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CO-LEARNING AND CO-CREATING A VENDING SYSTEM FOR AGROECOLOGY MARKET SHOPS IN TESO REGION

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ABSTRACT

In recent years, agroecology transitioning has gained prominence, emphasizing sustainable and community-based approaches to safe food production and distribution. One critical aspect of this transition is the establishment of Agroecology Market Shops, which serve as hubs for local food exchange, supporting small-scale producers and preserving traditional knowledge. These aspects require a well-designed vending system.

Our research focused on developing an efficient and cost-effective vending system for Agroecology Market Shops by actively involving Agroecology Businesses and research Networks in the Teso Region, including Soroti Bukedea, Kumi, and Pallisa Districts.

Through a systematic process of Co-learning, Co-creation, Facilitation, Transformative learning cycles and group discussions, we engaged various value chain actors, including producers, processors, marketers, and restaurant operators. Results revealed enablers for Agroecology Market Shops, different vending methods and actual community vending experiences. Ultimately, we co-created a vending system for Agroecology Market Shops in the Teso Region, and an agreement between vendors and consumers.

Keywords: Agroecology, Co-learning, Co-creation, Vending, Markets, Cycles

INTRODUCTION

In their study of markets in the Teso region, Ssekyewa (2022a) mentioned the use of loud speakers in vending of products in the weekly open market, but did not explore the whole area of vending in markets. In the review of Business and Market Models, Namanji, Ssekyewa & Awidi (2024 in press) described different market business cases, still the nature of vending systems for these businesses was not well presented. This is reason why, this co-learning activity chose not only to co-create an Agroecology (AE) Marketing system, but also to get going with the vending system associated with these markets.

Co-learning and Co-creation of a vending system for agroecology market shops is a collaborative endeavor which aims to revolutionize the traditional vending system by integrating principles of co-learning and co-creation. Through shared knowledge, expertise and resources, researchers, producers, processors, marketers and consumers are working together to design a vending system that not only supports their faming systems but also promotes ecological sustainability and resilience within the Teso region's agricultural sector (Ramaswamy & Gouillart, 2010; Van Dien & Fuchs,2023). Co-learning, Co-creation, and Agroecology are indispensable because Agroecology represents a holistic approach to achieving food system sustainability, by integrating various dimensions, including knowledge creation, redefining practices, and social mobilization (Rossi, 2019). Therefore, co-learning and co-creation are critical processes within Agroecology. While co-learning involves collaborative learning among diverse actors leading to collective understanding and action (ibid), co-creation of knowledge in agroecology is adaptive and responsive, addressing complex challenges faced by farmers and the agri-food system. Through co-creation, actors collaborate to generate new insights, practices, and solutions, a process which fosters innovation and resilience (Utter, White, Méndez, & Morris, 2021). Yet, for the success of this process, the multi-actor networks involved in co-learning and co-creation ought to interact, share knowledge, and engage in joint activities (Rossi, 2019) for effective agroecology marketing systems.

A marketing system with a mis-matching vending system would not function without an effective high demand for Agroecology products. For a marketing system to function and cause transitioning to Agroecology, it has to be accompanied by a well-planned vending system (Figure 1) because effective marketing strategies can enhance the visibility, appeal, and profitability of vending systems by driving consumer engagement and sales (Allmendinger & Lombreglia, 2005; Evans, 2010; Ramaswamy & Gouillart, 2010). In this report, we present a co-created vending system that matches the Agroecology Market shop (AE Market shop) for the Teso region.

The AE Market shop is based on shops existing in communities which produce or process AE products (Agroecology Business Networks/Farmer Research Networks). These are shops that offered themselves to market AE products within the community but with external linkages which enable their marketing or sourcing AE products from a distance but with respect of the Circular and Solidarity Economy principle. The aspect of a shop as an agroecology market is supported by other scholars such as (Mier et al., 2018; Vasco, Sánchez, Limaico, & Abril, 2018) who indicated that shops provide favorable market outlets. So, the proposed vending system is that which aligns with the AE Market shop as an ordinary shop transitioning to Agroecology and offering community-based customers AE products among

other products or exclusively as AE products. Though Restaurants serve food, in this case we consider them to be vendors of food more or less like shops.

In recent years, machines have been replacing human beings (Rifkin, 1995). They are making a significant impact in various African communities, providing convenient access to essential products, although for some, their accuracy has to be carefully checked (Kahn,2012). Possible machine vended AE products include cooking oil, milk, beers, wines and other well packaged products. Vending machines are revolutionizing access to everyday products in Africa, catering to diverse needs and improving livelihoods. Whether it's fresh milk, cooking oil, or sanitary pads, these machines are making life better for many because they are typically located in high traffic areas such as airports, office buildings and shopping centers for convenient access to goods on-the-go. The vending system presented and discussed here serves the purpose of human vending in AE Market shops as well as Restaurants, as illustrated in figure 1.

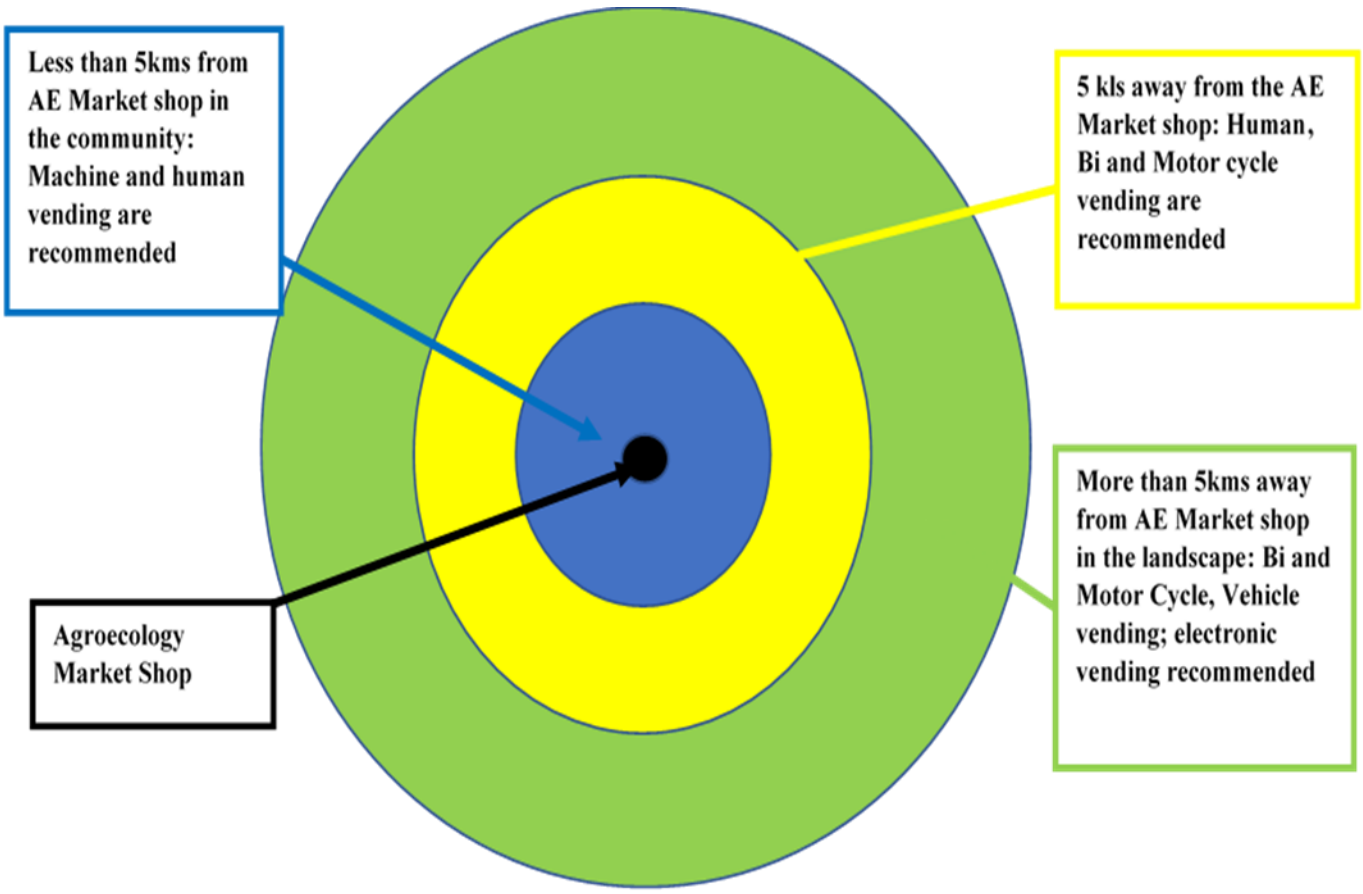

Figure 1 A theoretically visioned Vending System for the Agroecology Market shop in Teso Landscape

To clearly articulate the effectiveness of a vending system for Agroecology Market shop in the Teso landscape, this research project had to co-create and co-learn about the specific marketing gaps and coming out with the most appropriate questions that needed answers.

Co-learning questions

1-What may disable smooth functioning of the AE Market shop/Restaurant in your community?
2-Which characteristics of the AE Market shop/Restaurant would enable selling in the AE Market Shop or Restaurant?
3-What form of agreement would be in place to guide relationships of the AE Market shop with suppliers of AE products?
4-What would be the procedure for sourcing AE products to the AE Market shop or Restaurant?
5-What are the different ways through which the AE Market shop would sell AE products?
6-What is the best vending approach for the AE Market shop or a Restaurant in your community?

Theoretical Framework

To address the stated co-learning questions, this research project established a theoretical foundation for Sustainable Development based on several key concepts. These include: Sustainability and its principles (Weak, strong and absurdly strong sustainability), the interconnected pillars of sustainability (social, economic, and environmental), systems thinking, and the role of innovation, adaptation and competitiveness. These concepts collectively provided a robust framework that guided the development of a sustainable vending system for agroecology market shops.

The Brundtland report provides the most often used definition of sustainable development, as development which meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1986). This broad definition touches the importance of establishing a sustainable vending system because several Sustainable Development Goals (SDGs) are directly relevant to establishing a vending system for agroecology market shops. Accordingly, SDG1,2,3,5,8,12,13,15 and 17 have a direct linkage with and impact on vending systems for agroecology market shops (FAO[1]). For instance, SDG1 on No Poverty impacts agroecology market shops since these provide economic opportunities for small scale farmers and vendors, helping to lift them out of poverty through ensuring fair and stable prices for their products. To meet SDG2 on zero hunger, vending systems for Agroecology market shops promote access to safe food, and local sustainable agricultural practices thus enhancing food security and nutrition. Vending systems for agroecology market shops can provide fresh, locally-produced food with minimum or no use of harmful agrochemicals, thus reducing the reliance on industrial food systems, providing both human and environmental health, and promoting sustainable land-use practices. These aspects promote SDG3 on good health and well-being, SDG12 on Responsible consumption and Production, SDG13 on Climate Action, as well as SDG 15 on Life on Land. Key principles of agroecology such as fairness and participation encourage the involvement of women

[1] Agroecology and the Sustainable Development Goals | Agroecology Knowledge Hub | Food and Agriculture Organization of the United Nations (fao.org)

in key roles such as market operations. Thus, vending systems for agroecology market shops can empower women, promote gender equality and enhance their economic independence-SDG5 on Gender Equality.

If a vending system for agroecology market shops aligns with Sustainable Development Goals, such a system can contribute significantly to sustainable development. However, this can be critical if sustainability measurements including strong, weak and absurdly strong sustainability are not clearly understood. Namanji (2022) digested the aspects of weak, strong and absurdly strong sustainability indicating that while weak sustainability promotes economic development without regard to environmental health, strong sustainability emphasizes the complementarity of both natural and man-made systems-supporting each other and their use balanced. The extreme of strong sustainability leaves natural resources untampered with (Wu, 2013), with hope that nature alone can serve humanity. Agroecology market shops promote strong sustainability because they provide benefits for both people and the planet, and setting the ground for achieving social, economic and environmental sustainability.

Social sustainability encompasses community engagement in the development and operation of the vending system. This ensures that the system meets their needs and fosters a sense of ownership, equitable and accessible to all community members, including marginalized groups, thus promoting social equity. The system provides education and awareness or information about agroecological practices and the benefits of sustainable agriculture thus enhancing community knowledge and support for the system, enhancing ecological sustainability and resilience (Ramaswamy & Gouillart, 2010; Van Dien & Fuchs,2023). A vending system that offers fresh, locally-produced, and nutritious food options can improve the health and well-being of the community (WHO,2001).

An economically sustainable vending system provides avenues for sourcing products from local farmers, and the vending system supports the local economy and helps sustain small-scale agricultural businesses. In a study on green growth, Tran (2019) indicated that vendors work directly with family operated farms, and provides some examples of symbiotic linkages in overlooked local food system that can increase employment opportunities, improve farmers' well-being who are important actors in developing a green economy based on sustainable agriculture practices (ibid). There is implementation of cost-effective practices and technologies which can make the vending system economically viable in the long term, as well as creating employment opportunities in the community, from farming to vending operations. This creates market stability for agroecological products which can provide farmers with stable income and reduce economic uncertainty.

Environmental Sustainability in this perspective is understood within the lenses of i) resource efficiency: Utilizing efficient resource management practices, such as water conservation and renewable energy, minimizes environmental impact. This is supported by research on sustainable energy transitions and the importance of integrating ecological and socio-economic sustainability (Kandpal, Jaswal, Santibanez. & Agarwal, 2024). ii) Waste reduction: Implementing circular economy strategies to reduce waste, such as composting organic waste and using biodegradable packaging, support environmental sustainability and are key components in combating climate change and other environmental issues (Mingyu et al., 2023). iii) biodiversity conservation: Promoting agroecological practices that enhance biodiversity, such as crop rotation and polyculture, help maintain healthy ecosystems. This is highlighted in discussions on energy sustainability and the broader implications for environmental perspectives (Rosen, 2021). iv)

Climate resilience: Adopting practices that improve soil health and reduce greenhouse gas emissions can enhance the resilience of the vending system to climate change. The role of Environmental Impact Assessments (EIA) in evaluating greenhouse gas emissions and promoting long-term sustainability underscores this point (Kandpal, Jaswal, Santibanez, Gonzalez, & Agarwal, 2024). By integrating these aspects of sustainability, a vending system for agroecology market shops can contribute to the overall goals of sustainable development, benefiting the community, economy, and environment.

Systems thinking views sustainable development as a complex system where various components (social, economic and environmental) interact (Shi, Han, Yang, & Gao, 2019). It emphasizes the importance of understanding these interactions to create holistic and sustainable solutions to address challenges and establish thriving Agroecology products market shops. Systems thinking, when applied to sustainable development, offers several valuable approaches to establishing sustainable vending systems for agroecology market shops:

We isolate some pertinent aspects such as a *holistic view, interconnectedness, feedback loops, long term perspective, stakeholder involvement, resource efficiency* as well as *innovation and adaptation*. A *holistic view* implies that systems thinking encourages viewing the vending system as part of a larger ecosystem, including social, economic, and environmental components. This holistic perspective ensures that solutions address multiple aspects of sustainability simultaneously, rather than in isolation, and it is crucial for sustainable development as it considers the socio-economic and environmental aspects together (Saneh, 2018). This is in line with *interconnectedness* where there is need to recognize the interconnections between different elements (e.g. producers, processors, consumers, supply chains, and environmental impacts), systems thinking helps identify leverage points where small changes can lead to significant improvements in sustainability (ibid). Systems thinking emphasizes the importance of *feedback loops*, where the outcomes of actions are monitored and used to inform future decisions. They are a core concept in systems thinking, helping to understand how different parts of a system influence each other over time (Kim, 1999). This adaptive approach allows for continuous improvement and resilience in the vending system, which provides a sustainable *long-term perspective* that promotes long-term impacts and sustainability, ensuring that current actions do not compromise future needs (Sanneh, 2018).

Systems thinking involves *engaging various stakeholders* (Producers, vendors, consumers, policymakers) in the decision-making process. This inclusive approach ensures that diverse perspectives are considered, leading to more comprehensive and accepted solutions. Importantly, stakeholder involvement supports *resource efficiency* due to mechanisms that provide venues for understanding the flow of resources within the system, systems thinking can help optimize resource use, reduce waste, and enhance the overall efficiency of the vending system (ibid). Importantly, systems thinking fosters a culture of *innovation, adaptation*, and *competitiveness* encouraging the development of new technologies and practices that enhance sustainability (Niggli, Sonnevelt, & Kummer, 2023;[2]). This can include innovations in packaging, transportation, and sales methods that reduce environmental impact.

[2] https://foodsecurecanada.org/2024/03/05/strengthening-local-food-systems-public-markets-in-canada-as-a-versatile-alternative/

With innovative technological advancements, innovating new technologies such as digital payment systems, inventory management software, and mobile apps for customer engagement, can streamline operations and enhance customer experience. Other innovations in sustainable practices include first, innovations in packaging (e.g. biodegradable materials), waste management (e.g. compositing organic waste), and energy use (e.g. solar-powered vending machines) can reduce the environmental footprint of the vending system. Second, innovations in product development- such as agroecological snacks, or ready to eat meals made from locally sourced ingredients can attract a broader customer base and increase sales. Third, innovative marketing strategies and approaches including social media campaigns, community events, and co-learning cycles/workshops, can raise awareness about the benefits of agroecology and attract more customers and competitiveness. Fourth, market differentiation can be achieved by offering unique, high-quality agroecological products provided the vending system differentiates itself from conventional markets and attracts customers who value sustainability and local produce. Fifth, implementing cost-effective practices and technologies can reduce operational costs, making the vending system more competitive in terms of pricing (Kämäräinen & Punakivi, 2002). Other aspects such as customer loyalty and adaptability are crucial for sustainable vending systems. On the one hand, providing excellent customer service, maintaining product quality, and engaging with the community can build strong customer loyalty, ensuring repeat business and word-of- mouth referrals (Mittal et al, 2023). On the other hand, staying competitive requires the ability to adapt to changing market conditions, customer preferences, and regulatory environments. This might involve diversifying product offerings, adjusting pricing strategies, or adopting new business models (Reeves & Deimler, 2011).

By leveraging sustainability principles and its interconnected pillars, systems thinking, and understanding the role of innovation, adaptation and competitiveness, this theoretical framework enabled us envisage a thriving vending system for agroecology market shops, providing sustainable and high-quality products to the community while supporting local farmers and promoting environmental stewardship in the Teso Region, but which can ultimately contribute to the broader global goals of sustainable development. This was later articulated in ensuring an organized, holistic, innovative, and sustainable vending system through applying appropriate materials and methods.

MATERIALS AND METHODS

Geographic Scope: Teso Sub-region

The project concentrated in the Teso region, because of its current need of reintroduction of agrobiodiversity (Ekesa, 2022; Ssekyewa, 2022a) essential for sustainable food systems. Recent studies by the alliance for biodiversity indicated that inadequate diets contribute to child malnutrition, and only 58.9% of women of reproductive age and 41.3% of children aged 6 to 23 months met minimum dietary diversity in Teso (Induli, Termote, & Mutui, 2022). Wild foods remain important contributors to food and nutrition security in the region, but the number of available wild species has decreased slightly over the past 20 years (Ekesa, Fongar, & Nasser, 2022; Alliancebioversityciat.org).

Therefore, in the Teso Region, initiatives have focused on bringing back diverse crops and livestock breeds, a process which involves not only ecological aspects but also social and cultural dimensions (Rossi, 2019). To contribute to

these initiatives, we aimed at creating access to diverse, nutritious and safe foods for all, through organized, holistic, innovative and sustainable vending systems. Therefore, this study included the Teso region's districts of Bukedea, Kumi, Ngora, Pallisa and Soroti. These districts are part of the Teso Sub-region (Figure 2). However, Pallisa District is politically not in Teso Sub-region, even though it has Iteso people and borders with Teso Sub-region. Teso Sub-region has Amuria, Bukedea, Kaberamaido, Kapelebyong, Katakwi, Kumi, Ngora, Serere, and Soroti districts. It covers about 13,030 square kms, and with a population of about 2.5million. The sub-region speaks both Ateso and Kumam languages Figure 2.

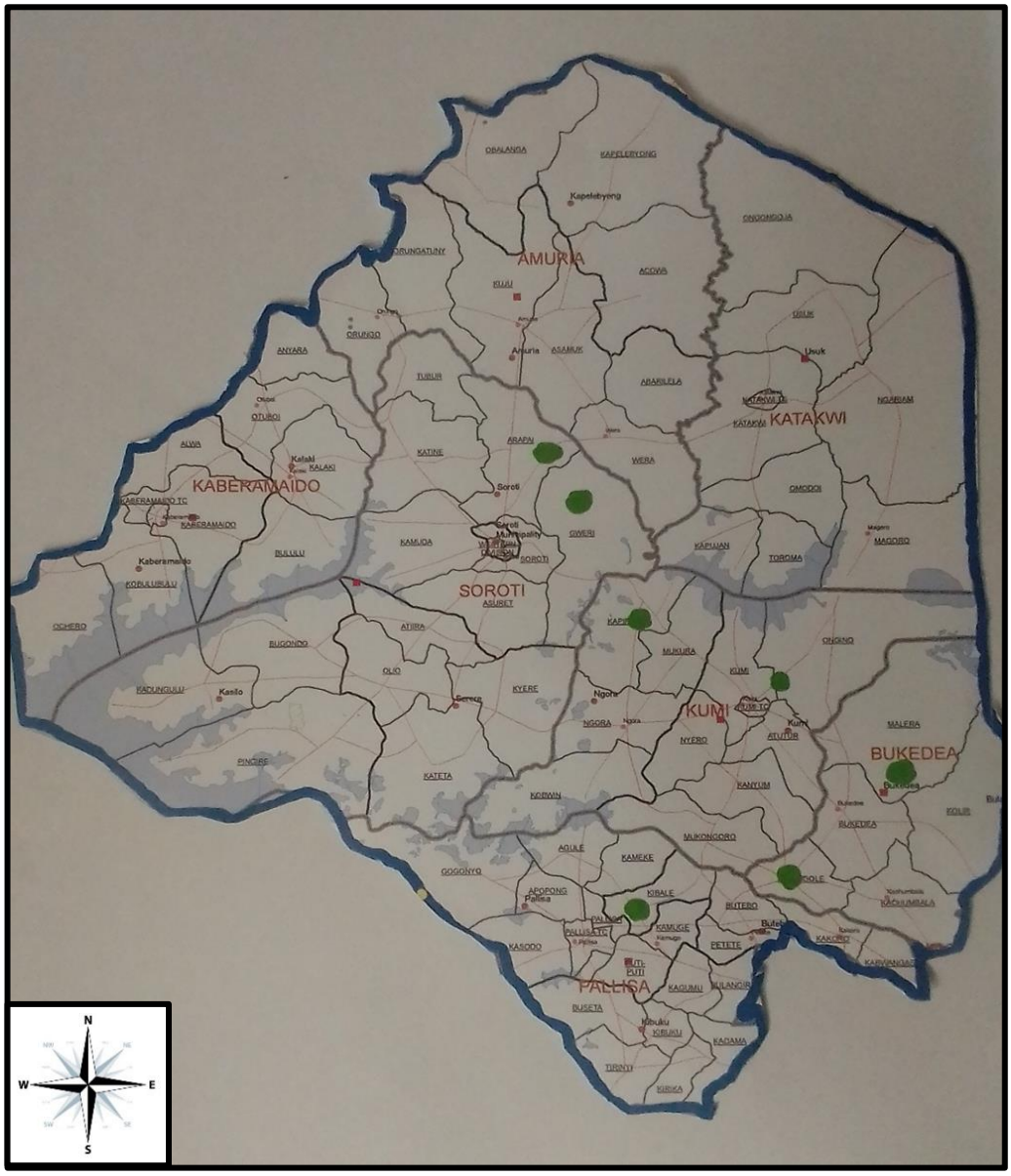

Figure 2 Teso Sub-Region Map modified from OCHA -Uganda-Teso Sub-Region Planning Map (2009). Green sports represent areas where the AEBN McKnight Project is focusing.

The Sample size and procedure

The methodological approach involved a purposive sample of four (4) Agroecology Business Networks (AEBNs), each having 10 members (Table 1).

Table 1 CCRP-FRN Project with products considered for co-learning and co-creating an AE products vending system

Project Area	**Project Group Name (AEBNs)**	**Categories#**	**Characteristic Business Model Commodities**
Bukedea	PKWI	Producers, Processors, and Marketers	Cassava, Sunflower
Pallisa	Irarak	Producers, Processors, and Marketers	Sorghum/Cereals-Rice Seeds Production/ Biodynamic fertilizers
Soroti	Super Aim	Producers, Processors, and Marketers Restaurant/consumer	Sorghum, Legumes Seed Production
Soroti	DAWIDA	Producers, Processors, Marketers, and Restaurant/consumers	Sorghum/Millet Flour Processing

Specific AEBNs group members were selected because earlier on they were involved in studies about identifying agroecology products and marketing challenges. Therefore, to solve those marketing gaps, it was found necessary to involve them in co-creating organized, holistic, innovative, and sustainable vending systems for AE products which was among those identified gaps. To achieve this, the study involved creating a vending system through a systematic process of concurrent Co-learning and Co-creation (Bettina et al., 2010; Nelson, Coe, & Haussmann, 2019; Richardson & Coe, 2021), as well as Facilitation and Transformative learning. These aspects are in line with the principles of systems thinking, and they encourage innovation, organized systems, and sustainability.

Co-learning and co-creating the vending system for Agroecology Market Shops involved collaborative efforts, knowledge sharing, and transformative processes. By participatory facilitation, we played a crucial role in enabling effective co-learning, where skilled facilitators created spaces for dialogue, reflection, and mutual understanding. Transformative learning occurred when participants challenged existing assumptions, and adapted practices that would make sense in their own situation. There were shifts in behavior and mindset of the involved FRNs/AEBNs in group discussions Figure 3.

Figure 3: Co learning and co-creation sessionsAs indicated in table 1 and figure 3, co-learning and co-creation were done in either groups of AE business types as producers, processors, marketers and restaurants or through groups of

Agroecology business networks. Co-created materials would then be shared and discussed in the plenary, and this was repeated in a cyclic manner, hence use of co-learning cycles. This entailed a series of reflections, discussions and negotiations towards generating a particular joint decision and to answer all questions (Figure 4).

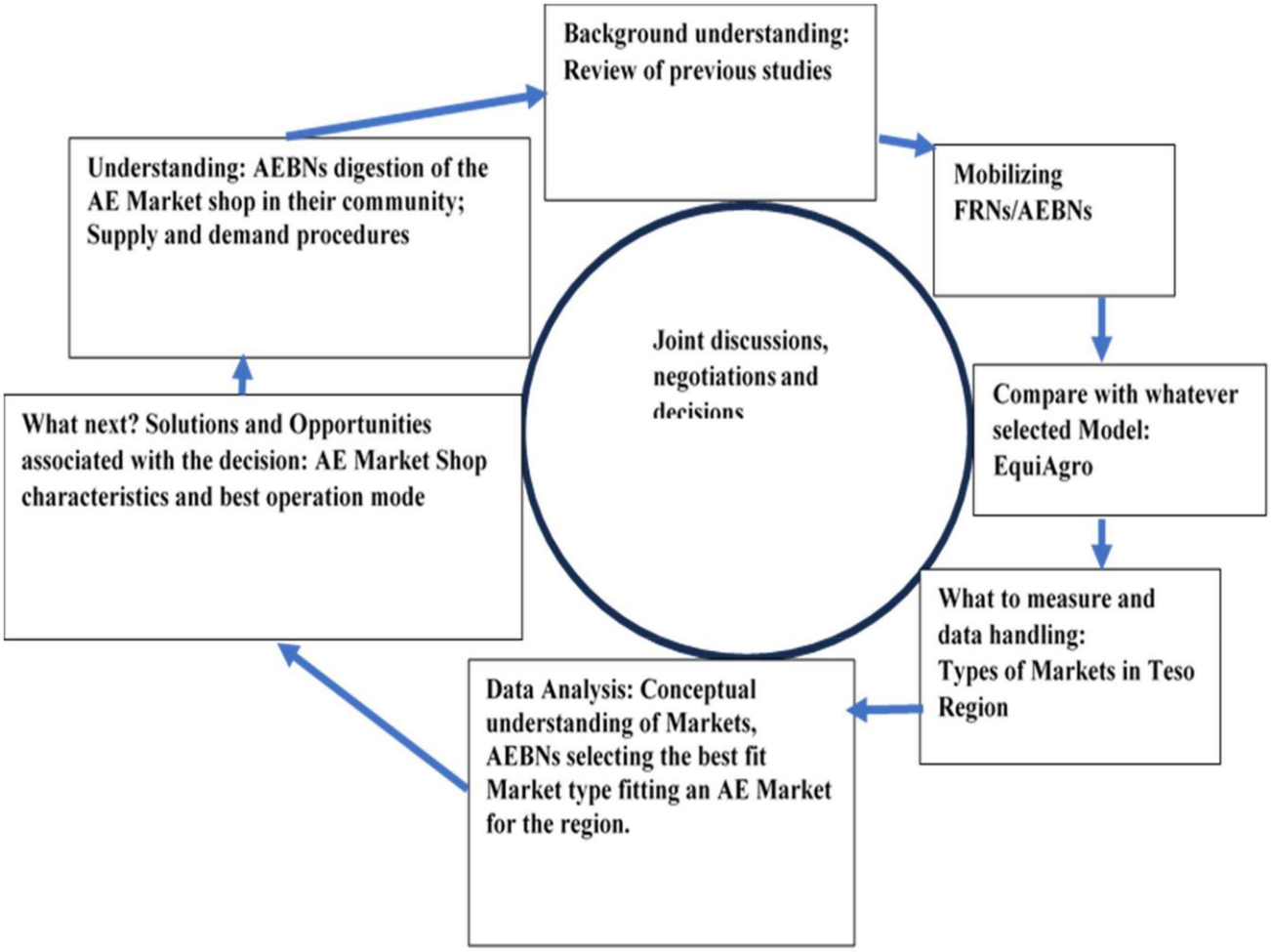

Figure 4 Farmer Research Network Cycle: Co-learning and Co-creation of Agroecology Markets in Teso Region

All findings were then synthesized by the AE expert team, analyzed and compiled together in relation to other documented findings, presented in tables and figures in a cyclic manner (Figure 5).

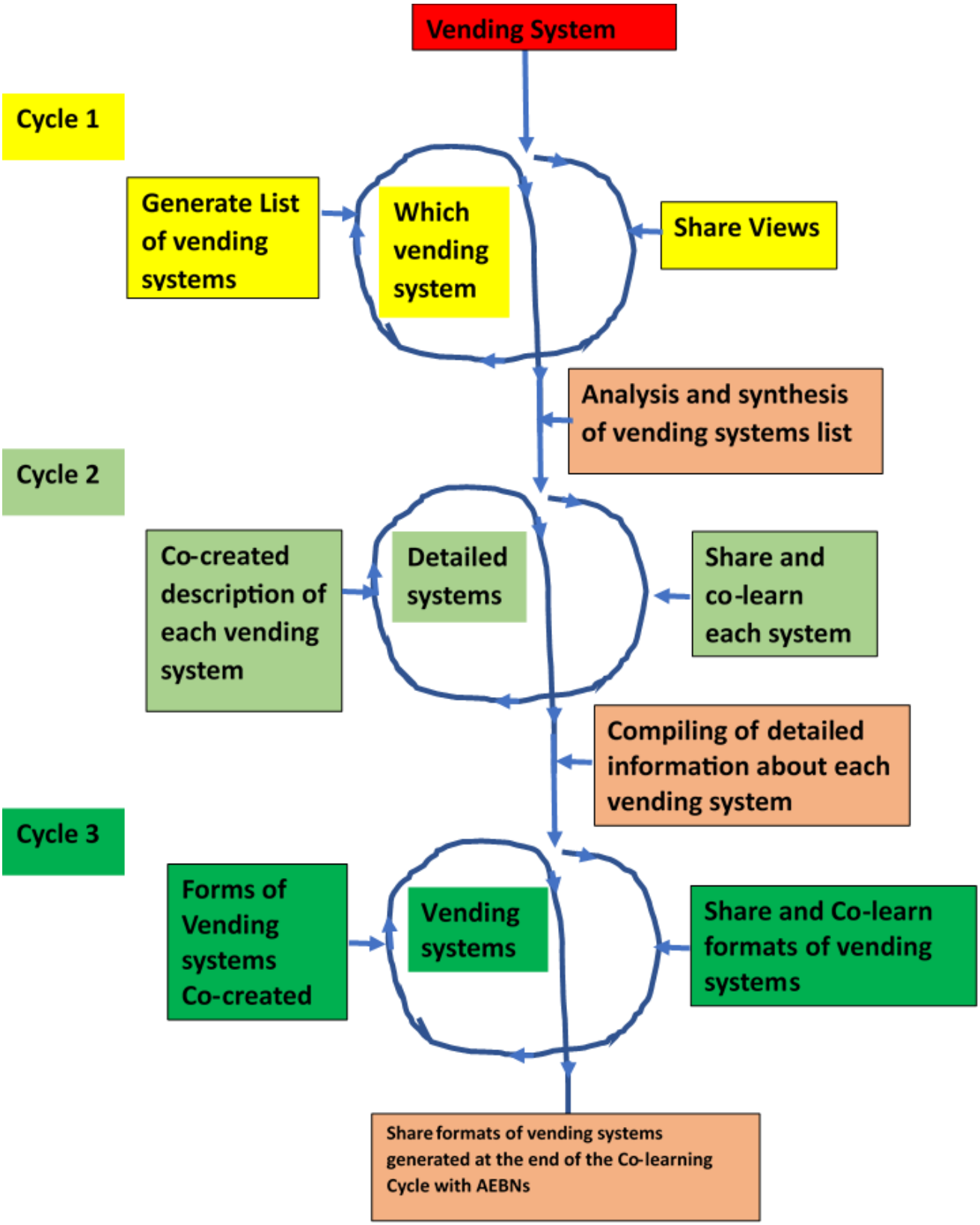

Figure 5 Co-learning cycles for the co-creation of the vending system for Agroecology Market Shops and Restaurants

RESULTS AND DISCUSSIONS

A vending system of a shop/Restaurant is the way stocking is synchronized with selling of business items using an inventory record. In a human managed systems, errors are bound to happen. As such, the Vending system of the AE Market Shop/Restaurant leverages factors that create smooth partnerships with producers, processors and consumers, thus building strong relationships among them (Day-Farnsworth, McCown, Miller, & Pfeiffer, 2009; Jacobsen, 2006). This working together encourages innovations as there is sharing of ideas and it is more sustainable. At the same time, the vending system addresses foreseen disablers/risks. However, we capitalize on enabling factors that support smooth running of AE Market shops/Restaurants. These are seen from the producer, processor, marketer and consumer/restaurant perspective. These enablers are viewed from a social, economic and environmental perspective to align them with Agroecology principles (Table 2), and within them, embedding systems thinking, innovative and organized systems as well as sustainability perspectives. AE Market shop/Restaurant owners are encouraged to take advantage of such factors to build their businesses as they transition to fully being an Agroecology Market shop/Restaurant.

Table 2 Enabling characteristics of the AE Market shop

AE Business	Category	Enablers	Most frequent enablers
Producers	**Social**		
		Community mind-set change	Mind-set, Networking
		Should network within and outside to give chance to acquire new ideas from other farmers, share opportunities and price comparison.	
		Have a talking farm i.e. have posters to allow those on the farm to locate enterprises and products	
		Have market linkages, this helps to know how the prices are balancing	
		Have gender balance and sensitivity	
		Have social and cultural aspect sharing	
		Should network within and outside to give chance to acquire new ideas from other farmers, share opportunities and price comparison.	
	Economic		
		Have Start-up capital i.e. money	Planning, Structures and equipment, Seeds
		Have a Farm plan i.e. clear lay out of the farm	
		Have a Business plan to show activities and time frame	
		Have stores and farm structures i.e. local granaries and cribs to allow farmers get better market prices, allow a farmer keep a quality seed for a long time.	
		Have post-harvest handling equipment and mechanisms in place e.g. tarplins and drying racks	
		Having locally available reliable seed with in the community i.e. in seed banks	
		Having a variety of seed for biodiversity	
		Have enough tools and equipment i.e. hoes, axes, slashers, pangas, wheel barrows to simplify the work i.e. during production	
		Have both skilled and unskilled labour i.e. this should be easy to get, cheap and make work fast to ensure quality work have timely planting.	
		Keep records to remember previous activities, know if you are making profit or loss but also track purpose	
		Having locally available reliable seed with in the community i.e. in seed banks	
	Environmental		
		Enough fertile land	Soil, Water
		A good location with a sign post and road map to the farm	
		Plant bio-organic pesticides, trees and shrubs e.g. Tobacco, Neem, Tithonia for bio fertilisers and also repel pests but also have pesticides thus boosting plant growth.	
		Availability of waste disposal points for both degradable and non-degradable waste to avoid pollution and contamination of soil Allow recycling of degradable wastes.	

		Have a reliable water source for irrigation	
		Have soil and water conservation measures in place	
Processors	**Social**		
		Gender inclusiveness with both skilled and unskilled labour	Gender inclusivity, Good governance
		Clear organisation structure for better governance	
		Continuous study about the business i.e. study visits	
		Adherence to government policy and regulations	
		Transparency through regular meetings and suggestion boxes	
		Networking and partnerships e.g. merging AE women and men	
	Economic		
		Production of high quality products	Quality, Standard, Branded, marketable, Efficient
		Pricing strategy should be pocket friendly	
		Advertising AE products through social media and exhibitions	
		Having good marketing centers	
		Proper business record keeping and Audit	
		Ensuring profitability of the AE business i.e. business growth	
		Efficiency and effective machinery i.e. quality check machines	
		Business plan	
		Standard processing procedures	
		Labelling and branding of AE products	
	Environmental		
		Source of raw materials from AE farmers	Safety, Healthy, Resource conservation, environment friendly
		Hazard free transportation i.e. wooden boxes	
		Use of recyclable storage materials e.g. drums, silos etc.	
		Storage on raised platforms	
		Use of environmental friendly Machinery	
		Structure should be well ventilated, should be having cleanable walls and floors	
		Proper location of the processing plant	
		Those operating should have PPEs	
		Health, safety and personal hygiene policies	
		Use of recyclable and degradable packaging materials	
		Collect the waste, decompose and use as manure for proper waste management of booth degradable and non-degradable	
		Having a green environment with trees and flowers around	
Marketers	**Social**		
		Awareness created	Feedback, Mind-set,
		Visitors' book	

		Suggestion box for direct communication and feed back	Customer care
		Gender inclusion	
		Packaging in all sizes affordable to consumers	
		Indigenous products	
		Recognition by authority	
		Mind-set change	
		Customer care	
	Economic		
		Labelled products	Standard, Records, Networking
		Certification of AEBNs	
		Record keeping	
		Receipt book i.e. invoices and delivery notes	
		Embrace ICT	
		Market linkages	
		Advertisements on social media, gatherings, radio talk shows, news papers	
		Transport for products	
		Should have financial systems e.g. bank accounts	
		Affordable prices	
		Marketing plan	
		Trading licence	
		Availability of quality mark	
		Audit in place	
	Environmental		
		An accessible business location	Accessible, Environment friendly
		Variety of AE products displayed	
		Should have degradable packaging materials	
		Use of bicycles to reduce emissions	
		Waste disposal sites e.g. dust bins, pits	
		Recycling of waste materials	
		Well organised	
Restaurant/Consumers	**Social**		
		Taking care of safety and health	Safety, Healthy
		Precautions to cook and serve clean food	
		Serving hot food	
		Recruitment of health persons	
		Smart staff	
		Taking care of safety and health	

		Precautions to cook and serve clean food	
		Networking/ promotion of good relations	
	Economic		Efficiency, Compliance
		Buying from AE markets	
		Joining saving groups	
		Compliance with government policy	
		Proper record keeping	
		Increased incomes	
	Environmental		
		Green environment with trees and flowers	Environment friendly
		Recycling of wastes e.g. remains of food to be given to animals like poultry and pigs	
		Ash to be used in kitchen gardens	
		Improve health humans	
		Provide shade e.g. tree shades	
		Improve weather conditions \	
		Clean environment and utensils	

According to AEBNs, an AE vending system must be concerned about social, economic and environmental aspects of the business. In this perspective, we argue that such a vending system would be sustainable if it is organised, incorporates systems thinking, encourages innovation and sustainability. Thus, the vending must be socially with the right mind-set, gender sensitive, with good governance, customer care, well networked and concerned about safety and health of the community, as is also envisaged by (Deore, & Lathia, 2019; Lefebvre, 2013). Likewise, the AE vending system is that which is economically well planned, efficient, compliant, based on standards, with quality, and has marketable branded products including structures, equipment, seeds, as well as one that keeps proper records. Environmentally, the vending system must be careful of resources like soil, water, and environmentally friendly, safe and healthy (Table 2). If the AE vending system is organized socially, economically and environmentally as explained above, there would be no limitations. However, findings showed some foreseen disablers that needed timely interventions and the extent to which stated interventions implied systems thinking (holistic), innovativeness, organized systems and sustainability.

Disablers of smooth functioning of the AE Market shop vending system, possible interventions and implications

Running a shop in a market set up is not a joke. There are always factors limiting its performance (Table 3). In this case, AEBN members identified their expected set-backs and co-created solutions that would enable flourishing of AE business in the community. Below we present such disablers and their co-created solutions, indicating what specific solutions imply in relation to the principles of systems thinking (holistic), innovativeness, organized systems and those leading to sustainability.

Table 3 AE Market shop disablers and co-created solutions

S/N	Disablers	Shop generated solutions	Implications
1	No compliance with policies	Access and follow AE principles and AE strategy through AE Business Assessment tools	An organised and sustainable system
2	Negative attitude	Hold a positive attitude and foster the same in your workers and customers	Positive attitude which encourages sustainability
3	Lack of certification	No need for certification as much as you market in the community. Follow AE Business assessment tool indicators.	An organised and sustainable system
4	Limited AE products variety	Create linkages and have agreements with your suppliers of multiple AE products	A holistic understanding, innovativeness and sustainability
5	Low market demand	Have an advertising plan. Always sensitize potential customers about the value, safety and health benefits of AE products	Being more innovative in the marketing strategy, encourages sustainability
6	Lack of consumer awareness	Continuously sensitize your customers; put up educational posters, banners, signpost.	Being more innovative in the marketing strategy, encourages sustainability
7	Poor communication	Have a talking AE Market Shop; use loud speakers to continuously tell about AE products	Being more innovative in the marketing strategy
8	Unhealthy competition	Engage continuous sensitization of customers; avoid any abusive language.	Having better organised and sustainable systems

9	Poor networking	Create as many linkages as possible through AEBNs	Being more innovative, and organised in creating sustainable networks
10	Illiteracy with in the community	Work with AEBNs to educate the community about AE products	Application of systems thinking-participatory approaches, encouraging sustainability
11	Lack of customer care	Handle customers carefully and attractively	Having sustainable markets
12	Short product shelf-life	Store your products in a cool and clean environment; unstock old AE products by selling them in bulk to schools etc.	Having organised systems, innovating appropriate and sustainable technologies
13	Limited customer satisfaction	Ensure the best and affordable AE products for your customers	Innovating cost-effective and sustainable production technologies
14	Pollution from non-AE business	Avoid mixing AE products with others	Having organised systems, innovating appropriate and sustainable technologies
15	Counterfeit products	Follow the AE products sourcing procedure provided.	Having organised systems
16	Seasonality of AE products	Establish and manage good storage conditions; stock value added AE products.	Innovativeness and competitiveness
17	Limited owner involvement	Let an AE knowledgeable person manage your AE Market Shop. Be there regularly	Having organised and sustainable systems
18	Low attendant motivation	Attitude change of the attendant/passion; handle workers with care and love; capacitate workers	Having organised and sustainable systems. Innovate and apply holistic approaches
19	Limited space for expansion	Plan your AE Market Shop properly	Having an organised set-up, innovativeness of space
20	Limited space for many products	Ensure adequate stocking of your AE Market shop	Having an organised set-up, innovativeness of space
21	Inadequate integration of AE products	Stock a good mix of AE products such that one person may find all they need in your one stop centre AE Market shop.	Having an organised set-up, innovativeness of space
22	Low supply of products	Work with AEBNs to ensure adequate supply of AE products; create necessary linkages	Applying principles of systems thinking and ensuring sustainable systems
23	Poor planning	Ensure proper planning of your AEBN shop; seek guidance from the AEBN	Innovativeness, systems thinking, sustainable practices
24	Limited capital	Stock what is fitting available funds and manage resources carefully	Sustainable practices, systems thinking (collaboration), and having organised systems
25	Poor shop structure	Ensure proper planning of your AE Market shop	Having an organised set-up, innovativeness of space
26	Poor storage	Put in place adequate storage facilities	Having organised systems, innovating appropriate and sustainable technologies
27	Post-harvest pests	Use environment friendly management of pests	Having sustainable systems
28	Poor recording keeping	Keep proper records for your AE Market shop	Being more organised and ensuring sustainable business
29	Low turnover	Stock and manage well to ensure proper AE business turnover	Being organised, innovative, applying holistic and sustainable approaches

Moving forward, the AEBNs undertook rigorous steps to overcome stated challenges on a daily basis. As indicated in table 3, we analyze what each provided solution implies in relation to organized systems, innovativeness, sustainability and systems thinking.

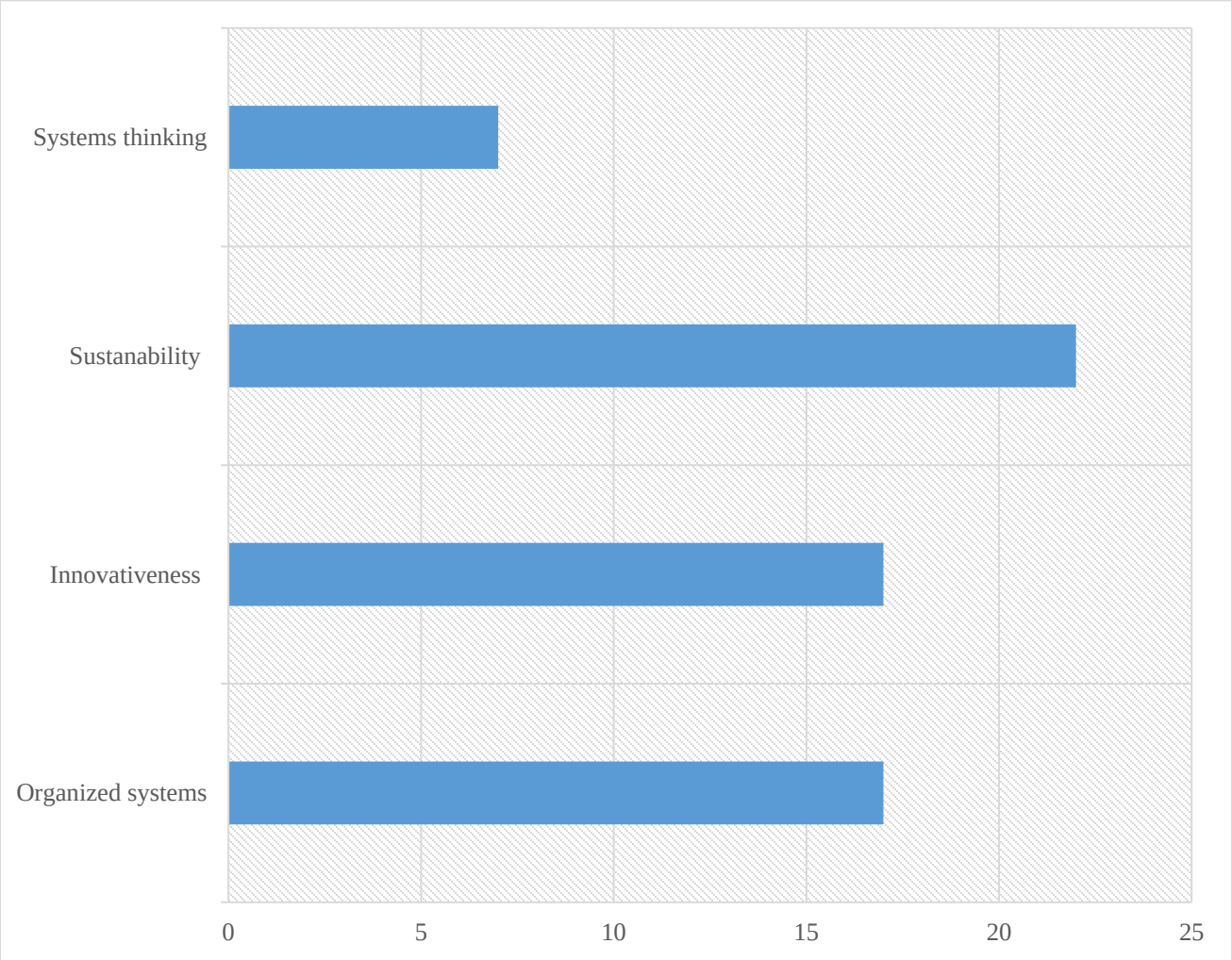

Figure 6: Extent to which provided solutions embed principles of organized systems, innovativeness, sustainability and systems thinking

From the results in figure 6, sustainability was identified as crucial and thus embedded in all solutions provided. Innovativeness and organized systems are equally important. Systems thinking, although important (Visser, 2019), its aspects were not articulated in provided solutions. This can be attributed to the limited understanding of the concept of systems thinking among AEBNs. We discuss the profound and interconnected linkage between organized systems, innovativeness, sustainability, and systems thinking.

Systems thinking provides a framework for understanding how organized systems operate and interact with their environment. By adopting a holistic view, it becomes easier to identify opportunities for innovation that can enhance sustainability (Visser, 2019). Innovativeness within organized systems often involves creating feedback loops that allow for continuous learning and adaptation. This is essential for developing sustainable practices that can evolve over time[3]. Systems thinking encourages collaboration across different disciplines and sectors. This is crucial for addressing complex sustainability challenges that require innovative solutions involving multiple stakeholders (ibid). Innovative solutions developed within organized systems can be scaled up to achieve broader sustainability goals. Systems thinking helps in identifying the most effective ways to implement and scale these innovations (Saylor academy, 2012). Organized systems that incorporate systems thinking and innovativeness are often more resilient and flexible. They can better withstand shocks and stresses, contributing to long-term sustainability[4].

The integration of organized systems, innovativeness, sustainability, and systems thinking creates a powerful synergy that can drive meaningful and lasting change. By understanding and leveraging the connections between these concepts, this research developed more effective strategies for achieving sustainable vending systems enabled from a social, economic and environmental perspective, contributing to the achievement of sustainable development goals. As a result, AE market shop vendors were able to identify ways of vending the AE products.

Different ways through which the AE Market shop would sell AE products

Members suggested the different ways through which AE products could be sold such as,

1- In a designated shelf section of the AE Market shop for processed products.
2- On a special cool shelf for perishable AE products or in form of a grocery.
3- Using mobile mechanisms like a human vending team going round the community or a tri-cycle driven through the community.
4- By use of a loud speaker system to communicate presence of AE products at the AE Market Shop.
5- The AE market shop attendant was expected to use the opportunity to continuously create awareness about the value of AE products to consumers.

Analyzing the different ways through which the AE market shop vendors would sell AE products, the identified vending mechanisms clearly articulate the integration of organized systems, innovativeness, sustainability and systems thinking as well as the social, economic and environmental aspects.

Designated Shelf Section for Processed Products on the one hand articulate social aspects through enhanced consumer convenience and accessibility, making it easier for customers to find and purchase processed products. It can also promote local culture and traditions if the products are locally sourced. Guidelines about food packaging and storage provide insights into how packaging and shelf organization can enhance consumer convenience and accessibility[5]. Economically, by organizing products efficiently, it can boost sales and support local producers, contributing to the local economy. It can also reduce waste by ensuring products are sold before expiration. Environmentally, proper

[3] systems_thinking_for_a2030.pdf (unssc.org)
[4] Sustainability is all about systems-thinking—here's why | Golisano Institute for Sustainability | RIT
[5] https://www.foodtr.org/assets/media/O2_Food%20Packaging%20and%20Storage%20Guide.pdf

shelving can help in maintaining product quality, reducing spoilage and waste. Since most of the products are locally sourced, it reduces the carbon footprint associated with transportation. On the other hand, while organized systems ensure a systematic arrangement of products, making it easier for customers to find what they need and for staff to manage inventory, innovativeness utilizes modern shelving solutions and possibly integrating tags for additional product information such as nutritional content, origin and best-before dates. This can enhance transparency, help customers make informed choices and control counterfeit products, an aspect which was among those identified by respondents as disabling the Agroecology market shops. Sustainability reduces waste by ensuring products are sold before expiration, implying the application of a First-in-First Out (FIFO) system which ensures that older products are sold before newer ones and it encourages the sale of locally processed goods, reducing transportation emissions. Since studied AE market shops are still struggling with storage facilities, this system would help to reduce waste. Systems thinking considers the entire supply chain from production to sale, ensuring efficiency and minimizing waste. This implies sourcing from local farmers, minimizing transportation time and ensuring that products are fresh when they reach the market. Results from the respondents' social, economic and environmental characteristics of the AE market shops (table 2) as well as the co-created solutions (table 3) indicate that the agroecology market shop vending system in the Teso region was designed to integrate these principles and become a model of efficiency, sustainability, and community empowerment.

Special Cool Shelf for Perishable AE Products or Grocery articulates Social aspects by ensuring that fresh, nutritious food is available to the community, which can improve public health. It also supports local farmers by providing a reliable market for their perishable goods. Economically, it reduces losses due to spoilage, ensuring that farmers and vendors get fair returns for their products. It can also attract more customers looking for fresh produce, boosting sales. Environmentally, proper refrigeration reduces food waste, which is a significant environmental issue. It also supports sustainable farming practices by providing a market for fresh, locally grown produce. These issues are also articulated by Wang, Zhang, Gao and Adhikari, (2018), as well as Pal and Kant (2020) who studied smart food storage and transport, supporting local producers by providing a reliable market for perishable goods, and fair returns for vendors. This implies that the special cool shelf for perishable AE products reflects an organized system which implements a structured approach to storing perishable items, ensuring they are kept at optimal temperatures to maintain freshness. However, this calls for innovativeness which opens up for the use of not necessarily advanced refrigeration technology but utilizing locally available materials to monitor and maintain ideal conditions. This leads to sustainability through reducing food waste since perishable items are preserved longer, and it supports local agriculture by providing a reliable market for fresh produce. When we integrate systems thinking here, we combine the needs of farmers, vendors, and consumers, ensuring a balanced and efficient flow of goods.

Mobile Mechanisms (Human Vending Team or Tri-cycle) have social dimensions such as increasing accessibility to AE products, especially in remote or underserved areas. The practice fosters community engagement and can create job opportunities (Fiore et al., 2024). Economically, it expands the market reach, potentially increasing sales and supporting local economies. It can also reduce overhead costs associated with maintaining a physical store. Environmentally, mobile vending can reduce the need for large, energy-intensive stores. If using eco-friendly transportation methods, it can also lower carbon emissions, leading to environmental sustainability that is crucial for

transitioning to sustainable food systems (Wezel, et al., 2020). Successful mobile mechanisms require Agroecology market shops to establish organized systems that ensure a mobile distribution network, and ensuring that products reach consumers efficiently. This implies vendors must innovate and employ creative methods like human vending teams or eco-friendly tri-cycles to reach a wider audience. This turns out to be sustainable since it reduces the need for large, energy-intensive stores and promotes the use of sustainable transportation methods. In all, it is important to integrate Systems Thinking because it considers the mobility needs of the community, ensuring accessibility and convenience while minimizing environmental impact.

The loud Speaker System to Communicate Presence of AE Products has a social dimension of raising awareness about the availability of AE products, encouraging community members to support local businesses. It can also foster a sense of community by keeping residents informed. Tisselli (2016) explored the importance of amplifying the voices of small-scale farmers and the role of information and communication to the creation of enabling environments for them to exercise their values. Economically, effective communication can drive foot traffic to the AE Market Shop, increasing sales and supporting local vendors. Environmentally, it reduces the need for printed advertisements, which can save paper and reduce waste. This research carried out consumer sensitization through organized systems that ensured a systematic approach to communication, ensuring consistent and clear messaging to the community about the availability of AE market shops. This involved innovativeness, by utilizing traditional yet effective methods such as the use of loud speakers, agroecology music, and word of mouth to reach a broad audience, possibly integrating with digital platforms for wider reach. This is sustainable because all approaches ensured the reduced need for printed materials, saving resources and reducing waste. In this perspective, Systems Thinking considers the communication needs of the community, ensuring everyone is informed and engaged.

Continuous Awareness by AE Market Shop Attendant is a social aspect since it educates consumers about the benefits of AE products, promoting healthier eating habits and supporting local agriculture. It can also build trust and loyalty among customers. Economically, informed consumers are more likely to purchase AE products, boosting sales and supporting local producers. It can also lead to repeat business and customer retention. Environmentally, awareness campaigns can highlight the environmental benefits of AE products, such as reduced carbon footprint and sustainable farming practices, encouraging eco-friendlier consumer choices. The World Economic Forum discusses how consumer awareness and demand for sustainable products are driving businesses to adopt eco-friendly practices. It highlights the importance of promoting the environmental benefits of products, such as reduced carbon footprint and sustainable farming practices[6]. For AE market shop attendants to realize continuous consumer awareness, there must be organized systems that provide a routine for educating consumers, ensuring consistent and ongoing awareness efforts. Use of creative methods (innovativeness) to engage customers, such as demonstrations, can be useful. Understanding the benefits of AE products ensures sustainable consumer choices and supporting local producers. In this case the application of Systems Thinking is necessary because it integrates consumer education into the overall market strategy, ensuring a holistic approach to promoting AE products.

Each of these strategies can significantly contribute to the social, economic, and environmental well-being of the community, creating a more sustainable and resilient local food system and they demonstrate a thoughtful integration

[6] https://www.weforum.org/agenda/2021/05/eco-wakening-consumers-driving-sustainability/

of organized systems, innovativeness, sustainability, and systems thinking, contributing to a more efficient, resilient, and sustainable market environment.

Co-created vending approach for AE Market shops

Moving forward with creating a sustainable agroecology market vending system, the following actions and reactions were meant to guide the vending system of the AE Market Shop (Table 4). Many more may be added by the AE Market shop keeper as long as they add value to the system. Different levels of market development shall require different methods, so the AE Market shop should apply them as appropriate and timely. We therefore present them categorized in priority order such that one may choose correctly what to start the business with, and what may come at a later stage. However, the AE Market shop owner has the responsibility to design his own vending system to match the AE marketing system.

Table 4 Actions required to run an effective Vending system, in priority order

Priority	Vending system Actions	Reason for the Action
1	Exercise self-control in all aspects of vending	In order to ensure flexibility and accountability in management of AE Market shop vending
2	Engage well oriented staff	To ensure implementation of necessary actions
3	Advertise AE products by all means e.g. signpost, loud speakers etc.	To build an effective demand and supply of AE products
4	Transparent display of safe and quality AE products	To ensure customers make informed decisions of products on clearly designated and labelled shelves
5	Sensitise the community	About AE products safety and health values
6	Offer incentives and commissions	To retain suppliers and consumers
7	Offer affordable and visible prices	Tag prices on AE products
8	Ensure customer care	As a routine practice to meet their needs
9	In build a traceability mechanism by coding your products	Coding enables one to know when the product was supplied and by whom.
10	Tag prices on all AE products	For transparency purposes
11	Keep proper records of income and expenditure	To help you define turnover and profits
12	Monitor and evaluate your AE Market shop regularly	AE assessment tools are available to help you in this activity. You will then know how your business is transitioning and growing, and which areas need improvement
13	Sustain a supply chain survey to be relevant	You need to know your suppliers very well, and accordingly plan your sourcing of products.
14	Conduct research on demand for AE products	You need to know your consumers very well, and accordingly plan your vending of products.
15	Ensure linkages to AE suppliers and consumers	A wide network ensures regular supply and demand
16	Always value time management	Time is money
17	Avoid selling AE products on credit	It helps to avoid debts accumulating
18	Use reliable tools and instruments e.g. weighing scale	It helps you not to cheat yourself or cheat your customers in weight or quality.
19	Install a reliable monitoring system i.e. CCTV cameras	This will help you avoid petty thefts.
20	Run a mobile vending system with some AE products	Supply customers who may not come to your AE Market shop, hence widen your supply/vending system.
21	Where relevant, apply a Digital marketing system	Reach your distant customers electronically, and then AE products are delivered to them.
22	Introduce electronic receipts to customers	Digital marketing requires an electronic receipt, but you may have a receipting machine in your AE shop to limit petty thieves.
23	Keep no family relationships in business	Business is for making money. Avoid any giving away a product without payment.
24	Put on corporate wear	This differentiates you from customers or thieves, makes the shop smart, and AE products safe from contamination by vending staff.

Co-created Agreement between AE Market Shop Vender and buyer/consumer

In order to create a robust relationship between the AE Market shop vender and consumer, it is important that these two enter into a formally binding agreement. This agreement is co-created with Teso region communities for ease of its application. An example is given below to guide the AE Market shop vender.

AE Market Shop Letter Head

Ref……
AEBN……District……..Date…….

Re: Agreement between …… AE Market shop/Restaurant and ……. ……..,
Consumer/Buyer
I…….., the AE Market shop owner hereby commit myself to marketing the following products,

1-
2-
3-
4-
5-
To……, the Consumer/Buyer on cash basis for the period
from……to…….

The following terms and conditions have been agreed upon by the two parties mentioned above. That is,

a) AE Market shop owner/vender……..
   i)Timely delivery of items
   ii) Quality products to be delivered
   iii)Compensation of items in case of damage

b) AE products buyer/consumer……
   i)Timely payment
   ii)Checking of products on delivery
   iii)Order to be made in time

Signed,

AE Market shop vender
Signature…….Date……
AE Products buyer/Consumer
Signature…….Date……
Witnessed by the AEBN Leader
Signature…….Date……

CONCLUSION AND POLICY RECOMMENDATIONS

In conclusion, our research contributes to the development of sustainable Agroecology Market Shops, fostering local food systems, economic resilience, and cultural preservation. By combining community insights with innovative solutions, we aim to enhance food sovereignty and promote agroecological practices in the Teso Region through developing an agroecology market shop vending system that incorporates principles of organized systems, innovativeness, sustainability, and systems thinking, as well as promoting social, economic and environmental well-being.

To further concretize this vending system and promote agroecology, we make pertinent recommendations including first, the investment in infrastructure development to enhance the efficiency of Agroecology Market Shops. This includes physical structures, transportation networks, and storage facilities, thus encouraging innovativeness. Second, collaboration with local authorities and community stakeholders to ensure adequate resources for market operations. This promotes systems thinking and sustainable operations.

Third, to promote Co-Creation and Collaboration, by encouraging the ongoing collaboration between value chain actors (producers, processors, marketers, and restaurant operators), thus concretising systems thinking and ensuring organised systems.

Fourth, facilitate regular co-creation workshops and learning cycles to address challenges collectively and improve the vending system. This promotes knowledge sharing and identifying innovative solutions. Fifth, ensure quality Standards by establishing traceability programs that verify adherence to agroecological principles and sustainable practices of products sold in Agroecology Market Shops. This implies that AE market shops shall have organised systems to ease traceability. It also ensures consumer trust and promotes healthy, nutritious food choices. Sixth, provide financial incentives to vendors who adopt eco-friendly practices, such as using reusable packaging or sourcing locally. Seven, strengthen the ongoing awareness campaigns to sensitize consumers about the benefits of Agroecology Market Shops and in these campaigns, highlight the positive impact on health, environment, and local economies. Lastly, but not least, integrate Agroecology Market Shops into broader national agricultural and food policies. This can be done by coordinating efforts across government agencies, NGOs, and private sector stakeholders to create a supportive policy environment.

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