Collaborative Approaches to Cultivating a Low-Carbon Food Supply Chain

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A low-carbon food supply chain reduces greenhouse gas emissions across production, processing, distribution, retail, and even consumption by integrating sustainable practices, innovative technologies, and efficient logistics. It is documented that key strategies for a low-carbon food supply chain include sustainable agricultural practices, alternative proteins and food material innovation, food processing and shelf-life extension, Sustainable distribution and logistics, From Farm to Fork practices, a low-carbon and circular food system, and so on.

This presentation first highlights some of the key results of the 2026 APEC Survey. "Discovering Innovative Food Processing Technology to Cultivate a Low-Carbon Food Supply Chain Survey" was conducted by a team in Chinese Taipei, for APEC Project PPSTII_210_2024A. The questionnaire used, aimed at understanding the recognition of cultivating a low-carbon food supply chain, consist of five sections, including: 1.overall recognition of low-carbon food supply chain; 2.policy supports in cultivating a low-carbon food supply chain; 3.funding supports in cultivating a low-carbon food supply chain; 4.industry maturity in cultivating a low-carbon food supply chain; and 5.cooperative thinking in cultivating a low-carbon food supply chain.

For the significance of investment in different areas of low-carbon food supply chain development, investment in food loss reduction received the highest score (3.21), followed by processing technologies (3.15). Investment in smart manufacturing systems (3.12) and supply chain management (3.09) received slightly lower scores.

In terms of respondents' assessments of government policy support for different segments of the low-carbon food supply chain, comparing the extent to which support should be provided and the extent of support received, overall, the results suggest that policy support is stronger for the traditional agricultural material production, processing, and consumption stages, while the support received for new agricultural material production and distribution remains more limited and generally falls short of what respondents considered necessary.

The survey results suggest that the types of government support provided to cultivate a low-carbon food supply chain differ across different segments, including material production, food processing, food distribution, and food consumption. In particular, government supports for food consumption are related mainly to initiatives to reduce food waste and public awareness campaigns promoting low-carbon diets, while the use of financial incentives and carbon credits remains limited.

We also collected the respondents' views on the perceived advantages of cultivating a low-carbon food supply chain. The most frequently cited advantage was the development of a more sustainable food production ecosystem (32). This was followed by improving the efficiency of the food supply chain (25) and creating opportunities for disruptive innovation (17). Enhancing the supply-demand balance of food distribution was also reported (15), though less frequently than the other benefits.

In addition, we present respondents' assessments of openness to innovation and to importing carbon reduction standards across different segments of the low-carbon food supply chain. For openness to innovation (e.g., new products, processes, business models), material production based on new technologies was rated the highest (3.91), followed by food processing (3.62). Moderate openness was reported for food distribution (2.85) and traditional agriculture (2.65), while food consumption exhibited the lowest openness (1.97).

We go further to present three cases of Chinese Taipei for Reference. The first case is AI Common Model and Pilot Trial Site Program, sponsored and promoted by the Department of Industrial Technology (DoIT), Ministry of Economic Affairs (MOEA). This program covers 19 industrial areas to promote both digital and green transformation for the sectors involved. There are 4 different AI Pilot Lines for the food industry, operated by the Food Industry Research and Development Institute.

The second case is about Gugo Kitechen, which runs a carbon neutral restaurant certified by BSI (British Standards Institution). We present an ecosystem perspective on the company's achievements, including university linkages, sustainable agricultural practices, the management of gas & electricity for energy efficiency, and the expansion of the "From Farm to Fork model". In particular, Gugo Kitechen's "From Farm to Fork model" has expanded from a restaurant base, to sale of low-carbon lunch boxes, and the operation of sustainable employee cafeteria for the Taipei City Government and

even eventually for electronics firms, which may help the companies to achieve their net-zero goals.

The third case concerns Young Ray Co., Ltd., which manages to turn used cooking oil into Sustainable Aviation Fuel (SAF). This company is a leader in circular economy in Chinese Taipei, specializing in the collection and refinement of Used Cooking Oil (UCO), which is collected from restaurant, food chain stores and street vendors at night markets, empowered by such smart technologies as AI, Machine Learning, and Blockchain. The company then refines waste oil into high-quality industrial oil used as feedstock for SAF, helping global partners reduce carbon emissions by up to 80%. For global reach of SAF, Young Ray has formed cross-border alliances with South Korea and Saudi Arabia. Young Ray's business model generates benefits to different kinds of stakeholders, including UCO Point of Origin, UCO collectors, oil and gas producers, and the government (ESG policy).

Taken together, we suggest that a low-carbon food supply chain/ecosystem involves multi-stakeholders and different industrial activities/segments, across production, processing, distribution, retail, and consumption; for the case of Young Ray Co., Ltd., even street vendors are involved. The ecosystem is so complicated that to achieve a low-carbon food supply chain/ecosystem, sustainable awareness, incentives, practices, technologies, networking are needed. Therefore, collaborative approaches are essential to the formation and operation of a low-carbon food supply chain/ecosystem. "Resilience is hard for one to achieve." So too is a low-carbon food supply chain/ecosystem.