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WHAT DO WE (NOT) KNOW ABOUT AGRICULTURAL ECONOMIC RESILIENCE? INSIGHTS FROM THE SYSTEMATIC LITERATURE REVIEW

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Abstract. The present paper explores the current state of knowledge about the agricultural economic resilience phenomenon. By applying a comprehensive and multifaceted literature review approach the emerging research fields in the area, current level of the operationalization of the agricultural economic resilience notion and challenges in the measurement of the agricultural economic resilience are discussed. The research is supplemented by the bibliographic analysis, which indicates the five main thematic areas in the agricultural economic resilience field evolving around food security issues, hurdles in measuring the agricultural resilience, systems-network approach on the agricultural resilience, agricultural ability to adapt to external perturbations and importance of the agricultural economic resilience in assuring the decent livelihood for the rural population of the least developed regions. The potential perspective research avenues for the future research on agricultural economic resilience are proposed.

Keywords: agriculture, economic resilience, agricultural resilience, bibliographic analysis.

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1. Introduction

Modern agriculture is facing unprecedented pressures from environmental degradation, climate change, population growth, and socio-economic disparities (Intergovermental Panel on Climate Change, 2019), which turning out simultaneously, aggravate each other's negative consequences. These challenges, coupled with growing uncertainty, are threatening the long-term viability of agriculture, making its resilience a top priority in contemporary agricultural discourse. The significance of agricultural economic resilience extends beyond its one phenomenon, profoundly intersecting with another fundamental concept in nowadays agriculture – sustainability. This elaborate relationship underscores the importance of resilient farming systems in ensuring food security, ecological balance, and socio-economic stability.

No wonder that research on agricultural resilience has surged in the last decade (Wang et al., 2018; Morel et al., 2019; Kangogo et al., 2020; Langemeyer et al., 2021; Chavez-Miguel et al., 2022; Gržinić et al., 2023), presenting a wide array of differing perspectives, concepts, and measurements. Agricultural economic resilience concept, depending on the study, ranges from a relatively narrow (recovery after the shock) to a very broad definition, covering a wide range of farming systems' capabilities to respond to various shocks and stressors: absorbing them, recovering from them, adapting to them and even transforming after them into qualitatively better states (Urruty et al., 2016; Melvani et al., 2020; Dardonville et al., 2021; Petersen-Rockney et al., 2021). Moreover, studies of agricultural economic resilience differ on the perspective – micro or macro (Czekaj et al., 2020; Petersen-Rockney et al., 2021; Chavez-Miguel et al., 2022; Buitenhuis et al., 2020; Suresh et al., 2022) – taken, offering potentially complementary insights into the resilience of farming systems at different levels. Furthermore, as agricultural resilience manifests diversely across different types of agricultural activities, a broad variety of potential determinants and tailored resilience-enhancing strategies have been proposed. Navigating the measurement of agricultural economic resilience, a myriad of metrics and indicators are revealed. Yet, due to the multidimensionality of resilience phenomenon together with farming systems' complexity, operationalizing resilience remains a challenge, necessitating further assessments and ongoing adaptations. Moreover, profound variations in agricultural economic resilience research underscore the need for context-specific approaches.

This review explores the multifaceted nature of agricultural economic resilience, synthesizing the previous research on its dimensions, perspectives, determinants, and measurement. Integrating insights from diverse perspectives and approaches, the review aims to contribute to the ongoing discourse on agricultural resilience by providing a comprehensive understanding of the agricultural economic resilience. By elucidating the complexity of the phenomenon and revealing the interplay between abovementioned factors, it seeks to inform evidence-based decision-making and promote the development of holistic strategies that foster resilient farming systems capable of addressing various challenges.

The review is structured into several sections, each addressing a key aspect of agricultural resilience, encompassing exploration of economic resilience dimensions, examination of micro and macro perspectives in agricultural resilience research, review of determinants of agricultural resilience, its variation across different types of agricultural activity, and presentation of diverse metrics and indicators used for the measurement of agricultural economic resilience. The review ends with the discussion and conclusions.

2. Literature review

The concept of agricultural economic resilience. Agricultural resilience is a multifaceted concept that encompasses the ability of farming systems to adapt, recover, and transform in the face of various stressors and shocks (Meuwissen et al., 2019). Understanding the nuances of agricultural resilience involves exploring different dimensions, including static vs. dynamic resilience and the strategic approaches of "bounce back" and "bounce forward." *Static resilience* in agriculture is characterized by the capacity of a system to return to its original state following a disturbance. This perspective views resilience as the ability to absorb shocks and maintain stability (Urruty et al., 2016; Döring et al., 2015). Research within this paradigm often focuses on identifying and reinforcing existing structures and practices that contribute to the stability of agricultural systems. Static resilience is commonly associated with traditional farming methods and well-established practices that withstand specific challenges without undergoing substantial changes (Melvani et al., 2020). Conversely, *dynamic resilience* is rooted in the idea that agricultural systems can evolve and transform in response to disturbances. Instead of reverting to a previous state, dynamic resilience involves adapting and embracing change to create a new equilibrium (Urruty et al., 2016; Döring et al., 2015). This approach recognizes that the environmental, economic, and social landscapes influencing agriculture are constantly evolving. Research on dynamic resilience seeks to identify factors that facilitate adaptive capacity, innovation, and the ability of farming systems to thrive in the face of uncertainty (Dardonville et al., 2021; Petersen-Rockney et al., 2021).

Agricultural economic resilience holds paramount importance in the context of sustainable development and varies significantly across different landscapes (Šūmane et al., 2018). This section explores the profound significance of agricultural economic resilience by examining its linkage with sustainability and recognizing the global variations in research and practices pertaining to agricultural resilience. The interplay between agricultural economic resilience and sustainability is intricate and symbiotic. Resilient farming systems contribute directly to the overarching goal of sustainability by ensuring the continued provision of food and other essential resources in the face of disturbances (Valencia et al., 2019; Vroegindewey & Hodbod, 2018). Sustainable agriculture aims not only to meet present needs but also to safeguard the ability of future generations to meet their own requirements. In this light, agricultural economic resilience emerges as a key determinant of sustainability, as it enables farming systems to withstand shocks and disruptions, maintaining productivity and ecological balance over time (Melvani et al., 2020). The linkage between agricultural economic resilience and sustainability is underscored by their shared focus on long-term viability. Resilient farming practices align with sustainable principles, emphasizing resource conservation, biodiversity preservation, and the mitigation of environmental impacts. Research in this domain often explores how resilient agricultural systems can contribute to broader sustainability objectives, creating a harmonious balance between economic viability, environmental stewardship, and social equity (Dardonville et al., 2022; Anantha et al., 2021).

Micro vs. Macro Perspectives in Agricultural Economic Resilience Research. The study of agricultural economic resilience can be approached from both micro and macro perspectives, each offering unique insights into the dynamics of farming systems. This section explores the significance of micro-level analysis, focusing on individual farm resilience and community/local systems, as well as macro-level analysis, encompassing national policies, strategies, and global resilience frameworks.

Micro-level Analysis. *Individual Farm Resilience*: At the micro level, understanding the resilience of individual farms is crucial for unraveling the intricacies of adaptation and recovery strategies. Individual farm resilience involves assessing the capacity of a specific farm to withstand and recover from disturbances (Czekaj et al., 2020). Factors such as farm size, crop diversity, technology adoption, and financial stability play pivotal roles in determining individual farm resilience (Petersen-Rockney et al., 2021; Acevedo et al., 2020). Micro-level studies delve into the day-to-day challenges faced by farmers, exploring the effectiveness of on-farm practices, risk management strategies, and the adaptability of the farming enterprise to changing conditions (Bertolozzi-Caredio et al., 2021; Spiegel et al., 2020). *Community and Local Systems*: Beyond individual farms, resilience at the micro level extends to community and local systems. Communities are the building blocks of agricultural landscapes, and their collective resilience determines the overall sustainability of the region (Sukhwani et al., 2019). Micro-level analysis explores the social capital, cooperation mechanisms, and shared resources within communities (Wulandhari et al., 2022; Hellin et al., 2018). Understanding how local systems cope with and recover from disturbances involves examining community-based strategies, such as collective decision-making, cooperative resource management, and shared infrastructure. The interactions between farmers, local institutions, and the surrounding ecosystem influence the overall economic resilience of agricultural landscapes (Chavez-Miguel et al., 2022; Beckwith, 2021; El Chami et al., 2020).

Macro-level Analysis. *National Policies and Strategies*: At the macro level, the focus shifts to national policies and strategies that shape the broader agricultural landscape. Governments play a vital role in fostering economic resilience by implementing policies that address systemic challenges and provide a supportive environment for farmers (Buitenhuis et al., 2020). Macro-level analysis involves evaluating the impact of agricultural policies, land-use planning, and resource allocation at the national level (Langemeyer et al., 2021; Ashkenazy et al., 2018). Policies promoting sustainable practices, risk reduction, and the equitable distribution of resources contribute to the resilience of the entire agricultural sector. Understanding how national frameworks align with the principles of economic resilience provides insights into the overarching strategies employed to enhance the adaptive capacity of the agricultural industry (Tittonell, 2020; Hansen et al., 2019). *Global Resilience Frameworks*: Agriculture operates within a global context, where interconnectedness and interdependence shape the resilience of food systems. Global resilience frameworks address transboundary challenges, such as climate change, trade dynamics, and the globalization of food production (Tu et al., 2019; Eakin et al., 2018; Roesch-McNally et al., 2018). Macro-level analysis explores how international organizations, treaties, and agreements influence agricultural resilience on a global scale (Leippert et al., 2020). Collaborative efforts, information sharing, and coordinated responses to global disruptions contribute to building a resilient global food system (Sá et al., 2019). Understanding the macro-level dynamics is essential for developing policies and frameworks that transcend national boundaries, fostering a collective approach to global agricultural economic resilience (Suresh et al., 2022; Huang et al., 2018).

As can be seen from Table 1, the dual perspectives of micro and macro analyses in agricultural resilience

Table 1. Analysis levels and focal objects of agricultural economic resilience research

Analysis Level	Research objects	References
Micro-level Analysis		
Individual Farm Resilience	- Farm size - Crop diversity - Technology adoption - Financial stability	(Czekaj et al., 2020; Petersen-Rockney et al., 2021; Acevedo et al., 2020; Bertolozzi-Caredio et al., 2021; Spiegel et al., 2020)
Community and Local Systems	- Social capital - Cooperation mechanisms - Shared resources - Community-based strategies (collective decision-making, cooperative resource management, shared infrastructure)	(Sukhwani et al., 2019; Wulandhari et al., 2022; Hellin et al., 2018; Chavez-Miguel et al., 2022; Beckwith, 2021; El Chami et al., 2020)
Macro-level Analysis		
National Policies and Strategies	- Agricultural policies - Land-use planning - Resource allocation - Sustainable practices - Risk reduction - Equitable resource distribution	(Buitenhuis et al., 2020; Langemeyer et al., 2021; Ashkenazy et al., 2018; Tittonell, 2020; Hansen et al., 2019)
Global Resilience Frameworks	- International organizations, treaties, agreements - Transboundary challenges - Climate change - Trade dynamics - Globalization of food production - Collaborative efforts and coordinated responses	(Tu et al., 2019; Eakin et al., 2018; Roesch-McNally et al., 2018; Leippert et al., 2020; Sá et al., 2019; Suresh et al., 2022; Huang et al., 2018)

research offer complementary insights into the intricacies of adaptive capacity and sustainable practices. Micro-level studies provide a detailed understanding of individual farm and community resilience, while macro-level analyses shed light on the broader policy and global frameworks influencing agricultural sustainability. Integrating insights from both perspectives is essential for developing holistic approaches that address the diverse challenges faced by farming systems at different scales, ensuring a resilient and sustainable future for agriculture worldwide.

Determinants of Agricultural Economic Resilience. Agricultural economic resilience is intricately tied to a myriad of determinants that span environmental, socioeconomic, and institutional dimensions (Meuwissen et al., 2019). This section delves into the key factors influencing agricultural economic resilience, exploring the impact of environmental conditions, socioeconomic variables, and institutional frameworks on the ability of farming systems to withstand and recover from disruptions.

Environmental Factors. *Climate and Weather Patterns*: The influence of climate and weather patterns on agricultural economic resilience is profound. Climate variations, including changes in temperature, precipitation, and extreme weather events, directly impact crop yields, water availability, and overall ecosystem health (Kukal & Irmak, 2018). Resilient farming systems employ adaptive strategies to cope with these variations, such as the selection of climate-resilient crops, implementing water management practices, and integrating weather forecasting into decision-making processes (Ghag et al., 2022; Srivastav et al., 2021). Understanding the specific vulnerabilities of agricultural systems to climate and weather patterns is vital for developing targeted resilience strategies that enhance adaptability and minimize risk (Morkūnas et al., 2022). *Soil Health and Fertility*: Soil health and fertility play a pivotal role in determining the resilience of agricultural ecosystems. Healthy soils contribute to improved crop productivity, nutrient cycling, and water retention, fostering a robust foundation for farming systems to withstand disturbances (Tahat et al., 2020). Practices such as crop rotation, cover cropping, and organic matter incorporation contribute to maintaining soil health (Wulanningtyas et al., 2021). Additionally, advancements in precision agriculture technologies enable farmers to monitor and enhance soil fertility. Sustainable soil management practices are integral to building economic resilience by ensuring the long-term viability of agricultural production in the face of environmental challenges (Yin et al., 2021).

Table 2. Determinants of agricultural economic resilience

Determinants of Agricultural Resilience	Factors	References
Environmental Factors		
Climate and Weather Patterns	- Changes in temperature, precipitation, and extreme weather events affect crop yields and water availability - Resilient strategies: selection of climate-resilient crops, water management, and weather forecasting	(Kukal & Irmak, 2018; Ghag et al., 2022; Srivastav et al., 2021)
Soil Health and Fertility	- Healthy soils contribute to improved crop productivity and water retention - Practices: crop rotation, cover cropping, organic matter incorporation - Precision agriculture technologies for monitoring and enhancing soil fertility	(Tahat et al., 2020; Wulanningtyas et al., 2021; Yin et al., 2021)
Socioeconomic Factors		
Access to Resources	- Financial resources (credit, insurance, subsidies) crucial for resilient infrastructure and technology adoption - Technological advancements (precision farming, remote sensing, climate-smart technologies) enhance productivity - Equitable access essential for diverse farming communities	(Goodwin et al., 2022; Kramer et al., 2020; Yin et al., 2021)
Education and Training	- Well-informed farmers better equipped to implement sustainable practices and adapt to changing conditions - Educational programs on climate-smart agriculture, sustainable land management, and financial literacy - Training initiatives empower farmers to navigate challenges and foster continuous learning	(Šūmane et al., 2018; Mashi et al., 2022; Shahbaz et al., 2022)
Institutional Factors		
Policy Frameworks	- Government policies on land use, water management, and disaster preparedness influence adaptive capacity - Resilient policies support sustainable practices, incentivize technological adoption, and provide a regulatory environment fostering innovation	(Le et al., 2018; Ashkenazy et al., 2018)
Support Systems and Networks	- Presence of support systems (cooperatives, extension services) and collaborative networks enhances collective resilience - Facilitates knowledge exchange, resource sharing, and coordinated responses during crises - Strengthening support systems at local, regional, and national levels is crucial	(Kangogo et al., 2020; Ji et al., 2018)

Socioeconomic Factors. *Access to Resources*: The socioeconomic dimension of agricultural economic resilience is influenced by farmers' access to crucial resources, both financial and technological. Financial resources, including credit, insurance, and subsidies, play a vital role in enabling farmers to invest in resilient infrastructure, adopt new technologies, and recover from economic shocks (Goodwin et al., 2022; Kramer et al., 2020). Moreover, technological advancements, such as precision farming, remote sensing, and climate-smart technologies, empower farmers to enhance productivity and adapt to changing conditions. Ensuring equitable access to these resources is essential for building economic resilience across diverse farming communities (Yin et al., 2021). *Education and Training*: Education and training contribute significantly to the adaptive capacity of farming systems. Well-informed farmers are better equipped to implement sustainable practices, respond to market dynamics, and adopt innovative technologies (Šūmane et al., 2018). Educational programs focused on climate-smart agriculture, sustainable land management, and financial literacy enhance farmers' decision-making capabilities (Mashi et al., 2022). Training initiatives that transfer knowledge and skills empower farmers to navigate challenges effectively, fostering a culture of continuous learning and adaptation within agricultural communities (Shahbaz et al., 2022).

Institutional Factors. *Policy Frameworks*: The role of policy frameworks in shaping agricultural economic resilience cannot be overstated. Government policies related to land use, water management, and disaster preparedness significantly influence the adaptive capacity of farming systems (Le et al., 2018). Resilient policies support sustainable practices, incentivize technological adoption, and provide a regulatory environment that fosters innovation. Aligning policy frameworks with the principles of economic resilience ensures that institutional support promotes long-term viability and fosters an environment conducive to agricultural sustainability (Ashkenazy et al., 2018). *Support Systems and Networks*: Agricultural economic resilience is bolstered by the presence of support systems and networks that facilitate knowledge exchange, resource sharing, and collaborative efforts (Kangogo et al., 2020). Farmer cooperatives, extension services, and community-based organizations create a social fabric that enhances the collective economic resilience of farming communities. These networks serve as conduits for information dissemination, access to resources, and coordinated responses during crises. Strengthening support systems and fostering collaborative networks at local, regional, and national levels is crucial for building resilient agricultural communities (Ji et al., 2018).

It can be summarized (Table 2) that agricultural economic resilience is a multifaceted concept influenced by environmental conditions, socioeconomic variables, and institutional frameworks. Climate and weather patterns, soil health, access to resources, education, policy frameworks, and support systems are identified as critical determinants. Resilient farming systems employ adaptive strategies, ensure equitable access to resources, and benefit from supportive policies and networks.

Hurdles of the implementation of factors increasing agricultural economic resilience

Having said, what are the main determinants of the agricultural economic resilience it is worth mentioning factors, which hinder the adoption of these measures/features. Considering climate and weather patterns group of factors it is worth mentioning, that more drought or cold resistant varieties, which are suggested to be selected as one of resilience increasing measures, are typically less productive. It leads to lower harvests, and, in order to feed the same amount of people, farmers need either more land, which is rarely feasible keeping in mind the desertification and other issues in the least developed world (Yang et al., 2022), or are forced to use even more pesticides, which, in turn, negatively affects both the agricultural sustainability and long term harvesting potential (Morkunas & Volkov, 2023) and even threatens the nutrition value of food produced (Wang et al., 2022).

Soil Health and Fertility factors group measures are more easily adoptable to abovementioned measures. Although even it is not spared of critique. It is argued , that adoption of the measures classified under this group can only slower the decrease in agricultural resilience, rather than to increase it (Amo-Agyemang, 2021). It is because almost all these measures are aimed at maintaining soil quality and fertility, but not increasing it. Of course, the adoption of precision agriculture (Petrović et al., 2024) might lead to increased harvest with lower amounts of water used or a more precise fertilizing, it still cannot fully stop or even reverse the soil degradation trend (Morkūnas et al., 2022).

According to the most of the literature, Socioeconomic determinants of agricultural economic resilience are among the most easily adoptable from the global perspective (Ahmed et al., 2025). Providing financial resources to farmers is a relatively low risk option for the lending institutions, as farmers provide products of constant demand – food (Žičkienė et al., 2022). Level of general education is increasing throughout the world and positively affect such notions as resilience and sustainability (Mahalik et al., 2021). Although it is expected that effect will be felt only till some point. Later a more specified agriculture – related educational programs for farmers will be required to increase agricultural resilience even more (Pienaah et al., 2024).

Institutional quality has its implications on almost all aspects of agricultural sector. It influences informal/shadow activities (Schneider et al., 2023), determines the following of contracts between labour and employees (Williams & Horodnic, 2018), assures maintaining of various standards (Velasco-Muñoz et al., 2021) and is responsible for the profitability levels (Volkov et al., 2019). Although it is widely agreed, that the system of policy and institutional frameworks is a reflection of broader social contract between the state and society (Loewe et al., 2021). These informal institutions, based both on cultural, historical, social, economic and demographic foundations are very resistant to changes, as if implemented, these changes should encompass all its constituent parts (Shafik, 2021) which is highly unlikely.

Variations of agricultural economic resilience among different types of agricultural activity. The economic resilience of agricultural systems is not a one-size-fits-all concept; rather, it varies significantly across different farming types. This section explores the unique challenges and resilience strategies employed in crop farming, livestock farming, and agroecological approaches, including organic farming and permaculture.

Crop Farming. *Grain Farming*: Grain farming, a cornerstone of global agriculture, faces distinct challenges that require specific resilience strategies. Grains, such as wheat, rice, and corn, are susceptible to climate variability and extreme weather events (Wang et al., 2018). Resilience in grain farming often involves the diversification of crops, adoption of drought-resistant varieties, and the integration of precision farming technologies (Bali et al., 2023). Additionally, sustainable soil management practices, such as minimal tillage and cover cropping, contribute to maintaining soil health and fertility, essential for the long-term economic resilience of grain farming systems (Farmaha et al., 2022). *Specialty Crops*: Specialty crops, including fruits, vegetables, and niche products, present a different set of challenges and opportunities for resilience. These crops are often more sensitive to fluctuations in temperature, pests, and market demands (Kerr et al., 2018; Kistner et al., 2018; Schreinemachers et al., 2018). Resilient strategies for specialty crop farming involve crop rotation, integrated pest management, and the development of niche markets to enhance economic stability (Yu et al., 2022; Amelework et al., 2021; Heeb et al., 2019). Emphasizing local and diversified markets can also mitigate risks associated with global supply chain disruptions, making specialty crop farming more adaptable to changing conditions (Wang et al., 2023).

Livestock Farming. *Dairy Production*: Dairy production, a vital component of livestock farming, requires a multifaceted approach to resilience. Challenges in dairy farming range from feed availability and animal health to market fluctuations (Kemboi et al., 2020; Hernández-Castellano et al., 2019). Resilience strategies include the implementation of climate-smart feeding practices, genetic selection for heat tolerance, and diversification of income sources, such as value-added dairy products (Shahbaz et al., 2022; Adesra et al., 2021; Carabaño et al., 2019). Robust animal health management, including disease prevention and vaccination programs, contributes to the overall economic resilience of dairy farming systems (Robertson, 2020). *Poultry Farming*: Poultry farming, characterized by its intensive nature, demands specific resilience measures to address biosecurity, disease outbreaks, and market volatility (Gržinić

Table 3. Comprehensive economic resilience strategies across diverse farming systems

Farming System	Resilience Strategies	References
Crop Farming		
Grain Farming	- Diversification of crops - Adoption of drought-resistant varieties - Integration of precision farming technologies - Sustainable soil management practices (minimal tillage, cover cropping)	(Wang et al., 2018; Bali et al., 2023; Farmaha et al., 2022)
Specialty Crops	- Crop rotation - Integrated pest management – Development of niche markets - Emphasis on local and diversified markets	(Kerr et al., 2018; Yu et al., 2022; Amelework et al., 2021; Wang et al., 2023)
Livestock Farming		
Dairy Production	- Climate-smart feeding practices - Genetic selection for heat tolerance - Diversification of income sources (value-added dairy products) - Robust animal health management (disease prevention, vaccination)	(Kemboi et al., 2020; Shahbaz et al., 2022; Robertson, 2020)
Poultry Farming	- Strict biosecurity protocols - Efficient waste management - Adoption of advanced ventilation and cooling technologies - Diversification of poultry products	(Gržinić et al., 2023; Makarynska & Vorona, 2023)
Agroecological Approaches		
Organic Farming	- Avoidance of synthetic inputs - Crop rotations - Cover cropping - Companion planting - Closed nutrient cycles and organic matter incorporation	(Tahat et al., 2020; Kanatas, 2020; Möller, 2018)
Permaculture	- Mimicking natural patterns - Utilizing diverse plant and animal species - Design principles (stacking functions, diverse polycultures, efficient energy/resource utilization)	(Morel et al., 2019; Hirschfeld & Van Acker, 2021)

et al., 2023; Jones et al., 2019). Resilient poultry farming involves strict biosecurity protocols, efficient waste management, and the adoption of advanced ventilation and cooling technologies to mitigate heat stress volatility (Gržinić et al., 2023). Diversifying poultry products, such as eggs and meat, and adapting to changing consumer preferences contribute to the economic resilience of poultry farming enterprises (Makarynska & Vorona, 2023).

Agroecological Approaches. *Organic Farming*: Organic farming, rooted in sustainable and environmentally friendly practices, embodies resilience by design. Avoiding synthetic inputs, organic farming enhances soil health, reduces chemical dependencies, and promotes biodiversity (Tahat et al., 2020). Crop rotations, cover cropping, and companion planting are integral components of organic farming that contribute to the overall economic resilience of the agroecosystem (Kanatas, 2020; Orzech & Załuski, 2020). The emphasis on closed nutrient cycles and organic matter incorporation fosters resilient farming practices that align with ecological principles (Möller, 2018). *Permaculture*: Permaculture, an integrated design philosophy, goes beyond individual farming practices to create sustainable and resilient ecosystems. By mimicking natural patterns and utilizing diverse plant and animal species, permaculture systems enhance overall resilience (Morel et al., 2019; Krebs & Bach, 2018). The design principles of permaculture, such as stacking functions, building diverse polycultures, and capturing and utilizing energy and resources efficiently, contribute to the self-sufficiency and adaptability of the farming system (Hirschfeld & Van Acker, 2021; McClintock & Simpson, 2018).

Resilience in different farming types requires tailored approaches that consider the specific challenges and opportunities inherent in each system (Table 3). From crop farming, with its diverse challenges in grain and specialty crop production, to livestock farming, including dairy and poultry production, and agroecological approaches like organic farming and permaculture, the economic resilience strategies employed are as diverse as the systems themselves.

Measurement of Economic Agricultural Resilience. The measurement of agricultural economic resilience encompasses a diverse array of approaches, reflecting the complex nature of farming systems and their responses to stressors (Serfilippi & Ramnath, 2018). This section explores the metrics and indicators used in assessing economic resilience, delves into the relationship between agricultural economic resilience and sustainability, and investigates the variations in research approaches across different regions.

Metrics and Indicators: Quantitative measures, such as yield stability, economic losses, and recovery time, offer objective and numerical insights into the economic resilience of agricultural systems. These metrics provide a structured approach for evaluating specific aspects of resilience, allowing for comparisons and trend analyses (Coomes et al., 2019; Morkūnas et al., 2018). Conversely, qualitative measures capture the more subjective dimensions, including community cohesion, adaptive capacity, and local knowledge systems. The integration of both types of measures is essential for a comprehensive understanding, recognizing that resilience extends beyond numerical outcomes to encompass economic, social, cultural, and institutional dimensions (Carrico et al., 2019; Wilson et al., 2018).

Operationalizing economic resilience: Operationalizing economic resilience faces challenges related to defining boundaries, establishing causality, and adapting to the dynamic nature of agriculture (Van et al., 2022; Helfgott, 2018). Defining standardized indicators across diverse contexts is challenging due to contextual variations. Moreover, causality between specific measures and resilience outcomes is intricate, given the multifactorial nature of disturbances in agriculture. Balancing the dynamic nature of agricultural systems requires ongoing assessments, acknowledging that economic resilience is a process influenced by changing conditions (Bennett et al., 2021; Darnhofer, 2021).

Global Variation in Agricultural Economic Resilience Research: Research on agricultural economic resilience exhibits considerable variation on a global scale, reflecting diverse environmental, economic, and social contexts. Different regions face distinct challenges, ranging from climate-related disruptions to economic disparities, influencing the economic resilience strategies adopted by local farming communities (Meuwissen et al., 2019; Ashkenazy et al., 2018). In developed countries, where technological advancements and well-established infrastructure prevail, research often focuses on precision agriculture, advanced risk management tools, and high-tech solutions to enhance economic resilience (Srivastav et al., 2021; Roy & George, 2020). Conversely, in developing nations, where challenges such as limited access to resources and climate variability persist, studies may concentrate on community-based approaches, traditional knowledge systems, and adaptive strategies to build economic resilience (Mfitumukiza et al., 2020; Lammerts van Bueren et al., 2018). Furthermore, cultural and institutional differences contribute to the global variation in agricultural economic resilience research. Localized practices, governance structures, and historical contexts shape the resilience capacities of farming systems (Romeo et al., 2021; Knickel et al., 2018). Understanding these variations is essential for designing targeted interventions and policies that align with the specific needs and challenges faced by diverse agricultural communities worldwide.

3. Bibliographic analysis

To enrich the analysis above with deeper understanding of the interrelations between various aspects of agricultural economic resilience, a bibliographic analysis was performed. The keywords selected for the research were "agricultural" or "agriculture" and "economic resilience" or "economically resilient" in the web of science SCIE data base using Boolean generator. The arguments for selection of this DB are the following: only highly praised journals with rigorous peer–review process are included into this DB (Usman & Ho, 2020), it is one of the 2 most used DB in scientometric analysis (Zhu & Liu, 2020) it is more suitable for the analysis of Open Access (OA) resources on a publication level compared to Scopus (Pranckutė, 2021). As free access to knowledge is being advocated in the world in the recent years (Tedersoo et al., 2021) we decided to choose a DB, which covers OA resources better. The research was conducted on 31–12–2024. The inclusion criteria were the following: a) only peer-reviewed scientific articles were selected for research; b) only articles written in English were considered; c) only articles dealing directly with agricultural resilience were investigated (i.e. articles focused on rural socio-economic resilience were excluded even though it touched agricultural resilience/had these words in a keywords list).

The most discussed topics in the agricultural resilience research. Analyzing the thematic scope in the agricultural economic resilience research, only terms with no less of 10 occurrences were investigated. This resulted in 5 distinct thematic hubs (see Figure 1). The green-colored hub is mostly concerned with resilience of agro-ecosystems encompassing such high-frequency keywords as *crop production, conservation, temperature, biodiversity, with a special focus on soil and yield*. From the literature analyzed above, it is no coincidence that they go together as many of them are considered to have important influence on agricultural economic resilience. The most often occurring term in this cluster is, however, *food security* – a concept linking and merging several themes in agricultural resilience research. Food security concept seems to be one of the central topics in agricultural resilience overall. The green hub is densely interconnected with the blue one. In the blue cluster keywords *household, livelihood, access, income, adoption, and age* highlight the attention given to socio-economic aspects of agricultural economic resilience. Another important keywords in this hub revolve around climate smart agriculture and its practices. This hub emphasizes the importance of the agricultural economic resilience in assuring the decent livelihood for the rural population of the least developed regions. The red hub is concerned with systems-network approach on the agricultural economic resilience, with a special focus on supply chain disruption management, and COVID pandemic. *Characteristic, structure, food systems, supply chain, city, COVID, China, governance* are the most popular concepts. Terms *characteristic* and *structure* stand out as being analyzed a lot not only in relation to red hub main terms but other themes under agricultural economic resilience research as well. The last two hubs – yellow and violet ones – both center around the term *model* and contribute to agricultural economic resilience research, however, they differ in focus and methodology. Yellow hub, encompassing terms of *performance, state, network, problem, function, set, effectiveness, failure, algorithm*, seems to be focused on examining the performance and states of agricultural systems and identifying problems related to ability of agriculture to adapt to external perturbations, while the violet hub with such keywords as *model, variable, addition, probability, resilient modulus, test, property, variation, parameter, sample*, is focused more on theoretical modelling and experimental testing to understand the economic resilience determinants and their variation under different conditions. The methodological approaches also differ as the yellow hub is more concerned with algorithms and network analysis, while the violet hub may employ statistical modelling and laboratory experiments. It should be noted as both hubs are shaped as prolonged ovals, suggesting the breadth and heterogeneity of the subject as well as emerging new concepts and research methodologies in the area of agricultural economic resilience, especially related to novel resilience evaluation and prediction methods.

The thematic analysis is supplemented with keywords co-occurrence (see Figure 2) investigation, which indicates much less dispersion in areas covered under agricultural economic resilience umbrella and supplements Noor et al. (2020) arguments about insufficiency of only keywords

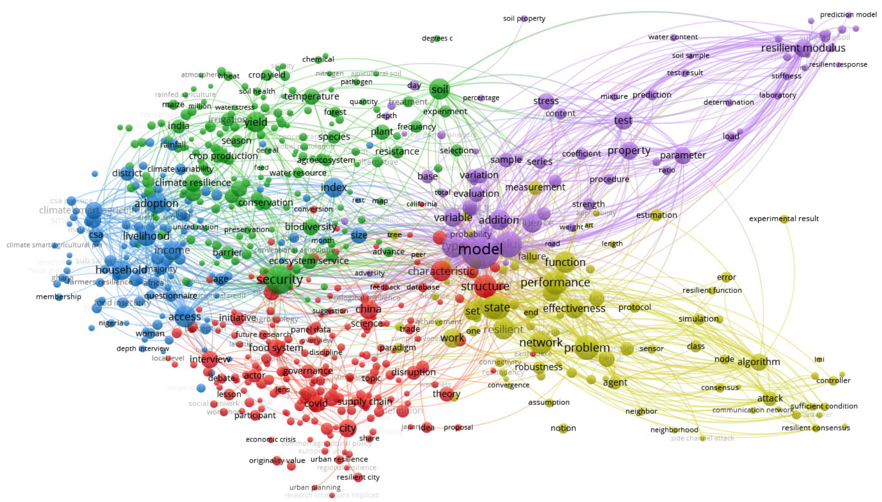

Figure 1. Co-occurrence of terms in an agricultural economic resilience research

analysis in identifying the main theoretical sprouts which have already emerged in particular scientific field. Only keywords appearing minimum 5 times were selected for the research.

Analyzing co-occurrence of keywords, several distinct clusters can be identified. The yellow one, containing such keywords as *climate change, food security, draught, farming systems, conservation agriculture,* indicates studies aimed at resilience of agro-systems in face of climate change and its impact on food security. The other easily distinguished hub (green-colored) is concerned mainly with evaluation of performance and states of a system as well as economic resilience control under disruptions and uncertainty. The most frequently appearing terms in this cluster are framework, security, performance, resilient, design, stability. Another distinct cluster – brown-colored – focuses on resilience modelling. The prolonged shape of both latter clusters may indicate emerging trends and concepts in the agricultural economic resilience research, especially related to new methods measuring and controlling resilience, as well as emergence of new vulnerabilities, such as data injection and cyber-attacks. Other several hubs are too densely interconnected to allow clearly distinguishing their boundaries, however terms *adaptation, management, vulnerability, socio-ecological systems and community resilience* stand out in the frequency of their use.

Overall, both thematic and key-word co-occurrence analysis yield relatively similar results, suggesting a strong alignment between the thematic structure of the literature and the co-occurrence patterns of keywords.

Outlets engaged in the dissemination of the knowledge on the agricultural economic resilience the most. Analysis of the outlets engaged in the dissemination knowledge on the agricultural economic resilience most was conducted using co-occurrence analysis with a 5 document occurrence threshold. The analysis reveals 3 main knowledge gathering clusters (see Figure 3), one centered around Sustainability journal (other significant journals in this group: Agriculture (Basel), Frontiers in sustainable food systems, Agronomy (Basel) and slightly more distinctly related Journal of Cleaner Production and Science of the Total Environment). Another cluster evolves around Agricultural Systems journal (other core outlets: Land Use Policy, International Journal of Agricultural Sustainability, Agricultural Economics and Environmental Research Letters). The third cluster is more homogeneous with most important being the Energy and Society journal and the Journal of Rural Studies (other important scientific outlets are Agroecology and Sustainable Food Systems, Global Food Security and Agriculture and Human Values).

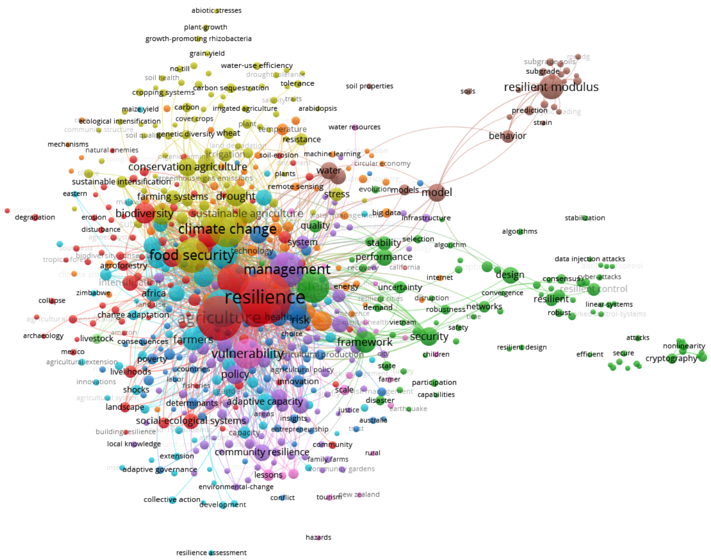

Figure 2. The co-occurrence of keywords in agricultural economic resilience research

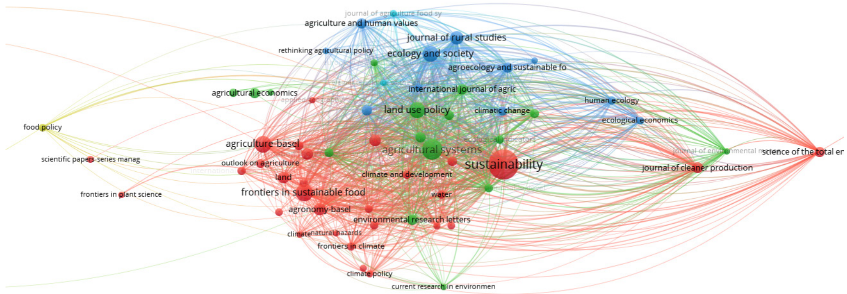

Figure 3. Bibliographic clustering of agricultural resilience research publishing journals

The most prolific authors in agricultural economic resilience domain

Analyzing the most prominent authors in agricultural economic resilience area (Table 4) we have distinguished 15 the most productive scholars, who has the biggest number of publications in WoS dedicated to agricultural economic resilience:

Table 4. The most productive scholars in agricultural economic resilience domain

Author	Papers on Agricultural economic resilience
Mabhaudhi, T.	22
Salvati, L.	16
Nhamo, L	15
Troell, M.	13
Reidsma, P	13
Meuwissen, M. M. P.	12
Mpandeli, S.	12
Prasad, P. V. V.	11
Bene, Ch.	11
Schlüter, M.	10
Modi, A. T.	10
Streimikiene, D.	9
Morkunas, M.	9
Severini, S.	9

Analysing domains in which the most prominent authors are engaged, a few distinct streams of research can also be envisaged. The first literature sprout aimed at clarifying agricultural economic resilience concept and conceptualizing it is represented by Meuwissen, M. M. P., Bene, Ch., Schlüter, M. Another stream is aimed at researching soil degradation, adapting to environmental changes and is led by Mabhaudhi, T., Modi, A., Th., Salvati, L., Nhamo, L. Another distinct theoretical line is focused around measurement of the agricultural economic resilience. This sprout is represented by Morkunas, M., Streimkiene, D., Severini, S. Improvement of biological properties of plants grown is of interest of Prasad, P. V. V., Troell, M., Mpandeli, S. Summing up it can be said, that analysis through the lens of the most prolific authors or the most discussed topics derives quite similar results, indicating that each theoretical stream under the agricultural economic resilience umbrella has its distinguished proponents among the academia.

Evolution of theory. The analysis reveals a notable development in how the economic resilience in agricultural context has been conceptualized and theorized over time. The earliest works touched upon resilience mainly through the perspective of risk management and vulnerability assessment (Mapp et al., 1979; Patrick et al., 1985). These studies, although not explicitly using the term "resilience," could nevertheless be considered as having laid the foundations by analysing how agricultural systems coped with various shocks and disturbances such as price volatility, natural disasters, policy changes, etc. (Boehlje & Trede, 1977; Hazell, 1992). These studies tended to focus on identifying strategies for mitigation of various risks and adaptation after the shocks.

A significant shift occurred, when growing recognition of agricultural systems as complex, adaptive and interconnected systems led to the inclusion of resilience principles derived from ecological sciences where resilience framework has been adopted much earlier and went through a significant development from defining resilience as a capacity to absorb or resist negative perturbations to interpreting it as a much broader phenomenon (Darnhofer, 2014; Urruty et al., 2016). This brought a more systemic perspective and emergence of theoretical discussions around key resilience concepts in agricultural economics such as: *absorptive capacity* (or the ability of an agricultural system to withstand shocks and minimize their immediate impacts), *adaptive capacity* (or the ability to adjust to changing conditions and to recover after the disturbances), and transformative capacity (or the ability to fundamentally shift the system to a new qualitative state or trajectory when existing conditions become unsustainable or not preferrable) (Allison & Hobbs, 2004). Literature began emphasizing the role of diversification, policy interventions, and community networks in mitigating economic disruptions (Darnhofer, 2014).

Gradually, economic resilience became deeply intertwined with sustainability (El Chami et al., 2020; Läpple & Thorne, 2018), although the interconnection of these two concepts is still much debatable (Nüchter et al., 2021; Marta Negri et al., 2021; Olfert et al., 2021). Studies increasingly focused on how global trade patterns, climate change, and digital advancements influence agricultural resilience (Gil et al., 2017; Dong, 2020; Finger, 2023). Furthermore, policy-oriented research started emphasizing adaptive governance, and the need for resilient food supply chains (Davis et al., 2020; Kumar & Singh, 2021).

A growing sophistication in the theoretical foundations of economic resilience in agriculture can be clearly observed as more recent literature demonstrates a much more nuanced understanding of economic resilience, recognizing its multidimensionality (general and specific resilience, absorptive, adaptive and transformative capacities), dynamics (evolving over time), context-specificity (being shaped by the unique ecological, economic, social, and institutional environments in which these agricultural systems operate), and scale-dependency (requiring a different lens at the farm, regional, and sectoral levels) (Meuwissen et al., 2019; Žičkienė et al., 2022; Hellin et al., 2023).

Furthermore, an increasing integration of different economic theories into resilience framework is being observed. Concepts from behavioural economics (Ma et al., 2025), institutional economics (Barszczewski, 2024; Gittins & McElwee, 2024; O'Hara, 2025), etc. are being employed to better understand the decision-making processes of farmers facing various disturbances, the role of institutions in fostering resilience, and the pathways to building resilience in different socio-economic contexts.

On the other hand, agricultural economic resilience is being integrated into broader discussions on climate-smart agriculture, circular economies, and socio-economic inclusivity (Hellin et al., 2023; Trivellas et al., 2023; Hilmi et al., 2024). Emerging models incorporate predictive analytics, artificial intelligence, and scenario planning to improve economic adaptability in agriculture. The literature now reflects a paradigm shift – resilience is no longer merely about surviving shocks but proactively thriving in dynamic global contexts.

Despite this notable evolution, areas where theoretical development remains quite nascent, can be identified. For example, the operationalization and measurement of transformative capacity of socio-economic agricultural systems still require further theoretical exploration, as well as the interplay between different dimensions of resilience and the potential trade-offs between them.

4. Discussion

The literature review reveals the multifaceted nature of agricultural economic resilience phenomenon and provides synthesized information on its dimensions, determinants, research perspectives, and measurement approaches. This discussion aims to delve deeper into the main themes touched on in the review, highlighting key findings and implications for further research and practice.

The Concept of Agricultural Resilience. The review unfolds two main dimensions of agricultural economic resilience, static (Melvani et al., 2020) and dynamic resilience (Urruty et al., 2016; Döring et al., 2015). Static resilience, characterized by the ability to return to an original state (or similar to the original state, as due to intrinsic characteristics of farming systems complex dynamic systems they can't return to the completely same state) following a disturbance, underscores the importance of maintaining the existing structures and practices, which have proved to be beneficial for the productivity and sustainability of the system. On the other hand, dynamic resilience reflects the ability of continuous adaptation and innovation to cope with evolving challenges, however, also to transform into qualitatively better states (Urruty et al., 2016; Döring et al., 2015). The latter is increasingly emphasized as especially important in today's environment of increasing changes and high uncertainty (Boschma, 2015). By recognizing the interplay between these two dimensions, stakeholders can develop comprehensive strategies balancing stability with flexibility, thus fostering more resilient agricultural systems. However, it should be mentioned that the interplay between the two dimensions is not fully understood yet, and they may not necessarily be coupled or mutually exclusive (Cowell et al., 2016; Hu & Hassink, 2020). Scholars argue that there may be trade-offs (a system may be robust and absorb a shock well and yet it may not be able to develop sufficient opportunities to adapt or transform itself when confronting future challenges) as well as synergetic effects (a system which exhibits speedy recovery is exhibiting precisely the sort of adaptive capacity that is critical for its long-term transformation) between these dimensions (Boschma, 2015; Fröhlich & Hassink, 2018).

Micro vs. Macro Perspectives. The review underscores the significance of adopting both micro and macro perspectives in agricultural economic resilience research and practice. Micro-level analysis (Bertolozzi-Caredio et al., 2021; Spiegel et al., 2020; Wulandhari et al., 2022; Hellin et al., 2018) offers insights into the resilience of individual farms and local communities, elucidating the intricacies of adaptation strategies and social dynamics. Understanding the challenges faced by farmers at the grassroots level as well as determinants of resilience (of both dimensions) is essential for all levels: farmers, who have to cope with increasing volatilities and new previously unknown risks, their communities, as well as for agricultural policy makers designing targeted interventions that address specific needs of various farmers' groups. Conversely, macro-level analysis (Buitenhuis et al., 2020; Langemeyer et al., 2021; Ashkenazy et al., 2018), which examines national policies, global frameworks, and transboundary challenges, highlight the role of governance structures and international collaboration in promoting economic resilience, which in turn has an important influence on stimulating sustainable development. Combining viewpoints from both perpsectives facilitates the creation of comprehensive strategies that tackle the diversity of challenges confronting agricultural systems across different contexts and scales.

Determinants of Agricultural Economic Resilience. The review shows a myriad of determinants, identified in the scientific literature (Ghag et al., 2022; Srivastav et al., 2021; Wulanningtyas et al., 2021; Goodwin et al., 2022; Shahbaz et al., 2022), potentially influencing agricultural economic resilience, encompassing environmental, socioeconomic, and institutional aspects. Climate variability, soil health, access to resources, education, policy frameworks, and support networks emerge as critical factors shaping resilience. Promoting economic resilience requires integrated approaches that balance ecological sustainability, economic viability, and social equity. By investing in climate-resilient agriculture, promoting sustainable land management practices, and strengthening support systems, stakeholders can enhance the resilience of farming systems and improve food security and livelihoods for millions of people worldwide. However, important consideration should be taken into account when analyzing resilience, as well as in the process of formation and application of resilience-enhancing measures – resilience is not a fixed property, rather it is a process and may evolve – increase or decrease (Martin & Sunley, 2015; Hu & Hassink, 2020) – depending on the system's characteristics and the ongoing processes within the systems and outside it. A system that is considered to be resilient at one point in time may not be such at another. Moreover, some scholars argue that economic resilience is context specific (Volkov et al., 2022), meaning that the indicators determining resilience of a particular system, or their importance may vary across different systems. In addition, since complex dynamic systems are constantly changing, some indicators may lose their importance or new indicators may obtain more significance. These dynamics are supported by the fact that, so far, no single (set of) component(s) has been identified as reliable predictors of economic resilience across farming systems, time, and contexts. Concluding, it is essential to know main potential determinants of economic resilience, however, when forming and applying specific measures to increase resilience, the peculiarities of each particular systems and its development should be taken into account.

Economic Resilience and Types of Agricultural Activity. The scientific literature reviewed highlights the diverse challenges faced by farms engaged in different types of agricultural activities. From grain farming (Bali et al., 2023; Farmaha et al., 2022) to specialty crop production (Wang et al., 2023; Kerr et al., 2018), and from dairy farming Shahbaz et al., 2022; Kemboi et al., 2020; Adesra et al., 2021) to poultry farming (Gržinić et al., 2023; Makarynska & Vorona, 2023), each agricultural sector faces unique challenges related to climate variability, market dynamics, and resource availability. Tailoring economic resilience strategies to specific farming contexts is essential for enhancing disturbance absorption and adaptation capacities. Sector-specific examples of resilience strategies have been provided to illustrate the variety and differences in increasing resilience across sectors. Furthermore, agroecological approaches such as organic farming and permaculture exemplify holistic and sustainable approaches to agriculture, emphasizing resilience by design through practices that enhance soil health, biodiversity, and ecosystem resilience.

Measurement of Agricultural Economic Resilience. The literature proposes an array of different resilience evaluation techniques ranging from quantitative (Coomes et al., 2019; Morkūnas et al., 2018) to qualitative (Carrico et al., 2019; Wilson et al., 2018) analysis. Although it is important to develop robust metrics and indicators to assess agricultural economic resilience accurately, which would allow for a more comparable and a more easily adaptable in other contexts set of measures, due to the dynamic nature of farming systems as well as of resilience phenomenon itself, qualitative studies are nevertheless as important as the quantitative ones, allowing to capture subjective dimensions (such as community cohesion, local knowledge systems, etc.) and more nuanced differences between resilience of different systems. Operationalizing economic resilience also faces challenges related to defining boundaries, establishing causality, and adapting to the dynamic nature of agriculture. Therefore, standardizing indicators across diverse contexts and balancing them with dynamic local assessments and long-term monitoring would be essential for accurately measuring agricultural economic resilience and informing evidence-based decision-making. The analysis of thematic scope in agricultural economic resilience research substantiates a multifaceted landscape characterized by distinct thematic hubs, providing valuable insights into the main topics and trends driving agricultural resilience research. Supplementing the thematic analysis with keyword co-occurrence investigation further elucidates the interconnected nature of research areas under the agricultural economic resilience umbrella. Overall, the combined analysis of thematic scope and keyword co-occurrence provides a comprehensive understanding of the current landscape of agricultural resilience research, highlighting the areas of focus and emerging trends. The main clusters of knowledge gathering have also been identified.

Bibliographic analysis. One of the most notable outcomes of the thematic and keyword co-occurrence analyses is the centrality of food security, not only as a frequent keyword but also as an integrative concept that bridges biophysical and socio-economic dimensions of resilience. This points up the multifaceted nature of agricultural resilience, requiring integrated approaches that address both the biophysical and socio-economic dimensions of agricultural systems. The emergence of system-network approaches, which emphasize network structures and governance, reflect an increasing concern with supply chain fragility and supply chain governance, especially in the light of global disruptions such as the COVID-19 pandemic. It's also worth noting that evolving hubs of modelling and methodological innovations point to the field's diversification and to the boost of interest in operationalizing resilience through data-driven and analytical tools. Altogether, the clustering analysis illustrates an evolving field transitioning from isolated topical studies to more integrative, systemic investigations aimed at capturing the multidimensional nature of agricultural resilience. The keyword co-occurrence analysis strengthens the thematic findings, particularly the prominence of food security, management, climate change, performance evaluation, and resilience evaluation. The identification of densely interconnected hubs without clear thematic boundaries supports the notion of agricultural resilience as a transdisciplinary domain. Interestingly, the emergence of clusters related to new measurement methods, and potential vulnerabilities like data injection and cyber-attacks points to a growing awareness of the complex and dynamic challenges facing agricultural systems in the 21st century. The shift towards complex systems thinking and the incorporation of concepts from behavioural, institutional, and ecological economics suggest a significant theoretical enrichment. Additionally, the recent incorporation of predictive analytics, artificial intelligence, and scenario planning signals a paradigm shift from reactive to proactive resilience-building strategies.

In summary, this systematic literature review provides a so far rare comprehensive overview of agricultural economic resilience, highlighting its significance in the context of sustainable development and food security. It elaborates several main aspects which should be considered both in organizing resilience research or applying the insights in practice: 1) Acknowledging the duality (static and dynamic) of resilience and balancing between maintaining existing structures and fostering innovation and adaptation to effectively navigate evolving challenges; 2) Integrating micro and macro perspectives; 3) Taking into account the variety of possible economic resilience determinants and possible impact variations due to specific contexts; 4)

Using standardized indicators across diverse contexts and balancing them with dynamic assessments. By addressing these implications, stakeholders can develop targeted strategies to enhance risk mitigation and adaptive capacity, promote sustainable practices, and build more resilient and sustainable agricultural systems for present and future generations more effectively. Continued research, policy development, and collaboration are needed to address the complex and interconnected challenges facing agriculture worldwide, especially in the areas of interplay between different economic resilience dimensions, standardization of economic resilience measurement, resilience determinants in the contexts of uncertainty, etc.

While overall the article provides a valuable synthesis of research on agricultural economic resilience, there are some limitations that should be considered. Although the article covers various dimensions, determinants and measurements of agricultural economic resilience and different perspectives on it, due to the vastness of the topic, it is challenging to encompass all relevant studies and perspectives within a single article, therefore the depth of analysis for certain subtopics is limited.

5. Conclusions

The analysis of studies examining agricultural economic resilience presented in this review underscores the multifaceted and dynamic nature of resilience phenomenon, highlighting its importance for sustainable agricultural development in the face of various challenges. The analysis of various dimensions, determinants, perspectives, and measurement approaches, offers several key conclusions.

Firstly, agricultural economic resilience encompasses two dimensions: static (maintaining stability) and dynamic (adapting and transforming into a qualitatively better state). The interplay between these dimensions, although not completely understood yet, should be recognized and considered in the strategies formed to increase resilience. Balancing stability with flexibility, is a potentially fruitful way of promoting overall resilience across diverse agricultural systems. Secondly, the micro and macro perspectives in agricultural economic resilience research have been identified to offer complementary insights into the resilience of farming systems. Micro-level analysis provides understanding of determinants and strategies of individual farms and communities' resilience, while macro-level analysis examines national policies and global frameworks impacting economic resilience at national and global levels. Integrating insights from both perspectives allows for the development of comprehensive approaches to address the diverse and increasing challenges faced by farming systems at different scales. Thirdly, agricultural economic resilience is influenced by an array of determinants encompassing environmental, socioeconomic, and institutional dimensions, however, the determinants are not universal, and vary significantly across different types of agricultural activity. Therefore, promoting resilience requires integrated approaches that balance ecological sustainability, economic viability, and social equity, tailored to the specific needs and challenges of diverse farming systems and agricultural communities. Fourthly, the measurement of economic agricultural resilience encompasses diverse approaches, ranging from quantitative to qualitative ones. Standardizing indicators and balancing quantitative and qualitative assessments is essential for accurately measuring economic resilience and at the same time grasping differences among different agricultural systems, thus informing evidence-based decision-making. Finally, by employing bibliometric methods, distinct thematic clusters have been identified, shedding light on the key topics, trends, and methodologies shaping this area of research.

Future research directions in agricultural economic resilience could be focused in the following directions: first, different sets of indicators for static and dynamic resilience could be derived. As it can be seen, that literature clearly distinguishes between these 2 types of resilience, although even the latest research in area (Volkov et al., 2025) use the unified set of indicators.

Another research direction stems from the analysis of economic agricultural resilience through the lens of farming types. It would be scientifically valuable to asses, which type of agricultural economic resilience is more relevant to different farming approaches. This would allow deriving tailored measures of increasing economic resilience of each of the farming types.

The third theoretical sprout could be oriented towards finding an answer, which level of agricultural economic resilience is considered acceptable, which sufficient, and which desirable? Having a quantitative benchmark would not only allow more meaningful comparisons between different farming types, countries, regulation regimes, but could also serve as a guidepost for some Governments aiming to achieve one or another level of agricultural economic resilience of their respective agricultural sectors.

In conclusion, promoting agricultural economic resilience requires a holistic understanding of its multidimensional nature, coupled with context-specific advantages and challenges faced by different farming systems. By embracing the duality of resilience phenomenon, integrating micro and macro perspectives, adopting complementary measurement approaches, addressing key determinants, and tailoring strategies to specific agricultural activities and contexts, stakeholders can foster resilient farming systems capable of thriving in the face of uncertainty and contributing to sustainable development globally. However, due to its vastly complex nature, the research of agricultural economic resilience is far from being over and needs to be continued in various directions, including the investigation of the relationships between different dimensions of resilience, standardization of economic resilience measurement, resilience determinants in the contexts of uncertainty, etc.

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References

Acevedo, M., Pixley, K., Zinyengere, N., Meng, S., Tufan, H., Cichy, K., Bizikova, L., Isaacs, K., Ghezzi-Kopel, K., & Porciello, J. (2020). A scoping review of adoption of climate-resilient crops by small-scale producers in low- and middle-income countries. *Nature Plants*, *6*(10), 1231–1241. https://doi.org/10.1038/s41477-020-00783-z

Adesra, A., Srivastava, V. K., & Varjani, S. (2021). Valorization of dairy wastes: Integrative approaches for value added products. *Indian Journal of Microbiology*, *61*(3), 270–278. https://doi.org/10.1007/s12088-021-00943-5

Ahmed, O., Faiz, M., Abdelali, L., Khoali, S., Pulvent, C., Mohamed, S., Mbaye, M. S., & Glauben, T. (2025). Unlocking climate change resilience: Socioeconomic factors shaping smallholder farmers' perceptions and adaptation strategies in Mediterranean and Sub-Saharan Africa regions. *Regional Sustainability*, *6*(1), Article 100195. https://doi.org/10.1016/j.regsus.2025.100195

Allison, H. E., & Hobbs, R. J. (2004). Resilience, adaptive capacity, and the "lock-in trap" of the Western Australian agricultural region. *Ecology And Society*, *9*(1), Article 3. https://doi.org/10.5751/ES-00641-090103

Amelework, A. B., Bairu, M. W., Maema, O., Venter, S. L., & Laing, M. (2021). Adoption and promotion of resilient crops for climate risk mitigation and import substitution: A case analysis of cassava for South African agriculture. *Frontiers in Sustainable Food Systems*, *5*, Article 617783. https://doi.org/10.3389/fsufs.2021.617783

Amo-Agyemang, C. (2021). Decolonising the discourse on resilience. *International Journal of African Renaissance Studies-Multi-, Inter-and Transdisciplinarity*, *16*(1), 4–30. https://doi.org/10.1080/18186874.2021.1962725

Anantha, K. H., Garg, K. K., Barron, J., Dixit, S., Venkataradha, A., Singh, R., & Whitbread, A. M. (2021). Impact of best management practices on sustainable crop production and climate resilience in smallholder farming systems of South Asia. *Agricultural Systems*, *194*, Article 103276. https://doi.org/10.1016/j.agsy.2021.103276

Ashkenazy, A., Calvão Chebach, T., Knickel, K., Peter, S., Horowitz, B., & Offenbach, R. (2018). Operationalising resilience in farms and rural regions – Findings from fourteen case studies. *Journal of Rural Studies*, *59*, 211–221. https://doi.org/10.1016/j.jrurstud.2017.07.008

Bali, A., Rawal, S., & Singla, K. (2023). Challenges and strategies to improve drought tolerance in plants through agronomic managements. In *Salinity and drought tolerance in plants* (pp. 491–506). Springer. https://doi.org/10.1007/978-981-99-4669-3_24

Barszczewski, M. (2024). How institutions are related to agriculture? Systematic literature review. *Research Papers in Economics and Finance*, *8*(1). https://doi.org/10.18559/ref.2024.1.924

Beckwith, L. (2021). No room to manoeuvre: Bringing together political ecology and resilience to understand community-based adaptation decision making. *Climate and Development*, *14*(2) 1–12. https://doi.org/10.1080/17565529.2021.1904811

Bennett, E. M., Baird, J., Baulch, H., Chaplin-Kramer, R., Fraser, E., Loring, P., Morrison, P., Parrott, L., Sherren, K., Winkler, K. J., Cimon-Morin, J., Fortin, M.-J., Kurylyk, B. L., Lundholm, J., Poulin, M., Rieb, J. T., Gonzalez, A., Hickey, G. M., Humphries, M., ..., & Lapen, D. (2021). Chapter one – Ecosystem services and the resilience of agricultural landscapes. *Advances in Ecological Research*, *64*, 1–43. https://doi.org/10.1016/bs.aecr.2021.01.001

Bertolozzi-Caredio, D., Garrido, A., Soriano, B., & Bardaji, I. (2021). Implications of alternative farm management patterns to promote resilience in extensive sheep farming. A Spanish case study. *Journal of Rural Studies*, *86*, 633–644. https://doi.org/10.1016/j.jrurstud.2021.08.007

Boehlje, M., & Trede, L. (1977). Risk management in agriculture. *Journal of ASFMRA*.

Boschma, R. (2015). Towards an evolutionary perspective on regional resilience. *Regional Studies*, *49*(5), 733–751. https://doi.org/10.1080/00343404.2014.959481

Buitenhuis, Y., Candel, J. J. L., Termeer, K. J. A. M., & Feindt, P. H. (2020). Does the common agricultural policy enhance farming systems' resilience? Applying the resilience assessment tool (ResAT) to a farming system case study in the Netherlands. *Journal of Rural Studies*, *80*, 314–327. https://doi.org/10.1016/j.jrurstud.2020.10.004

Carabaño, M. J., Ramón, M., Menéndez-Buxadera, A., Molina, A., & Díaz, C. (2019). Selecting for heat tolerance. *Animal Frontiers*, *9*(1), 62–68. https://doi.org/10.1093/af/vfy033

Carrico, A. R., Truelove, H. B., & Williams, N. E. (2019). Social capital and resilience to drought among smallholding farmers in Sri Lanka. *Climatic Change*, *155*(2), 195–213. https://doi.org/10.1007/s10584-019-02449-y

Chavez-Miguel, G., Bonatti, M., Ácevedo-Osorio, Á., Sieber, S., & Löhr, K. (2022). Agroecology as a grassroots approach for environmental peacebuilding: Strengthening social cohesion and resilience in post-conflict settings with community-based natural resource management. *GAIA – Ecological Perspectives for Science and Society*, *31*(1), 36–45. https://doi.org/10.14512/gaia.31.1.9

Coomes, O. T., Barham, B. L., MacDonald, G. K., Ramankutty, N., & Chavas, J.-P. (2019). Leveraging total factor productivity growth for sustainable and resilient farming. *Nature Sustainability*, *2*(1), 22–28. https://doi.org/10.1038/s41893-018-0200-3

Cowell, M., Gainsborough, J. F., & Lowe, K. (2016). Resilience and mimetic behavior: Economic visions in the great recession. *Journal of Urban Affairs*, *38*(1), 61–78. https://doi.org/10.1111/juaf.12210

Czekaj, M., Adamsone-Fiskovica, A., Tyran, E., & Kilis, E. (2020). Small farms' resilience strategies to face economic, social, and environmental disturbances in selected regions in Poland and Latvia. *Global Food Security*, *26,* Article 100416. https://doi.org/10.1016/j.gfs.2020.100416

Dardonville, M., Bockstaller, C., & Therond, O. (2021). Review of quantitative evaluations of the resilience, vulnerability, robustness and adaptive capacity of temperate agricultural systems. *Journal of Cleaner Production*, *286,* Article 125456. https://doi.org/10.1016/j.jclepro.2020.125456

Dardonville, M., Bockstaller, C., Villerd, J., & Therond, O. (2022). Resilience of agricultural systems: Biodiversity-based systems are stable, while intensified ones are resistant and high-yielding. *Agricultural Systems*, *197,* Article 103365. https://doi.org/10.1016/j.agsy.2022.103365

Darnhofer, I. (2014). Resilience and why it matters for farm management. *European Review of Agricultural Economics*, *41*(3), 461–484. https://doi.org/10.1093/erae/jbu012

Darnhofer, I. (2021). Resilience or how do we enable agricultural systems to ride the waves of unexpected change? *Agricultural Systems*, *187,* Article 102997. https://doi.org/10.1016/j.agsy.2020.102997

Davis, K. F., Downs, S., & Gephart, J. A. (2020). Towards food supply chain resilience to environmental shocks. *Nature Food*, *2*(1), 54–65. https://doi.org/10.1038/s43016-020-00196-3

Dong, L. (2020). Toward resilient agriculture value chains: Challenges and opportunities. *Production and Operations Management*, *30*(3), 666–675. https://doi.org/10.1111/poms.13308

Döring, T. F., Vieweger, A., Pautasso, M., Vaarst, M., Finckh, M. R., & Wolfe, M. S. (2015). Resilience as a universal criterion of health. *Journal of the Science of Food and Agriculture*, *95*(3), 455–465. https://doi.org/10.1002/jsfa.6539

Eakin, H., Sweeney, S., Lerner, A. M., Appendini, K., Perales, H., Steigerwald, D. G., Dewes, C. F., Davenport, F., & Bausch, J. C. (2018). Agricultural change and resilience: Agricultural policy, climate trends and market integration in the Mexican maize system. *Anthropocene*, *23*, 43–52. https://doi.org/10.1016/j.ancene.2018.08.002

El Chami, D., Daccache, A., & El Moujabber, M. (2020). How can sustainable agriculture increase climate resilience? A systematic review. *Sustainability*, *12*(8), Article 3119. https://doi.org/10.3390/su12083119

Farmaha, B. S., Sekaran, U., & Franzluebbers, A. J. (2022). Cover cropping and conservation tillage improve soil health in the southeastern United States. *Agronomy Journal*, *114*(1), 296–316. https://doi.org/10.1002/agj2.20865

Finger, R. (2023). Digital innovations for sustainable and resilient agricultural systems. *European Review of Agricultural Economics*, *50*(4), 1277–1309. https://doi.org/10.1093/erae/jbad021

Fröhlich, K., & Hassink, R. (2018). Regional resilience: A stretched concept? *European Planning Studies*, *26*(9), 1763–1778. https://doi.org/10.1080/09654313.2018.1494137

Ghag, S. B., Alok, A., Rajam, M. V., & Penna, S. (2022). Designing climate-resilient crops for sustainable agriculture: A silent approach. *Journal of Plant Growth Regulation*, *42*(10), 6503–6522. https://doi.org/10.1007/s00344-022-10880-2

Gil, J. D. B., Cohn, A. S., Duncan, J., Newton, P., & Vermeulen, S. (2017). The resilience of integrated agricultural systems to climate change. *Wiley Interdisciplinary Reviews Climate Change*, *8*(4). https://doi.org/10.1002/wcc.461

Gittins, P., & McElwee, G. (2024). Farm adaptive business strategies in crisis management: COVID-19. *Journal Of Rural Studies*, *111*, Article 103393. https://doi.org/10.1016/j.jrurstud.2024.103393

Goodwin, D., Holman, I., Pardthaisong, L., Visessri, S., Ekkawatpanit, C., & Rey Vicario, D. (2022). What is the evidence linking financial assistance for drought-affected agriculture and resilience in tropical Asia? A systematic review. *Regional Environmental Change*, *22*(1), Article 12. https://doi.org/10.1007/s10113-021-01867-y

Gržinić, G., Piotrowicz-Cieślak, A., Klimkowicz-Pawlas, A., Górny, R. L., Ławniczek-Wałczyk, A., Piechowicz, L., Olkowska, E., Potrykus, M., Tankiewicz, M., Krupka, M., Siebielec, G., & Wolska, L. (2023). Intensive poultry farming: A review of the impact on the environment and human health. *Science of the Total Environment*, *858*(3), Article 160014. https://doi.org/10.1016/j.scitotenv.2022.160014

Hansen, J., Hellin, J., Rosenstock, T., Fisher, E., Cairns, J., Stirling, C., Lamanna, C., van Etten, J., Rose, A., & Campbell, B. (2019). Climate risk management and rural poverty reduction. *Agricultural Systems*, *172*, 28–46. https://doi.org/10.1016/j.agsy.2018.01.019

Hazell, P. B. R. (1992). The appropriate role of agricultural insurance in developing countries. *Journal of International Development*, *4*(6), 567–581. https://doi.org/10.1002/jid.3380040602

Heeb, L., Jenner, E., & Cock, M. J. W. (2019). Climate-smart pest management: Building resilience of farms and landscapes to changing pest threats. *Journal of Pest Science*, *92*(3), 951–969. https://doi.org/10.1007/s10340-019-01083-y

Helfgott, A. (2018). Operationalising systemic resilience. *European Journal of Operational Research*, *268*(3), 852–864. https://doi.org/10.1016/j.ejor.2017.11.056

Hellin, J., Fisher, E., Taylor, M., Bhasme, S., & Loboguerrero, A. M. (2023). Transformative adaptation: From climate-smart to climate-resilient agriculture. *CABI Agriculture and Bioscience*, *4*(1). https://doi.org/10.1186/s43170-023-00172-4

Hellin, J., Ratner, B. D., Meinzen-Dick, R., & Lopez-Ridaura, S. (2018). Increasing social-ecological resilience within small-scale agriculture in conflict-affected Guatemala. *Ecology and Society*, *23*(3). https://doi.org/10.5751/ES-10250-230305

Hernández-Castellano, L. E., Nally, J. E., Lindahl, J., Wanapat, M., Alhidary, I. A., Fangueiro, D., Grace, D., Ratto, M., Bambou, J. C., & de Almeida, A. M. (2019). Dairy science and health in the tropics: Challenges and opportunities for the next decades. *Tropical Animal Health and Production*, *51*(5), 1009–1017. https://doi.org/10.1007/s11250-019-01866-6

Hilmi, Y. S., Tóth, J., Gabnai, Z., Király, G., & Temesi, Á. (2024). Farmers' resilience to climate change through the circular economy and sustainable agriculture: A review from developed and developing countries. *Renewable Agriculture and Food Systems, 39,* Article e15. https://doi.org/10.1017/S1742170524000097

Hirschfeld, S., & Van Acker, R. (2021). Review: Ecosystem services in permaculture systems. *Agroecology and Sustainable Food Systems*, *45*(6) 794–816. https://doi.org/10.1080/21683565.2021.1881862

Hu, X., & Hassink, R. (2020). Adaptation, adaptability and regional economic resilience: A conceptual framework. In G. Bristow & A. Healy (Eds.), *Handbook on regional economic resilience* (pp. 54–68). Edward Elgar Publishing. https://doi.org/10.4337/9781785360862.00009

Huang, X., Li, H., Zhang, X., & Zhang, X. (2018). Land use policy as an instrument of rural resilience – The case of land withdrawal mechanism for rural homesteads in China. *Ecological Indicators*, *87*, 47–55. https://doi.org/10.1016/j.ecolind.2017.12.043

Intergovermental Panel on Climate Change. (2019). Summary for policymakers. In P. R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, & J. Malley (Eds.), *Climate change and land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. IPCC. https://www.ipcc.ch/srccl/cite-report/

Ji, C., Jia, F., & Xu, X. (2018). Agricultural co-operative sustainability: Evidence from four Chinese pig production co-operatives. *Journal of Cleaner Production*, *197*, 1095–1107. https://doi.org/10.1016/j.jclepro.2018.06.279

Jones, P. J., Niemi, J., Christensen, J.-P., Tranter, R. B., & Bennett, R. M. (2019). A review of the financial impact of production diseases in poultry production systems. *Animal Production Science*, *59*(9), 1585–1597. https://doi.org/10.1071/AN18281

Kanatas, P. (2020). Mini-review: The role of crop rotation, intercropping, sowing dates and increased crop density towards a sustainable crop and weed management in arable crops. *Journal of Elementology*, *30*(1).

Kangogo, D., Dentoni, D., & Bijman, J. (2020). Determinants of farm resilience to climate change: The role of farmer entrepreneurship and value chain collaborations. *Sustainability*, *12*(3), Article 868. https://doi.org/10.3390/su12030868

Kemboi, D. C., Antonissen, G., Ochieng, P. E., Croubels, S., Okoth, S., Kangethe, E. K., Faas, J., Lindahl, J. F., & Gathumbi, J. K. (2020). A review of the impact of mycotoxins on dairy cattle health: Challenges for food safety and dairy production in Sub-Saharan Africa. *Toxins*, *12*(4), Article 222. https://doi.org/10.3390/toxins12040222

Kerr, A., Dialesandro, J., Steenwerth, K., Lopez-Brody, N., & Elias, E. (2018). Vulnerability of California specialty crops to projected mid-century temperature changes. *Climatic Change*, *148*(3), 419–436. https://doi.org/10.1007/s10584-017-2011-3

Kistner, E., Kellner, O., Andresen, J., Todey, D., & Morton, L. W. (2018). Vulnerability of specialty crops to short-term climatic variability and adaptation strategies in the Midwestern USA. *Climatic Change*, *146*(1–2), 145–158. https://doi.org/10.1007/s10584-017-2066-1

Knickel, K., Redman, M., Darnhofer, I., Ashkenazy, A., Calvão Chebach, T., Šūmane, S., Tisenkopfs, T., Zemeckis, R., Atkociuniene, V., Rivera, M., Strauss, A., Kristensen, L. S., Schiller, S., Koopmans, M. E., & Rogge, E. (2018). Between aspirations and reality: Making farming, food systems and rural areas more resilient, sustainable and equitable. *Journal of Rural Studies*, *59*, 197–210. https://doi.org/10.1016/j.jrurstud.2017.04.012

Kramer, B., Hellin, J., Hansen, J., Rose, A., & Braun, M. (2020). *Building resilience through climate risk insurance: Insights from agricultural research for development* (Working Paper No. 287). Climate Change, Agriculture and Food Security.

Krebs, J., & Bach, S. (2018). Permaculture–scientific evidence of principles for the agroecological design of farming systems. *Sustainability*, *10*(9), Article 3218. https://doi.org/10.3390/su10093218

Kukal, M. S., & Irmak, S. (2018). Climate-driven crop yield and yield variability and climate change impacts on the U.S. great plains agricultural production. *Scientific Reports*, *8*(1), Article 3450. https://doi.org/10.1038/s41598-018-21848-2

Kumar, P., & Singh, R. K. (2021). Strategic framework for developing resilience in agri-food supply chains during COVID 19 pandemic. *International Journal of Logistics Research and Applications*, *25*(11), 1401–1424. https://doi.org/10.1080/13675567.2021.1908524

Lammerts van Bueren, E. T., Struik, P. C., van Eekeren, N., & Nuijten, E. (2018). Towards resilience through systems-based plant breeding. A review. *Agronomy for Sustainable Development*, *38*(5), Article 42. https://doi.org/10.1007/s13593-018-0522-6

Langemeyer, J., Madrid-Lopez, C., Mendoza Beltran, A., & Villalba Mendez, G. (2021). Urban agriculture – A necessary pathway towards urban resilience and global sustainability? *Landscape and Urban Planning*, *210,* Article 104055. https://doi.org/10.1016/j.landurbplan.2021.104055

Läpple, D., & Thorne, F. (2018). The role of innovation in farm economic sustainability: Generalised propensity score evidence from Irish dairy farms. *Journal of Agricultural Economics*, *70*(1), 178–197. https://doi.org/10.1111/1477-9552.12282

Le, T. N., Bregt, A. K., van Halsema, G. E., Hellegers, P. J. G. J., & Nguyen, L.-D. (2018). Interplay between land-use dynamics and changes in hydrological regime in the Vietnamese Mekong Delta. *Land Use Policy*, *73*, 269–280. https://doi.org/10.1016/j.landusepol.2018.01.030

Leippert, F., Darmaun, M., Bernoux, M., & Mpheshea, M. (2020). *The potential of agroecology to build climate-resilient livelihoods and food systems*. Food and Agriculture Organization of the United Nations FAO and Biovision. https://doi.org/10.4060/cb0438en

Loewe, M., Zintl, T., & Houdret, A. (2021). The social contract as a tool of analysis: Introduction to the special issue on "Framing the evolution of new social contracts in Middle Eastern and North African countries". *World Development*, *145*, Article 104982. https://doi.org/10.1016/j.worlddev.2020.104982

Ma, Y., Mamun, A. A., Hoque, M. E., Masukujjaman, M., & Ja'afar, R. (2025). Modeling behavioral insights to mobilize private investment in climate change adaptation: Evidence from Chinese investors. *Environment Development and Sustainability*. https://doi.org/10.1007/s10668-025-06058-x

Mahalik, M. K., Mallick, H., & Padhan, H. (2021). Do educational levels influence the environmental quality? The role of renewable and non-renewable energy demand in selected BRICS countries with a new policy perspective. *Renewable Energy*, *164*, 419–432. https://doi.org/10.1016/j.renene.2020.09.090

Makarynska, A., & Vorona, N. (2023). Analysis of the poultry meat market and justification of expanding its range. *Zernovì Produkti ì Kombìkorma*, *22*(3), 25–32. https://doi.org/10.15673/gpmf.v22i3.2459

Mapp, H. P., Hardin, M. L., Walker, O. L., & Persaud, T. (1979). Analysis of risk management strategies for agricultural producers. *American Journal of Agricultural Economics*, *61*(5), 1071–1077. https://doi.org/10.2307/3180377

Marta Negri, M., Cagno, E., Colicchia, C., & Sarkis, J. (2021). Integrating sustainability and resilience in the supply chain: A systematic literature review and a research agenda. *Business Strategy and the Environment, 30*(7), 2858–2886. https://doi.org/10.1002/bse.2776

Martin, R., & Sunley, P. (2015). On the notion of regional economic resilience: conceptualization and explanation. *Journal of Economic Geography*, *15*(1), 1–42. https://doi.org/10.1093/jeg/lbu015

Mashi, S. A., Inkani, A. I., & Obaro, D. O. (2022). Determinants of awareness levels of climate smart agricultural technologies and practices of urban farmers in Kuje, Abuja, Nigeria. *Technology in Society*, *70*, Article 102030. https://doi.org/10.1016/j.techsoc.2022.102030

McClintock, N., & Simpson, M. (2018). Stacking functions: Identifying motivational frames guiding urban agriculture organizations and businesses in the United States and Canada. *Agriculture and Human Values*, *35*(1), 19–39. https://doi.org/10.1007/s10460-017-9784-x

Melvani, K., Bristow, M., Moles, J., Crase, B., & Kaestli, M. (2020). Multiple livelihood strategies and high floristic diversity increase the adaptive capacity and resilience of Sri Lankan farming enterprises. *Science of the Total Environment*, *739,* Article 139120. https://doi.org/10.1016/j.scitotenv.2020.139120

Meuwissen, M. P. M., Feindt, P. H., Spiegel, A., Termeer, C. J. A. M., Mathijs, E., Mey, Y. de, Finger, R., Balmann, A., Wauters, E., Urquhart, J., Vigani, M., Zawalińska, K., Herrera, H., Nicholas-Davies, P., Hansson, H., Paas, W., Slijper, T., Coopmans, I., Vroege, W., & Ciechomska, A. (2019). A framework to assess the resilience of farming systems. *Agricultural Systems*, *176,* Article 102656. https://doi.org/10.1016/j.agsy.2019.102656

Mfitumukiza, D., Roy, A. S., Simane, B., Hammill, A., Rahman, M. F., & Huq, S. (2020). *Scaling local and community-based adaptation* (Background Paper). GCA. https://gca.org/wp-content/uploads/2020/12/Local_Adaptation_Paper_-_Global_Commission_on_Adaptation.pdf

Möller, K. (2018). Soil fertility status and nutrient input–output flows of specialised organic cropping systems: A review. *Nutrient Cycling in Agroecosystems*, *112*(2), 147–164. https://doi.org/10.1007/s10705-018-9946-2

Morel, K., Léger, F., & Ferguson, R. S. (2019). Permaculture. *Encyclopedia of Ecology*, *4*, 559–567. https://doi.org/10.1016/B978-0-12-409548-9.10598-6

Morkunas, M., & Volkov, A. (2023). The progress of the development of a climate-smart agriculture in Europe: Is there cohesion in the European Union? *Environmental Management*, *71*(6), 1111–1127. https://doi.org/10.1007/s00267-022-01782-w

Morkūnas, M., Rudienė, E., & Ostenda, A. (2022). Can climate-smart agriculture help to assure food security through short supply chains? A systematic bibliometric and bibliographic literature review. *Business, Management and Economics Engineering*, *20*(2), 207–223. https://doi.org/10.3846/bmee.2022.17101

Morkūnas, M., Volkov, A., & Pazienza, P. (2018). How resistant is the agricultural sector? Economic resilience exploited. *Economics & Sociology*, *11*(3), 321–332. https://doi.org/10.14254/2071-789X.2018/11-3/19

Noor, S., Guo, Y., Shah, S. H. H., Nawaz, M. S., & Butt, A. S. (2020). Research synthesis and thematic analysis of twitter through bibliometric analysis. *International Journal on Semantic Web and Information Systems (IJSWIS), 16*(3), 88–109. https://doi.org/10.4018/IJSWIS.2020070106

Nüchter, V., Abson, D. J., Von Wehrden, H., & Engler, J. O. (2021). The concept of resilience in recent sustainability research. *Sustainability, 13*(5), Article 2735. https://doi.org/10.3390/su13052735

O'Hara, S. (2025). Living in the age of market economics: An analysis of formal and informal institutions and global climate change. *World*, *6*(1), Article 35. https://doi.org/10.3390/world6010035

Olfert, A., Walther, J., Hirschnitz-Garbers, M., Hölscher, K., & Schiller, G. (2021). Sustainability and resilience – a practical approach to assessing sustainability in innovative infrastructure projects. In G. Hutter, M. Neubert, & R. Ortlepp (Eds), *Building resilience to natural hazards in the context of climate change* (pp. 75–111). Springer. https://doi.org/10.1007/978-3-658-33702-5_5

Orzech, K., & Załuski, D. (2020). Effect of companion crops and crop rotation systems on some chemical properties of soil. *Journal of Elementology*, *25*(3), 931–949. https://doi.org/10.5601/jelem.2020.25.1.1904

Patrick, G. R., Wilson, P. N., Barry, P. J., Boggess, W. G., & Young, D. L. (1985). Risk perceptions and management responses: Producer-generated hypotheses for risk modeling. *Journal of Agricultural and Applied Economics*, *17*(2), 231–238. https://doi.org/10.1017/S0081305200025243

Petersen-Rockney, M., Baur, P., Guzman, A., Bender, S. F., Calo, A., Castillo, F., De Master, K., Dumont, A., Esquivel, K., Kremen, C., LaChance, J., Mooshammer, M., Ory, J., Price, M. J., Socolar, Y., Stanley, P., Iles, A., & Bowles, T. (2021). Narrow and brittle or broad and nimble? Comparing adaptive capacity in simplifying and diversifying farming systems. *Frontiers in Sustainable Food Systems*, *5*, Article 564900. https://doi.org/10.3389/fsufs.2021.564900

Petrović, B., Bumbálek, R., Zoubek, T., Kuneš, R., Smutný, L., & Bartoš, P. (2024). Application of precision agriculture technologies in Central Europe-review. *Journal of Agriculture and Food Research*, *15*, Article 101048. https://doi.org/10.1016/j.jafr.2024.101048

Pienaah, C. K., Antabe, R., Arku, G., & Luginaah, I. (2024). Farmer field schools, climate action plans and climate change resilience among smallholder farmers in Northern Ghana. *Climatic Change*, *177*(6), Article 90. https://doi.org/10.1007/s10584-024-03755-w

Pranckutė, R. (2021). Web of Science (WoS) and Scopus: The titans of bibliographic information in today's academic world. *Publications, 9*(1), Article 12. https://doi.org/10.3390/publications9010012

Robertson, I. D. (2020). Disease control, prevention and on-farm biosecurity: The role of veterinary epidemiology. *Engineering*, *6*(1), 20–25. https://doi.org/10.1016/j.eng.2019.10.004

Roesch-McNally, G. E., Arbuckle, J. G., & Tyndall, J. C. (2018). Barriers to implementing climate resilient agricultural strategies: The case of crop diversification in the U.S. Corn Belt. *Global Environmental Change*, *48*, 206–215. https://doi.org/10.1016/j.gloenvcha.2017.12.002

Roy, T., & George, K. J. (2020). Precision farming: A step towards sustainable, climate-smart agriculture. In *Global climate change: Resilient and smart agriculture* (pp. 199–220). Springer. https://doi.org/10.1007/978-981-32-9856-9_10

Romeo, R., Manuelli, S., Geringer, M., & Barchiesi, V. (2021). *Mountain farming systems – Seeds for the future: Sustainable agricultural practices for resilient mountain livelihoods*. Food and Agriculture Organization of the United Nations. https://doi.org/10.4060/cb5349en

Sá, M. M. de, Miguel, P. L. de S., Brito, R. P. de, & Pereira, S. C. F. (2019). Supply chain resilience: The whole is not the sum of the parts. *International Journal of Operations & Production Management*, *40*(1), 92–115. https://doi.org/10.1108/IJOPM-09-2017-0510

Schneider, F., Morkunas, M., & Quendler, E. (2023). An estimation of the informal economy in the agricultural sector in the EU-15 from 1996 to 2019. *Agribusiness*, *39*(2), 406–447. https://doi.org/10.1002/agr.21774

Schreinemachers, P., Simmons, E. B., & Wopereis, M. C. S. (2018). Tapping the economic and nutritional power of vegetables. *Global Food Security*, *16*, 36–45. https://doi.org/10.1016/j.gfs.2017.09.005

Serfilippi, E., & Ramnath, G. (2018). Resilience measurement and conceptual frameworks: A review of the literature. *Annals of Public and Cooperative Economics*, *89*(4), 645–664. https://doi.org/10.1111/apce.12202

Shafik, M. (2021). *What we owe each other: A new social contract for a better society*. Princeton University Press. https://doi.org/10.1515/9780691220277

Shahbaz, P., ul Haq, S., Abbas, A., Batool, Z., Alotaibi, B. A., & Nayak, R. K. (2022). Adoption of climate smart agricultural practices through women involvement in decision making process: Exploring the role of empowerment and innovativeness. *Agriculture*, *12*(8), Article 1161. https://doi.org/10.3390/agriculture12081161

Spiegel, A., Soriano, B., Mey, Y., Slijper, T., Urquhart, J., Bardají, I., Vigani, M., Severini, S., & Meuwissen, M. (2020). Risk management and its role in enhancing perceived resilience capacities of farms and farming systems in Europe. *EuroChoices*, *19*(2), 45–53. https://doi.org/10.1111/1746-692X.12284

Srivastav, A. L., Dhyani, R., Ranjan, M., Madhav, S., & Sillanpää, M. (2021). Climate-resilient strategies for sustainable management of water resources and agriculture. *Environmental Science and Pollution Research*, *28*(31), 41576–41595. https://doi.org/10.1007/s11356-021-14332-4

Sukhwani, V., Shaw, R., Mitra, B. K., & Yan, W. (2019). Optimizing Food-Energy-Water (FEW) nexus to foster collective resilience in urban-rural systems. *Progress in Disaster Science*, *1*, Article 100005. https://doi.org/10.1016/j.pdisas.2019.100005

Suresh, A., Krishnan, P., Jha, G. K., & Reddy, A. A. (2022). Agricultural sustainability and its trends in India: A macro-level index-based empirical evaluation. *Sustainability*, *14*(5), Article 2540. https://doi.org/10.3390/su14052540

Šūmane, S., Kunda, I., Knickel, K., Strauss, A., Tisenkopfs, T., Rios, I. des I., Rivera, M., Chebach, T., & Ashkenazy, A. (2018). Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture. *Journal of Rural Studies*, *59*, 232–241. https://doi.org/10.1016/j.jrurstud.2017.01.020

Tahat, M. M., Alananbeh, K. M., A. Othman, Y. A., & Leskovar, D. I. (2020). Soil health and sustainable agriculture. *Sustainability*, *12*(12), Article 4859. https://doi.org/10.3390/su12124859

Tedersoo, L., Küngas, R., Oras, E., Köster, K., Eenmaa, H., Leijen, Ä., Pedaste, M., Raju, M., Astapova, A., Lukner, H., Kogermann, K., & Sepp, T. (2021). Data sharing practices and data availability upon request differ across scientific disciplines. *Scientific Data, 8*(1), Article 192. https://doi.org/10.1038/s41597-021-00981-0

Tittonell, P. (2020). Assessing resilience and adaptability in agroecological transitions. *Agricultural Systems*, *184,* Article 102862. https://doi.org/10.1016/j.agsy.2020.102862

Trivellas, P., Mavrommati, S., Anastasopoulou, A., Grapas, C., & Kallikantzarou, E. (2023). Agro living labs: Creating innovative, sustainable, resilient and social inclusive food systems. *IOP Conference Series Earth and Environmental Science*, *1185*(1), Article 012036. https://doi.org/10.1088/1755-1315/1185/1/012036

Tu, C., Suweis, S., & D'Odorico, P. (2019). Impact of globalization on the resilience and sustainability of natural resources. *Nature Sustainability*, *2*(4), 283–289. https://doi.org/10.1038/s41893-019-0260-z

Urruty, N., Tailliez-Lefebvre, D., & Huyghe, C. (2016). Stability, robustness, vulnerability and resilience of agricultural systems. A review. *Agronomy for Sustainable Development*, *36*(1), Article 15. https://doi.org/10.1007/s13593-015-0347-5

Usman, M., & Ho, Y. S. (2020). A bibliometric study of the Fenton oxidation for soil and water remediation. *Journal of Environmental Management, 270*, Article 110886. https://doi.org/10.1016/j.jenvman.2020.110886

Valencia, V., Wittman, H., & Blesh, J. (2019). Structuring markets for resilient farming systems. *Agronomy for Sustainable Development*, *39*(2), Article 25. https://doi.org/10.1007/s13593-019-0572-4

Van, J., Kangogo, D., Gülzari, Ş. Ö., Dentoni, D., Oosting, S. J., Bijman, J., & Klerkx, L. (2022). Theoretical positions and approaches to resilience assessment in farming systems. A review. *Agronomy for Sustainable Development*, *42*(2), Article 27. https://doi.org/10.1007/s13593-022-00755-x

Velasco-Muñoz, J. F., Mendoza, J. M. F., Aznar-Sánchez, J. A., & Gallego-Schmid, A. (2021). Circular economy implementation in the agricultural sector: Definition, strategies and indicators. *Resources, Conservation and Recycling*, *170*, Article 105618. https://doi.org/10.1016/j.resconrec.2021.105618

Volkov, A., Balezentis, T., Morkunas, M., & Streimikiene, D. (2019). Who benefits from CAP? The way the direct payments system impacts socioeconomic sustainability of small farms. *Sustainability*, *11*(7), Article 2112. https://doi.org/10.3390/su11072112

Volkov, A., Morkunas, M., Balezentis, T., & Streimikiene, D. (2022). Are agricultural sustainability and resilience complementary notions? Evidence from the North European agriculture. *Land Use Policy*, *112*, Article 105791. https://doi.org/10.1016/j.landusepol.2021.105791

Volkov, A., Morkūnas, M., Zickiene, A., & Rudiene, E. (2025). Will European agriculture be resilient? Assessment of the share and economic resilience levels of the future European farmer profiles: Evidence from Lithuania. *Agricultural and Food Economics, 13,* Article 16. https://doi.org/10.1186/s40100-025-00361-x

Vroegindewey, R., & Hodbod, J. (2018). Resilience of agricultural value chains in developing country contexts: A framework and assessment approach. *Sustainability*, *10*(4), Article 916. https://doi.org/10.3390/su10040916

Wang, D., Saleh, N. B., Byro, A., Zepp, R., Sahle-Demessie, E., Luxton, T. P., Ho, K. T., Burgess, R. M., Flury, M., White J. C., & Su, C. (2022). Nano-enabled pesticides for sustainable agriculture and global food security. *Nature Nanotechnology*, *17*(4), 347–360. https://doi.org/10.1038/s41565-022-01082-8

Wang, J., Vanga, S., Saxena, R., Orsat, V., & Raghavan, V. (2018). Effect of climate change on the yield of cereal crops: A review. *Climate*, *6*(2), Article 41. https://doi.org/10.3390/cli6020041

Wang, Q., Zhou, H., & Zhao, X. (2023). The role of supply chain diversification in mitigating the negative effects of supply chain disruptions in COVID-19. *International Journal of Operations & Production Management*, *44*(1), 99–132. https://doi.org/10.1108/IJOPM-09-2022-0567

Williams, C. C., & Horodnic, A. (2018). *Tackling undeclared work in the agricultural sector* (European Platform Undeclared Work, 2021-09). European Platform. https://doi.org/10.2139/ssrn.3437406

Wilson, G. A., Hu, Z., & Rahman, S. (2018). Community resilience in rural China: The case of Hu Village, Sichuan Province. *Journal of Rural Studies*, *60*, 130–140. https://doi.org/10.1016/j.jrurstud.2018.03.016

Wulandhari, N. B. I., Gölgeci, I., Mishra, N., Sivarajah, U., & Gupta, S. (2022). Exploring the role of social capital mechanisms in cooperative resilience. *Journal of Business Research*, *143*, 375–386. https://doi.org/10.1016/j.jbusres.2022.01.026

Wulanningtyas, H. S., Gong, Y., Li, P., Sakagami, N., Nishiwaki, J., & Komatsuzaki, M. (2021). A cover crop and no-tillage system for enhancing soil health by increasing soil organic matter in soybean cultivation. *Soil and Tillage Research*, *205,* Article 104749. https://doi.org/10.1016/j.still.2020.104749

Yang, Z., Gao, X., Lei, J., Meng, X., & Zhou, N. (2022). Analysis of spatiotemporal changes and driving factors of desertification in the Africa Sahel. *Catena*, *213*, Article 106213. https://doi.org/10.1016/j.catena.2022.106213

Yin, H., Cao, Y., Marelli, B., Zeng, X., Mason, A. J., & Cao, C. (2021). Soil sensors and plant wearables for smart and precision agriculture. *Advanced Materials*, *33*(20). https://doi.org/10.1002/adma.202007764

Yu, T., Mahe, L., Li, Y., Wei, X., Deng, X., & Zhang, D. (2022). Benefits of crop rotation on climate resilience and its prospects in China. *Agronomy*, *12*(2), Article 436. https://doi.org/10.3390/agronomy12020436

Zhu, J., & Liu, W. (2020). A tale of two databases: The use of Web of Science and Scopus in academic papers. *Scientometrics, 123*(1), 321–335. https://doi.org/10.1007/s11192-020-03387-8

Žičkienė, A., Melnikienė, R., Morkūnas, M., & Volkov, A. (2022). CAP direct payments and economic resilience of agriculture: Impact assessment. *Sustainability*, *14*(17), Article 10546. https://doi.org/10.3390/su141710546