007 tonnes of rice, or production increase of 4.7 percent. Other data suggest that there is a production decrease of 4.7 percent during 2006/2007 compare to 2005/2006 (WAOB, 2008). In 2007/2008 it was expected that there was a 2.1 percent rise in production although still require importing 1.6 MT.

Using the above data, consumption of 130 kg per capita, would produce 29,237,637 tonnes of rice. However, if consumption per capita reaches 139 kg, there would be a deficit of national rice provision. Therefore, the high rice consumption should be reduced and exchange with non-rice carbohydrates (root crops). If the annual rice consumption per capita of 130 kg can be reduce to 100 kg such as in China and South Korea, this would lower rice requirement as much as 23.08 percent from national requirement. Apart from national level, rice provision at provincial and district levels should also be considered due to the existing surplus and deficit areas.

Corn production in Indonesia during 2002-2007 has experience an increase. The 2002 production which was only 9,654,105 tonnes increased to 12,300,000 tonnes in 2007. Indonesia still needs to import as much as 1,800,000 tonnes to meet the domestic requirement for corn. The global condition of corn production in 2006 indicated an international market price of only US$ 135 per tonne, and US$ 250 per tonne in 2008. Major producers of corn are United States of America (40 percent), China (20 percent), Europe (7 percent), and Brazil (6 percent) from world requirements. These countries would reduce their corn production to meet domestic requirements as bio-fuels, which could threaten the sustainability of corn supply in Indonesia.

The highest annual consumption of soybean per capita was achieved in 1999, *i.e.*, 13.16 kg/capita/year, and decreased since 2000 until now. In 2007 the soybean consumption was about 9.10 kg/capita. The small of soybean consumption decrease and the relatively high soybean production decrease as well as annual population growth have caused Indonesia to import soybean in great amount since 1999 until now. Soybean import in 1990-1998 was only about 343,000-541,000 tonnes, and increased drastically to 1,133,000-1,343,000 tonnes during 1999-2007.

Soybean productivity has slightly increased since 1990, which was 1.11 tonnes/ha, and in 2007 was 1.29 tonnes/ha. At the same time, there has been a reduction of 58.85 % of total planted area from 1,334,000 ha in 1990 to 549,000 ha in 2007. This resulted in the domestic production of only 35 percent out of the total national requirements in 2007.

The increase planted area of major food commodities are very much determined by their prices which are often very low during harvest thus provide disadvantages to the farmers. Therefore central and regional government policies are necessary to monitor and determine prices which will benefit the farmers. The current high prices of food is an opportunity for farmers to increase farming activities if low priced production facilities are available, irrigation channels are improved and damaged road facilities are improved.

## 2.2. Global Agricultural Conglomeration and Its Impacts on Indonesia

Although there has been a significant development of agricultural technologies during the last decade, nevertheless the global food production and productivity

did not show attractive figures and there was a tendency of world food involution. The annual growth of wheat production during the last 4 years was only 1.2 percent in average, which was lower than the world population growth. For 3 years in a row, *i.e.*, in 2005/2006, 2006/2007 and 2007/2008, the global production of wheat was lower that its consumption which resulted in the ever recorded highest price of wheat in history. At the same time, annual global rice production has increased to 1.9 percent in average and for corn was 2.2 percent. Rice and corn productions were relatively better that wheat's where global production is in line with consumption (FAO, 2007).

Although there was no significant flare in production, the global food trade has experienced unfavourable fluctuation for importer countries, such as for wheat. Even though during the past few years global wheat production was lower than consumption, the total global trade of wheat has increased from 112.8 million metric tonnes in 2004/2005 to 116.9 million metric tonnes in 2008/2009. During the same period, global rice trade has decreases from 29.2 to 27.1 million metric tonnes and global corn trade has experience a significant increase from 76.0 to 93.3 million metric tonnes (FAO, 2007).

The price of food is determined by global food trade even though the total amount of trade is only about 10% of total world production. Most of the food are produced and consumed internally, and in many developing world, they are produced and consumed directly by the producers. In 2008, international trade market for wheat, corn, rice, bio oil, meat and milk products are 18%, 8.5%, 7.4%, 20.4%, 8.9%, and 5.8% respectively.

To be a major food producer does not guarantee the country to become a major player in world food trade. For example, although USA ranks fourth as wheat producer in the world, nevertheless USA is the biggest wheat exporter in the world. Indonesia is one of major rice producers in the world, but Indonesia also imports rice. During the 1960s, developing countries were the world exporters of rice and other major agricultural products and had food trade surplus of $ 7 trillion annually. Ironically, such surplus started to disappear since end of 1980s and early 1990s and became the net agricultural products importers (Guzman, 2008). Currently, developed countries are taking over world food trade, where on the other hand, 70% developing countries are net food importers. The three major exporters of wheat are United States of America followed by, European Union and Argentina. Meanwhile, trade in milk and its by products are controlled by European Union, New Zealand, USA, Australia and Ukraine. Currently, rice trade is the only trade that is still controlled by developing countries such as Thailand, Vietnam, India, Pakistan and China. During the past few years, USA has become one of major players in global rice trade and ranks fourth in the world for global rice exporter.

Apart from conglomeration of food trade in international/regional level, conglomeration is also occurring at company level. There are only 5 companies that control 90% of world seed trade, *i.e.*, Cargill (USA), ADM (USA), Louis Dreyfus (France), ConAgra (USA), and Bunge (USA). When the world is experiencing food crisis, the revenues of these industries increased between 30 to 67% in 2007 compare to 2006. During the first quarter of 2006, ADM (Aecger Daniel Midland) recorded an increase in revenue of almost 700% from its agricultural sector. More than 90% of seed markets and agricultural

inputs (pesticides and herbicides) are also controlled by 6 multinational companies, *i.e.,* Monsanto (USA), DuPont (USA), Syngenta (Swiss), BASF (Germany), Bayer (Germany) and Dow (USA). Monsanto controls 41% of world corn seed trade, 25% soybean, 31% bean, 38% cucumber, 34% chilli, 29% paprika, 23% tomato and 25% garlic and 90% of transgenic seed.

World food conglomeration has also impacted on Indonesia. Farmers have strived because all production inputs are not under their controls. Indonesia purposely lower import tariff for wheat and soybean to zero percent in 2008. Control of all food sectors including production inputs, trade and prices for several major commodities by world food system conglomeration has caused Indonesia to fall into food trap. Hence, there is a requirement for new paradigm and formulation of research agenda and national food system development that are resilient to the dynamic of global food system.

# III Strategic Research Agenda for Food Sector

## 3.1. New Paradigm

Within the food sector, new paradigm will force bigger control over natural resources by the people. Resource control on local scale such as by household units has higher potential to produce food rather than bigger scale resource control. This condition will drive food production and diversification at local level based on local ecosystem and culture. On the other hand, bigger control over resources will increase people's welfare which will result in higher ability to purchase. Generally, these conditions will drive the establishment of food sovereignty and security at local and national levels.

Development that empowers and improves welfare of people should be based on agrarian viewpoint based on new paradigm: Development that is wise, sovereign and sustainable. This new paradigmatic view can be further justified as follows:

***Firstly***, in communities where the majority of the people are dependent, live in and thrive from agricultural environment, most of the agricultural resources (especially land, water, aquatic resources) should be control by the people, because agriculture forms the foundation of living and the most possible to be developed tomorrow.

***Secondly,*** land and agricultural resources in broad term should be viewed as more than commodities due to their attached basic social dimensions. Consequently, their distribution and utilization cannot be controlled by market power.

***Thirdly***, devolution of agrarian resources to villagers and local/indigenous people, thus strengthening the acquisition of production tools that are fundamental for communities categorized as dependent on agricultural resources.

## 3.2. Development Principles

Considering the above conditions and problems, food security strategy in the middle of food trade changing map, should be sharpened, from upstream to downstream. Several basic principles to develop a roadmap and research agenda as a result of gap development are as follows:

1) Carry out consistent agrarian reform according to the mandate as highlighted by Indonesian acts.
2) Integrate efforts to increase income and alleviate poverty through improved education, nutrition and health. The steps can be initiated through accelerating village development by focussing on groups with low income. The dimension of development that is oriented toward uniformity is very relevant to empower egalitarian economy.
3) Opening up of new lands to fulfil national food supply outside Java. These lands will be managed to supply raw materials for food processing by using the diversity of local superior commodities Government should also ensure1 that the people have easy access to production

[1] Effort to maintain the continuity of agricultural products facilities should be carry out by the government within the empowering paradigm to develop independency and autonomy of the people.

facilities, improved irrigation network, improved damaged road to new lands or current land own by the people.

4) Reposition of thoughts and role of tertiary education, government institutions and private institutions in agricultural and village development.
5) Review Indonesian position in international agreements related to food and agriculture that are not relevant to food sovereignty principles.
6) Integrate food diversity strategy with food technology development that are recognized and accessible by the communities, strengthening capacities of regional, local and farmers institutions capacity to ensure food sovereignty. These can be done through:
   a. Synergy between Agriculture, Industries, Trade and Health Services and other related institutions to formulate activities and work indicators for food security at district level.
   b. To generate income to guarantee access, it is necessary to have support from research that are directed to provide alternative food/additional products that are: 1) able to take the role of import substitute, 2) able to take the role as export commodities, and 3) develop community food habits that are based on superior local resources.
   c. Develop farmer's institution that are managed and run by farmers themselves to strengthen the bargaining position of farmers toward outsiders.
7) From the supply side, the future policy on increasing food production should be based on the development of various food productions other than rice that are oriented on developing local food commodities. In short term, incentives for farmers are required for production, marketing and post harvest technology, specifically for food products such as root crops, animal-based, vegetables and fruits that are consumed in low level.

8) Establish networks and knowledge management for food sovereignty that link central, regional and local levels, with main focus on food sufficiency (surplus/deficit) and people's nutritional sufficiency level. This information is necessary to distribute food to deficit areas, provide direct aid, provide jobs opportunities, or provide direct aid to food prone areas. Increasing farmers' sovereignty for seed through development of local seed bank that is initiated and managed by farmers, as well as strengthening farmers' capacity in developing and distributing seeds.
9) Develop local potentials and superiors and technology for agricultural and village development through cluster approach. This strategy will allow the growth of synergic steps that will benefit all parties and end at strengthening the nation's autonomy.
10) Developing technology that possess the following characters:
    a. Simple, such as provision of equipments and simple maintenance, able to use local fuels. This type of technology will be easily adapted, especially where there is a need for quick response.
    b. Appropriate and labour intensive, to absorb local labours.
    c. Based on indigenous knowledge, that is, the technology appreciate and highly recognize local potentials related to wisdom, resources including energy, as well as local knowledge and culture.
    d. Stimulate the growth of additional values of all biomass products in Indonesia. These additional values should occur along the value chain of such commodities. The resulting additional values will produce economical benefits that can be enjoyed internally, thus generating income as well as pull it away from food prone situation.

Other that producing additional values, the developed technologies should also able to push the growth of upstream-downstream linkages comprising of various economic activities. One of short term challenges is relating fresh commodities production centres with on-going food industries. The development of such intermediate products can be done by involving the regional government as real efforts in driving local economy.

### 3.3. Aim of Development

Based on the above discussed gaps, the 2008-2012 research agenda and roadmap are divided into two big agendas, i.e., specific agenda to secure rice provision and agenda to increase locally based economic activities t increase income and access to food, especially economic access.

#### a. Agenda for Rice Provision Security

Rice provision is still an important agenda to meet Indonesian food requirement. Therefore the national agenda for rice provision security must be carry out as well as the supporting research agenda.

The road map to secure rice provision can be explained in 3 ways, *i.e*:

1) Agrarian reform
2) Securing the existing food production lands both economically and sustainably.
3) Utilization of marginal lands to increase paddy productions

#### a.1. Agrarian Reform

a. Formulation of operational framework to carry out agrarian reform especially related to impartiality of land distribution. This is specifically done to support policy

on providing production assets (in this case water) to peasants. The operational framework includes land technical, law, social and political aspects, to ensure transparency of all stakeholders including NGOs. One of such concrete step is to return the rights of local resources to the local and indigenous communities.

b. Independent research on local products claims by local and indigenous people on resources that have been categorized as state land or state forest land. This should be based on a principle that agricultural resources have fundamental roles for local communities.
c. Participative mapping to determine area boundaries that are claimed by local/indigenous people is necessary to reduce inappropriate perception of state and community lands. Furthermore, to prevent horizontal conflicts, agreements between indigenous communities are necessary.
d. Maintenance of local land and natural resources to be use by local people, in the form of regulations (even acts) that can maintain common pool resources for the benefit of local people and regulate their utilization.
e. Further develop land utilization systems based on local knowledge and ecosystem that are more productive, competitive and sustainable.
f. Study on increasing reform access to improve farmers' welfare, through development of micro-finance, subsidy, and development of seed bank for the farmers.

### a.2. Food Production Land Security

The current available lands for food production have a long history. Problems related to technology and cultivation are well understood by the agents on these lands. The most encountered problem is lack of economic incentives

resulting in the tedious land processing and drives land conversions.

Hence, research agenda for securing lands for food production should be conducted by integrating the technical, economical and environmental aspects. The following steps must be taken:

a. Preventing further conversion of agricultural land through various instruments such as fiscal instrument and if possible applying the concept of "eternal food land".
b. Moratorium of land conversion for the 8.9 million hectares of rice field that are distributed per province. During this step, Regional Government must guarantee that these areas receive protection against land conversion. Boundary determination must be conducted together with national land Agency.
c. Studies on regional and provincial space planning for areas that are the pockets for food production. The studied aspects should include social, economical, cultural and resource preservation in area planning and implementation mechanism/apparent and consistent applications of regulations for both central and regional levels.
d. Studies on fiscal policies to reduce conversion rate especially for technically irrigated rice field that have use great investments. The proposed policy should be made so that land conversion would be very expensive and unsuitable.
e. Formulation of incentive policies to conduct activities on irrigated lands.
f. Studies on land conservation and rehabilitation, including water resources preservation and management of water catchments areas. The studies include several aspects such as conservation-based activities, husbandry, plantation, fisheries and forestry (including forest for food reserve) and community participation in preventing land degradation and

rehabilitation. Furthermore, studies are also necessary to ensure water conservation and utilization of rainfall and runoff, and development of water infrastructures for water utilization efficiency.

g. Studies on the application of progressive tax system for those who convert fertile lands and ”abandon” fallow lands, or incentive for those otherwise. The studies include system, mechanism and impacts on agricultural production potentials and lost/gain of economic potentials.

### a.3. Utilization of marginal lands to increase paddy production

Agricultural extension programme to increase rice production on non-rice field often faced with stress related conditions such as acid soil with low water holding capacity and always submerged by water thus limiting oxygen. Therefore, utilization of marginal lands should be continued through discoveries of better rice varieties.

Experiments on dry field rice varieties that are developed by IPB often face obstacles when it comes to conducting multi locations experiments. The general objective and focus point of this research is to produce operational procedures to produce rice on various marginal lands based on New Plant Type that are produced by IPB. Two main activities related to this are: (1) Development and examination of multi-location of dry field rice variety that is tolerant to acid soil (dry land), and (2) Development and examination of multi-location of dry field rice variety that is tolerant to peat swamp and tidal lands (wet land).

### b. Agenda for production increase and provision of non-rice and fisheries- and husbandry- based food

Although rice is a major food commodity, however the problem of food security in Indonesia is not only a problem of rice provision. Therefore, apart from the

need to carry out systematic efforts to secure rice provision as discussed above strategic research development for other commodities should also be step up and develop. In order to supply major carbohydrates, the development of various root crops or grains (such as sorghum and corn) and other starchy food (sago, breadfruit) both within the context of cultivation and development of their by products are necessary. Cultivation can be perform in rice field, dry land and integrated with forestry and plantation (*agro-forestry*). Currently, Indonesian food consumption is still imbalance due to the consumption pattern where there is a high proportion of rice and low consumption of vegetable and fruits, nuts and fisheries and husbandry-based food. Lack of micro nutrition (hidden hunger) is also prevalent thus the development of commodities such as vegetables, fruits, fish, livestock and nuts is important to carry out and form a strategic step to overcome food and nutrition problems face by Indonesia.

### c. Agenda for Economic Growth to Increase Food Access

Food access can be divided into physical and economic. Physical access relates to location and geographical conditions that sometimes hinder people's access to food. While economic access is much related to the ability of someone/people to purchase food. In other words, this relates to the ability to purchase. Various studies clearly suggest that there is a relationship between poverty, purchasing power and occurrence of food vulnerability (Flores, 2001).

The relatively high ability to purchase will allow privileged people to fulfil their own needs although food prices are relatively high. The relatively high ability to purchase will benefit various parties including farmers, thus prices for

certain agricultural products (such as rice) do not always have to be establish low, which resulted in farmers' low income. The relatively high ability to purchase also widen the demand spectrum (on primary & secondary necessities), thus can push industrial development. The growth of additional value industries based on local potentials is an accurate strategy to take to boost regional economy based on local potentials. These additional values are expected to generate jobs and income for local people. The Indonesian regional autonomy and diversity of regional potentials open opportunities to carry out this strategy.

In economic term, the ability to purchase strongly relates to income acquired from economic activities. The parameter use to measure economic activity is economic growth. In other words, economic growth will require labours and generate jobs thus the people would get incomes. Unfortunately, this does not always go as expected. The real economic problems face by Indonesia can be grouped into four questions as follows, (1) How to stimulate growth (Pro Growth), (2) How to provide jobs (Pro Job), (3) How to alleviate poverty (Pro Poor), (4) How to empower regional resources (Pro Indigenous Resources). These four questions must be answered simultaneously based on attached potentials.

The simultaneous answers for the above questions should become the main foundations to drive regional economy to increase people's access, especially economic access for food. In order to achieve this, several significant determinants to consider are the establishment of upstream-downstream links, establishment of additional value along the food commodity chain and synchronization of regional activities.

**d. Strategic Research for Food Sector Timeline**

The Tables below illustrate the proposed activities for strategic research for food sector from 2008 – 2012. Generally the Research Agenda is divided into two main groups, *i.e.*: 1) Improving Food Supply and Quality (Rice and Non Rice), and 2) Increasing Food Access.

In Improving Food Supply and Quality, the research agenda is divided into: 1) Increasing paddy production and productivity through: a) Development of Superior Seed Variety, b) Increasing Production Efficiency, Paddy Productivity and Environmental Preservation, c) Increasing Paddy Added Value; 2) Supporting Research in Rice Provision Safety; 3) Research on Non-Paddy Development, 4) Research on Food Development from Fisheries and Husbandry, and 5) Research on Increasing Food Quality in Overcoming Multiple Nutrition and Food Consumption Diversification. The second part composes of strategic research in Increasing Food Access.

## 3.4. Proposed Activities and Work Period for Research and Development in Food Sector

Table 3.1. First Priority Activities

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| **INCREASING FOOD SUPPLY AND QUALITY (RICE AND NON RICE)** | | | | | | | |
| **I. RESEARCH AGENDA FOR INCREASING RICE PRODUCTION AND PRODUCTIVITY** | | | | | | | |
| **A. Development of Superior Seed Varieties** | | | | | | | |
| 1. Identification, testing and development of promising lines to produce new superior variety (low percentage of empty pods, resistant to crop disturbance organism (OPT), good quality) | Basic | Regional | → | → | → | → | → |
| 2. Development of superior variety of dryland rice specific to locations that are tolerant to stress (biotic/abiotic, tolerant to acidic land, shade and rice blast and neck blast diseases) and good quality | Basic | Local | → | → | → | → | → |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| 3. Development of superior hybrid rice variety | Basic | Regional | | | | | |
| 4. Development of new improved rice variety specific to wet lands (such as wet field rice tolerant to peat and tidal lands) | Applied | Local | | | | | |
| 5. Identification and development of superior rice variety for functional food:<br>• low in glycaemia index<br>• high in Fe<br>• high in Vitamin A | Basic | Local | | | | | |
| **B. Improvement of Production Efficiency, Productivity and Environmental Preservation** | | | | | | | |
| 1. Development of Precision Farming (measured input agriculture) through inputs application (variety, seed, fertilizer, water, organic materials, ameliorant) according to production target and environmental preservation | Applied | Local | | | | | |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| 2. Development of fertilizer technology including engineering of slow release fertilizer, organic fertilizer, utilization of micro organisms | Applied | Local | | → | → | → | → |
| 3. Development of appropriate technology to lower post-harvest losses/increase rendement | Applied | Regional | | → | → | → | → |
| 4. Development of control technology for rice pests and diseases | Applied | Regional | | → | → | → | → |
| 5. Development of organic rice | Applied | Local | | → | → | → | → |
| **C. Enhancement of Added Economic Value of Paddy** | | | | | | | |
| 1. Development of local seed bank that is initiated and managed by farmers, and strengthening farmers' capacities in seed development and distribution | Applied | Local | | | → | → | → |
| 2. Development of rice bran and grit for food variety (functional food rich in fibre, oil) | Applied | Local | | | → | → | → |
| 3. Waste utilization for various needs (husk and straw for fuels, fertilizer, paper, etc.) | Applied | Local | | | → | → | → |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| **II. SUPPORTING RESEARCH AGENDA FOR RICE PROVISION SECURITY** | | | | | | | |
| 1. Organization of operational framework to conduct agrarian reform particularly related to sensible land distribution | Applied | Regional | | | | | |
| 2. Study of moratorium prospect for shift in land use for the 8.9 million hectares of available wet rice field | Action Research | Regional | | | | | |
| 3. Study of regional and provincial spatial plans for regions that are the food production pockets | Action Research | Regional | | | | | |
| 4. Study of fiscal policy to lower conversion rate particularly of technically irrigated rice field that have exhausted great investments | Applied | Regional | | | | | |
| 5. Incentive policy making to conduct activities on irrigated land | Applied | Local | | | | | |
| 6. Conservation and land rehabilitation studies, including water resources preservation and watershed management. | Action Research | Local | | | | | |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| 7. Independent research on local and indigenous people's claims on natural resources classified inside state land or state forest land. | Applied | Local | | → | → | → | → |
| 8. Participatory mapping to determine boundaries of areas claimed by the local/indigenous people to reduce inappropriate perceptions of state and community lands. | Applied | Local | | → | → | → | → |
| 9. Study on progressive tax application for those who convert fertile lands and "abandon" fallow lands, or incentive for those otherwise. | Basic | Regional | → | → | → | | |
| **III. RESEARCH AGENDA FOR DEVELOPMENT OF NON-RICE FOOD** | | | | | | | |
| **A. Starchy Food (Non grain and tuber / Starchy seeds)** | | | | | | | |
| 1. Breeding and cultivation of sorghum and other various local non rice grain | Basic | Local | | → | → | → | → |
| 2. Improve the productivity and quality of cassava, sweet potato, taro, konyaku potato, brick canna and breadfruit for food | Applied | Local | | → | → | → | → |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| **B. Horticulture (Vegetables and Fruits) and Soybean** | | | | | | | |
| 1. Breeding, cultivation and post harvest handling of various superior vegetables (high in economic value, rich in vitamin-mineral) | Applied | Local | → | → | → | → | → |
| 2. Breeding, cultivation and post harvest handling of various superior fruits such as manggosteen, papaya, pineapple, banana, mango (high in economical value, rich in vitamin-mineral) | Applied | Local | → | → | → | → | → |
| 3. Breeding and cultivation to enhance soybean productivity | Basic | Regional | → | → | → | → | → |
| **IV. RESEARCH AGENDA FOR DEVELOPMENT OF FISH AND LIVESTOCK FOOD** | | | | | | | |
| **A. Fisheries** | | | | | | | |
| 1. Genetic engineering of fish seed to increase production | Basic | Regional | → | → | → | → | → |
| 2. Development of fish and other seafood to improve nutrition | Applied | Local | → | → | → | → | → |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| 3. Development of fish and seafood processing technology to improve consumers acceptance | Applied | Local | | | | | |
| 4. Development of low budget fish food | Applied | Local | | | | | |
| 5. Development of marine culture for various fish cultures (grouper, shrimp, etc) and sea grass | Applied | Local | | | | | |
| 6. Development of artificial breeding of various fish such as tilapia, etc. | Applied | Local | | | | | |
| 7. Development of fish disease prevention technology such as DNA vaccine for KHP virus, etc | Applied | Regional | | | | | |
| 8. Rehabilitation of cultivation areas | Applied | Local | | | | | |
| 9. Study of Pollution Status of Fresh and Salt Water Culture Areas | Basic | Local Regional | | | | | |
| 10. Study of Coastal Area Productivity as Supporting Areas for Fish Culture | Basic | Local | | | | | |
| 11. Study of Fish Population Stock for Supporting the Available Information | Basic | Local Regional | | | | | |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| 12. Rehabilitation of Ecosystem-Based Lakes in Jabodetabek in the Effort to Increase Their Functions and Benefits | Basic | Local | | → | → | → | → |
| 13. Ecosystem-Based Fisheries Management in Paparan Banjir, Kampar Kiri Sungai, Riau | Basic | Local | | → | → | → | → |
| 14. Research on the Study of Development of Tropical Fish Resource Stock Model | Basic | Local | | → | → | → | → |
| **B. Husbandry** | | | | | | | |
| 1. Breeding of local superior animal (productive, easily adapted, resistant to disease) particularly for Garut lamb, Balinese/Sumbawan cow and local poultries (alabio, etc) | Basic | Local | → | → | → | → | → |
| 2. Germ Plasma Preservation, specifically for Garut lamb and Balinese cattle | Applied | Local | → | → | → | → | → |
| 3. Compartments in local livestock breeding | Basic | Local | → | → | → | → | → |
| 4. Development of Local Superior Poultry (*Breeding*) | Basic | Local | | → | → | → | → |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| 5. Development of Locally Based Poultry Feed | Applied | Local | | | | | |
| 6. Development of Local Cattle (Breeding) | Applied | Local | | | | | |
| 7. Development of Locally based Cattle Feed | Basic Applied | Local | | | | | |
| 8. Development of Dairy Animals | Applied | Local | | | | | |
| 9. Development of Dairy Animals Feed | Applied | Local | | | | | |
| **V. RESEARCH AGENDA FOR ENHANCEMENT OF FOOD QUALITY TO PREVENT AND OVERCOME MULTIPLE NUTRITIONS AND FOOD DIVERSIFICATION** | | | | | | | |
| **A. Development of Food Products for Under Nutrition Problem** | | | | | | | |
| 1. Identification of potential vehicle for fortification of zinc, vitamin A, iodine and other important micro nutrition | `Applied | Local | | | | | |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| 2. Efficacy and Effectiveness of food fortification and supplements for people with nutrition deficiency | Applied | Local | | | | | |
| **B. Development of Food Products for Over Nutrition and Functional Food** | | | | | | | |
| 1. Development of food products for the prevention of degenerative diseases (high in fibre, low in glycemic index) | Applied | Local | | | | | |
| 2. Development of various functional food | Applied | Local | | | | | |
| **C. Development of Food Diversification** | | | | | | | |
| 1. Development of various flour products made from tuber, sago and breadfruit | Applied | Regional | | | | | |
| **VI. RESEARCH AGENDA FOR CLIMATE CHANGE SECTOR** | | | | | | | |
| 1. Study of climate impact on agricultural biodiversity and food diversification | Basic | Regional | | | | | |
| 2. Study of adaptation and mitigation of climate change on cultivation system | Applied | Regional | | | | | |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| 3. Development of small scale farmers protection mechanism from negative impacts of climate change | Applied | Regional | | | | | |
| **VII. RESEARCH AGENDA FOR FOOD POLICY AND INSTITUTION** | | | | | | | |
| 1. Study of the integration of poverty alleviation and improved food consumption quality and quantity of poor households | Applied | Regional | | | | | |
| 2. Study of food distribution system efficiency | Applied | Regional | | | | | |
| 3. Study of family economic empowerment to improve food access | Applied | Local | | | | | |
| 4. Development of food information system | Applied | Regional | | | | | |
| 5. Development of food and nutrition education and education effectiveness through various means and channels to improve food consumption and food security | Applied | Regional | | | | | |

| First Priority Activities | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| 6. Study on the international and regional conventions, and Indonesian law and regulations related to food sovereignty and farmers empowerment | Applied | Local | | | | | |
| 7. Study on early warning system and food vulnerability mitigation | Applied | Regional | | | | | |
| 8. Study on international food trade system and its impacts on Indonesia | Applied | Local | | | | | |
| 9. Study on seed development institution (VUB) at community level/participatory plant breeding | Applied | Regional | | | | | |
| 10. Study on macro economic policy effectiveness (fiscal, monetary) in increasing food access and incentives for farmers | Applied | Regional | | | | | |
| 11. Study on institutional strengthening in food production and marketing | Applied | Regional | | | | | |
| 12. Study of the impacts of food subsidy and removal of subsidy | Applied | Regional | | | | | |
| 13. Food development model based on food ecological economic research and food Malthusian economic research | Applied | Regional | | | | | |

Tabel 3.2. Second Priority Activities

| SECOND PRIORITY ACTIVITIES | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| **INCREASE OF FOOD SUPPLY AND QUALITY (RICE AND NON RICE)** | | | | | | | |
| **I. RESERACH AGENDA FOR INCREASING RICE PRODUCTION AND PRODUCTIVITY** | | | | | | | |
| **A. Improving Rice Production Efficiency and Productivity and Environmental Preservation** | | | | | | | |
| 1. Development of System of Rice Intensification | Applied | Regional | | → | → | → | → |
| **B. Improving Rice Added Economic Value** | | | | | | | |
| 1. Development of rice for industrial raw materials (based on starch and flour) | Applied | Local | | | → | → | → |
| **II. RESEARCH AGENDA FOR NON-RICE FOOD DEVELOPMENT** | | | | | | | |
| **A. Starchy Food (Non Rice and Tuber Cereals/ Starchy Seeds)** | | | | | | | |
| 1. Development of agroforestry (catch crop, filling crop, intercrop, edge crop) to increase production of paddy, corn and various root crops, shade-tolerant nuts | Applied | Local | | → | → | → | → |

| SECOND PRIORITY ACTIVITIES | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| **III. RESEARCH AGENDA FOR FISH AND LIVESTOCK-BASED FOOD DEVELOPMENT** | | | | | | | |
| **A. Fisheries** | | | | | | | |
| 1. Development of fish catching technology such as catch equipment set-net, squid attractor, etc | Applied | Local | → | → | → | → | → |
| 2. Development of deep sea fish shelter technology | Applied | Local | → | → | → | → | → |
| 3. Development of bone separator technology package in increasing efficiency of fishery resources utilization and maintenance of biodiversity | Applied | Local | → | → | → | → | → |
| **B. Husbandry** | | | | | | | |
| 1. Study of wildlife potential as novelty in livestock | Basic | Local | → | → | → | → | → |
| 2. Development of Local Poultry Management | Applied | Local | → | → | → | → | → |
| 3. Development of Post-Harvest Technology, Product Diversification and Food Security | Applied | Local | → | → | → | → | → |

| SECOND PRIORITY ACTIVITIES | Research Status | Research Scale | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| 4. Development of Local Cattle Development | Applied | Local | | | | | |
| 5. Development of Dairy Management | Applied | Local | | | | | |
| **IV. RESEARCH AGENDA FOR FOOD POLICY AND INSTITUTION** | | | | | | | |
| 1. Academic study of basic concepts, scientific foundations, social, political and economic issues of food sovereignty | Applied | Local | | | | | |
| 2. Study and formulation of operational framework and facilitation of agrarian reform | Applied | Regional | | | | | |
| 3. Institutional study of food at community level | Applied | Regional | | | | | |

Table 3.3. Additional Research Agenda Activities

| ADDITIONAL RESEARCH AGENDA ACTIVITIES | Research Status | Research Scale |
|---|---|---|
| **I. PROPOSED MAIN RESEARCH ACTIVITIES** | | |
| 1. Development of forest for food | Applied | Local |
| 2. Development based on traditional people wisdom | Applied | Local |

| ADDITIONAL RESEARCH AGENDA ACTIVITIES | Research Status | Research Scale |
|---|---|---|
| 3. Inventory of forest food sources | Applied | Local |
| 4. Development of forest for food reserves | Applied | Local |
| 5. Agribusiness outlook food commodities: representative farm and Small-Medium Food Enterprises | Applied | Regional |
| 6. Accessibility of Small-Medium Food Enterprises to commercial credit | Applied | Regional |
| 7. Study of entrepreneurship for farmers and Small-Medium Food Enterprises | Applied | Regional |
| 8. Development of bio-*ageus* for sustainable agriculture | Basic | Regional |
| 9. Development of food diseases identification methods by bio-molecular application | Basic | Regional |
| 10. Development of environmental health-based pests management method | Applied<br>Action<br>Research | Regional |
| 11. Utilization of microhydro for the development of village productive economy | Applied | Local |
| 12. Development of diesel fuel warmer through optimum utilization of raw coconut oil (cco) as alternative fuel | Applied | Local |
| 13. Development of sea plants based bio-ethanol production technology | Applied | Regional |
| 14. Soy bean cake | Basic<br>Applied<br>Action<br>Research | Local |
| 15. Development of probiotic for shrimp culture | Basic<br>Applied<br>Action<br>Research | Local |

| ADDITIONAL RESEARCH AGENDA ACTIVITIES | Research Status | Research Scale |
|---|---|---|
| 16. Development and utilization of mushroom for food and medicine | Basic<br>Applied<br>Action<br>Research | Local |
| 17. Development and utilization of honey bee | Basic<br>Applied<br>Action<br>Research | Local |
| 18. Development and utilization of bacteria as bio-control and green fertilizer | Basic<br>Applied<br>Action<br>Research | Local |
| 19. Empowerment of traditional markets as wheel for village communities | Basic | Local |
| 20. Revitalization of village granaries during shrimp recession | Basic | Local |
| 21. Feasibility analysis for horticultural business | Basic | Local |
| 22. Development of natural food colouring | Basic<br>Applied | Local |
| 23. Development of natural preserve | Basic | Local |
| 24. Individual revitalization for provision of family food | Action research | Regional |
| 25. Tracing local wisdoms within agroforestry system | Action research | Local |
| 26. Application of integrated agriculture for food safety | Action research | Regional |
| 27. Development of high starch banana for food security in dry areas | Applied | Local |

| ADDITIONAL RESEARCH AGENDA ACTIVITIES | Research Status | Research Scale |
|---|---|---|
| 28. Control of papaya mealybug (*Paracoccus marginatus*) for food security | Applied | Local |
| 29. Development of marginal agricultural land system | Action research | Local |
| 30. Implementation of integrated pest control for rice planting | Action research | Regional |
| 31. Study on the impact of global warming on food pest and disease status | Action research | Regional |
| 32. Utilization of biopharmaceutical to improve health, efficiency quality of stock/fish production | Basic Applied | Local Regional |
| 33. Utilization of endophytic microbe to increase food material production | Basic Applied | Local |
| 34. Development of starchy potato-based food with high quality and productivity | Action research | Regional |
| 35. Initialization of bioinformatics to develop local seeds | n.a | n.a |
| 36. Precision farming simulation | n.a | n.a |
| 37. Food physics to increase fruit and vegetables quality | n.a | n.a |
| 38. Improvement of food quality through physical process | n.a | n.a |
| 39. Development of soy sauce made from land snail and little snail | n.a | n.a |
| 40. Study of Coconut Crab (*Birgus latro*) Population and Culture | Applied | Regional |
| 41. Development of Mud Crab (*Scylla spp*) | Applied | Regional |
| 42. Potential and development of *Squilla mantis* shrimp | Applied | Regional |
| **II. PROPOSED SUPPORTING RESEARCH ACTIVITIES** | n.a | n.a |
| 1. Strengthening of farmers groups and *gaprakan* in food production and marketing | Applied | Regional |

| ADDITIONAL RESEARCH AGENDA ACTIVITIES | Research Status | Research Scale |
|---|---|---|
| 2. Development of contaminant detector kit on snail to improve export competitiveness | Basic | Local |
| 3. Development of additive multiplicative model for plant tolerance selection | Basic | Regional |
| 4. Development of multiresponse calibration and adulteration technique of natural medicine | Basic | Regional |
| 5. Development and application of multiple geoinformatic criteria on poverty data in Indonesia | Basic | Regional |
| 6. mapping of land potentials for the development of water retention in Jabotabek | Basic | Regional |
| 7. Establishment of new lake in Bopunjur in controlling flood in Jakarta. (*action research*) | Applied | Regional |
| 8. Land evaluation of centres in each region | Action research | Regional |
| 9. Homegarden for agrarian reform | Applied | Regional |
| 10. Strengthening of GIS and remote sensing application for land management | n.a | n.a |
| 11. Development of portal system to rediscover information on agricultural products | n.a | n.a |
| 12. Development of provision of food pattern system | n.a | n.a |
| 13. Optimization of husk furnace in increasing mushroom quality in Bandung | n.a | n.a |
| 14. Development of antibiotic | n.a | n.a |
| 15. Development of Phytopharmaceutical for animal health and food | n.a | n.a |
| 16. Socialization and Promotion of Animal Protein Food Sources from Various Livestock | Applied | Local Regional |

| ADDITIONAL RESEARCH AGENDA ACTIVITIES | Research Status | Research Scale |
|---|---|---|
| 17. Development of Local Livestock Business Institution | Applied | Local |
| 18. Development of Local Livestock Regions (centres) | Applied | Local |
| 19. Study of Food Provision Policies | Applied | Local |
| 20. Development of Integrated Livestock Business Area | Applied | Local |

# IV Conclusions

In order to become the World Class University, IPB must organize itself, and one such way is through the formulation of research. The Research Agenda for Food Sector is formulated to organize and direct research conducted by IPB academic society, to be more integrated and sustainable in order to provide meaningful contribution for development of Indonesia.

This Research Agenda for Food Sector is built upon various aspects that are more than just development inputs and technology processes, but also taking into account policy and economic aspects. This research agenda is expected to strengthen cooperation between study units and research centres to conduct integrated research to minimize overlapping research. Furthermore, this research agenda will be very helpful in allocating research funds and establishing research targets terms.

We hope that these thoughts contribution will benefit the development and strengthening of research among IPB academic society.

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