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Special issue: Agri-food systems transformation: sustainability, resilience, and the role of technology

Editorial

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Abstract

The agri-food systems around the world are faced with the challenges from unprecedented short-term shocks and long-term supply and demand shifts. The need for transformation towards more sustainable and resilient agri-food systems has thus risen to the centre of attention of agribusiness industry and policy decision makers. Technological innovations in the areas of supply chain management, environmental protection, and nutrition improvement have a potential of playing an important catalytic role in such systematic transformations. This special issue includes 11 research articles examining a range of strategic and technological solutions aimed at facilitating the resilience and sustainability of agri-food systems to shocks such as COVID-19, pest infestations, trade restrictions, shifting diets and consumer preferences, armed conflicts, and extreme weather events. The research findings and insights provide implications for a wide range of food and agribusiness stakeholders including managers and policy makers.

Keywords: agri-food systems transformation, sustainability, resilience, technological innovations
JEL code: D81, L16, Q13, Q16, Q56

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Continuous enhancements of agri-food systems are crucial for the livelihoods and wellbeing of people around the world, especially those in low-income countries. However, with rapid demographic transition, urbanization, dietary shifts, and climate change, past achievements would be increasingly challenged if no further transformation of agri-food systems is undertaken. Unprecedented shocks from the eruption of the COVID-19 pandemic and recent geopolitical tensions have posed additional threats to the functioning of agri-food systems and led to substantial setbacks in food and nutrition security. The global prevalence of moderate or severe food insecurity increased sharply in 2020 and mostly endured in 2021, whereas the prevalence of undernourishment jumped to 9.3% in 2020 and further to 9.8% in 2021, from merely about 8% during 2015 and 2019 (FAO, 2022). The need to enhance the sustainability and resilience of agri-food systems is hence more urgent than ever.

Technological innovation and applications, such as biotechnologies, digitalization and agroecological farming, could play a major role in catalyzing the transformation of agri-food systems towards sustainability and resilience. Thanks to the adoption of novel technologies, the world's agricultural production has grown rapidly over past decades. Yet in the meantime, current production systems have revealed negative ecological and safety consequences including soil erosion, water pollution, deforestation, biodiversity losses, and human health risks. To increase the sustainability and resilience of agri-food systems, there is a clear necessity to shift the focus of technology from the efficient food production to the facilitation of value chain development, environmental protection, public health, and nutrition improvement.

The Editor-in-Chief's Office of IFAMR and the AAEA Agribusiness Economics & Management (AEM) Section have partnered to publish this special issue which includes 11 papers that investigate topics surrounding new and emerging technologies, risk and resilience, and sustainable development of agri-food systems in both advanced and developing economies.

The paper 'Economic and environmental impacts of agricultural non-tariff measures: evidence based on ad valorem equivalent estimates' by Rui Mao, Yuhang Liu, and Xiaoxi Wang examines the economic and environmental impacts of non-tariff measures in the agri-food systems based on ad valorem equivalent estimates. It utilizes a gravity model and bilateral trade data to estimate ad valorem equivalents of non-tariff measures. It further quantifies the environmental impact of non-tariff measures by incorporating the estimations in the GTAP model and a multi-regional input-output table of Eora26. The results highlight the levels of welfare distortions and carbon emissions resulting from non-tariff measures imposed on agricultural trade. The paper contributes further empirical evidence to the existing literature on the trade deterrent effects of agricultural non-tariff measures.

The paper 'Agri-food trade resilience among food-deficit countries during the COVID-19 pandemic' by Soojung Ahn and Sandro Steinbach examines the resilience of low-income and food-deficit countries (LIFDC) to the unique agri-food trade related challenges during COVID-19 pandemic induced lockdowns. The analysis is based on the application of an augmented gravity model that accounts for dynamic treatment effects to the dataset covering monthly product-level trade data for 100 exporters and 197 importers during a five-year period between 2016 and 2021. The unobserved supply and demand shocks are accounted for by using high-dimensional fixed effects that vary at exporter-importer-product level over time. The results indicate that the COVID-19 induced lockdown measures affected LIFDCs more than other countries due to their high reliance on food imports. The paper discusses the differential impact and recovery across countries highlighting the importance of food reserves as well as diverse agri-food trade and transportation networks.

The paper 'COVID-19 disruptions and pivoting in SMEs in the hidden middle of Kenya's potato and fish value chains' by Diego Naziri *et al.* examines the impacts of the pandemic and strategic and operational responses by small and medium enterprises (SMEs) in Kenyan second largest food crop, potatoes, and a major agricultural sector, fisheries. The analysis is focused on traders and processors and is based on data from a survey of 937 respondents including information on pre-pandemic situation, short-term adaptation strategies during pandemic induced restrictions, and long-term adaptation strategies during recovery period.

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The authors discuss the impact of restrictions on operations and supply-chain transformations that was observed in the wake of COVID-19 including market concentration and pivoting toward more localized procurement and shorter supply-chains. The management implications are discussed focusing on improving resilience to shocks.

The paper 'Healthy diet and food system transformation in China' by Binjian Yan, Yiru Wang, and Yingheng Zhou focuses on the transformation of China's food systems from aiming to solve food problems to tackling current health and environmental issues. The paper uses the Chinese dietary data from the Global Diet Database and reveals the changing dietary pattern from 1990 to 2018 to highlight differences between urban and rural areas and across consumers with various education levels. It shows that the intake of food and beverage, macronutrients, and micronutrients in urban areas is higher than that in rural areas. More specifically, the difference in food and beverage intake between urban and rural areas is significant and the gap has been gradually widened. By contrast, although differences in both the food and beverage intake and the macronutrients intake across education levels are significant, the gap has remained relatively stable. And the difference in micronutrients intake is insignificant. These results imply that the dietary pattern of population groups in China is not coordinated. Resting on these findings, the paper proposes policy recommendations covering agricultural production, supply chain management, public institutions, and the education for public awareness of building a sustainable food system with a healthy dietary pattern.

The paper 'How resilience innovations in food supply chains are revolutionizing logistics, wholesale trade, and farm services in developing countries' by Thomas Reardon and Rob Vos reveals that agri-food systems of developing countries have been pummeled by successive shocks over the past decades, including the Russia-Ukraine war, COVID-19 pandemic, climate shocks from hurricanes, floods to droughts, animal and plant diseases, intensified road banditry and local conflicts, and overlaying all these, deep transformation in markets themselves with new requirements for quality and food safety. Yet their food supply chains have remained relatively resilient. It shows that food supply chains typically involve deep 'pivoting' by one segment or value chain and 'co-pivoting' by another to facilitate the former. Based on a conceptual framework that it presents, the paper illustrates the pivoting and co-pivoting process using a variety of examples from Africa and Asia, which include pivoting toward e-commerce by Asian retailers and co-pivoting by delivery intermediaries, pivoting toward quality production by African and Asian horticultural farmers and co-pivoting by mobile outsourcing firms in farming and marketing; and pivoting towards building redundant ports to protect rice milling operations from climate shocks in Asia by agribusiness and logistic firms. The paper then provides implications for policies to facilitate these adaptions and resilience strategies of agribusiness firms.

The paper 'Internet celebrities, public opinions and food system change in China: a new conceptual framework' by Xiaoping Zhong, Jingjing Wang, and Xiaohua Yu sees internet celebrities as a powerful influence on the opinions and behaviors of consumers through affecting their feelings and attitudes. In order to assess the influence of internet celebrities, the paper proposes a comprehensive framework that consists of individual-social-subjective-objective (IS-SO) dimensions to model the role of opinion leaders on the public's subjective values, consumption decisions, perceived cultural changes, and attitudes towards agribusiness rural development. The IS-SO framework is then applied to analyze the impacts of Ms. Li, Ziqi, an internet celebrity well-known for her beautiful and influential videos on food and rural issues in China. Their findings confirm that the internet celebrity can affect the public's feelings, opinions, and emotional values at both individual and societal levels. Consequently, the celebrity might influence food systems by promoting both the sales of related agricultural products and the positive impression of rural society.

The paper 'The role of information heterogeneity in blockchain-based traceability systems: evidence from fresh fruit buyers in China' by Qianqian Zhai, Qian Li, Ali Sher, and Chao Chen examines consumers preferences for 16 traceable information attributes in fresh fruits using data from a survey of consumers in China. The authors used a best-worst scaling approach to identify the pieces of fruit traceability information most valued by respondents. Using a random parameter logit model, findings from this study suggest that traceable information most valued by consumers are testing information, chemical pesticide, and quality

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certifications. The least popular information attribute was logistics information. Using latent class modeling, the paper further identifies four different consumer segments signaling significant heterogeneity in the relative value placed on traceable information attributes.

The paper 'Assessing the impact of digital financial inclusion on agricultural total factor productivity in China' by Shixian Zhai, Chao Peng and Yu Sheng investigates the role of financial innovations in agricultural development. Based on the panel data from China's National Rural Fixed-Point Survey during 2011 and 2018 as well as the Digital Financial Inclusion Index of Peking University, it employs a dynamic panel fixed-effect empirical setting to analyze how the access to digital inclusive financing platform could influence the agricultural total factor productivity and to identify determining factors at the household level. The paper finds that the digital financial inclusion has a significant hysteresis positive impact on the agricultural total factor productivity, which comprises two specific components, i.e. agricultural technical progress and agricultural technical efficiency changes. The paper also shows that the usage depth of financial services has the largest effect compared to the other two dimensions of the digital financial inclusion.

The paper 'Participation in a mutual fund covering losses due to pest infestation: analyzing key predictors of farmers' interest through machine learning' by Lisa Hoschle, Samuele Trestini, and Elisa Giampietri utilizes primary data and machine learning algorithms to examine main drivers of Italian farmers' intention to participate in a risk management mechanism supported by the European Union Common Agricultural Policy. Specifically, it applies Least Absolute Shrinkage and Selection Operator (LASSO) machine learning technique to test hypotheses related the effect of behavioral and personality factors on intention of fruit growers' in the Veneto Region highly affected by invasive insect *Halyomorpha halys* infestation to participate in the Mutual Funds (MF) that are designed to cover risks not covered by traditional agricultural insurance. The findings highlight several key factors affecting potential participation in MF including the interplay between expected loss from *H. halys* infestation and perceived benefits from MF, as well as discusses potential policy implications.

The paper 'R&D goal seeking and risk taking in R&D investments' by Desmond Ng develop a R&D goal seeking model to examine the risk-taking behaviors that impact a biotechnology firm's investments in R&D. BioScan database was used to collect financial and patent data from 405 biotechnology firms over a 26-year sampling period from 1987 to 2013. Using fixed effects linear regressions, the paper theoretically and empirically examines Below and Above R&D performance-aspiration deviations influence a firm's risk-taking in its R&D and that market dynamism plays an important role in this decision-making process.

The paper 'Exploring how EU agri-food SMEs approach technology-driven business model innovation' by Giustina Pellegrini, Camila Silva de Mattos, Verena Otter, and Geoffrey Hagelaar provides insights into how EU agri-food sectors small and medium-sized enterprises (SEMs) cope with technological transformation. The paper explores the drivers and barriers of agri-food SME's in EU for technological transformations and the strategies these companies use to overcome barriers related to technological transformation. An exploratory qualitative multiple case study design was completed using in-depth semi-structured interviews with 14 EU agri-food SMEs that have engaged in technological transformations. The paper identifies seven main groups to draw the baths of the technological transformation process for agri-food SMEs based on similarities in terms of drivers, barriers, and strategies. One common strategy was adopted by all 14 companies to overcome barriers related to technological transformation. This strategy was the employment of partnerships and collaborations that allow companies to successfully enter new markets.

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