

Science Diplomacy as the Engine for Future Foods

Fun Man Fung* and Rui A. Gonçalves*

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 Metrics & More Article Recommendations**KEYWORDS:** *science diplomacy, food security, UN SDGs, future foods, climate resilience, urban agriculture, citizen science*

I. INTRODUCTION

Achieving a sustainable future for food is a complex challenge intersecting with United Nations Sustainable Development Goals (SDGs), including zero hunger, climate action, and partnerships for the goals.¹ Food security is shaped by climate change, population growth, technological advancements, and socioeconomic disparities, requiring global cooperation. Science diplomacy, which involves scientific collaborations across borders, offers a powerful framework for addressing shared challenges and fostering mutually beneficial partnerships. In particular, Science diplomacy now navigates rapid scientific progress, urgent global challenges, and complex geopolitics. For example, the Geneva Science and Diplomacy Anticipator (GESDA)'s effort involves (1) predicting impacts of emerging technologies, (2) fostering honest debates on benefits and risks to identify optimal uses, and (3) promoting global action over unilateral approaches to address humanity's challenges and to shape future governance.² Operating at the nexus of science, technology, and international relations, science diplomacy aims to promote peace, prosperity, and sustainable development through cooperation in research and innovation. In this context, it serves as a vital bridge, fostering international collaboration in research, technology, and policy to build resilient food systems. Food production is highly sensitive to climate events like floods or droughts, which disrupt crop yields globally, underscoring the need for scientific research to develop data-driven solutions (SDG 13: Climate Action).³ This Viewpoint explores how science diplomacy drives progress toward food security, innovation in future foods, and resource mobilization, promoting sustainable development across borders.⁴

II. SCIENCE DIPLOMACY - A CATALYST FOR SDG ACHIEVEMENT IN FOOD SECURITY

II.A. Citizen Science for Data-Driven Solutions. Science diplomacy enables citizen science initiatives that collect global data on climate impacts on food production (Figure 1), linking food security (SDG 2) with climate action (SDG 13). Engaging stakeholders like farmers and consumers, these projects gather real-time data on soil health, climate conditions, and crop performance, accelerating sustainable agricultural practices.⁵ International collaboration ensures coordinated data collection, enabling evidence-based policies to enhance food security in



Figure 1.

vulnerable regions. Open-access platforms democratize data, fostering knowledge sharing and aligning with partnerships for the goals (SDG 17).⁶

II.B. Bridging the Gap in Agricultural Research. Science diplomacy addresses disparities in agricultural research between developed and developing countries, supporting zero hunger (SDG 2).⁷ Collaborative research programs, open-source platforms, and technology transfer agreements share expertise in sustainable farming, climate-resilient crops, and efficient irrigation. These efforts ensure developing nations access innovative tools, reducing food insecurity.⁸ For example, smart materials for urban farming enhance resilience to climate challenges.⁹ Science diplomacy also promotes strategies to minimize food loss and valorize waste, fostering circular sustainability.¹⁰

II.C. Guiding Emerging Technologies. Emerging technologies like gene editing, synthetic biology, and precision agriculture hold transformative potential for future foods but require ethical frameworks. Science diplomacy fosters international discourse to ensure responsible development, aligning with responsible consumption and production (SDG 12).¹¹ Collaboration among scientists, policymakers,¹² and civil society ensures technologies address food security equitably, respecting diverse sociocultural perspectives and enhancing sustainability.

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III. SCIENCE DIPLOMACY PROPELLING INNOVATIVE FOOD SYSTEMS

III.A. Scaling Up Urban Agriculture and Vertical Farming. Urban agriculture and vertical farming reduce reliance on long-distance transportation, minimize waste, and enhance local food security, supporting SDG 12.¹³ Science diplomacy promotes knowledge exchange and technology transfer, enabling countries to adapt hydroponic and aquaponic systems to local conditions. Joint research and policy sharing standardize urban agriculture frameworks, ensuring scalability and integration into global food systems while respecting regional traditions.¹⁴

III.B. Building Resilience through Collaborative Research. Climate change threatens food security, necessitating resilient crops and alternative proteins like plant-based or lab-grown options. Science diplomacy enables collaborative research on drought-resistant varieties and sustainable proteins, addressing zero hunger (SDG 2) and climate action (SDG 13).¹⁵ International partnerships and knowledge-sharing platforms accelerate adoption, particularly in vulnerable regions, enhancing global food system resilience.¹⁶

III.C. Leveraging Technology for Food Waste Reduction. Food waste, a critical challenge, impacts SDG 12.¹⁷ Science diplomacy fosters collaboration between scientists and technologists to develop tools like AI, blockchain traceability, and sensor technologies. These optimize food distribution, reduce spoilage, and facilitate food-sharing initiatives. International partnerships enhance scalability and adaptability, ensuring technologies are accessible and culturally appropriate, supporting a circular food economy.¹⁸

IV. REINVIGORATING THE UN SDG AGENDA WITH SCIENCE DIPLOMACY

IV.A. Gamified Platforms for Public Engagement. Gamification enhances public engagement in food sustainability through citizen science and awareness campaigns.¹⁹ Science diplomacy facilitates the development of gamified platforms that incentivize participation and promote sustainable food choices. These platforms, adapted cross-culturally, align with public engagement strategies, making sustainability accessible and motivating behavioral change.²⁰

IV.B. Measuring Impact beyond Numbers. Traditional quantitative metrics often fail to capture social and cultural dimensions of SDGs like peace and justice (SDG 16) in food security. Science diplomacy supports qualitative assessment methodologies, integrating ethnographic research and participatory evaluations.²¹ This holistic approach ensures cultural knowledge and indigenous knowledge are valued, enhancing policy coherence across borders.

IV.C. Mobilizing Resources through Partnerships. Traditional government aid is limited in financing food sustainability research. Science diplomacy fosters partnerships among governments, private sectors, and philanthropists, supporting SDG 17. Innovative funding mechanisms like public–private partnerships and impact investing expand resources for sustainable food systems, ensuring equitable allocation and long-term impact.

In conclusion, science diplomacy is the engine for international collaboration and scientific progress,²² driving sustainable food systems and future foods. By fostering cross-border partnerships, knowledge exchange, and technological innovation, it advances SDGs related to food security, climate

resilience, and responsible consumption. The ongoing need for innovation, collaboration, and public engagement highlights science diplomacy's critical role. As technologies like lab-grown meat and precision agriculture evolve, science diplomacy ensures ethical, equitable, and harmonized approaches, creating transformative solutions that bridge divides and secure a sustainable food future globally.

AUTHOR INFORMATION

Corresponding Authors

Fun Man Fung – School of Chemistry, University College Dublin, Dublin 4, Ireland; UCD Geary Institute for Public Policy, University College Dublin, Dublin D04 N9Y1, Ireland; Department of Chemistry, Stanford University, Stanford, California 94305-5080, United States; orcid.org/0000-0003-4106-3174; Email: funman.fung@ucd.ie

Rui A. Gonçalves – School of Materials Science and Engineering, Nanyang Technological University, Singapore 639798; orcid.org/0000-0003-4543-3945; Email: rui.goncalves@ntu.edu.sg

Complete contact information is available at:

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Notes

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