Original Paper

Theories and models for sustainable agroecology business networks.

Lessons for agroecology business networks and markets in Eastern Uganda-Teso region

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Received: 20 March 2025 | **Accepted:** 23 May 2025 | **Published:** 7 June 2025

Keywords: agroecology; sustainability; theories; models; business.

Abstract. *We study theories and models for sustainable agroecology business networks and lessons applicable to agroecology businesses and markets in Eastern Uganda. Agroecology, as both a science and social movement, offers promising solutions for building resilient food systems. However, transitioning from conventional market-driven agriculture to agroecology-based systems presents challenges, particularly in the marketing of agroecological products. To address this gap, we examine various theories and models for sustainable agroecological business networks, aiming to identify interventions that catalyse the transitioning and sustainability of agroecological business networks through enhanced marketing. Methods involved document analysis, following interpretive qualitative research, and stakeholder participatory market system mapping and development. The results indicated seven theories shaping the principles and practices of agroecology business networks, one approach for developing market systems, and ten models for social, economic, and environmental interventions in agroecology networks. The Model for Women's Entrepreneurship in Agroecology and Food Systems scored the highest at 93% to address the disablers of transitioning towards agroecology. From this model, and with support of other literature, we proposed the EquiAgro; A gender-inclusive Agroecological Business Model for Agroecology Business Networks and Markets. Our conclusions provide strategies for co-creating sustainable, resilient and socially inclusive agricultural systems that prioritize environmental stewardship and community well-being.*

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1. Introduction

Agroecology embraces diverse, sustainable farming practices. Sustainable food systems research has been high on the global agenda (Doner & De Vries, 2023) since the 2021 United Nations Food Summit (UN, 2021). With the integration of ecological principles into agriculture, agroecology has gained prominence as a sustainable farming approach with the potential to build climate-resilient

livelihoods and food systems (Leippert et al., 2020). Recently, Wezel (2015) clarified the confusion around agroecology, showing it as a science, social movement, and set of practices using indigenous knowledge to promote biodiversity and sustainable production without applying agrochemicals (Rossing et al., 2020). It applies the food system perspective by linking with systems ecology and represents a transdisciplinary scientific field in which concepts from systems ecology are linked to agriculture, focusing particularly on smallholder farms (Gliessman et al., 2017). In the agri-food sector, sustainability is crucial because this sector contributes enormously to environmental and socioeconomic impacts (Doner & De Vries, 2023).

According to FAO (2020), market-driven agriculture that mainly focuses on productivity and income generation leads to unsustainable food systems, characterized by extreme societal imbalances, inequitable food distribution, food waste, and environmental destruction. These systems have mainly disadvantaged smallholder farmers by limiting their contribution to achieving Zero Tolerance to Poverty (SDG 1.0), food and nutrition security (SDG 2.0-Zero Hunger), and life on land/resilient systems (SDG 15.0) (UN, 2015). Therefore, sustainable food systems, as defined by Brundtland et al., (1987), envisage a food system that is sufficient, healthy, and available for all generations and in line with the environmental carrying capacity of the planet (Rockström et al., 2009). Such resilient and sustainable food systems should also be well aligned and supported by government policies (Namanji, 2024). We need to clearly understand how an agroecology-market-driven system can solve the current problem of market-driven agriculture, taking the case of the Teso region in Eastern Uganda.

1.1 Problem statement and aim of the study

In Eastern Uganda, the McKnight Foundation initiated the Collaborative Crop Research Programme-Farmer Research Network (CCRP-FRN) towards the establishment and success of Agroecology business networks as a crucial aspect of sustainable development SDGs (2015). However, recently Ssekyewa et al. (2022) indicate that, on average, farmer agroecology businesses/markets in the Teso region were only 53% agroecological. In addition, small-scale farmers in Teso FRNs who were supported over time under CCRP tested and proved agroecological practices to be favorable in increasing productivity while contributing to environmental and social sustainability. However, surplus agroecological products beyond their household needs cannot be marketed within the existing market outlet system. Projects noted this as a potential demotivation for sustaining agroecological practices and businesses, so the need

to review agroecology business models, identify best practices, and co-develop an agroecology business and market model that can be adopted in Eastern Uganda through participatory market mapping (Practical Action, n.d.).

This article explores various agro-ecological business theories and models that can be applied in relation to social, economic, and environmental interventions, offering valuable lessons for the thriving of Agroecology business networks (AEBNs) and markets in this region. The aim is to tackle Learning Question 4 of McKnight Foundation funded project on 'Inclusive Learning, Co-creation and Sharing of Knowledge on Transitioning to Agroecology catalysed by access to markets'. Therefore, based on other existing and related models of ABNs, this research mainly answers two questions: What are the social, economic, and environmental interventions required to enable ABNs in the Teso region to break even, thrive, and attain resilience and sustainability? Second, what is the best-fit agroecological market or business model for FRNs in Eastern Uganda? To answer these questions effectively, this study reviewed theories and models for sustainable agroecological business networks with the guidance of a theoretical and analytical framework for AEBNs.

2. The theoretical and analytical framework for Agroecology Business Networks

Several foundational theories shape the principles and practices of agro-ecological business networks. When agroecological business networks integrate these foundational theories, the result is a sustainable, resilient, and socially inclusive agricultural system that prioritizes environmental stewardship and community well-being (Figure 1).

Agroecology business networks (AEBNs) are collaborative platforms that bring together various stakeholders in the agricultural sector, including producers, processors, marketers/outlets, consumers, researchers, and policymakers. These networks focus on promoting and implementing agroecological practices, sharing knowledge, and markets 'through networking and social organization' (Anderson, 2019, p. 28), which prioritize sustainable and environmentally friendly approaches to farming. They may facilitate co-learning regarding agroecology farming, biodiversity conservation, soil health, and other sustainable agricultural practices. By fostering collaboration, AEBNs seek to create sustainable agroecology businesses, set up with consideration of agroecology principles, and anchored by the circular and solidarity economy principles. It is worth noting that there are challenges with businesses due to the failure to

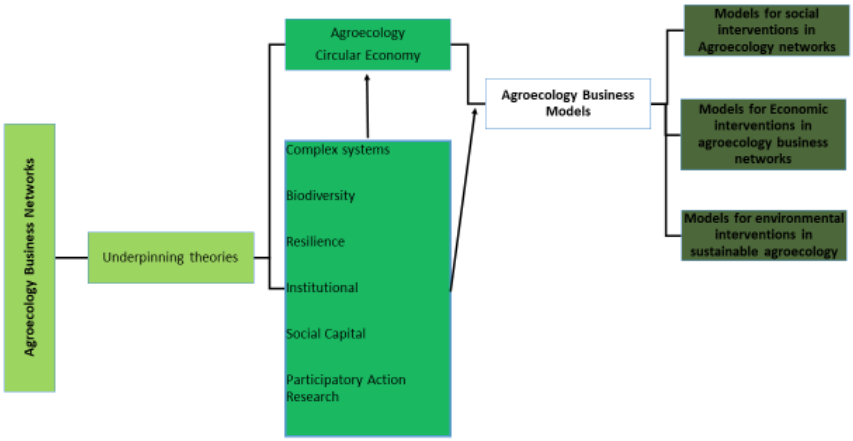

Figure 1. Theoretical framework for agroecology business networks

recognize holistic, multisector, and multi-actor considerations, thus working in silos between different approaches and actor groups (Anderson, 2019, p. 28). AEBNs help bridge this gap by embracing the landscape approach and, hence, be holistic in all aspects. Other related key theories that act as enablers of successful AEBNs include the Complex systems theory (Capra, 1996; Eksvard et al., 2014; Hammond, 1997; Jacobson et al., 2011; Jenny & Russel, 2001; Laszlo & Kripner,1998; Kim, 1999; Mitchel & Newman, 2002; Midega et al., 2018; Green & Sadedin, 2005; Checkland, 1981; Oner & Saritas, 2005; Wilson, 2008), Biodiversity (Boyle & Boontawee, 1995; Brundtland, 1986; UNCBD, 1992; Barrios et al., 2020; UNSDG, 2015; West & Brockington, 2006), Resilience (Leippert, 2020; Bohan et al., 2013; Anderson, 2019, Ajen at al., 2019; Altieri et al., 2015; FAO, 2014; Folke et al., 2010), Institutional (Isgren & Ness, 2014; Fuenfschilling, 2014; Bastian & Coveney, 2013; Bazaara, 2003; Namanji et al., 2017; North, 1990; Ostrom, 2008; Ribot et al., 2010), Social capital (Lin, 1999; Nieves & Osorio, 2013; Zhong et al., 2012) and Participatory (Lopez-Garcia et al., 2018; Mier et al., 2018; Guzman, 2013; Mandez et al., 2017; Cuellar-Padilla & Calle-Collado, 2011; Brundtland, 1986; Chambers, 1992; 1997; 2010) theories (Table 1). These theories guide social, economic, and environmental interventions in agroecology businesses, leading to equitable food systems in which agroecological market actors together make sense of the market system

and identify actions that support improved inclusivity and market growth (Practical Action, n.d.). To clearly articulate the theories underpinning AEBNs, this review applied a content analytical framework (La Das, 2008). Following the steps of content analysis, we first decided the level of analysis as themes and flexibly decided the number of concepts to include in order to answer the research questions. In addition, we applied interpretive qualitative analysis (Guba & Lincoln, 1994; Tubey et al., 2015; Yanow, 2015), acknowledging the importance of interpretivism. This theoretical and analytical framework provides answers to research questions using relevant materials and methods.

3. Materials and methods

3.1 Study description

The Teso sub-region, previously known as Teso District, is a sub-region in Eastern Uganda that consists of Amuria, Bukedea, Kaberamaido, Kapelebyong, Katakwi, Kumi, Ngora, Serere, and Soroti Districts. The sub-region covers an area of 13,030.6 km and is home to an estimated 2.5 million people of Iteso and Kumam ethnicities. Politically, the Pallisa District does not belong to the Teso sub-region, although it populates larger parts of this district[1]. Teso is counted among the most progressive farmers of Uganda, and the region is composed of one livelihood Zone Eastern-Central Low Land, Cassava, Sorghum, and Groundnuts zones. The crops grown included cassava, sweet potatoes, sorghum, finger millet, peas, groundnuts, maize, and rice maize. Other oil seed crops include Simsim and sunflower. Cotton is a major cash crop. Mixed crops and livestock farming are practiced, and cultivation using oxen is the primary agricultural technology. Livestocks are kept extensively in areas that are tsetse-fly free, and the use of crop residues is very common[2].

We need to clearly understand the status of AEBNs in the Teso region by taking case studies from the project areas, including the Bukedea, Pallisa and Soroti districts. In a series of workshops, we conducted co-learning with the respective project AEBNs, as shown (Table 1).

Table 1. CCRP-FRN Projects with products considered for furthering the transition to agroecology [Appendix A]

[1] Dbedia: Teso sub-region
[2] https://www.facebook.com/1ateso/posts/food-and-the-ugandan-cuisine-the-ugandan-cuisine-is-very-much-focused-on-carbohy/1089632544477865/

We gathered the characteristics of project AEBNs to establish their enablers and disablers towards transitioning to agroecology. Through Participatory Market Systems Development (PMSD), we co-created the most appropriate agroecology business and market model that can be adopted in Eastern Uganda. We compared the primary findings from the respective AEBNs to the existing literature on agroecology business models through document review and analysis.

3.2 Document analysis

This review primarily followed interpretive qualitative research by reading relevant documents as appropriate data sources. To achieve this, we applied a document analysis method (Bowen, 2009) that involved a back-and-forth interplay with the relevant documents and scrutinized and compared the literature content to generate organized and categorized ideas. First, we explored academic journals, books, and research papers on agroecology and related business models to understand existing theories and practices. Second, we utilized online databases, such as Google Scholar, to find relevant articles, case studies, and reports. Third, we checked government reports from agricultural and environmental departments, as they often contain valuable insights into agroecological initiatives and policies. Fourth, we visited the websites of non-governmental organizations (NGOs) and international agencies such as FAO, IFOAM, the National Organic Agriculture Movement of Uganda (NOGAMU), Participatory Ecological Land-Use Management (PELUM-UGANDA), and Agroecology Europe for reports and case studies relevant to the African context. Fifth, we checked the websites of the companies involved in agroecology to understand their business models, strategies, and success stories. In doing so, we critically evaluated sources and cross-referenced information and considered the context and applicability of each business model in different geographical and socio-economic settings. We organised this information through text categorization and identifying patterns and themes that allowed for its complete analysis, and presentation in tables.

4. Results and discussion

The results identify seven theories as underpinning AEBNs, one approach to develop a market system, and ten models for social, economic, and environmental interventions in agroecology networks.

4.1 Theories underpinning Agroecology business networks

Agroecology encompasses the study of ecological processes applied to agricultural systems and provides the relationship between agricultural production systems and ecological processes, where agriculture is more respectful of the environment and its ecological specificities (FAO, 2016).

Scholars highlight diverse perspectives on what constitutes a theory[3]. For instance, Dennis McQuail (1983) shows a theory as consisting of a set of ideas of varying status and origin which seek to explain or interpret some phenomenon. Kurt Lewin (1958) indicates a theory as a way of explaining the ordering and recurrence of various events in the ecosphere, while Wilbur Schramm (1963) identifies a theory as something that acts as a "crap-detector" enabling us to separate scientific statements from unscientific ones, and Severin and Tankard (1982) showed a theory as a set of ideas of systematic generalizations based on scientific observation, leading to further empirical observation. In common, all definitions emphasize that theories aim to explain phenomena or events, are systematic, meaning they are organized and structured sets of ideas, often involve generalizations that apply to multiple instances or observations, are based on scientific observation and evidence, and are essential tools in both understanding and predicting aspects of the natural and social world. Therefore, in the context of this study, below are theories and approaches found relevant to the AE business and markets.

4.1.1. Circular and solidarity economy

The circular and solidarity economy principle is central to AEBNs because this principle emphasizes the efficient use of resources minimization of waste, thus aligning with sustainable development goals (UN-SDGs, 2015). The SDGs that are most relevant to this principle and which also inform this research, include 1-*No poverty*; 2-*Zero hunger*; 3-*Good health and well-being*; 5-*Gender equality*; 8-*Inclusive decent work and economic growth*; 12-*Resiponsible consumption and production patterns*; 15-*Life on earth* and 17-*Partnerships for sustainable development*. These SDGs contribute to the realization of sustainable complex systems.

4.1.2 Complex systems theory

Sustainable complex systems are envisaged in complex systems theory (Capra, 1996; Eksvärd et al., 2014; Hammond, 1997; Jenny & Russel, 2001; Laszlo & Krippner, 1998) in which agroecology views agricultural systems as complex,

[3] Ten scholarly definitions of theory with relevant citations

dynamic systems with interconnected components. This theory recognizes nonlinear interactions within ecosystems, highlighting the importance of understanding the entire system rather than isolated parts. This then forms a system as a structured set with components that function interactively (Kim, 1999; Eksvard et al., 2014) and share a lot of information and energy with its environment, which is transformed from input to output. This system is open and provides and receives feedback through the transmission and return of information rather than the usual way of perceiving the world as a linear cause-effect perspective. Therefore, the feedback loop shows the interconnected elements and relationships in world systems (Kim, 1999). The United Nations Development Group (2010), Checkland (1981), Eksvärd et al. (2014), and Oner and Saritas (2005) describe open and complex systems, emphasising the focus beyond our immediate system to broaden our understanding of the entire system at the landscape level (Wilson, 2008). To achieve this open-mindedness, these scholars encourage us to utilize systems thinking, a cognitive process that involves thinking about the world using the concept of systems in terms of processes, connectedness, and relationships rather than isolated elements (Capra, 1996; Eksvärd et al., 2014; Hammond, 1997; Jenny & Russel, 2001; Namanji et al., 2016; 2017). Thus, dealing with various interactions within the system would ensure the sustainable use of resources for sustainable development as is also articulated (United Nations Development Group, 2010). This complexity forces us to integrate ideas that seem mutually exclusive within the framework of reductionist thinking (Morin, 1992, p. 381), by taking apparent opposites such as men and women, society and ecosystem, and reason and emotion as interdependent complements that should coexist in harmony and unity.

In the context of this study, attaining sustainable systems requires a holistic approach that acknowledges the interconnectedness of social, economic, and environmental issues, and plays an important role in mapping market systems.

4.1.3 Market systems mapping

In developing market systems, market mapping reflects systems thinking, in which market actors identify the interconnections and relations with one another (Practical Action, n.d.). Thus, an agroecology business must recognize and take advantage of the complexity of various actors and components in the landscape, with their inherent interconnectedness. Accordingly, Participatory Market Mapping (PMM) engages various stakeholders such as producers, processors, suppliers, consumers, employees, and partners in the process of creating a market map (Albu & Griffith, 2006). Instead of being driven solely by internal perspectives or market research, the PMM integrates the insights, experiences,

and perspectives of those directly involved in or directly affected by market dynamics. This approach fosters collaboration, generates diverse viewpoints, and leads to more comprehensive and actionable market insights and strategies. PMM works hand-in-hand with Participatory Market Systems Development (PMSD), and both approaches emphasize the involvement and collaboration of various stakeholders in understanding and improving market dynamics. While PMM focuses on creating visual representations of the market landscape through stakeholder engagement, PMSD takes a broader perspective by engaging stakeholders in analyzing and enhancing the entire market system, including its structures, relationships, and processes. The aim of the PMSD is to address systemic issues and promote sustainable market development by fostering collaboration, identifying opportunities for innovation and inclusion, and facilitating innovation among diverse stakeholders (Horton et al., 2023; Albu & Griffith, 2006; Griffith, 2008; Bamuturaki et al., 2018). This implies acknowledging the importance of diversity within networks and agroecological businesses.

4.1.4 Biodiversity

Diverse agroecology businesses enhance community resilience by reducing vulnerability to pests, diseases, and environmental changes and ensuring a more stable food supply through inclusivity by accommodating different farming practices and the needs of various community members. Diversified and ecologically sound agricultural practices lead to diversification of income-generating activities and local economic empowerment. Biodiversity is the variety and variability among living organisms and the ecological complexes in which they occur (Boyle and Boontawee, 1995). The World Community committed itself to conserving biodiversity, sustainable resource use, and the fair sharing of genetic resources as a means to achieve sustainability (UNCBD, 1992). In the context of agroecology businesses and networks, biodiversity encourages the involvement of a variety of plant and animal species in agricultural systems. This implies the creation of resilient ecosystems, pest control, and sustainable agricultural practices. Diverse crops and ecosystems within agroecological networks enhance overall system stability and productivity, reducing dependence on external inputs such as pesticides. A biodiverse approach is advantageous for fostering more balanced and resilient agricultural and agroecological business systems, aligning with the elements and principles of agroecology (Barrios et al., 2020) as envisaged in resilience theory.

4.1.5 Resilience theory

Accordingly, agroecological business networks draw from resilience theory as one of the crucial production elements of agroecology (Leippert, 2020), to enhance the capacity of farming systems to reduce sensitivity and to adapt and recover from disturbances. This involves building diverse and robust agroecological networks (Bohan et al., 2013) that can withstand shocks and changes as well as understanding the connectedness of individual land-use decisions with landscape dynamics (Anderson, 2019). To achieve sustainability, AEBNs should have the capacity to absorb disturbances, adapt to changing conditions, and maintain their essential functions and structures. These business networks must build agricultural production, processing, marketing, and consumer systems that can withstand shocks such as climate variability, technological changes, market fluctuations, and changing consumer needs, while promoting sustainability. Thus, there is a need to emphasize the interconnectedness of ecological, economic, and social elements within all systems (Ajena et al., 2020). To achieve this, applying institutional theory is paramount.

4.1.6 Institutional theory

This plays a crucial role of aligning practices with sustainable principles because, success in agroecology as a practice and agroecology networks are influenced by institutional 'designs in regard to knowledge, markets and policies' (Isgren & Ness, 2014, p. 14), as well as recognizing the importance of formal and informal rules, norms, and structures that shape behavior and coordinated activities of social groups (Fuenfschilling, 2014) within the agriculture sector.

4.1.7 Participatory action research theory

A stable institutional structure is one in which there is inclusiveness and stakeholders within that system are part of the decision-making process where Participatory Action Research (PAR) theory promotes local sovereignty and empowerment (López-García et al., 2018; Mier et al., 2018). As a collaborative methodological approach, PAR enables local communities to achieve the autonomy and self-management of their food systems (Guzman, 2013).

PAR in agroecology business networks involves producers, processors, marketers, and business owners as active participants in research and decision-making processes. PAR principles emphasize collaborative, inclusive approaches where local knowledge is combined with scientific expertise to develop context-specific solutions to address social practices that cause global concerns, such as

environmental damage (Kemmis, 2013). Although there are some critiques of action research as a method of social inquiry (McTaggart, 1994), this practice remains the most preferred and justified mode of inquiry (Guzman, 2013; Mendez et al., 2017; Cuéllar-Padilla & Calle-Collado, 2011) and its principles are in line with Social Capital theory (Lin, 1999).

4.1.8 Social capital theory

The success of agroecological networks relies on social capital, emphasizing the value of relationships, trust, and cooperation among actors in the agricultural value chain. In this context, farmers, producers, processors, marketers, and businesses benefit more from cooperation because strong social networks facilitate knowledge sharing, resource exchange, and collective decision making (Nieves & Osorio, 2013; Zhong et al., 2012). We need to gain an understanding of how these theories apply to agroecology business models through the lens of social, economic, and environmental interventions for agroecology business networks and propose a market/business model for agroecology farmer research networks in Eastern Uganda.

4.2 Business and Market Models for Agroecology Business Networks

In this section, we characterize the different business and market models. A model is a simplified representation of a system, phenomenon, or process that is used to explain, predict, or understand its behavior (Murray,2007; Halloun, 2007). This definition highlights that models are essential for simplifying complex systems, making them easier to study and understand. They are used across various disciplines to test theories, make predictions, and provide insights into the workings of different phenomena. In this study, having identified the enablers and disablers towards transitioning to agroecology, we isolated only the marketing disablers and the capacity of each reviewed model to address the identified disablers, in view of the local situation in Teso. After identifying the most appropriate model to address marketing disablers, and how each model addresses social, economic, and environmental aspects, we engaged stakeholders in PMM and PMSD to co-create the best-fit agroecology business model for the FRNs in eastern Uganda (conducted in a workshop). Moving forward, we discuss the Agroecology Business and Market models, first with the community-supported agriculture model.

4.2.1 Community-supported agriculture business model

Community-Supported Agriculture (CSA) is a distinctive agroecological business model that has recently gained prominence as a sustainable alternative to

conventional farming practices (Mert & Miele, 2021; Rommel et al., 2019; White, 2015; Woods et al., 2017). This model fosters a direct connection between consumers and local farmers, emphasizing community involvement, ecological responsibility, and creation of a mutually beneficial relationship. Espelt (2020) showed that CSA began in the 1980s by two European farmers, Jan Vander Tuin and Trauger Groh, who were influenced by Rudolf Steiner's biodynamic agriculture ideas. Accordingly, the two were convinced that CSA promotes a direct connection between producers and consumers and enables market access at fair prices (Espelt, 2020).

Although Harmon (2014) has reported shareholding, subscription, and organizational as the basic typology of CSA, others such as Espelt (2020) have shown that different territories have developed specific CSA models that consider four types of CSA: producer-led, consumer-led, producer-community partnerships, and community-owned farms (Espelt, 2020). Some cases of community-supported agriculture initiatives in Africa include the Mamelodi Market Garden in South Africa, which involves local communities in sustainable agriculture practices, offering shares to residents in exchange for a portion of the harvest (Phiri, 2018) as well and initiatives to close gaps between food production processing and consumption (Mtetwa, 2019). Other cases include the Zimbabwe Smallholder Organic Farmers Forum (ZIMSOFF), aimed at connecting small-scale farmers with urban consumers through CSA models to improve the livelihoods of organized and empowered agroecology smallholder farmers in Zimbabwe[4], and the case of farmers who saved seed markets in Malawi (Practical Action, n.d.). Among CSA cases out of Africa is the Community Supported farmers in Romania (Moellers & Bîrhală, 2014), mainly aiming at promoting social economy through maintaining biodiversity and a healthy environment, guarantee nourishing and healthy products in Romania (ibid).

At its core, CSA operates on a subscription-based system where consumers, often referred to as 'shareholders' or 'members,' invest in a farm by purchasing a share of its produce. In return, they receive a regular supply of fresh locally grown food. This direct link between farmers and consumers not only ensures a stable income for farmers but also provides consumers with a direct understanding of where their food comes from, fostering a sense of community and transparency. Thus, the key components of the CSA model include the basis of subscription, sustainability, organic farming, community engagement, and local economic impact. In both cases of CSA in Malawi and Romania, we

[4] www.zimofforum.org

recognize the importance of trust, stakeholder collaboration, participation, effective coordination, and communication among stakeholders in developing effective market systems. However, challenges exist with the CSA model. The upfront financial commitment required by consumers may limit participation, and the success of the model depends on the effective communication and coordination between farmers and shareholders. Furthermore, the seasonal nature of agriculture can lead to variations in the quantity and diversity of produce, posing logistical challenges to both farmers and consumers.

4.2.2 CERD-UGANDA organic products market business model

According to Ssekyewa et al. (2022), there has been an organic agriculture initiative in Uganda that specifically focuses on the establishment and challenges of the Organic Products Market (OPM) at Abaita Ababiri, Katabi Town Council. The basis of the OPM was the approval of the National Organic Agriculture Policy (NOAP) in 2019 to support this sector. Thus, the Center for Ecosystems Research and Development (CERD-UGANDA) has been aiding farmers in optimizing Organic Agriculture. The OPM is East Africa's first physical market launched in November 2021 and focuses on organic products (Figure 2).

The market aims to align with national and international policies, including the NOAP and Sustainable Development Goals (SDGs 2030). The main objectives of OPM were to support farmers in accessing an avenue for their production, enhancing food security, and contributing to sustainable development.

The OPM structure and operations are based on a systematic procedure that involves sourcing, inspecting, delivering, and selling organic products. Different organizations and individual stakeholders, support the market by buying stalls, supplying organic products, and sharing knowledge, respectively. According to the 2022 report on market performance, despite initial challenges related to supply-demand dynamics, limited organic production availability, delayed occupancy of stalls by owners, low consumer turnout, and financial sustainability, CERD-Uganda has persevered to uphold the organic sector. CERD-Uganda aimed to allow the market to sustain itself, but encountered difficulties due to low sales and expenses, affecting restocking and overall market viability. Thus, contrary to previous reports suggesting a thriving organic subsector in Uganda, the actual scenario reveals limited availability of organic products, with most products likely directed towards export markets (Ssekyewa et al., 2022). Efforts should focus on raising consumer awareness of organic product markets and developing such markets across Uganda to facilitate access to safe food while reducing transportation costs and carbon footprint.

Figure 2. Launch of the Organic Products Market at Abaita Ababiri-Entebbe

In line with the above description of the OPM, the most suitable agroecology market model appears to be a *collaborative and systematic approach, with emphasis on integrating various stakeholders,* to establish and sustain an Organic Products Market. This model prioritizes alignment with national and international policies while focusing on supporting farmers, enhancing food security, and contributing to sustainable development. This review highlights the key concepts of this agroecological market model, including collaboration, systemic operations, policy alignment, consumer awareness, and market development, as well as financial and operational sustainability.

4.2.3 Farmers' markets business model

Farmers' markets have emerged as a thriving agroecology business model that offers a direct and vibrant avenue for farmers to connect with their local communities, offering nearly what everyone (producers, processors, marketers, and consumers) needs (Gillespie et al., 2007). These markets embody the principles of sustainability, localism, and ecological responsibility, creating a space where consumers can access fresh, locally grown produce, while fostering a deeper understanding of the food system (Gillespie et al., 2007). At the heart of farmers' markets is the direct-to-consumer approach, which eliminates intermediaries and establishes a direct link between farmers and the community. Farmers showcase a variety of products and create a marketplace that allows consumers to interact directly with those responsible for growing their food. This transparency in the supply chain not only builds trust, but also provides consumers with the opportunity to learn about the farming practices employed and make informed choices about the food they purchase.

Agroecology is a central theme in farmers' market models. Many vendors in these markets embrace sustainable farming practices, emphasizing soil health, biodiversity, and natural pest management. By prioritizing agroecological principles, farmers contribute to the overall well-being of the environment and promote a more resilient and diverse agricultural system. Consumers, in turn, have the opportunity to support these environmentally friendly practices while enjoying fresh, nutritious, high-quality, and seasonal produce (O'Kane & Wijaya, 2015).

In addition to promoting agroecology, farmers' markets serve as engines for local economic development. By supporting local farmers and producers, these markets contribute to the community's economic resilience. The money spent in farmers' markets tends to circulate within the local economy, creating a positive feedback loop that benefits both farmers and nearby businesses. The economic impact extends beyond the market itself, influencing job creation and fostering a sense of community pride since small farmers are included in the business game (Vorley et al., 2009).

The social aspect of farmers' markets is another significant dimension of the agroecological business model. These markets often become community hubs where residents gather not just to shop, but also to socialize. Farmers' markets host events, cooking demonstrations, and educational sessions, creating opportunities for people to learn about sustainable agriculture, healthy cooking practices, and supporting local farmers. Communal engagement strengthens the bond between farmers and consumers, fostering a shared commitment to a sustainable and locally rooted food system.

Although farmers' markets offer numerous benefits, challenges still exist. Seasonal variations in product availability, weather conditions that affect outdoor markets, and the need for farmers to commit time to market participation are factors that require careful consideration. Additionally, ensuring affordability for a diverse range of consumers is crucial for maintaining the inclusivity of farmers' markets.

4.2.4 Full-time agroecology and organic agriculture market within an existing permanent municipality market (Case of Kitooro Market by CERD-Uganda)

This market model is embedded within an established permanent municipality market, leveraging existing infrastructure and foot traffic, while carving out a dedicated space or section for agroecology and organic agricultural products.

The key concepts and descriptions of the Full-Time Agroecology and Organic Agriculture markets within an existing permanent municipality market model are illustrated in Table 2.

Table 2. Key Concepts and description of the Full-time Agroecology and Organic Agriculture Market within an existing Permanent Municipality Market Model [Appendix A].

Accordingly, this market model offers a synergistic blend of traditional market infrastructure with a specialized focus on sustainable agroecological products. Through centralized management, rigorous sourcing procedures, stall allocation to diverse actors, comprehensive record-keeping, and regular supervision, the model ensures quality, transparency, and sustainability, while meeting consumer demand for ethically produced, environmentally friendly agricultural products.

However, this market model has challenges, such as competition with conventional market vendors, timely availability of organic products, and consumer awareness about the availability of affordable organic products.

4.2.5 Doughnut business model

The doughnut business model is an economic framework that envisions a world in which people's needs are met without overshooting environmental limits (Raworth, 2017). In her book, "*Doughnut Economics. Seven Ways to think like a 21st-century Economist"* Kate Raworth, focuses on this model to ensure that humanity does not fall into the" "social foundation", which represents a shortfall of basic needs, while also avoiding the' "ecological ceiling", which signifies environmental degradation beyond planetary boundaries. Therefore, this model is a conceptual framework that integrates environmental and social dimensions. Accordingly, the inner circle or 'doughnut hole' represents the minimum environmental requirements for sustainability, while the outer ring represents the maximum social threshold (also see Rossing et al., 2020), as shown in Figure 3 (DEAL,2021). The goal is to operate within this 'doughnut' ensuring environmental sustainability without compromising social equity and wellbeing in the transition to agroecology. To conceptualize the doughnut model as an approach to agroecological transitioning, we propose a framework that balances various aspects of agriculture within certain limits (Figure 3).

Although doughnut is not traditionally linked to agroecology, it offers a conceptual framework for envisioning a balanced and sustainable approach to agriculture that respects both ecological boundaries and social foundations. This model can be more adaptable and applicable if it is further developed through

stakeholder engagement and contextualization within the specific contexts and challenges of transitioning to agroecological systems.

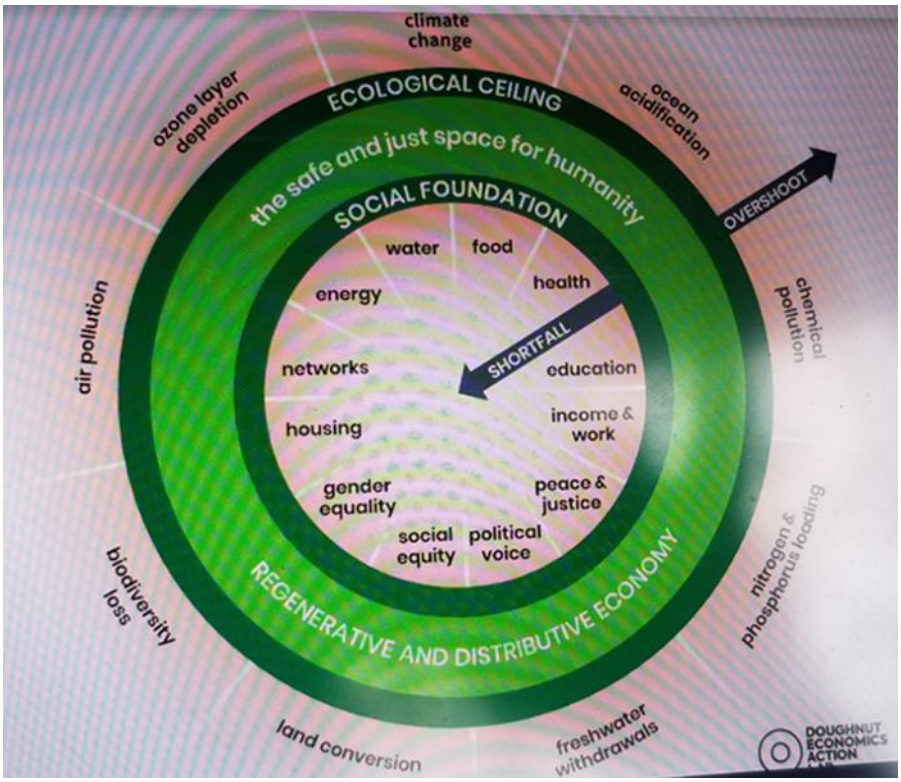

Figure 3. The Doughnut model: Adopted from *Doughnut Economics Action Lab, 2021*.

4.2.6 Model for women's entrepreneurship in agroecology and food systems

Modern challenges within agriculture and food systems necessitate innovative designs that uplift women across the social, economic, and environmental spheres (Akowedaho et al., 2023).

While women are pivotal in every phase of the food system, ranging from agricultural production to safeguarding household nutrition, they encounter significant hurdles in accessing vital resources, such as land, seeds, and markets (Nicoletis, 2019). Often, they are denied equitable access to essential tools and resources, which hinders their potential to enhance productivity and income.

Consequently, this disparity perpetuates poverty and marginalization and constrains their ability to bolster food security and sustainable growth (Esaff Uganda, 2023).

The ecological business framework has emerged as a viable avenue for women, offering access to critical resources, such as land and finance. Furthermore, it underscores their indispensable role in agriculture and food systems, fostering their entrepreneurial spirit and advancing agroecological production and marketing. The synergy between agroecological producers and female entrepreneurs exemplifies how shared knowledge amplifies the efficiency of agroecology farming (Goodman, 2012).

By championing women's entrepreneurship in eco-friendly practices, we reinforce participatory assurance systems that are vital for agroecological and sustainable food networks (Koohafkan, 2016). This model elucidates the symbiotic relationship among female entrepreneurship, agroecological farming, and food systems, positioning the agroecological business model as a pivotal catalyst.

The agroecological business paradigm fosters collaborative learning within sustainable food systems, paving the way for transformative positive shifts (Rossi, 2021). Harnessing the potential of female entrepreneurship to drive co-learning in food systems is a golden opportunity for stakeholders to realize sustainable food system goals. The key concepts and descriptions of the model are presented in Table 3.

Table 3. Key concepts and description of the Model for Women's Entrepreneurship in Agroecology and Food Systems [Appendix A]

4.2.7 Agroecology business model for school and community gardens

A school garden situated either on or adjacent to the school premises serves as an invaluable educational tool (Blair, 2009). Such gardens immerse children in lessons on environmental awareness, the origins of food, and the significance of nutritious eating. By making education hands-on and interactive (ACB Consulting Services, n.d.), these gardens captivate students' interest and enhance their learning experiences (Ramey-Gassert, 1994).

Ecologically, both school and community gardens contribute to expanding green spaces, mitigating carbon footprints, and combating soil erosion (Wheeler, 2013). They amplify opportunities for communities to consume locally sourced vegetables and fruits, promote nutrition, and enhance physical activity. Beyond

these benefits, these gardens elevate community members' and students' knowledge of cultivation, harvest, and culinary practices, fostering social interactions and enhancing property values (See What Grows, n.d.).

Indirectly, schools and community gardens address public health imperatives through community engagement. They cater to a myriad of community needs, encompassing food security, enhanced nutrition, increased physical activity, fortified socioeconomic ties, and bolstered psychological well-being. As academic days extend and extracurricular engagements multiply, particularly for young children, fostering interactions with nature has become paramount.

These gardens empower students to translate their knowledge of sustainable food sources into tangible actions that augment the availability of fresh, nutritious foods, especially in areas where socioeconomic constraints impede access (Teig, 2009). Engaging in gardening cultivates independence, fosters connection with nature, increases self-esteem, enhances coping mechanisms, and mitigates stress and negative emotions among children (Nishii, 2011).

Both schools and community members shoulder the responsibility for preserving natural resources by adopting agroecological farming practices. Such practices not only protect the environment but also bolster livelihoods (Mongabay, 2023). The key concepts of this model include community engagement, education and awareness, local consumption, livelihoods, ecological preservation, cultural diversity, resilience building, educational platforms, collaborative knowledge sharing, systemic integration, community building, empowerment, and independence.

4.2.8 Business models for sustainable food systems (Donner & De Vries, 2023)

These authors reviewed business models for sustainable food systems and showed the urgency of the attention of agri-food systems to sustainability. They indicated that although a diversity of business models can contribute to sustainability and provide several 'business models for sustainable food systems,' there is a need to develop a 'new business model typology' that considers the 'wider business ecosystem.' This is in line with this review, which aims to develop a best-fit business model for Agroecology Business Networks in Eastern Uganda. These scholars identified the three best business models contributing to sustainable food systems including local food networks which they also termed as 'alternative, place-based and social food networks' (Boccia & Scognamiglio, 2019; Croft et al., 2019; Drejerska et al., 2019; Häger et al., 2021; Hingley et al., 2011; Mair & Sumner, 2019; Swaffield et al., 2019), Circular business models (Cavicchi & Vagnoni, 2021; Del Vecchio et al., 2022; Donner & Radic, 2021;

Donner et al., 2021; Fortunati et al., 2020; Klein et al.; 2022; Moggi & Dameri, 2021; Närvänen et al., 2021; Röder et al., 2020), and 'Disruptive business models (Kuokkanen et al., 2019; Radcliffe et al., 2021; Ulvenblad et al., 2019) such as focusing on alternative protein-source products, alternative distribution chains, sustainable production, and community-oriented food' (Donner & De Vries, 2023, p. 9). The key concepts and descriptions of the respective business models are presented (Figure 4).

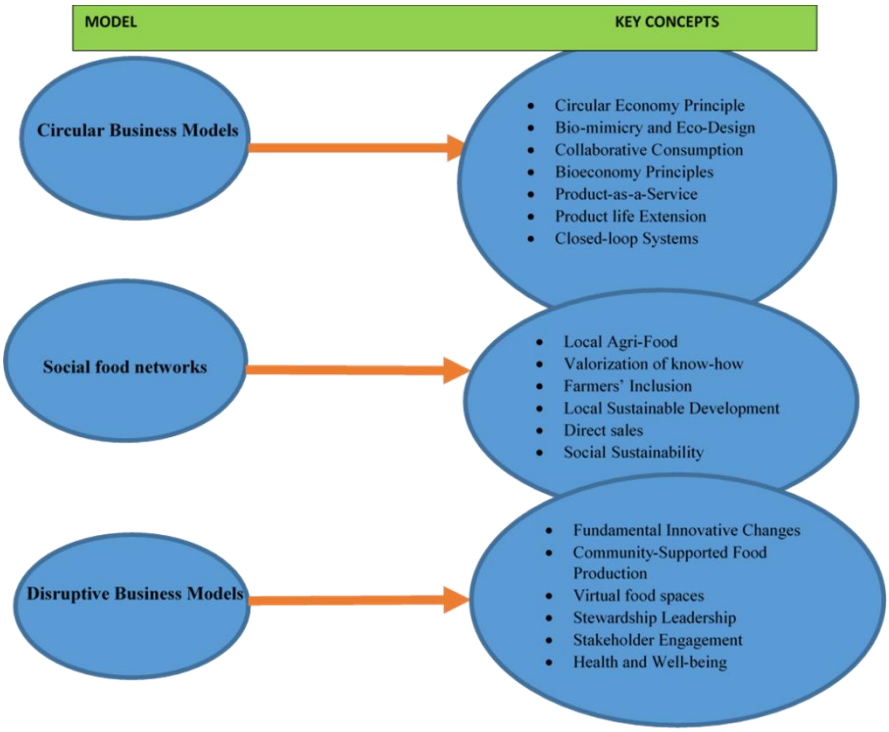

Figure 4. Key concepts of Business models for Sustainable food systems as identified by Donner and Devries, 2023.

4.3 Nexus between theories and models

Identified theories and models were each aligned with the other to derive the most appropriate configuration of the AE business one would desire to see. Thus we show the relationships between Social, Economic, and Environmental

interventions within the context of the studied models in relation to the studied theoretical perspectives. We describe these relationships by arguing that:

Social interventions emphasize community cohesion, shared values, and collaborative governance (Bodin, 2017), while encouraging community involvement, knowledge sharing, and participatory decision-making. They foster social capital through direct connections between producers and consumers (Ansari et al., 2012), volunteer work, and farm visits, as well as promoting inclusivity, trust, and solidarity among participants. In all of these social interventions, it is possible to address challenges such as maintaining social cohesion, conflicts, and sustaining participation, all of which promote agroecology.

Economic interventions focus on efficiency by reducing inputs, minimizing waste, and promoting value chain integration. They also provide stable income for farmers through direct market access, risk-sharing, and long-term contracts that support local economic empowerment and diversification of income-generating activities, thus encouraging a circular economy (Genovese, 2017; De Steur et al., 2016). Challenges such as market dynamics, institutional inertia, and limited access to resources can be addressed by advocating for alternative institutional arrangements and policy changes to support small-scale agroecological farming practices.

Environmental interventions prioritize ecological responsibility through smart climate practices, soil health promotion, and biodiversity conservation. They promote the resilience of farm ecosystems through crop rotation, cover cropping, and natural pest control methods, all of which contribute to environmental sustainability by reducing carbon emissions, supporting biodiversity, and promoting local food systems. Environmental interventions are in place to address challenges such as climate change impacts, balancing ecological sustainability with economic demands, and ensuring the equitable distribution of benefits among farmers (Scher et al., 2012; Venkatramanan & Shah, 2019; Beste, & Lorentz, 2022). Overall, all the reviewed models demonstrate how applying relevant theories integrating social, economic, and environmental interventions can create a more sustainable and resilient food system, while addressing various challenges and lessons for fostering community well-being and agricultural sustainability.

4.4 Understanding the AE business status in Teso region

Having reviewed the above theories and models, we critique the Teso region to better understand the situation of markets in relation to agroecology.

A study on understanding markets in Eastern Uganda (Ssekyewa et al., 2022) indicated that of the six markets visited, four were weekly open markets, including the Kasilo market in the northwest of Serere District towards Lake Kyoga shores (Tuesdays), Ocaapa market in the South of Serere District towards Kumi (Wednesdays), Arapai market in the East of Soroti, Arapai District (Thursdays), and Ocori Modgmin market East of Katakwi District (Fridays). The two full-time permanent markets included the Soroti Central market and the Popular Women Knowledge Initiative (PWKI), which is located in Bukedea TC, Bukedea District.

The results of this study indicated that weekly open markets had the same design and were managed in the same way by local governments, but with variations observed in the quantity of agricultural produce stocked by vendors and overall market physical size. In situ, observed estimates of cereals, such as millet grain stocked by a vendor, ranged from approximately 5 kg to approximately 50 kg. Regarding physical space, the largest observed market was Ocori Modgmin, which stretched to approximately 5 ha.

The results indicated that, although the studied markets had strong social, economic, and environmental aspects rated at 53percent agroecological, there were still challenges in transitioning to agroecology.

It was noted that weekly open markets had no permanent buildings other than the toilet facility, stalls were of make-shift, and all agricultural products were sold on the ground with no shelves and no proper hygiene (Figure 5).

Figure 5. State of open Markets in the Teso Region

Markets were located in broad open peri-urban or rural spaces. Other challenges of the studied markets included gaps in traceability, such as the lack of an in-built feedback mechanism, coding systems for business entities, standard labelling of goods, and direct provision of consumer information. Success in agroecological business models and markets requires an enabling environment along the entire value chain.

4.5 Determining factors enabling or disabling AE in Teso region

Identifying the enablers and disablers for Agroecology Business Networks to transition towards Agroecology is an important aspect, such that corrective measures for solving them are taken. Therefore, in a two-day co-learning workshop, we carried out sensitization of AEBNs, including producers, processors, marketers, and consumers or restaurant owners, who shared their enablers and disablers, towards transitioning to agroecology, and solutions for overcoming challenges were identified (Figures 6 and 7).

The results indicated that there were other challenges identified by AEBNs, some of which are similar to those identified during the study on understanding markets in Eastern Uganda by Ssekeywa et al. (2022), which are the fundamental factors that disable the transition to agroecology, as well as failing the success of agroecology markets (Figure 6).

Figure 6. Groups in Co-learning sessions

As shown in figure 7, the enablers and disablers provide insights into the factors that facilitate or hinder the transition to agroecology in various aspects of the agricultural value chain, including production, processing, marketing, and consumption. Addressing these challenges and leveraging enablers can accelerate the adoption of agroecological practices and promote sustainable food systems.

Accordingly, producers identified some of the solutions to the disablers, including timely planting, networking, having storage facilities, adding value to products, conducting good market research, knowledge sharing and networking, monitoring and evaluation of past production activities before starting new ones, availability of irrigation, availability of an indigenous seed bank, collaboration for high volumes, for better prices, and always working within the principles of agroecology.

Processors identified the most important solutions to their disablers as quality packaging, using good business language, collective bargaining, having quality control measures, market research and networking, adhering to government policies and regulations, using high-quality raw materials, wider marketing, source advanced technology for processing and packaging, training of workers, standardized packaging and branding, and having good storage facilities.

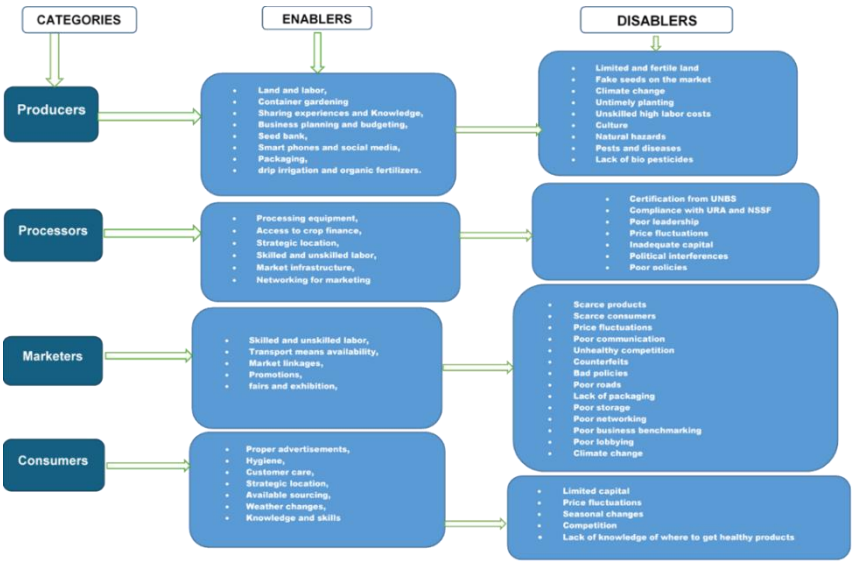

Figure 7. Enablers and Disablers of AEBNs Transitioning towards Agroecology

Consumers and restaurant owners identified the most important solutions to their disablers as having a good business plan, providing a diversity of products, observing hygiene and sanitation, employing skilled and unskilled labor, identifying strategic locations for business, ensuring connectivity with marketers, and collaborating with farmers who produce agro-ecologically.

Marketers identified the most important solutions to their disablers: conducting good market research, adding value to products, having proper storage facilities, good negotiation and communication skills, customer care, avoiding overstocking, being full time in operation, creating customer awareness, stocking quality products and materials, and responding to customer needs.

4.6 Marketing business models' capacity to address existing disablers

Given that marketing is the main theme and it presented the largest number of disablers (14), this report further scrutinized the disablers provided by the marketing team to analyze which of the reviewed business models had more capacity to address the challenges of agroecological transitioning.

Figure 8 shows the capacities of the respective models to address the identified challenges.

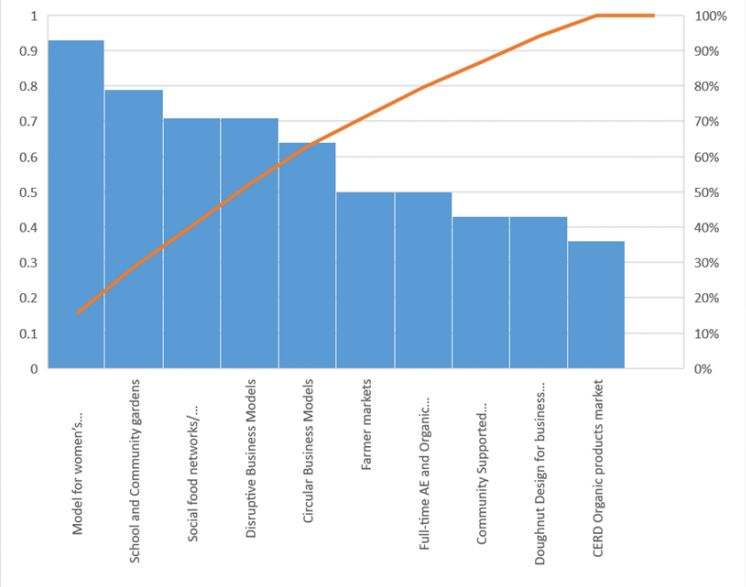

Figure 8. Extent to which identified models solve marketing challenges

Table 4. Means and capacity for each model to address challenges [Appendix A]

Results indicate that each model presents unique strategies to overcome marketing disablers and improve agricultural food systems, with varying degrees of effectiveness, as indicated by their capacity percentages.

Figure 8 indicates the model for women's entrepreneurship in agroecology and food systems, PGS (Akawedaho et al., 2023) scoring the highest (93%) with the capacity to address challenges or disablers towards transitioning to agroecology. The Model for School and Community Gardens scored second with 79%, and Social Networks and Disruptive Business Models were in third position with a score of 71% each.

These results make sense because unlike some other reviewed models, research on the model for women's entrepreneurship in agroecology and food systems was conducted in Uganda, so it pertains to the local setting and context of the local region. Second, studies such as Aguilar (2021), Charbit (2018), Chukwudi and Victor (2022), Nyahunda (2021), and Kovaleva et al. (2022) indicate that women empowerment is crucial in advancing the climate change agenda, agroecology is high on the global climate agenda, and women's involvement is a crucial aspect.

However, it should also be noted that sustainability requires inclusive development of both men and women (Perrons & Dunford, 2013; Hurlbert et al., 2019), yet also, due to cultural hindrances, women in entrepreneurship control less or no resources such as tools, seeds, and land (Nicoletis, 2019), implying that working with male counterparts is necessary. The studied Agroecology Business Networks in the Teso region include both male, female and youth participants, so moving forward with only females would segregate male and the youth participants. Therefore, this research found it very important to develop a model that is inclusive of all, which was developed by capitalizing on the model for women's entrepreneurship in agroecology and food systems, as well as the ability of each model to address social, economic, and environmental aspects.

4.7 Emerging co-created AE business and market model for Teso region

Utilizing information from all studied models and the theoretical framework, and enriching that information with other important components that could be missing in the best selected model (Model for women's entrepreneurship in Agroecology and food systems) but found valuable in other reviewed models, we

propose a model termed as the *EquiAgro; A Gender-inclusive Agroecological Business Model for advancing Agroecology Business Networks and Markets in Teso Region* in table 5.

The desired agroecology businesses and markets in the Teso region would include components described in the co-created model for agricultural entrepreneurship, which emphasizes components as described in table 5. These elements are categorized into Social, Economic, and Environmental aspects. However, some elements overlap between categories because they address multiple aspects, such as technological integration, which benefits both economic efficiency and environmental sustainability. Similarly, elements such as monitoring and evaluation are relevant across all three categories, as they assess impacts on social, economic, and environmental fronts. Other overlapping elements include farmers' market access and supply chains, which overlap between environmental and economic aspects, certification and quality standards between economic and environmental aspects as well as Integration of women into eco-friendly agroecological practices, overlapping between social and environmental aspects (Table 5).

Table 5. Components and description of the proposed EquiAgro; A Gender-inclusive Agroecological Business Model For Agroecology Business Networks and Markets in Teso Region [Appendix A].

With the proposed model identified from all the gathered information (theories, models, and sensitization of AEBNs), we take a participatory market systems development and participatory market mapping approach by bringing all agroecology business networks together in a workshop to make sense of the reviewed business and market model components and to co-create components/actions for inclusive market growth. The outcome was preference for an agroecology market shop, with components indicated in (Table 5 and figure 9).

By integrating these elements into the business model, the agroecological networks in the Teso region can foster sustainable agricultural practices, improve livelihoods, and promote environmental stewardship. This is to act as a self-assessment and monitoring tool for Agroecology Businesses to gauge their business level of transitioning to agroecology. Regular adaptation and collaboration with local communities are crucial to the success and sustainability of this model.

4.8 Lessons for agroecology business networks in Eastern Uganda

The biggest lesson is to ensure community engagement and empowerment to co-learn and co-create in the decision-making processes and prioritize their needs for success.

We acknowledge that several elements overlap across categories, as they address multiple aspects of sustainable agriculture and community development. For example, partnerships and collaboration can simultaneously contribute to social cohesion, economic growth, and environmental conservation. Similarly, measuring and communicating impacts is crucial for assessing progress across social, economic, and environmental dimensions. When business networks in Eastern Uganda apply these lessons, they can build resilient and sustainable models that benefit both farmers and the environment, while contributing to the overall development of the region.

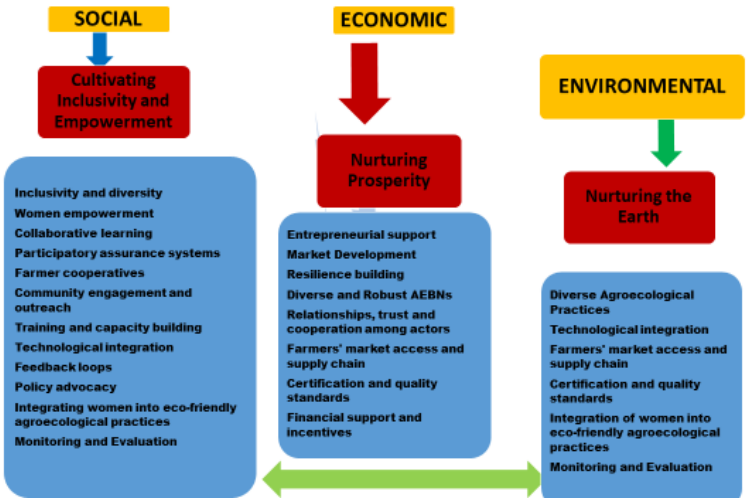

Figure 9. Social, Economic, and Environmental aspects of the EquiAgro Model

4.9 Future research

The need for co-learning comparisons across East and South African countries to understand the respective business and market models and business networks can help transition towards sustainable, diverse, and complex food systems. In

addition, we propose further research into co-learning and co-creation to improve selected agroecological markets and business models in Uganda.

Acknowledgments

We acknowledge and express gratitude for the support of the McKnight Foundation regional and international teams availed for this study. CERD-UGANDA has worked jointly with other project partners, including Uganda Martyrs University, Popular Knowledge Women Initiative (PKWI), and Ateker Transformation for Sustainability Initiatives (ATSI) to conclude this study. Their valuable contributions are greatly appreciated.

References

ABC Consulting Services. 2023. https://www.acbconsultingservices.com/school-construction-project-management/the-benefits-of-school-gardens/

ACSA. https://acsa-ug.org/

Aguilar Revelo, L. (2021). *Gender equality in the midst of climate change: What can the region's machineries for the advancement of women do?*

Ajena, F., Bossard, N., Clément, C., Hilbeck, A., Oehen, B., Thomas, J., & Tisselli, E. (2020). *Agroecology & digitalisation traps and opportunities to transform the food system, IFOAM organics Europe rue du commerce*, *124* p. BE1000. Brussels, Belgium.

Albu, M., & Griffith, A. (2006). Mapping the market: Participatory market-chain development in practice. *Small Enterprise Development*, *17*(2), 12.

Altieri, M. A., Nicholls, C. I., Henao, A., & Lana, M. A. (2015). Agroecology and the design of climate change-resilient farming systems. *Agronomy for Sustainable Development*, 35(3), 869–890. https://doi.org/10.1007/s13593-015-0285-2

Anderson, C. R., Bruil, J., Chappell, M. J., Kiss, C., & Pimbert, M. P. (2019). From transition to domains of transformation: Getting to sustainable and just food systems through agroecology. *Sustainability*, *11*(19). https://doi.org/10.3390/su11195272

Ansari, S., Munir, K., & Gregg, T. (2012). Impact at the "bottom of the pyramid": The role of social capital in capability development and community empowerment. *Journal of Management Studies*, *49*(4), 813–842. https://doi.org/10.1111/j.1467-6486.2012.01042.x

Atilla Oner, M. A., & Saritas, O. (2005). A systems approach to policy analysis and development planning. *Technological Forecasting and Social Change*, *72*(7), 886–911. https://doi.org/10.1016/j.techfore.2004.11.002

Bamuturaki, K., Schmidt, O., Wakabi, B. M., Mbabazi, G. M., Mawenu, R., Musobozi, P., & Rubalema, A. (2018). *Enhancing farmer conscientisation through participatory development practice: Our experience with participatory market research in the Rwenzori region, Western Uganda.*

Barrios, E., Gemmill-Herren, B., Bicksler, A., Siliprandi, E., Brathwaite, R., Moller, S., Batello, C., & Tittonell, P. (2020). The 10 Elements of agroecology: Enabling transitions towards sustainable agriculture and food systems through visual narratives. *Ecosystems and People*, *16*(1), 230–247. https://doi.org/10.1080/26395916.2020.1808705

Bastian, A., & Coveney, J. (2013). The responsibilisation of food security: What is the problem represented to be? *Health Sociology Review*, *22*(2), 162–173. https://doi.org/10.5172/hesr.2013.22.2.162

Bazaara, N. (2003). *Decentralization, politics and environment in Uganda, environmental governance in Africa Working Paper No. 7*, January. Institutions and Governance Program. World Resources Institute.

Beste, A., & Lorentz, N. (2022). *Ecosystem soil. Bringing nature-based solutions on climate change and biodiversity conservation down to earth.*

Blair, D. (2009). The child in the garden: An evaluative review of the benefits of school gardening. *The Journal of Environmental Education*, *40*(2), 15–38. https://doi.org/10.3200/JOEE.40.2.15-38

Bodin, Ö. (2017). Collaborative environmental governance: Achieving collective action in social-ecological systems. *Science*, *357*(6352), eaan1114. https://doi.org/10.1126/science.aan1114

Bohan, D. A., Raybould, A., Mulder, C., Woodward, G., Tamaddoni-Nezhad, A., Bluthgen, N., Pocock, M. J. O., Muggleton, S., Evans, D. M., Astegiano, J., Massol, F., Loeuille, N., Petit, S., & Macfadyen, S. (2013). Networking agroecology. In G. Woodward & D. A. Bohan (Eds.). *Ecological Networks in an Agricultural World*, *49* (pp. 1–67). Academic Press. https://doi.org/10.1016/B978-0-12-420002-9.00001-9

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, *9*(2), 27–40. https://doi.org/10.3316/QRJ0902027

Brundtland, G. H. (1986). World Commission on Environment and Development. *Environmental Policy and Law*, *14*(1), 26–30.

Capra, F. (1996). The web of life: A new scientific understanding of living systems. *Anchor.*

CERDUG. CERD-UGANDA. www.cerdug.org

Chambers, R. (1992). *Rural appraisal: Rapid, relaxed and participatory*, IDS Discussion Paper 311. IDS.

Chambers, R. (1997). *Shortcut and participatory methods for gaining social information for projects. Inter-American Institute for co-operation on agriculture.*

Chambers, R. (2010). Paradigms, poverty and adaptive pluralism. *IDS Working Papers*, 2010(344), 1–57. https://doi.org/10.1111/j.2040-0209.2010.00344_2.x

Charbit, Y. (2018). *Women as actors in addressing climate change. International handbook on gender and demographic processes* (pp. 317–328).

Checkland, P. (1981). *Systems thinking, systems practice*. John Wiley & Sons.

Chukwudi, A. S., & Victor, O. (2022). Collaborative Action on Climate Change and Empowerment of Women in Africa: How sustainable is SDGs 13?. Gender and Behaviour, *20*(1), 19029–19041.

Cuéllar-Padilla, M., & Calle-Collado, Á. (2011). Can we find solutions with people? Participatory action research with small organic producers in Andalusia. *Journal of Rural Studies*, *27*(4), 372–383. https://doi.org/10.1016/j.jrurstud.2011.08.004

Doughnut Economics Action Lab, 2021, About Doughnut Economics,

https://doughnuteconomics.org/about-doughnut-economics (accessed: 06.17.2024)

De Steur, H., Wesana, J., Dora, M. K., Pearce, D., & Gellynck, X. (2016). Applying Value Stream Mapping to reduce food losses and wastes in supply chains: A systematic review. *Waste Management*, *58*, 359–368. https://doi.org/10.1016/j.wasman.2016.08.025

Donner, M., & De Vries, H. (2023). Business models for sustainable food systems: A typology based on a literature review. *Frontiers in Sustainable Food Systems*, *7*, 1160097. https://doi.org/10.3389/fsufs.2023.1160097

Eksvärd, K., Lönngren, G., Cuadra, M., Francis, C., Johansson, B., Namanji, S., Rydberg, T., Ssekyewa, C., Gissén, C., & Salomonsson, L. (2014). Agroecology in practice: Walking the Talk. Sciences, S. U. o. A. (ed.). *Urban and Rural Development*. Swedish University of Agricultural Sciences, 88.

Espelt, R. (2020). Agroecology prosumption: The role of CSA networks. *Journal of Rural Studies*, *79*, 269–275. https://doi.org/10.1016/j.jrurstud.2020.08.032

Esaffuganda. 2023. Women small-scale farmers demand equitable access to and control over agricultural resources https://www.esaffuganda.org/post/women-small-scale-farmers-demand-equitable-access-to-and-control-over-agricultural-resources

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: Integrating resilience, adaptability and transformability. *Ecology and Society*, *15*(4), 20. https://doi.org/10.5751/ES-03610-150420

Food and Agriculture Organization, International Fund for Agriculture Development, United Nations Children's Fund, W. F. P., & World Health Organization. (2020). *The State of food security and Nutrition in the World; Transforming Food Systems for Affordable Healthy diets 42 pages* p. 9699en. https://doi.org/10.4060/ca

Food and Agriculture Organization. (2014a). The state of the World's forest genetic resources. *Commission on Genetic Resources for Food & Agriculture Rome*, 1–291.

Food and Agriculture Organization. (2014b). Building a common vision for sustainable food and agriculture. Food and Agriculture Organization of the United Nations. http://www.fao.org/3/a-i3940e.pdf

Fuenfschilling, L., & Truffer, B. (2014). The structuration of socio-technical regimes—Conceptual foundations from institutional theory. *Research Policy*, *43*(4), 772–791. https://doi.org/10.1016/j.respol.2013.10.010

Genovese, A., Acquaye, A. A., Figueroa, A., & Koh, S. C. L. (2017). Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications. *Omega*, *66*, 344–357. https://doi.org/10.1016/j.omega.2015.05.015

Gillespie, G., Hilchey, D. L., Hinrichs, C. C., & Feenstra, G. (2007). Farmers' markets as keystones in rebuilding local and regional food systems. *Remaking the North American food system: Strategies for sustainability*, 65–83.

Gliessman, S., Putnam, H., & Cohen, R. (2017). Agroecology and Basis, participatory knowledge production and exchange as an agroecology, for food system change: The case of the community network. In A. Wezel (Ed.), *Agroecological practices for sustainable agriculture principles, applications, and making the transition* (pp. 201–228). Imperial College Press.

Goodman, D., DuPuis, E. M., & Goodman, M. K. (2012). Alternative food networks: Knowledge, practice, and politics. https://www.routledge.com/Alternative-Food-Networks-Knowledge-Practice-and-Politics/Goodman-DuPuisGoodman/p/book/9780415747691

Green, D. G., & Sadedin, S. (2005). Interactions matter—Complexity in landscapes and ecosystems. *Ecological Complexity*, *2*(2), 117–130. https://doi.org/10.1016/j.ecocom.2004.11.006

Griffith, A. (2008). *Participatory market system development*.

Guzmán, G. I., López, D., Román, L., & Alonso, A. M. (2013). Participatory action research in agroecology: Building local organic food networks in Spain. *Journal of Sustainable Agriculture*, *37*(1), 127–146. https://doi.org/10.1080/10440046.2012.718997

Halloun, I. A. (2007). Modeling theory in science education (Vol. 24). Springer Science & Business Media.

Hammond, D. R. (1997). *Toward a science of synthesis: The heritage of general systems theory*. University of California Berkeley.

Harmon, A. H. (2014). Community supported agriculture: A conceptual model of health implications. Austin. *Journal of Nutrition and Food Sciences*, *2*.

High Level Panel of Expert. (2019). http://www.agroecology-europe.org

Holt-Giménez, E. (2002). Measuring farmers' agroecological resistance after Hurricane Mitch in Nicaragua: A case study in participatory, sustainable land management impact monitoring. *Agriculture, Ecosystems and Environment*, *93*(1–3), 87–105. https://doi.org/10.1016/S0167-8809(02)00006-3

Horton, D., Devaux, A., Bernet, T., Mayanja, S., Ordinola, M., & Thiele, G. (2023). Inclusive innovation in agricultural value chains: Lessons from use of a systems

approach in diverse settings. *Innovation and Development*. United Nations, *13*(3), 517–539. https://doi.org/10.1080/2157930X.2022.2070587

Hurlbert, M., Baptiste, B., Fletcher, A., Rivera-Ferre, M. G., Mahadevia, D., & Vincent, K. (2019). *Gender in inclusive approaches to climate change, land and sustainable development*.

Isgren, E., & Ness, B. (2017). Agroecology to promote just sustainability transitions: Analysis of a civil society network in the Rwenzori region, Western Uganda. *Sustainability*, *9*(8), 1357. https://doi.org/10.3390/su9081357

Jacobson, M. J., Kapur, M., So, H.-J., & Lee, J. (2011). The ontologies of complexity and learning about complex systems. *Instructional Science*, *39*(5), 763–783. https://doi.org/10.1007/s11251-010-9147-0

Jenny, S., & Russel, A. (2001). Systems Theory and Policy Practice: An exploration. *Policy Sciences*, *34*(1), 15.

Kemmis, S., McTaggart, R., Nixon, R., Kemmis, S., McTaggart, R., & Nixon, R. (2014). Introducing critical participatory action research. *The action research planner: Doing critical participatory action research*, 1–31.

Kim, H. D. (1999). *Introduction to systems thinking. Pegasus communication Inc. IMS*, *0013e*.

Koohafkan, P. (2016). Forgotten agricultural heritage:reconnecting food systems and sustainable development. Routledge. https://www.routledge.com/Forgotten-Agricultural-Heritage-Reconnecting-food-systems-and-sustainable/Koohafkan-Altieri/p/book/9781138204157

Koohafkan, P., & Altieri, M. A. (2016). *Forgotten agricultural heritage: Reconnecting food systems and sustainable development*. Taylor & Francis.

Kovaleva, M., Leal Filho, W., Borgemeister, C., & Kalungu, J. W. (2022). Understanding needs and potentials for gender-balanced empowerment and leadership in climate change adaptation and mitigation in Africa. *Sustainability*, *14*(15), 9410. https://doi.org/10.3390/su14159410

Landis, D. A., Wratten, S. D., & Gurr, G. M. (2000). Habitat management to conserve natural enemies of arthropod pests in agriculture. *Annual Review of Entomology*, *45*, 175–201. https://doi.org/10.1146/annurev.ento.45.1.175

Laszlo, A., & Krippner, S. (1998). Systems theories: Their origins, foundations, and development. *Advances in Psychology-Amsterdam*, *126*, 47–74.

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 and BioVision. https://doi.org/10.4060/cb0438en

Makulabuys. https://makulabuys.shop

McGreevy, S. R., Tamura, N., Kobayashi, M., Zollet, S., Hitaka, K., Nicholls, C. I., & Altieri, M. A. (2021). Amplifying agroecological farmer lighthouses in contested territories: Navigating historical conditions and forming new clusters in Japan. *Frontiers in Sustainable Food Systems*, *5*, 699694. (Not in text). https://doi.org/10.3389/fsufs.2021.699694

Méndez, V. E., Caswell, M., Gliessman, S. R., & Cohen, R. (2017). Integrating agroecology and participatory action research (PAR): Lessons from Central America. *Sustainability*, *9*(5), 705. https://doi.org/10.3390/su9050705

Mert-Cakal, T., & Miele, M. (2021). Community supported agriculture (CSA): Significance and prospects for growth for individuals, communities, and food systems. *CABI Reviews*, *16*. https://doi.org/10.1079/PAVSNNR202116061

Midega, C. A. O., Pittchar, J. O., Pickett, J. A., Hailu, G. W., & Khan, Z. R. (2018). A climate-adapted push-pull system effectively controls fall armyworm, Spodoptera frugiperda (J E Smith), in maize in East Africa. *Crop Protection*, *105*, 10–15. https://doi.org/10.1016/j.cropro.2017.11.003

Mier y Terán Giménez Cacho, M., Giraldo, O. F., Aldasoro, M., Morales, H., Ferguson, B. G., Rosset, P., Khadse, A., & Campos, C. (2018). Bringing agroecology to scale: Key drivers and emblematic cases. *Agroecology and Sustainable Food Systems*, 42(6), 637–665. https://doi.org/10.1080/21683565.2018.1443313

Mitchell, M., & Newman, M. (2002). Complex systems theory and evolution. Encyclopedia of evolution, *1*, 1–5.

Moellers, J., & Bîrhală, B. (2014). Community Supported Agriculture: A promising pathway for small family farms in Eastern Europe? A case study from Romania. *Appl. Agric. Forestry Res* · 3/4, *64*, 139–150. https://doi.org/10.3220/LBF_2014_139-150

Morin, E. (1992). From the concept of system to the paradigm of complexity. *Journal of Social and Evolutionary Systems*, *15*(4), 371–385. https://doi.org/10.1016/1061-7361(92)90024-8

Mongabay. 2023. https://news.mongabay.com/2023/07/agroecology-schools-help-communities-restore-degraded-land-in-guatemala/

Mtetwa, M. (2019). *Dijo-An Agri-park (agro-processing plant) to empower informal vendors via urban agriculture to alleviate unemployment and food insecurity in Mamelodi West* (Doctoral dissertation, University of Pretoria).

Murray, A. B. (2007). Reducing model complexity for explanation and prediction. Geomorphology, 90(3-4), 178-191.

Namanji, S., Francis, C., & Ssekyewa, C. (2016). Environment Policy Formulation: A systems Process in Uganda. *Journal of Sustainable Development in Africa*, 18, *3*, 53–79.

Namanji, S., Francis, C., & Ssekyewa, C. (2017). Environmental policy implementation in Uganda: Extent to which decentralized natural resource management incorporates systems thinking. *Journal of Sustainable Development in Africa*, 19, *3*, 218–244.

Namanji, S. (2024). Navigating the policy landscape in Uganda: problem representations and silences towards transitioning to Agroecology as a business. *Visions for Sustainability*, 22, 10672, 1-35. http://dx.doi.org/10.13135/2384-8677/10672

Nicoletis, E. (2019). Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. High Level Panel of Experts on Food Security and Nutritionof Committee on World Food Security. https://www.fao.org/3/ca5602en/ca5602en.pdf

Nieves, J., & Osorio, J. (2013). The role of social networks in knowledge creation. *Knowledge Management Research and Practice*, *11*(1), 62–77. https://doi.org/10.1057/kmrp.2012.28

Nishii, J. (2011). The therapeutic benefits of gardening:cultivating Health through Interaction with Nature. Alliant International University ProQuest dissertations publishing, *2013*, 3567663.

North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.

NOGAMO. https://nogamu.org

Nyahunda, L. (2021). Social work empowerment model for mainstreaming the participation of rural women in the climate change discourse. *Journal of Human Rights and Social Work*, *6*(2), 120–129. https://doi.org/10.1007/s41134-020-00148-8

O'Kane, G., & Wijaya, S. Y. (2015). Contribution of farmers' markets to more socially sustainable food systems: A pilot study of a farmers' market in the Australian Capital Territory (ACT), Australia. *Agroecology and Sustainable Food Systems*, *39*(10), 1124–1153. https://doi.org/10.1080/21683565.2015.1081858

Ostrom, E. (2008). *Institutions and the environment*, Journal compilation. Institute of Economic Affairs. Blackwell Publishing.

Ostrom, E., & Cox, M. (2010). Moving beyond panaceas: A multi-tiered diagnostic approach for social-ecological analysis. *Environmental Conservation*, *37*(4), 451–463. https://doi.org/10.1017/S0376892910000834

OMANET. Organic Market Network

Perrons, D., & Dunford, R. (2013). Regional development, equality and gender: Moving towards more inclusive and socially sustainable measures. *Economic and Industrial Democracy*, *34*(3), 483–499. https://doi.org/10.1177/0143831X13489044

PELUM-Uganda. https://pelumuganda.org

Phiri, O. (2018). *An ethnography of the Mandela Peace Park senior citizens food garden in Mamelodi Township Tshwane: A social critique of the economism in contemporary urban agriculture policies and projects* (Doctoral dissertation, University of Pretoria).

Practical Action. (n.d.) Participatory Market Mapping. https://practicalaction.org/pmsd-toolkit/tools/participatory-market-mapping/

Practical Action. (n.d.). Farmers saved seed systems. https://practicalaction.org/pmsd-toolkit/farmer-saved-seed-systems-malawi/

Ramey-Gassert, L., Walberg III, H. J., & Walberg, H. J. (1994). Reexamining connections: Museums as science learning environments. *Science Education*, *78*(4), 345–363. https://doi.org/10.1002/sce.3730780403

Raworth, K. (2017). *Doughnut economics. Seven ways to think like a 21st-century economist*. Penguin Random House.

Ribot, J. C., Lund, J. F., & Treue, T. (2010). Democratic decentralization in sub-Saharan Africa: Its contribution to forest management, livelihoods, and enfranchisement. *Environmental Conservation*, 37(1), 35–44. https://doi.org/10.1017/S0376892910000329

Rockström, J., Steffen, W., Noone, K., Persson, A., Chapin, F. S., Lambin, E. F., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., . . . Foley, J. A. (2009). A safe operating space for humanity. *Nature*, *461*(7263), 472–475. https://doi.org/10.1038/461472a

Rommel, M., Abson, D., & Lang, D. (2019). *International community supported agriculture*.

Rossi, A., Coscarello, M., & Biolghini, D. (2021). (Re)Commoning Food and Food Systems. The contribution of social innovation from solidarity economy. *Agriculture*, *11*(6), 548. https://doi.org/10.3390/agriculture11060548

Rossi, A. C. (2021). *The Contribution of Social Innovation from Solidarity Economy Agriculture*, 116–548.

Rossing, W. A. H., Kormelinck, A. G., Alliaume, F., Dogliotti, S., Duncan, J., Huenchuleo, C., Klerkx, L., Trienekens, J., & Gaitán-Cremaschi, D. (2020). Transitioning to the safe and just space inside "the doughnut" by means of agroecological niche food systems: Insights from Chile and Uruguay. *International Journal of Agriculture and Natural Resources*, 47(3), 295–311. https://doi.org/10.7764/ijanr.v47i3.2258

RUCID. https://www.rucid.org

Scherr, S. J., Shames, S., & Friedman, R. (2012). From climate-smart agriculture to climate-smart landscapes. *Agriculture and Food Security*, *1*, 1–15.

Sekyewa, B. A. D., & P. M. (January 2023). Womens Entreprenuership in agroecology and food systems. *International Journal of Current Science Research and Review*, 296–304.

See What Grows. School Gardening & Community Garden. https://seewhatgrows.org/our-causes/community-gardens-seed-preservation/

Ssekyewa, C., Namirembe, S., Wellard, K., Ojju, D., Asio, N., & Babirye, G. (2022). Understanding Markets in Teso Region, Eastern Uganda:establishing agroecology markets Linkages for local agroecology actors. *Journal of Innovative Technologies and Business for Sustainable Development*, *4*.

Teig, E., Amulya, J., Bardwell, L., Buchenau, M., Marshall, J. A., & Litt, J. S. (2009). Collective efficacy in Denver, Colorado: Strengthening neighborhoods and health through community gardens. *Health and Place*, 15(4), 1115–1122. https://doi.org/10.1016/j.healthplace.2009.06.003

Teig, E., Amulya, J., Bardwell, L., Buchenau, M., Marshall, J. A., & Litt, J. S. (2009). Collective efficacy in Denver, Colorado: Strengthening neighborhoods and health through community gardens. *Health & place*, *15*(4), 1115-1122.

Tscharntke, T., Klein, A. M., Kruess, A., Steffan-Dewenter, I., & Thies, C. (2005). Landscape perspectives on agricultural intensification and biodiversity – Ecosystem service management. *Ecology Letters*, *8*(8), 857–874. https://doi.org/10.1111/j.1461-0248.2005.00782.x

United Nations Development Group. (2010). *Thematic paper on MDG 7; Environmental Sustainability*.

United Nations. (2021). Available online at: https:. Press release about Food Systems Summit. http://www.un.org/en/food-systems-summit/news/food-systems-hold-power-%E2%80%98realise-vision-better-world%E2%80%99-says-un-secretary-general. Accessed on 15th April 2025.

UNSDG. (2015). Transforming our World: The 2030 Agenda for sustainable Development. *A/RES*/70/1.

Venkatramanan, V., & Shah, S. (2019). Climate smart agriculture technologies for environmental management: The intersection of sustainability, resilience, wellbeing and development. *Sustainable Green Technologies for Environmental Management*, 29–51.

Vorley, B., Lundy, M., & MacGregor, J. (2009). Business models that are inclusive of small farmers. In *Agro-industries for development* (pp. 186–222). CABI Publishing.

West, P., & Brockington, D. (2006). An anthropological perspective on some unexpected consequences of protected areas. *Conservation Biology*, *20*(3), 609–616. https://doi.org/10.1111/j.1523-1739.2006.00432.x

Wheeler, S. (2013). *Planning for sustainability: Creating livable, equitable and ecological communities*. Routledge.

White, T. (2015). The branding of community supported agriculture: Collective myths and opportunities. *Journal of Agriculture, Food Systems, and Community Development*, *5*(3), 45–62.

Wilson, G. A. (2008). From "weak" to "strong" multifunctionality: Conceptualising farm-level multifunctional transitional pathways. *Journal of Rural Studies*, *24*(3), 367–383. https://doi.org/10.1016/j.jrurstud.2007.12.010

Woods, T., Ernst, M., & Tropp, D. (2017). *Community supported agriculture: New models for changing markets* (No. 1470-2021-3186).

Zhong, X., Huang, Q., Davison, R. M., Yang, X., & Chen, H. (2012). Empowering teams through social network ties. *International Journal of Information Management*, *32*(3), 209–220. https://doi.org/10.1016/j.ijinfomgt.2011.11.

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Funds

This work was supported by the McKnight Foundation under Grant Number 23-292.

Competing Interests

The authors declare no competing interests.

Citation

Namanji, S., Ssekyewa, C., & Awidi, C. (2025). Theories and models for sustainable agroecology business networks. Lessons for agroecology business networks and markets in Eastern Uganda-Teso region. *Visions for Sustainability*, 24, 11823, 1-39. http://dx.doi.org/10.13135/2384-8677/11823