MONTHLY FOCUS NO 4 - 2011

New Food Security Strategies in the Age of Global Food Crises

By PARK Hwan-Il

Co-authored by

KANG Hee-Chan, KIM Hwa-Nyeon,

LIM Soo-Ho, Moon Weh-Sol

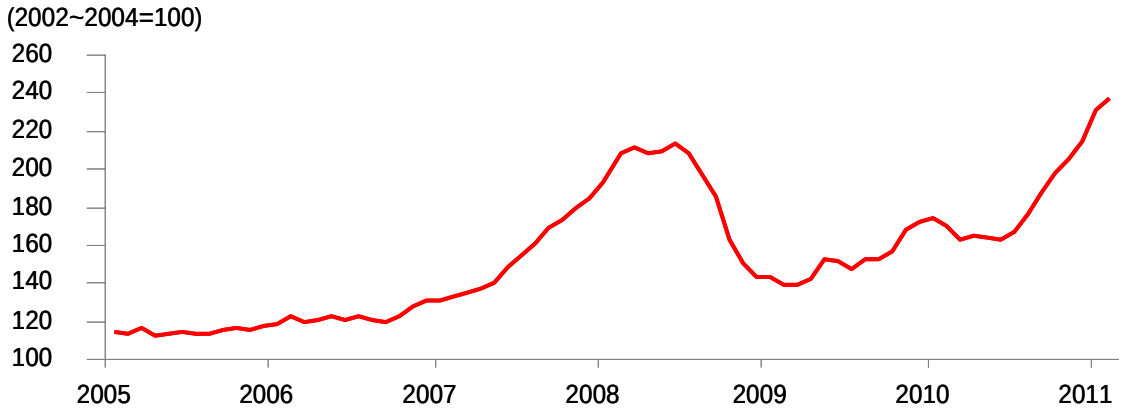
April 2011

SAMSUNG ECONOMIC RESEARCH INSTITUTE

I. A New Concept of Food Security

The world's food supply is currently in transition from an era of persistent surpluses to one of chronic shortages and imbalances. Weather abnormalities caused by climate change have worsened anxiety over the food supply, while the public has grown more aware of the inherently limited supply of land, water, and environmental capacity. Moreover, demand for grain, particularly corn, is also growing due to increased use of bio-fuel in the United States, China, and the European Union, further worsening disparities in regional food supplies. This is because food production and exports is concentrated in a limited number of countries, while food demand is greatest in emerging and underdeveloped countries in Asia, the Middle East, and Africa. On top of this, rising food prices have prompted major countries to pursue protectionist food policies to ensure their own food security, which in turn has pushed food prices higher and spurred growing anxieties about food. The FAO Food Price Index recently hit a record high in February 2011, after seven straight months of increases. In response, countries around the world have put increased priority on securing stable supplies of safe food.

Figure 1. FAO Food Price Index



Source: Food and Agriculture Organization.

In Korea, rising income and awareness of food has shifted focus from quantity to quality by prioritizing health and environmental preservation. As consumer preferences for healthy, environmentally sustainable food increase, food policy will likewise need to shift to respond to these changes. New concepts that measure both "food supply" in the traditional sense, and "food value" in the contemporary sense, must be internalized and practiced. While it will always be important to manage food through quantitative

metrics like “food self-sufficiency rates,” there is also an increasing need for food policy that incorporates environmental concerns (including water, land and ecosystems) as well as public health. In other words, food policy requires a comprehensive strategy that considers both food supply stability and food safety.

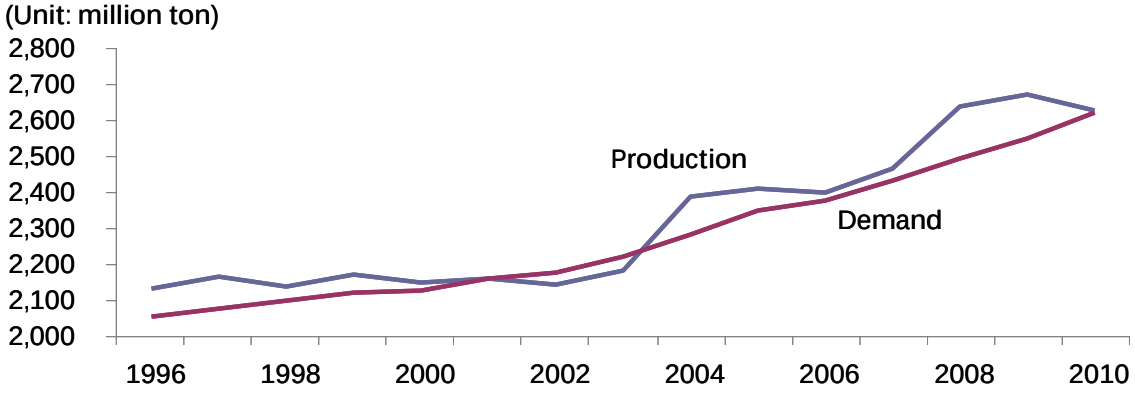
Accordingly, the main objectives of this study are to develop an index that embraces new concepts in food security, and suggests tasks that can contribute to improvement of the index. The study analyzes Korea’s current situation with respect to food demand, supply, and distribution in the international food market, and seeks out major variables that take into account food security levels in terms of safety and stability. The study concludes with alternatives for the establishment of food policy.

II. Main Threats to Food Security

1. Demand Side: Increasing and Diversifying Demand for Food

It is likely that supply disruptions will continue to recur due to rising grain consumption as the world’s population grows both in income and numbers. Global population is projected to reach 9.1 billion by 2050, with most of this population increase in developing and underdeveloped countries in Africa, Asia, and South America. In 2050, global demand for food is expected to rise to 3 billion tons, while food production will need to increase by over 70 percent compared to current levels. A rise in world grain demand from strong income growth and resulting increases in food consumption in emerging markets (including China and India) is expected to further expand demand.

Figure 2. Global Grain Production and Consumption



Source: Food and Agriculture Organization, Food Outlook (Nov. 2010)

Serious concerns are thus arising that the current shift from food surpluses to food shortages will not be temporary, but will become a permanent fixture of daily life. In the past, grain production generally increased while meeting demand, but since 2010, global food consumption has begun to exceed production.

Demand for grain has been further stoked by biofuel production (particularly ethanol production in the United States). This has led to soaring demand for corn. In 2010, 35 percent of US corn yields was sent to ethanol distillers. Corn prices have thus gone up, causing burdens for the livestock industry, as well as for food producers that use corn as a raw material. Conversion of land for corn production, moreover, has caused a decline in the production of competing crops like wheat and soybeans, and reduced pastureland for livestock grazing. Since high oil prices will continue and drive up demand for biofuel, the increase in grain demand will likely persist.

In Korea, imports of feed crops have been trending up in line with changes in food consumption patterns. Diets have shifted from traditional staples like rice to high-protein meat and dairy products, generating greater demand for grains like wheat and corn. As the scale of food imports has increased, so has public awareness of food safety. Issues concerning imported food safety, including genetically modified crops, are also gaining increased public attention, while demand for environmentally-friendly agricultural products has increased on changing consumer preferences. Consumers are now seeking quality, taste, and safety rather than considering only quantity or price when grocery shopping.

2. Supply Side: Increasing Production Volatility Driven by Climate Change

Climate change has caused weather abnormalities, and induced supply disruptions in grain production due to increased natural disasters. In 2010, weather abnormalities in grain producing areas decimated crop production. Such extreme weather events are expected to continue into 2011. Russia, Ukraine, and China in particular were hit hard by disasters like droughts and floods that cut grain yields, while in the southern hemisphere, *La Nina*, a recurrent phenomenon of unusually cold ocean temperatures, is likely to have negative effects as well.

Table 1. Climate Disasters in Summer 2010 in Major Grain-producing Nations

Disaster-Hit Countries	Flood-Hit Countries
Russia No.2 in wheat production No.3 in exports **Ukraine** No.7 in wheat production, No.5 in exports No.7 in corn production, No. 4 in exports	**China** No.1 in wheat production No.7 in soybean production, No.4 in exports **Canada** No.4 in wheat production, No.2 in exports No.5 in soybean exports

Note: Based on 2009-2010 grain year.

Source: US Department of Agriculture, Korea Price Data System.

With food producing countries hinting at "weaponizing" food through export restrictions, it is now increasingly likely that food security among importing countries will be threatened by diminishing supplies. In the summer of 2010 when anxiety over food supplies grew intense, Russia and Ukraine imposed restrictive measures on grain exports. Coupled with a forecast for severe weather abnormalities to increase in the next few years, it is likely that anxiety over food supplies will spread, and "weaponization" of food will occur more often.

Furthermore, climate change detrimental to water quality, soil pollution, and ecosystem degradation is hampering productivity. Water quality in particular is greatly affected by changes in temperature and precipitation caused by climate change. Since water quality has a huge impact on natural ecosystems and agricultural productivity, changes in water quality will need to be carefully monitored. Although warmer temperatures and increased precipitation owing to global warming may actually play a positive role in Korea's agriculture by improving conditions for its traditional flooded paddy rice farming, increases in temperature and rainfall beyond optimum levels are likely to bring adverse effects that outweigh any benefits. In the medium- and long run, uncertainty and volatility from global grain production will increase due to changes in water quality, soil, and ecosystems.

3. Trade Side: Instability of Food Imports and Increasing Overseas Dependency

The international grain market is a classic example of a "thin" market, where trading volumes are small in comparison to total production volumes. It is also a "residual" market in that the crops that it trades are typically left over from domestic consumption, and in having low ability to rapidly ramp up production to meet external demand. Thus,

domestic populations without adequate food stocks may experience stress from supply shortages. The primary reason that advanced countries in Europe and Northern America have maintained food self-sufficiency at over 100 percent is that they have prepared themselves for such potential emergency situations by stabilizing domestic grain prices and achieving food security.

The international grain market is subject to an oligopoly of the four major global grain conglomerates: Cargill, Archer Daniels Midland, LDC, and Bunge. These firms perform grain trading functions and affect government policy with respect to international trade and agricultural markets using their massive capabilities to obtain information worldwide. Furthermore, by vertically integrating agriculture and financial services, the grain majors exercise tremendous leverage over the worldwide food industry. Business for grain majors has expanded beyond traditional trading of crops to seeds, fertilizers, food and food processing, finance, and bio-energy production. At times, the four grain majors have encroached on consumer welfare by exerting their influence on agricultural producers, or by creating an oligopoly regime.

Korea's food import structure shows that high dependence on a few countries or a few companies (i.e. the grain majors) can cause substantial instability in risk management. Korea's imports of corn, wheat and soybeans mostly come from the United States, Australia, Brazil, Argentina and Canada. Since Korea brought in 72.9 percent of its total import volume of grain through the four majors (as well as Japanese general trading companies like Marubeni and Mitsubishi), it has been subject to the market power and influence of these providers. Korea's grain buyers usually purchase on an as-needed basis at a fixed price through lowest-price public bids, rather than using the grain futures market or long-term supply contracts. This kind of grain-purchasing practice has exposed the nation to a considerable degree of risk. Rising grain prices from lax risk management will lead to an increase in processed food prices, leading to consumer price hikes. According to estimates from one study, a 10 percent increase in corn prices leads to a 3.6 percent rise in prices for starches and sugars, while a 10 percent increase in soybean prices will lead to a 2.5 percent rise in the cost of cooking oil. The effects of price hikes for imported grains on domestic consumer prices generally appear for consumers after a time lag of three to six months.

Table 2. Share of Korea's Imports from Grain Majors

(Unit: %)

	Four Grain Majors				Japanese Traders	Others	Share of Majors
	Cargill	ADM	BUNGE	LDC			
3 Grains	31.7	16.7	5.5	3.0	16.0	27.2	56.9

Note: Based on import volumes for three grains (wheat, soybeans and corn) from 2003 to 2008
Source: Reassessed on the basis of Dae-sup Lee et al. (2009), "An Analysis of International Grain Markets and Reform Measures for Korea's Grain Import Methods," Korea Rural Economic Institute.

III. SERI's Food Security Index

Among food security indices, the most representative and frequently used indices are food and grain "self-sufficiency rates." The former refers to the share of domestically produced food among a nation's overall food consumption, while the latter includes feed grains in its assessments. "Self-sufficiency" is the most convenient tool in terms of interpretation. However, self-sufficiency fails to reflect food accessibility and food stability, and has limitations as an appropriate measurement of food security.

To measure food security, the International Fund for Agricultural Development (IFAD[1]) developed a food security index that takes into consideration not only volumes of food production and consumption but also food volatility. This index, however, has inherent limitations due to its use of the unproven assumption that growth in food production and consumption will enhance food security. It also has inherent flaws in its failure to reflect the ability to supply food from overseas, as well as grain price fluctuations, and changing consumer demand.

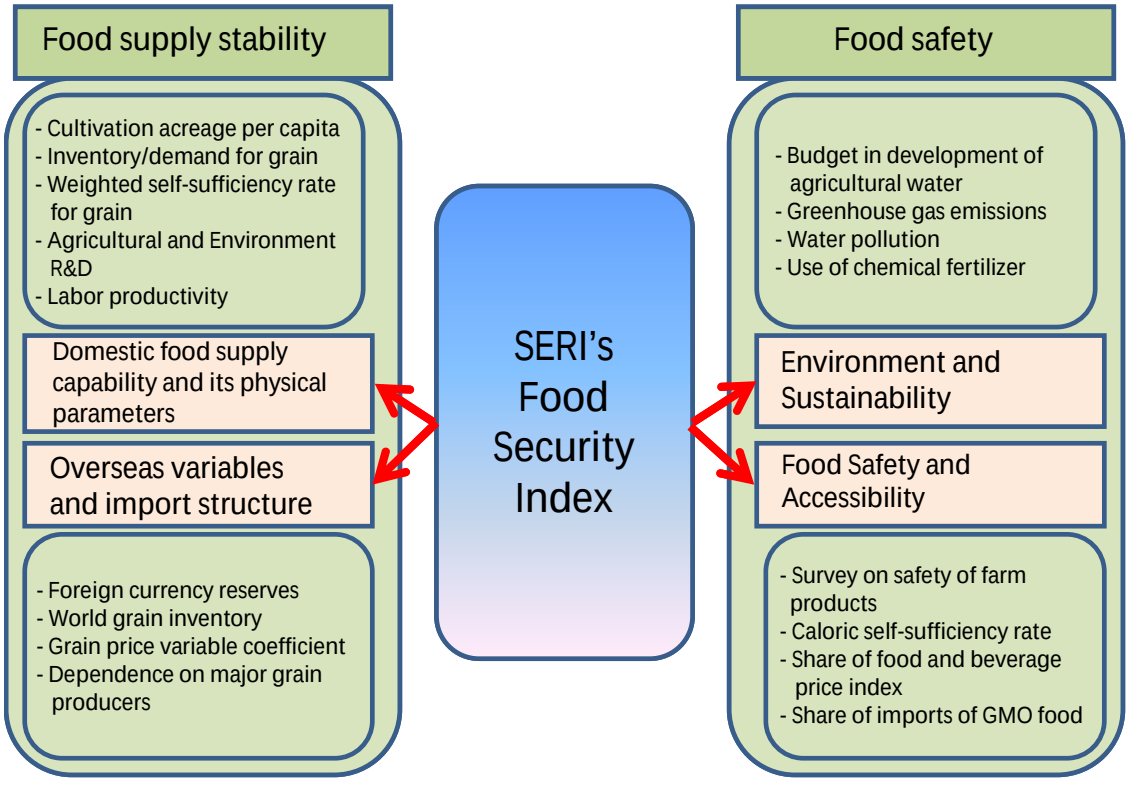
In this era, food security not only requires traditional agricultural policies oriented toward stability, but also policies oriented toward procuring healthy and environmentally sustainable food. Accordingly, it is now time to devise an index that pursues both "food security" in the traditional sense, as well as current concerns like sustainability and conservation. Food security in the 21st century must be achieved in the context of both food stability and food safety. In general, there is an inverse relationship between stability and safety, but concurrent promotion of both should be set as a food policy goal. A 21st century food security policy should develop multi-dimensional methods to comprehensively improve food stability and food safety. This is

[1] IFAD: International Fund for Agricultural Development

a particularly important task for Korea in that its food stability is low due to high overseas food dependency, even as its people demand high levels of food safety. Hence, there is an urgent need for a national food policy that boosts stability and safety at the same time.

Accordingly, SERI's Food Stability and Safety Index takes into account "food supply stability" as indicated by domestic and overseas supply capability, as well as "food safety", in terms of environmental friendliness, sustainability, safety, and accessibility. Each of the two sectors, food supply stability and food safety, is further classified into two sub-indicators, and each indicator takes into account five variables. To assess the index, annual data were used from 2002, as the data commonly used were all available from this time. SERI's Food Stability and Safety index sets 2005 as a base year to measure relative changes, and the 20 variables that constitute the index occupy an equal share.

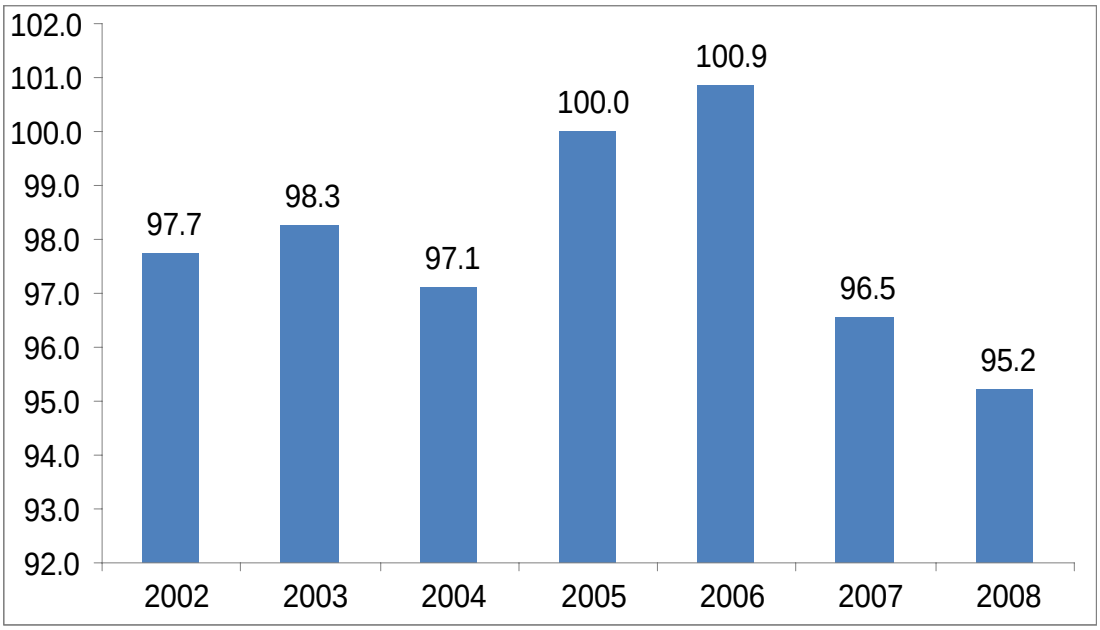
Figure 3. SERI's Food Stability and Safety Index



The findings of this study suggest an urgent need to upgrade food security levels because Korea's food security has significantly worsened since 2006. The overall food

security index declined from a peak of 100.9 in 2006 to its lowest level of 95.2 in 2008. In particular, safety appears much poorer than stability (in 2008, the index was 96.2 for stability versus 94.2 for safety). Food security levels stabilized in 2005 and 2006, but significantly fell from 2007 due to deterioration in overseas variables, import structure, and food safety.

Figure 4. SERI Food Security Index



Source: Samsung Economic Research Institute.

Food stability (which covers domestic food supply capability and its physical parameters as well as overseas variables and import structure) was 96.2 in 2008, showing improvement from its lowest level in 2002. After reaching its highest level in 2006, however, food stability experienced a continuous decline. The main culprits of this decline were the worsening overseas variables and import structure since 2007, caused by rapidly increased grain price volatility and intensified import source concentration.

Table 3. Food Stability Index

	2002	2003	2004	2005	2006	2007	2008
Stability Index	95.21	96.26	95.95	100.00	101.08	97.76	96.21

Source: Samsung Economic Research Institute.

Food safety fell to its lowest level in 2008 at 94.2, down more than 5.85 compared to 2005, indicating a need for efforts to improve food safety. As food imports have increased, so has anxiety over agricultural product safety. Against these spiraling increases in the share of GMO food imports, the food safety index has been sliding downwards. According to the results of the agricultural products safety inspection, grades of "unsuitable" with respect to food products significantly increased in 2008, with more than two out of every 100 products tested found to contain hazardous levels of pesticides and heavy metals. Furthermore, the share of imported GMO agricultural products, which was around 30 percent in the past, rapidly rose to over 50 percent in 2008, posing a greater threat to food safety.

Table 4. Food Safety Index

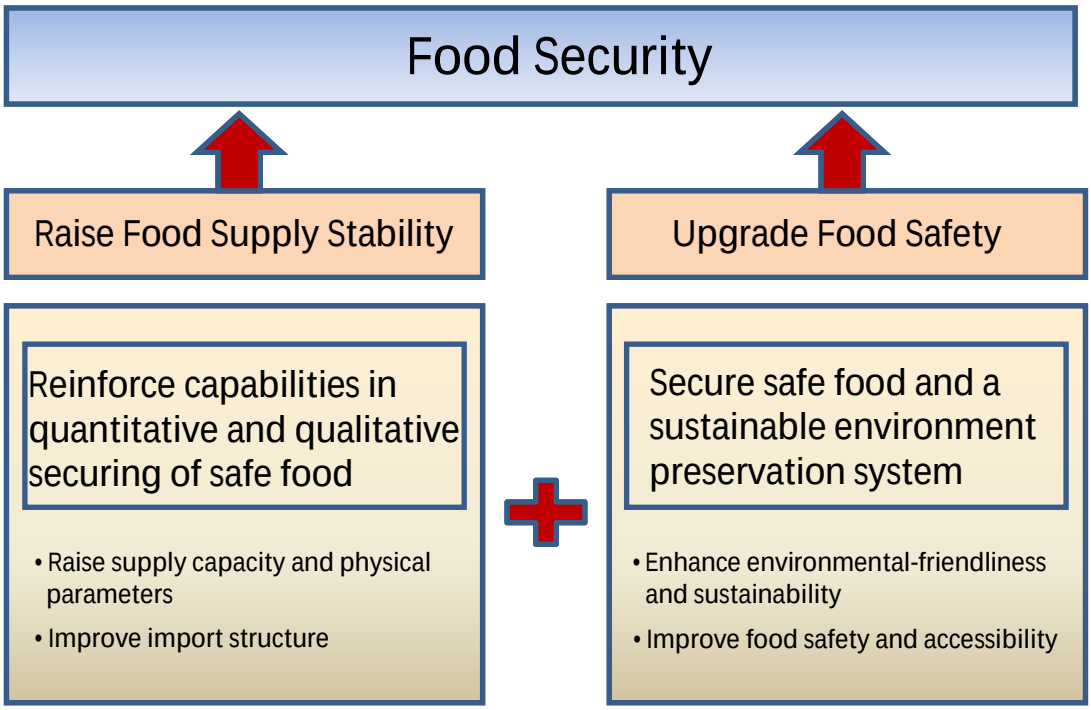
	2002	2003	2004	2005	2006	2007	2008
Safety Index	100.24	100.27	98.26	100.00	100.63	95.32	94.20

Source: Samsung Economic Research Institute.

IV. Tasks Ahead to Build Food Security Levels

Conventional food policy in Korea focuses on rice supplies, and emphasizes in particular "rice-centered quantitative factors." The nation's future food security however, needs to meet requirements for both stability and safety, and must therefore encompass both rice and other grains. Food security can only be achieved by reinforcing capabilities in quantitative and qualitative securing of safe food, and by establishing a sustainable environmental conservation system.

Figure 5. Strategy for Raising Food Security



V. Strategy for Raising Food Supply Stability

Enhancement of Domestic Supply Capability and Associated Physical Parameters

Once a food crisis occurs, excessive overseas dependence is greatly detrimental to food security, because it becomes very difficult to purchase food on international markets, regardless of the amount of foreign exchange reserves. As securing a domestic production base is a fundamental measure to enhance food supply capability, maintenance of domestic production capacity is *de facto* insurance against shortages on the international market.

First, idle farmland and reclaimed land should be developed to raise domestic production capacity. In areas with decreasing rice farming, it is desirable to convert paddy fields to dry fields for the production of wheat, corn, or soybeans; and for farmland that lies fallow during the winter months, it is desirable to expand cultivation of food and feed crops other than rice. In particular, it is desirable to effectively exploit reclaimed land like that in Saemangum to enhance domestic production capacity, contributing to a greater degree of food self-sufficiency.

Second, the current food stock system should be reformed through active utilization of the private sector. All grains except rice should be stocked in private storage facilities, while all costs incurred should be supported by the government. For major grains, a certain percentage (about 17 percent) should be set aside as mandatory stocks. Based on the government's earmarks for food in 2008, corn and wheat fell short of goals by 870,000 tons and 170,000 tons, respectively.

Table 5. Comparison of Optimum Stocks by Major Grain

(Unit: 1,000 tons)

Classification	Rice	Corn	Wheat	Soybeans
Total Demand	4,671	9,318	2,565	1,599
Year-end Stocks	675	690	256	77
Optimum Stocks	780	1,556	428	267
Shortfall of Stocks	105	866	172	190

Note: Based on "2008 crop year" (starting from November 1, 2007 ending on October 31, 2008)
Source: Recalculated on the basis of Major Statistics for Agriculture, Forestry and Fishery Products (2010), Ministry for Food, Agriculture, Forestry and Fisheries.

Third, the R&D budget for the agriculture and environment sector should be increased substantially. The agriculture and environmental conservation R&D budget relative to the total national R&D budget should be raised to over 15 percent from 8.3 percent in 2008. For development of new technologies that can contribute to expansion of agricultural production capacity, it is urgent to promote maximum utilization of private sector capabilities and to establish a comprehensive, public-private joint research complex.

Improvement of Import Structure and Capability

First, it is necessary to secure foreign bases for food production through overseas agricultural development. The government should provide comprehensive support for domestic firms that are striving to build food production bases abroad, and should make arrangements for the appropriate financial resources through overseas agricultural development funds. It is also necessary to set up a general control tower to prevent and handle the risks of overseas agricultural development at a governmental level.

Second, grain import price risks should be managed by better utilizing the futures markets. Instead of spot trading exposed to price volatility, it is better to use risk-

hedging methods through futures markets, including through basis[2] trading. At this juncture, it is crucial to actively nurture experts who understand both international grain markets and finance.

Third, improvement of the import structure will require more direct purchases as well as diversification of import sources. In order to respond to the oligopoly imposed by the "global majors" and to alleviate price volatility risk, it is essential to nurture homegrown grain majors. As well, the concept of a "self-development rate" and/or "self-supplying rate" as used in the energy and mineral resources sector should be applied to grain.

Fourth, it is urgent that an early warning system be established to monitor the international grain market. Monitoring should be upgraded to perform continuous surveillance of fluctuations in the international grain market, and to detect abnormal risk factors in advance. A manual could be devised to respond to the occurrence of price fluctuations and supply/demand disruptions, and a data network should be constructed to enable any one in Korea to access the latest information about the overseas grain supply.

Finally, a roadmap for agricultural cooperation with North Korea should be drawn up for concrete action. Development of food resources in North Korea through inter-Korean agricultural cooperation is useful in the context of building South Korea's overseas food base, while at the same time preparing for surging food demand upon unification. Over the long-term, food resource development in North Korea should be carried out in a gradual manner, from a pilot phase of inter-Korean cooperation, through special agricultural zones, to a full scale agricultural community.

VI. Strategy for Upgrading Food Safety

Enhancement of Environmental-Friendliness and Sustainability

First, it will be necessary to strengthen multifaceted assistance to farming households that use environmentally-friendly methods, and to augment a direct subsidy program for environmentally-friendly agriculture. Assistance for environmentally-friendly agriculture should be intensified for the purposes of environmental conservation and

[2] "Basis" means the difference between the futures price and the cash price at a specific location at a particular time. In terms of volatility risk, the basis is relatively less than the cash price, and thus the basis has a relatively lower level of price risk at the time of trading.

food production by promoting sustainable agriculture. It is thus desirable to systemize the supply and long-term leasing of environmentally-friendly cultivation techniques, equipment, and facilities, to enhance awareness of environmentally-friendly agriculture through continuous education.

Second, greenhouse gas emissions from the agricultural sector can be reduced by improving technology and decreasing transportation distances. Reduction in greenhouse gases through improvement of food production technology and shortening of "food miles" can also greatly contribute to enhancement of stable food supplies and food safety. In order to minimize food travel distances, movements like local food, cyber trading sites, direct trading malls, and urban "plant factories" should be promoted. Logistics and distribution systems also need to be greatly simplified.

Third, climate change adaptation in the agricultural sector should be fostered through technology development to prevent climate induced damage, including changes in the circumstances of producing areas, and risks from blight and pest outbreaks. As agriculture is substantially affected by climate, awareness of the need to adapt to climate change is as important as mitigation of greenhouse gas emissions. Capabilities for climate change adaptation should be strengthened through development of climate-resilient crops and seeds, and improvement of cultivation techniques. A warning system should also be established to forecast the harmful effects of climate change on agricultural ecosystems and weather.

Improvement of Food Safety and Accessibility

First, a food safety system must take root by expanding the number of items certified as safe, as well as by certifying producers and facilities. This will necessitate implementation of the existing five management systems—"Good Agricultural Practices" (GAP), farm-to-table traceability, "Hazard Analysis and Critical Control Points" (HACCP), identification of the origins of food products, and food safety investigations—with an enlarged scope of application. In order to heighten consumers' awareness of certified safe foods, it will also be necessary to intensify education and public relations.

Second, due to increasing demand for food services and expanding school lunch programs, it is important to secure safety in the post-production process, including distribution and consumption. Support should be provided for infrastructure, like integrated data processing systems, to ensure traceability, as well as for sanitation

management facilities in the distribution process. It is also desirable to ensure a higher degree of safety by expanding the use of HACCP certification for processed food production companies and logistics businesses.

Finally, since safety fears have grown on increased import of agricultural products due to the gradual opening of Korea's agricultural market, imported food safety must be strengthened through consolidation of quarantine agencies and expansion of local quarantine inspections. Various quarantine agencies that once divided the role of quarantine inspections for importing food should be consolidated to increase efficiency. Furthermore, food safety should be increased by intensifying quarantine inspections of food being exported onsite within the food exporting country.

VII. Overall Suggestion: Implementation of 'THE Food' Project

As a method to comprehensively enhance food supply stability and safety, this study suggests implementation of the "THE Food Project." THE stands for "Tasty," "Healthy," and "Environmentally-friendly." By providing quality food at reasonable prices through the "THE Food Project," it will become possible to include disadvantaged parts of society. The project's objectives are to reinforce a quality-food supply system and to enhance the value of natural resources along with effective advancement of food systems that interconnects production, distribution, and consumption of food.

The "THE Food Project" can boost autonomy in the food industry by fostering food-related industries, creating new job opportunities, and increasing value-added in peripheral industries. Major efforts should be focused on comprehensive improvement in the crop cultivation environment, such as land, water and ecosystems, not only to achieve quantitative increases in food but also to strengthen food production capacity. The supply capability of "THE Food" can be enhanced through creation of new consumption markets, and for this, growth of related industries is indispensable. Stable procurement and supply of food resources can be ensured through development of food production technology in combination with cutting-edge technology, and consultation from experts on international trade and logistics.

VIII. Conclusion and Implications

Food security in the 21st century not only involves a stable supply of food in quantitative and qualitative terms, but also a comprehensive approach that considers safety, health, and environmental factors. The task of strengthening food supply stability lies between the two axes of "enhancement of domestic supply and associated physical parameters," and "improvement of import structure and capability," whereas the task of upgrading food safety stands between the two axes of 'enhancement of environmental-friendliness and sustainability' and 'improvement of food safety and accessibility.'

SERI's food security index, which tracks both stability and safety of the food supply, marked its lowest level in 2008 after peaking in 2006. This implies an urgent need for policy development and implementation to raise food security levels, as Korea's food security situation has been deteriorating continuously from 2007.

Enhancing consciousness of and respect for agriculture is another imperative for successful food security policy. A variety of policies for improvement of food security usually turn out to be most effective when implemented with long-term and systematic methods. Rash Policy implementation based on the expectation of short-term achievements always invites adverse effects. It is thus better to keep in mind that agriculturally developed countries and those with higher food security levels share a common characteristic that they have all carried out systematic and practical policies without resorting to short-term methods or appeals.

Finally, for successful implementation, government policies should be coupled with a more mature public awareness of agriculture and food security. The widespread stereotype that agriculture is a backwards and one dimensional industry needs to give way to a new acceptance of agriculture's nature as a complex industry indispensable for the health of society. It is no longer feasible to act as if food simply grows by itself and will always be bountiful. Instead, the public needs to be aware that sustainable production of food requires continuous management of the environment and natural resources. Investing time and money now to enhance food security is like insurance premiums paid for the future. If the public can take this step, it will have come half the way to achieving genuine food security on its own.