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# Sustainable Sourcing in Food Trade Networks: A Network Approach

**Laura Calzada-Infante**
Engineering School
University of Oviedo, Spain
calzadalaura@uniovi.es; adenso@uniovi.es

**B. Adenso-Diaz**
Engineering School
University of Oviedo, Spain
calzadalaura@uniovi.es; adenso@uniovi.es

**Nicanor Garcia Alvarez**
Port Authority of Gijon, Spain
ngarcia@puertogijon.es

## Abstract

European fresh-fruit supply chains increasingly depend on international trade to satisfy demand beyond domestic production capacity. This study proposes an integrated network and optimization framework to evaluate how trade structure, sourcing distance and sustainability objectives interact in food supply systems. Using European fruit trade flows as an empirical application, Complex Network Analysis is used to characterize the topology of the trade network and identify the functional role of countries as suppliers, importers or intermediaries. The results show that fruit miles have not decreased consistently over time, despite growing social and institutional attention to sustainable consumption. Fruits that can be produced within Europe present the greatest potential for distance reduction, while products structurally dependent on extra-European origins offer more limited improvements. Overall, the study contributes a decision-support perspective for analyzing food trade networks, combining descriptive network indicators with prescriptive optimization to assess opportunities for reducing transport-related impacts in agri-food supply chains.

## Keywords
Food Miles, Trade Networks, Supply Chain Sustainability and Agri-Food Logistics.

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## Biographies
**Dr. Laura Calzada-Infante** holds a PhD in Economics and Business from the University of Oviedo, a Master's Degree in Industrial Organisation and Business Management, and a Master's Degree in Civil Engineering. She is an Associate Professor of Operations Management at the Polytechnic School of Engineering of Gijón. She has previously worked as an Assistant Professor at the University of Oviedo. She has published 18 articles in international journals.

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She is the co-author of a book on Mixed Integer Linear Programming. Her current research focuses on food loss and food waste in food supply chains.

**Dr. Adenso Díaz** is a Professor of Operations Management at the Polytechnic School of Engineering of Gijón. He worked for seven years at the National Steel Company and has been an Associate Professor at the University of Michigan and a visiting professor at the University of Colorado. He is the author of five books related to Operations Management and its optimisation. He has published around 100 scientific articles in international journals and has led European and national research projects, as well as contracts with companies. He is an associate editor of the journals Omega: The International Journal of Management Science and Journal of Heuristics.

**Dr. Nicanor Garcia Alvarez** holds a PhD in Economics and Business from the University of Oviedo, a Master's Degree in Port Management and Planning and Intermodality, and a degree in Computer Engineering. He has more than 25 years' experience in information technology, digital transformation and cybersecurity. He currently holds the position of Head of the Digitalisation and Cybersecurity Division at the Port Authority of Gijón. His career combines the strategic management of information systems with academic research in the maritime-port sector. He is the author of several international scientific publications on maritime traffic, and his doctoral thesis was recognised with the Award for Best Doctoral Thesis by the Smart Ports Chair. Specialised in cybersecurity, systems administration, cloud environments, virtualisation and ICT governance, he has led digital transformation projects, advanced security systems and complex corporate architectures. He has experience as an evaluator of European cybersecurity projects for the European Commission, as well as a university lecturer and trainer in subjects related to information technology and knowledge management.

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