

Advancing Technology for Low-Carbon Food Supply Chain and its Challenges

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The Development and Global Participation of Green Transformation in Taiwan's Food Industry: The global food industry is currently undergoing a significant transformation driven by climate change, sustainability goals, and evolving international regulations. This presentation focuses specifically on the food industry's green transformation through technology, while also addressing broader regional challenges identified through APEC survey research. Taiwan's modern food industry has now entered a new phase characterized by green processing, digital transformation, and advanced food technologies. Regulatory pressures are accelerating the global transition toward low-carbon food systems. International frameworks such as the EU Deforestation Regulation, the Corporate Sustainability Reporting Directive, and sustainability disclosure standards from the International Sustainability Standards Board require companies to measure and disclose greenhouse gas emissions. In Taiwan, the Climate Change Response Act and emerging carbon pricing mechanisms are strengthening climate governance, while the Financial Supervisory Commission mandates that listed companies disclose greenhouse gas inventories in alignment with IFRS sustainability standards. These policies integrate carbon emissions into production costs and encourage companies to develop carbon management capabilities, while government initiatives promote green investment, technological innovation, and the advancement of a sustainable low-carbon economy.

Gaps and Challenges in Developing a Low-Carbon Food Supply Chain: Significant decarbonization gaps persist throughout the APEC food system. Raw material production is a major source of emissions, yet structural changes

in agricultural practices are challenging, and investment in alternative ingredients and innovative technologies remains limited. In food processing, outdated equipment and insufficient adoption of low-carbon technologies contribute to high emissions, while many enterprises face difficulties accessing policy incentives for green transformation. Food distribution generates substantial waste and lacks incentives to invest in a circular economy. On the consumption side, behavioral change is difficult to achieve, and the absence of green consumption standards further impedes progress.

Challenges and Responses in the Food Industry: To address these challenges, the food industry can pursue three strategic directions. First, optimize production resources through digital transformation, artificial intelligence, and smart manufacturing to enhance efficiency and reduce energy consumption. Second, promote by-product upcycling and whole-food utilization to minimize waste and generate new economic value. Third, develop alternative foods and innovative production systems—including plant-based and microbial proteins—supported by fermentation technologies, biotechnology, and precision agriculture to reduce the carbon footprint of food production. Examples from Taiwan's food industry demonstrate how companies are advancing low-carbon transformation by improving equipment efficiency, adopting smart manufacturing technologies, optimizing packaging, and recovering energy from wastewater. Additionally, firms are developing low-carbon sourcing strategies and collaborating across supply chains to reduce lifecycle emissions.

Conclusion: In conclusion, the transition toward a low-carbon food supply chain presents both challenges and opportunities for the global food industry. Technological innovation, regulatory frameworks, and cross-sector collaboration will play crucial roles in facilitating this transformation. By investing in advanced research and development, strengthening international cooperation, and aligning with global sustainability standards, the food industry can accelerate green growth while ensuring long-term resilience, food security, and environmental sustainability.