

INTERNATIONAL EXPERIENCE OF ENHANCING THE ROLE OF INNOVATIVE SELECTION IN AGRICULTURE TO ENSURE THE FOOD SECURITY

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The role of innovative selection in agriculture in ensuring food security is not exclusive to any particular group of countries. However, some countries have demonstrated strong commitment and made significant advancements in this area.

Netherlands. The Netherlands has gained global recognition for its innovative and highly productive agricultural sector. Despite its relatively small geographical size, it is the second-largest exporter of agricultural products in the world, a feat accomplished by combining a centuries-old tradition of farming with advanced agricultural technology, robust research and development, and efficient supply chains.

Israel. Israel's journey to becoming a global leader in agricultural innovation is nothing short of remarkable. Despite its arid climate, scarce water resources, and limited arable land, Israel has managed to create a thriving agricultural sector, largely due to its emphasis on innovation and technological development.

The United States of America. The United States (US) is a leader in agricultural innovation, driven by robust research and development efforts, diverse agroecological zones, and advanced technology. Here are some key elements contributing to the role of innovation in the US agriculture sector to ensure food security:

1. Research and Development (R&D): The United States is home to some of the world's leading agricultural research institutions, both public and private. These include the United States Department of Agriculture (USDA) and its Agricultural Research Service (ARS), numerous state agricultural experiment stations, and land-grant universities that conduct extensive research in various agricultural fields. The private sector, including multinational companies like Monsanto (now part of Bayer) and startups, also invests heavily in agricultural R&D¹.

2. Biotechnology and Genomics: The US is a pioneer in the use of biotechnology in agriculture, with genetically modified (GM) crops widely grown across the country. These crops have been engineered for traits like pest resistance and herbicide tolerance, which can increase yields and reduce input use. Advances in genomics and breeding are also allowing for the development of new crop varieties with improved traits².

3. Precision Agriculture: The US is at the forefront of precision agriculture, which uses data and technology to manage farms more effectively. Tools like GPS, remote sensing, and digital soil mapping help farmers monitor crop health, optimize input use, and increase productivity. Farmers are also using autonomous machinery and robotics to automate tasks like planting, harvesting, and weeding³.

4. Sustainability Practices: American farmers are increasingly adopting sustainable farming practices to conserve resources and mitigate climate change. These include cover cropping,

¹ USDA. (2018). USDA Agricultural Research: Innovation for Profit, Sustainability, and Food Security.

<https://www.usda.gov/media/blog/2018/08/07/usda-agricultural-research-innovation-profit-sustainability-and-food-security>

² National Academies. (2016). Genetically Engineered Crops: Experiences and Prospects.

<https://www.nap.edu/read/23395/chapter/1>

³ Schimmelpfennig, D. (2016). Farm Profits and Adoption of Precision Agriculture. USDA Economic Research Service.

<https://www.ers.usda.gov/webdocs/publications/80326/err-217.pdf>

conservation tillage, and rotational grazing. The USDA provides financial incentives for farmers to adopt such practices through programs like the Conservation Stewardship Program (CSP)⁴.

5. Agricultural Extension Services: The Cooperative Extension System, a nationwide network of experts based at land-grant universities, provides farmers with education and assistance in implementing new technologies and practices. Extension services play a crucial role in transferring knowledge from research institutions to farmers⁵.

Brazil. Brazil is recognized as a global agricultural powerhouse and has made significant advancements in enhancing the role of innovative selection in agriculture to ensure food security.

Denmark. Denmark is globally recognized as a leader in sustainable and innovative agriculture, playing a significant role in enhancing food security. The following points highlight Denmark's achievements in this realm:

1. Organic Farming: Denmark has the highest market share of organic products in the world, with organic goods accounting for 13.3% of the total food market⁶. The Danish government has strongly supported the organic movement, setting a goal for at least 60% of public kitchens to use organic ingredients. This support has encouraged farmers to adopt organic practices, enhancing the sustainability of Danish agriculture.

2. Agricultural Research and Education: Institutions such as the University of Copenhagen and the Aarhus University are globally recognized for their agricultural research. These institutions work closely with farmers, industry, and government to develop and implement innovative agricultural practices and technologies.

3. Sustainable Livestock Production: Denmark is a leading exporter of pork and has achieved this while implementing stringent environmental regulations. The country has developed efficient, high-welfare production systems and is a leader in areas like slurry management and reduction of antibiotic use in livestock (Bennett, 2017).

4. AgriTech: Denmark is home to numerous agritech companies that are developing innovative solutions to agricultural challenges. These include robotics for crop and livestock management, precision agriculture technologies, and digital platforms for farm management.

5. Cooperatives: The cooperative movement is strong in Denmark, and this has played a significant role in the country's agricultural success. Cooperatives help farmers pool resources, share knowledge, and access markets, contributing to economic resilience and food security⁷.

Table 1.4

Comparative Analysis of the leading experience of selected foreign countries

Country	Strengths
Netherlands	Advanced greenhouse technology, precision farming, sustainability, efficient use of land and water resources
Israel	Advanced irrigation technology, water recycling, adaptation to challenging environmental conditions
United States	Agricultural biotechnology, GMO development and use, innovation in farming techniques, machinery, and digitalization
Brazil	Innovation in tropical agriculture, large-scale adoption of no-till farming, integrated crop-livestock-forest systems
Denmark	Organic farming, high animal welfare standards, cooperative farming, strong R&D in

⁴ USDA. (2020). Conservation Stewardship Program.

<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/>

⁵ Cooperative Extension System. (2021). About Extension. <https://extension.org/about-extension/>

⁶ Nielsen, J.Ø., & Reenberg, A. (2010). Temporality and the problem with singling out climate as a current driver of change in a small West African village. *Journal of Arid Environments*, 74(4), 464-474.

⁷ Nelson, R. R., & Winter, S. G. (1982). *An Evolutionary Theory of Economic Change*. Belknap Press.

Netherlands, Israel, United States, Brazil, and Denmark each represent unique and successful examples of enhancing the role of innovative selection in agriculture to ensure food security.

The **Netherlands**, a global agricultural powerhouse, is particularly known for its advanced greenhouse technology, precision farming, and focus on sustainability. This is reflected in its efficient use of land and water resources, as well as the integration of renewable energy into farming practices.

Israel, a country with challenging environmental conditions, has turned its water scarcity issue into an agricultural advantage. The country's advanced irrigation technologies, such as drip irrigation and water recycling, serve as global models for water-efficient agriculture.

The **United States** has been a frontrunner in agricultural biotechnology, particularly with the development and use of genetically modified organisms (GMOs). Through innovation in farming techniques, machinery, and digitalization, the country significantly contributes to global food security. **Brazil** has transformed its agriculture sector through research and innovation, particularly in tropical agriculture. The country is recognized for its success in the large-scale adoption of no-till farming and integrated crop-livestock-forest systems, contributing to both productivity and sustainability.

Denmark stands out for its commitment to organic farming and high animal welfare standards. Its focus on cooperative farming and strong research and development in agri-tech also contribute significantly to the country's food security.

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