4th Global Summit on Advances in Earth Science and Global Change
September 29–October 1, 2025, Vancouver BC, Canada
https://advanced-earth-climate-change-peersalleyconferences.com/

The Food Crisis in the New Cold War Era and Korea's Response focusing on Food Recycling and Waste Management

Cherl-Ho Lee, Emeritus Professor
Korea Food Security Research Institute, Korea University. Seoul, Korea
chlee@korea.ac.kr

Causes and consequences of global food crises during last two decades

(1) The 2007/2008 World Grain Crisis

- triggered by the use of US corn for ethanol production. 1/3 of US corn for fuel. Grain prices hiked over two times.
- Food shortage in poor countries, Restrictions on grain exporting countries.

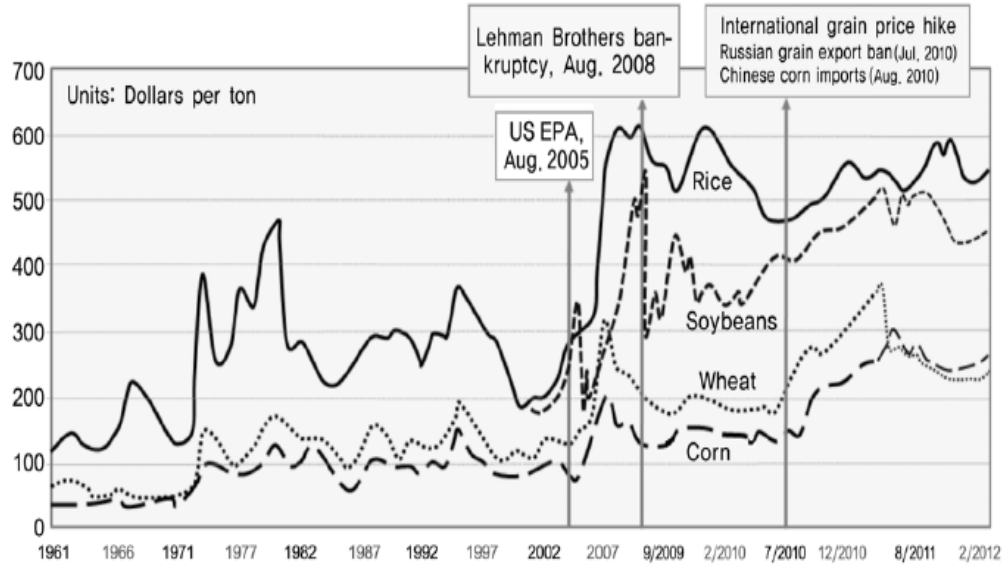


Figure 1. Changes in International Grain Prices

(1961- 2012) (Lee, 2024)

(2) Weather Disasters in 2010/11

- Extreme draught in Russia, China, and US. Massive flooding in Pakistan, Australia & Thailand.
- Food shortages in Africa and Middle East countries. Food demanding riots in over 30 countries. Jasmin Revolution in Tunisia, Fall of Egypt's Mubarak regime.

Causes and consequences of global food crises during last two decades

(3) Prevalence of Livestock Infectious Diseases

- caused by globalization- Increasing movement of people and goods.
- FMD, Avian Influenza, ASF, etc. Large-scale stamping out. Great food loss.
- Number of cattle and pigs buried due to FMD in Korea in 2010/11- 3,479,962 heads. Due to AI, 26 million poultry (2016), 33 million ducks (2017) were killed.

(4) COVID-19 Pandemic

- Coronavirus infection in Wuhan, China in December 2019. Global pandemic in 3 months.
- Over 7 million people died. Blockage of the movements of people and goods.
- World's number of undernourished people in 2020 increased 15% from the previous year.

Causes and consequences of global food crises during last two decades

(5) Ukraine War and Food Weaponization

- Russian invasion of Ukraine in February 2022.
  War between major food exporters.
- Food crisis in Africa and Middle East.
  Export restriction of food exporting countries.

Table 1. Changes in grain prices due to war in Ukraine and drought in South America

	March 14, 2022	Last Year	Average Year	Changes compared to	
				Last Year	Average Year
Wheat	403	234	180	72.2%	123.9%
corn	295	218	147	35.3%	100.7%
Soybean	614	520	361	18.1%	70.1%

(Chicago Futures Exchange, May 2022)

New Cold War and Trump's Tariff War

- US-China conflict and trade war in 2018
- Trump's doctrine- America First, MAGA. Superpower weakening.
- Return to protective trade. Global inflation & recession.

- Tension is moving from North Atlantic Ocean to North Pacific Region.
- Korea and Japan will be situated at the center of the turmoil.
- Severe food crisis is anticipated in the two countries where most of the food is imported from the US and China.

- World structure has changed from the previous ideological struggle between liberal democracy and communism to systemic competition between inclusive political system and exploitative political system.

(Acemoglu & Robinson, 2012)

Food Security Situation in Korea

- Total area of Korean Peninsula- 223,404 km^2
  (North Korea 123,138 km^2, South Korea 100,449 km^2)
- Agricultural land in South Korea (2023)- 1.52 million ha. (15.1% of total land)
- Arable land per capita (2023)- 0.04 ha (World average 0.24 ha. China 0.10 ha, USA 0.66 ha)

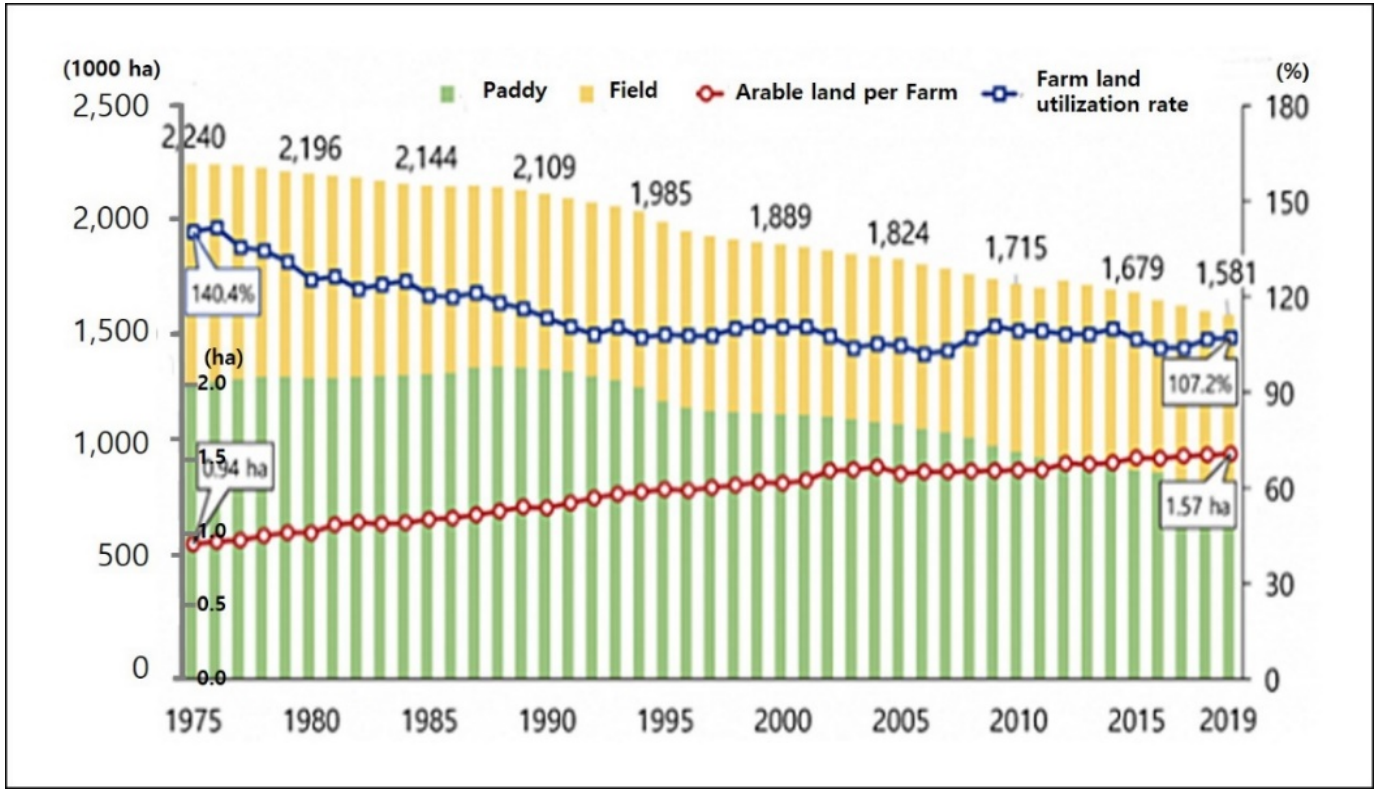


Figure 4. Changes in arable land area (paddy, field), arable area per farm household, and arable land utilization rate in Korea (Lee, 2024)

Food Security Situation in Korea

- Population in South Korea (2023)- 51.71 million
- Farm household population 2.09 million (4% of the total)
- Population density (2023)- 515.4/km^2 (Highest among the OECD countries)
- Daily Per capita Nutrient supply (2021)- Energy 3,156 kcal, Protein 113.3g, Fat 123.6g
- Grain import, million M/T (2022)- Wheat 4.405 (1.717), Maize 11.809 (9.489), Soybean 1.302 (0.984)*
- Rice production in South Korea (2022)- 3.882 million M/T (WTO compulsory rice import- 400,000 M/T per year)

* ( ) for animal food use

Food Security Situation in Korea

- Grain self-sufficiency rate (2021)- 18.5%
  (Rice 84.6%, Wheat 0.7%, Maize 0.8%, Soybean 5.9%)
- Nutrient self-sufficiency rate (2021)- Energy 32.0%,
  Protein 41.3%, Fat 19.4%

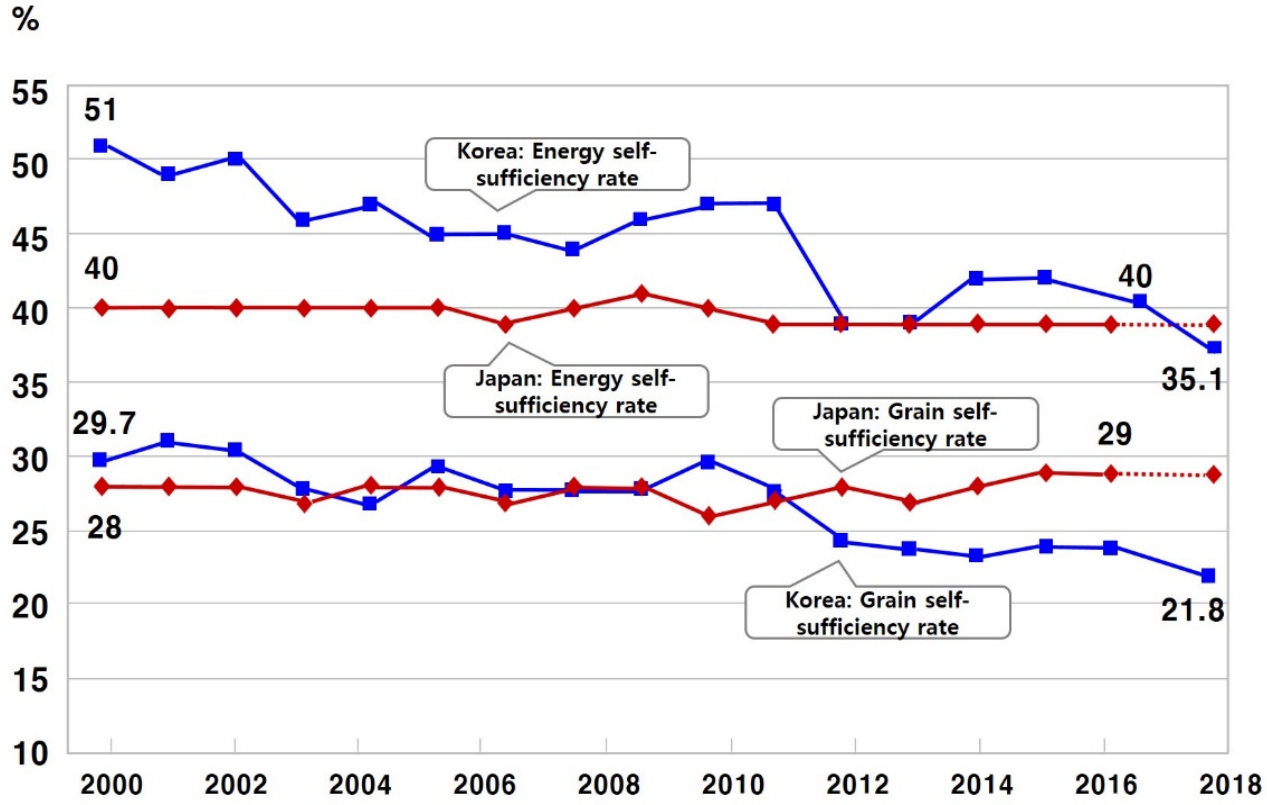


Figure 5. Changes in food self-sufficiency rates in Korea and Japan (2000-2018)

(Lee, 2024)

2022 Global Food Security Index Ranking

FOOD SECURITY ENVIRONMENT				
Rank / 113			Score	Δ
1	↔	Finland	83.7	+1.0
2	↔	Ireland	81.7	+0.1
3	▲5	Norway	80.5	+2.1
4	▲5	France	80.2	+1.9
5	▼2	Netherlands	80.1	+0.2
6	▼2	Japan	79.5	0
=7	▼3	Canada	79.1	-0.4
=7	▲4	Sweden	79.1	+1.4
9	▼3	United Kingdom	78.8	-0.5
10	▲7	Portugal	78.7	+1.7
11	▼1	Switzerland	78.2	+0.2
12	▼1	Austria	78.1	+0.4
13	▼6	United States	78.0	-0.7
=14	▲1	Denmark	77.8	+0.5
=14	↔	New Zealand	77.8	+0.4
16	▲2	Czech Republic	77.7	+1.1
17	▲5	Belgium	77.5	+3.0
18	▼7	Costa Rica	77.4	-0.3
19	▼4	Germany	77.0	-0.3
20	▼2	Spain	75.7	-0.9

FOOD SECURITY ENVIRONMENT				
Rank / 113			Score	Δ
21	▼1	Poland	75.5	+0.5
22	▲15	Australia	75.4	+4.7
23	▲3	United Arab Emirates	75.2	+1.6
24	▲3	Israel	74.8	+1.7
=25	▼2	Chile	74.2	-0.2
=25	▲14	China	74.2	+3.6
27	▼2	Italy	74.0	-0.1
28	▲1	Singapore	73.1	+0.3
29	▲3	Bulgaria	73.0	+0.8
30	▼9	Qatar	72.4	-2.2
31	▼1	Greece	72.2	-0.3
32	▲5	Kazakhstan	72.1	+1.4
33	▲9	Uruguay	71.8	+2.6
34	▲11	Hungary	71.4	+2.9
35	▼4	Oman	71.2	-1.1
36	▼1	Slovakia	71.1	+0.1
37	▼10	Peru	70.8	-2.3
38	▲2	Bahrain	70.3	+1.0
39	▲5	South Korea	70.2	+1.3
40	▼16	Panama	70.0	-4.2

Scores are normalized 0-100, where 100=best conditions

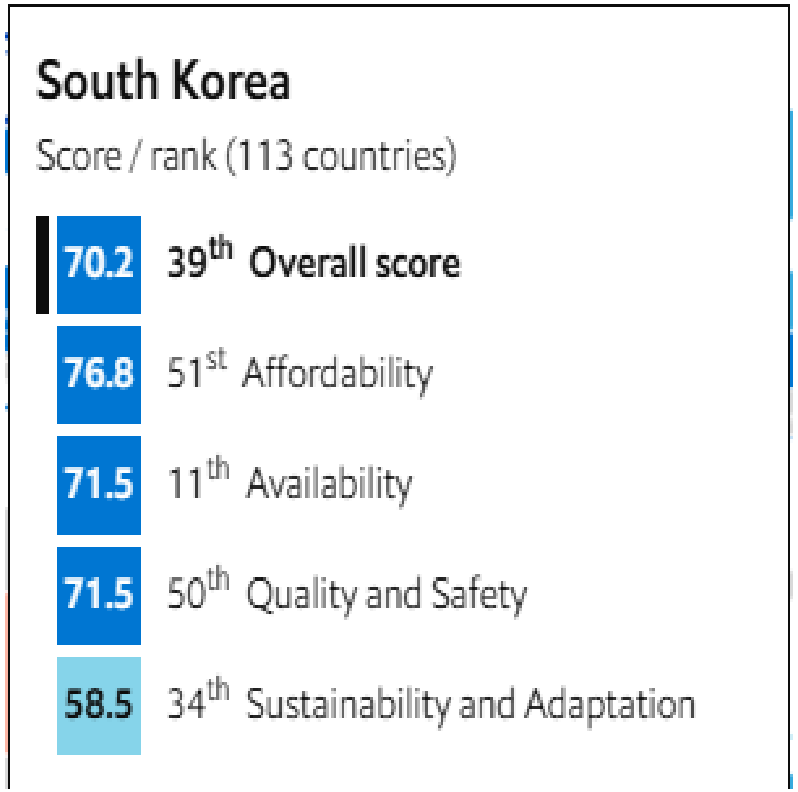
'=' denotes tie in rank

Δ = change in score, 2022 compared with 2021

▲ = Rank improved ▼ = Rank deteriorated ↔ = No change in rank

(Economist Intelligence Unit, 2022)

South Korean scores and ranks of the GFSI four issues (2022)



(Economist Intelligence Unit, 2022)

The Korean GFSI ranking is decreasing every year.

Changes in GFSI ranking

	2012	2022
Japan	16th	6th
Korea	21st	39 th
China	38th	14th

The reason for the Korea's downward ranking is mainly due to the inconsistency in Korea's food policy.

Proposals for the enactment of Food Security Law in the Republic of Korea

- Related ministries must be led consistently by the National Food Security Committee under the Prime Minister's office.

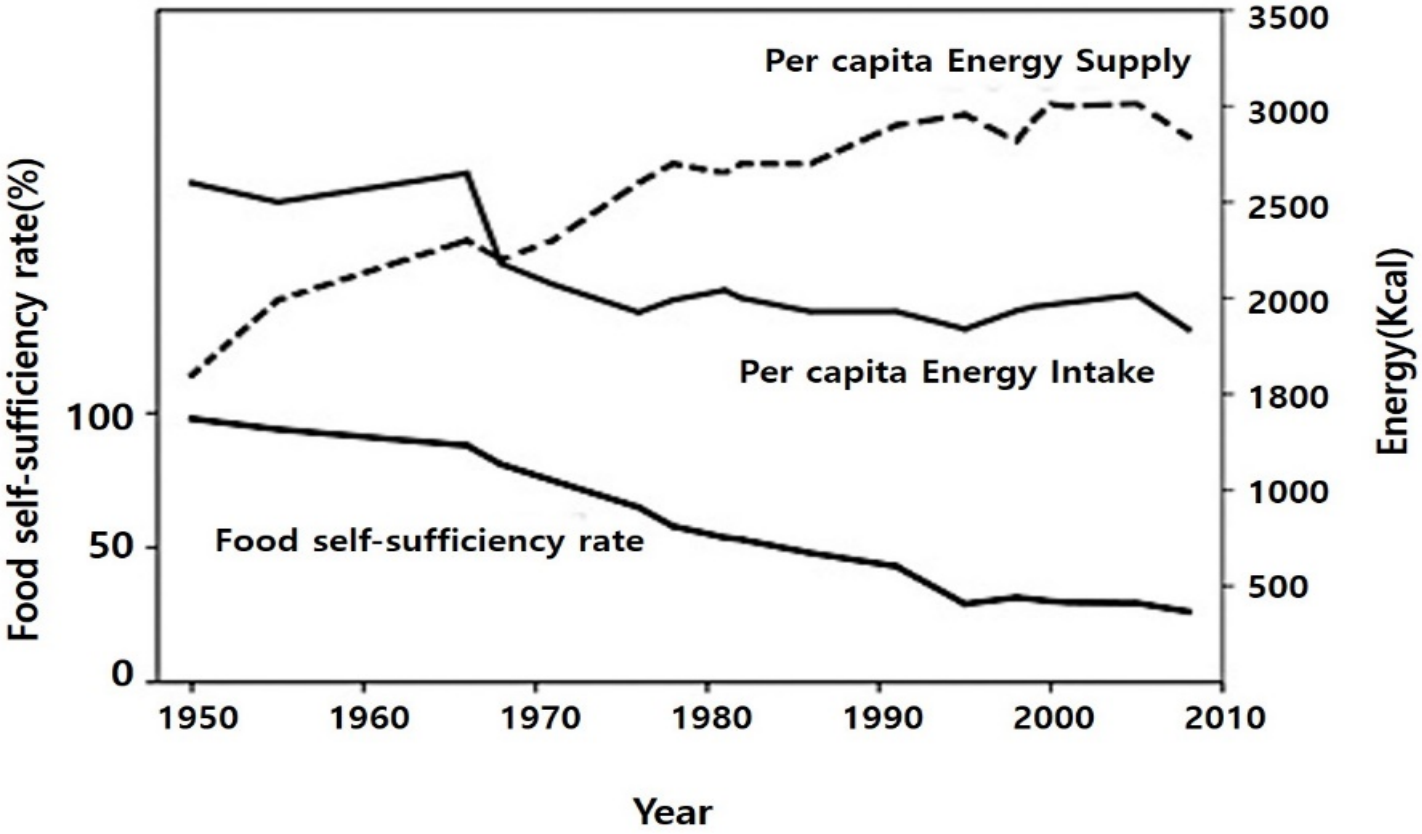
- The following action plans were suggested.

(1) Free rice support system for crisis management of the low-income vulnerable class
(2) Legislation of 1.2 million tons of rice stockpiling in preparation for the Korean unification
(3) Expansion of grain storage facilities and construction of food complexes
(4) Reinforcing government support to expand raw material inventory of private companies
(5) Support for food self-sufficiency and target responsibility system
(6) Reinforcing support for overseas grain distribution business by private companies
(7) Reinforcement of overseas agricultural cooperative projects with private companies
(8) Research support and utilization of biotechnology
(9) Fostering of the food industry and advancement of Food Tech
(10) National movement to reduce food waste

(Korea Food Security Research Foundation, October 2022)

Food recycling and waste management in Korea

State of food waste in Korea



In Korea, which relies heavily on imported food, food self-sufficiency and food security cannot be discussed without improving the current intemperate eating behavior in which 1/3 of food supplied is discarded as waste.

Figure 7. Annual changes in energy supply and actual energy intake per person per day and changes in food self-sufficiency rate (Lee 2024)

State of food waste in Korea

- Annual amount of agri-food waste in South Korea (2019)
  - 5 million tons
    - Distribution and cooking – 57%
      - Leftover food - 30%
      - Discarded during storage - 9%
      - Uneaten food - 4%

Average daily amount of agri-food waste- 13,314 tons/day

Amount of waste per person- 270g/day

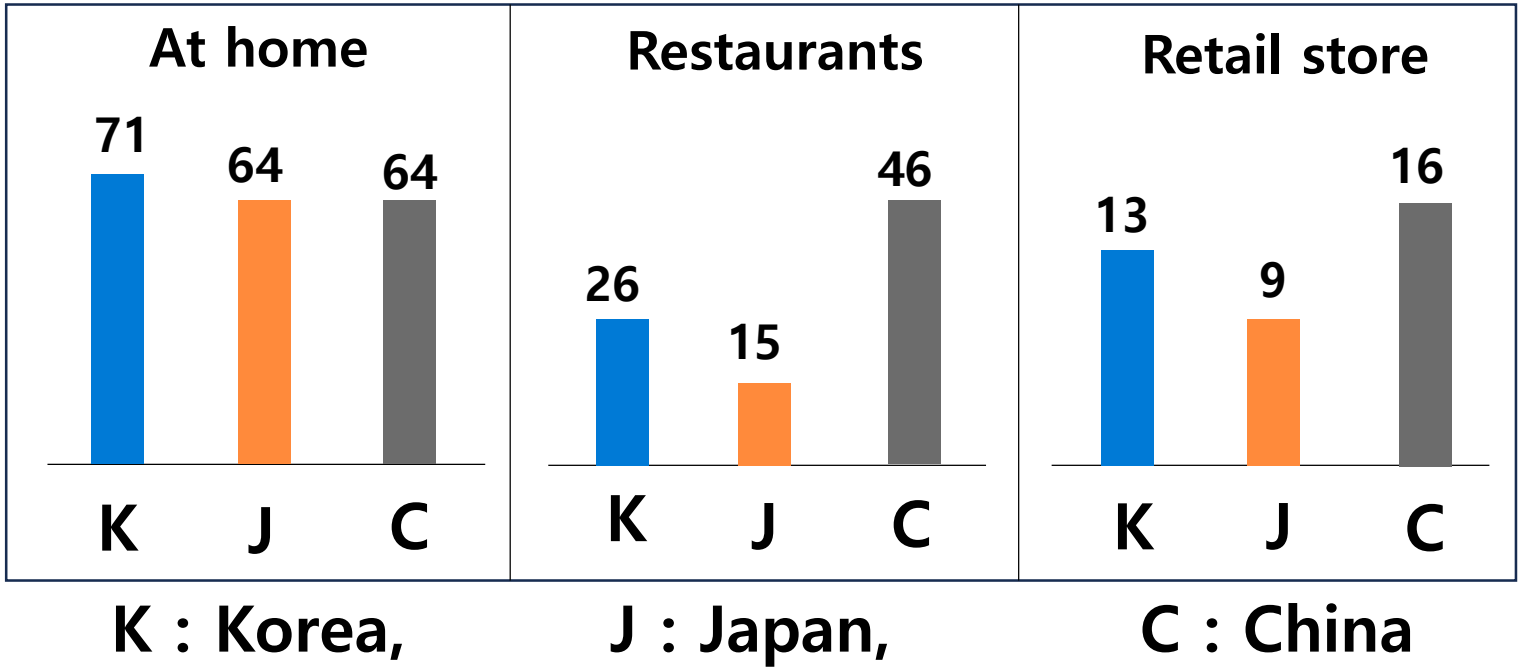
Annual amount of agri-food waste per person

- 110kg/year
  - Discarded at home - 71kg
  - Food service establishments- 26kg
  - Retail store - 13kg

Comparison of annual agri-food waste per capita among three Northeast Asian countries

Annual waste per person
Japan 88 kg
Korea 110 kg
China 126 kg

Unit: kg/person/year



(Hong et al., 2021)

Korean government's action to reduce food waste

- 1997 Enactment of the Waste Management Act
- 1998 Ministry of Environment's Food Waste Reduction and Recycling Basic Plan
- 2002 Establishment of Standards for manufacturing and use of food waste for feed products
- 2005 Nationwide Implementation of waste separation and disposal system
  Prohibition of direct landfill of food waste
- 2008 Establishment of measures to convert waste resources and biomass into energy
- 2009 Volume-based disposal fee system for household food waste
  Guidelines for reducing food waste in restaurants and catering establishments
- 2013 Nationwide implementation of Food waste volume-based disposal fee system
- 2016 Prohibition of ocean discharge of wastewater and sewage
  Enactment of Basic Law on Resource Circulation
- 2018 The First Basic Resource Circulation Plan (2018-2027)
- 2024 Implementation of Consumption date (Use-by) labeling system (MFDS)

Methods of Food waste disposal in Korea

Methods of food waste disposal In Korea (2016)

Landfilling	2.5%
Incineration	7.3%
Recycling	90.1%

Food waste recycling methods

Animal feed	42%
Composting	35%
Biogas etc.	22%

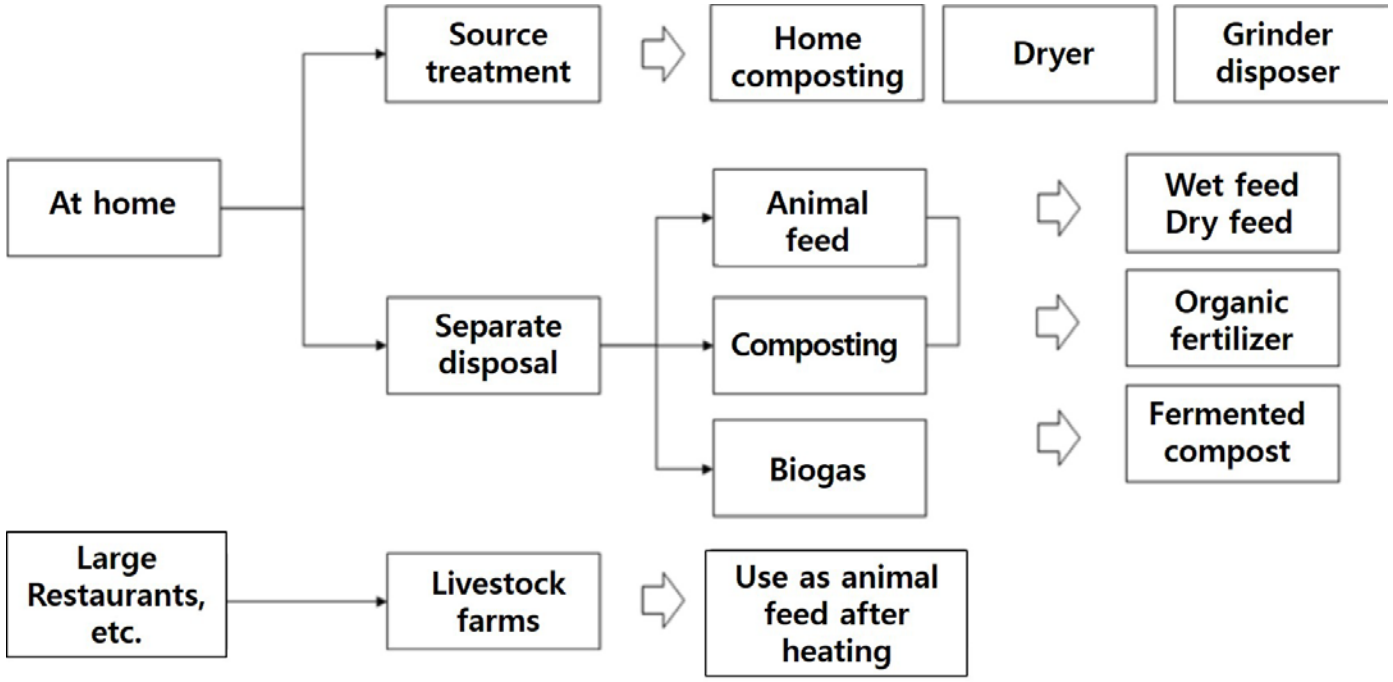


Figure 9. Food waste recycling method in Korea (Hong et. al. 2021)

Food waste feed is divided into wet feed and dry feed.
Wet feed can only be used as feed for pigs.
The use of wet food waste feed has been banned since the outbreak of African swine fever in 2022.

Private sector activities to reduce food waste

- Efforts by large restaurants and catering businesses to reduce food waste
- Recycling of food processing by-products and new product development using waste (Upcycling) by food manufacturers
- Discount sales of ugly fruits and vegetables and foods with an impending expiration date by distributors
- Activation of food bank

In the past, post-facto approach focused on disposing of discarded food waste, and now emphasis is being placed on preemptive efforts to reduce food waste.

Private sector activities to reduce food waste

- A Korean catering company, CJ Freshway, has been working with WFP on the Zero Waste, Zero Hunger campaign since 2019.
- OB Beer Company uses beer waste in various products, including yeast extract, energy bars and cosmetics.
- Pulmuone, the largest tofu producer in Korea, is also developing new products to upcycle soybean residue and washing water.
- In addition, many companies manufacture and sell juices, seasonings, snacks, etc. using ugly fruits and vegetables or processing byproducts.

Private sector activities to reduce food waste

Korean on-line markets, Coupang, CJthemarket, Kirly, Gmarket, have special corner for ugly fruit and vegetables.

Uglyus is an online store specializing in eco-friendly, ugly vegetables

Purchasing products of near use-by date or wonky fruit and vegetables at retail stores at less than half the price is becoming a new trend.

Uglyus , an online store specializing in eco-friendly, ugly vegetables (www.uglyus.co.kr).

Status of Korean Food Bank Users (2015)

National and regional food banks operate, with 280 food banks and 127 food markets in Korea as of 2015

The largest group of food bank users are recipients of basic livelihood security (4,625) and those in the near-poorest bracket (3,368)

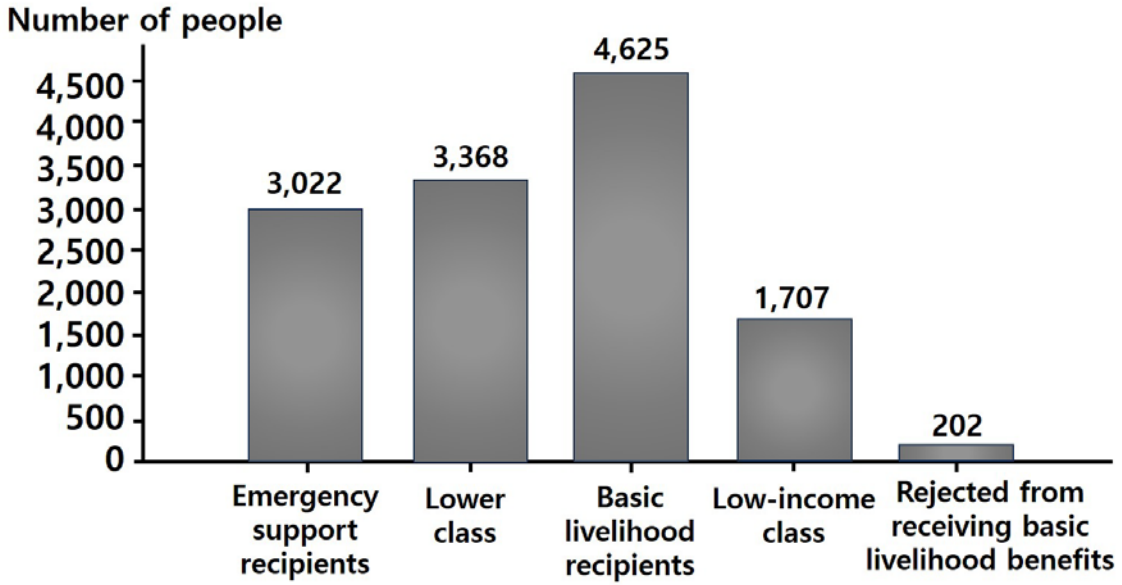


Figure 11. Status of Korean Food Bank Users (2015)
http://www.foodbank1377.org (Chae et. al. 2016)

A system is needed to protect food donors from food-related accidents caused by donated food (Article 8 of the Food Donation Promotion Act). Recently, "**Spoiler Alert**," developed at MIT, is attracting global attention as a system that reduces food waste by connecting food donors and recipients in real time using cutting-edge information and communication technologies (ICT) such as the web, smartphone apps, and online markets. http://fortune.com/2015/05/01/how-tech-can-stop-the-looming-food-crisis/

National movement to reduce food waste

- Korea Food Security Research Foundation has organized a food waste reduction national movement promotion committee centered on the food industry in 2019.
- The committee developed working plans for each sector including food supply, processing, distribution, service, waste utilization, regulations and systems, and education and communication.
- Committee members started a campaign on social media to announce “my food action” to reduce food waste.
- The purpose statement, the proposal to the government and the national code of action were uploaded on the Foundation homepage (www.foodsecurity.or.kr).

National Code of Action to Reduce Food Waste

1. Recognizing the importance of food, let us be grateful to those who produce, store, process, cook, and sell food
2. Break the habit of buying or cooking more food than necessary.
3. Know how to store food and keep it at low temperature as possible.
4. Do not throw away sell-by date expired food, because use-by date is longer than sell-by date.
5. When cooking or eating, do not leave leftovers and clean the back seat after eating.
6. From the president to elementary school children, let's everybody decide his/her own 'food action' to reduce food waste and practice it everyday life.

The committee urged the government to organize a joint task force (TF) of related ministries to revise various laws that encourage food waste and to enhance upcycling of food processing by-products. Devising preemptive measures to reduce amounts of waste generated in the food supply and consumption chain is necessary.
Reducing food waste by one-half can increase the food (calorie) self-sufficiency rate of Korea from 32% to 50% .

Thank you very much.