The Future of Digital Technology in Agroecology

Workshop Report

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[1]University of Exeter, [2]A Bigger Conversation

Introduction

This report captures findings from a workshop held in April 2024 at the University of Exeter. The workshop responded to recent research suggesting agroecological farming could be better served by emerging digital technologies. The workshop asked 18 participants with practitioner and academic expertise in agroecology, social science, computer science, ecology, research funding, and agri-tech to explore what successful development of digital technology for agroecology would look like, how it could be facilitated, and what challenges existed.

Background

Digital technologies, including automated machines and data-collecting devices, are increasingly developed for and used in farming. This area has seen substantial investment by the British government in recent years, both in research funding and grants to farmers. Funding is to enable these technologies to provide solutions to pressing challenges in the farming industry after Brexit and the Covid-19 pandemic such as climate adaptation, labour shortages and international competitiveness.[1]

One area of farming that receives less attention in policy and funding is agroecology. Agroecology is a broad umbrella term that includes a range of different farming approaches such as organic, biodynamic and regenerative farming and permaculture. Each of these have different degrees of standardisation and definition but share a commitment to working with ecological systems and functional biodiversity and are built on social values such as justice, equity and collective approaches to learning and governance.

Proponents of agroecology argue that these approaches provide pathways towards sustainable, resilient, and equitable food and farming systems, beyond the business-as-usual of intensive farming that has contributed to a range of environmental and economic problems

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[1] For example, the £220 million technology grants announced by then-Prime Minister Rishi Sunak in February 2024, which provided funding for farmers to purchase automated and robotic technologies. https://www.gov.uk/government/news/pm-to-announce-major-innovation-boost-for-farmers-feeding-the-nation-20-february-2024

in Britain and globally. If and how digital technologies might fit with these pathways remains an open question, especially given arguments that agri-tech development has contributed to the persistence of problematic intensive farming methods.

Agroecology is typically perceived as a low-tech approach to farming, but in practice it embraces innovation and new knowledge. Research conducted by the workshop conveners has nevertheless indicated that agroecological farming is not currently well served by developers and markets for digital technology.

Hartley and Williamson conducted focus groups with stakeholders in British animal agriculture in July 2023 to understand their views on different types of digital technologies in livestock farming. These focus groups revealed that organic and regenerative farmers felt excluded from the development and potential benefits of digital livestock technologies, seeing few on the market that served their distinct needs.[2]

Thomas and Woodward's group co-organised workshops with agroecological farmers across the UK in 2022 and 2023 in order to understand how they made choices and judgements about what technology was appropriate for agroecology. These workshops demonstrated that there were not yet clear and collectively shared views among agroecological farmers on the use of digital technologies and whether they were appropriate to the practical conditions and philosophical and political commitments underpinning their farming approaches.[3]

In both cases, agroecological farmers had expressed an interest in the potential for digital technologies to support their work, values and objectives, if developed and used in suitable ways. The authors therefore came together to convene a workshop that would explore in more detail what successful development of digital technology for agroecology would look like, how this could be facilitated, and what challenges existed.

The Workshop

The workshop was held at the University of Exeter on 16 April 2024. Funding was provided by the UK Research Council EPSRC via DIGIT Lab, a research centre in which Hartley and Williamson are embedded as the Responsible Research and Innovation team.

18 people participated, including agroecological farmers (spanning organic and regenerative farms and market gardens); academic social scientists, computer scientists and an ecologist; and representatives of the national research funder Innovate UK and of Devon County Council's agri-tech team. Participants were primarily invited from the southwest of England, to facilitate ease of travel.

The workshop convened discussion around four questions that the organisers had determined were important for consideration based on their existing research and were

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[2] Williamson, H.F. & S. Hartley. 2024. Responsible development of digital livestock technologies for agricultural challenges: Purpose, practicality and effects are key considerations. *Sociologia Ruralis*. 64(4): 662-684 https://doi.org/10.1111/soru.12492

[3] Mason, A., P. Thomas & L. Woodward. 2024. *Agroecological Intelligence: Establishing criteria for agroecologically appropriate technology*. Final report. A Bigger Conversation

agreed with participants at the start of the workshop. The questions aimed not simply to identify needs and opportunities to which digital technology could provide solutions, but to start from an agroecological perspective on what makes technology successful and how it fits within the wider set of values and organisational forms that are held by agroecological farmers.

The questions are:

1. How do we define success for technology in agroecology?
2. What kinds of networks and collaborations produce successful technologies?
3. What do we need to steer technology towards agroecology?
4. What can agroecology contribute to digital technology?

Participants discussed the questions across two sets of breakout groups and plenary discussions. Discussion themes were written down and collated at the end of the workshop.

Results

How do we define success for technology in agroecology?

Agroecological approaches to farming involve a range of distinct practices and goals, such as maintaining biodiversity alongside food production, and are also driven by a range of social values. Definitions of success are therefore shaped by these social and practical commitments, which go beyond typical criteria of success for much commercial technology development such as practical efficacy and affordability.

Workshop participants raised a number of goals that were valued within agroecology, and which could be taken as measures of success based on whether digital technologies contributed to achieving them. These included: improving the financial resilience and profitability of agroecological farms; improving the mental and physical wellbeing of farmers; improving ecological diversity and environmental resilience; increasing the diversity of agricultural production systems; increasing the health of animals; facilitating meaningful work; improving marketing systems; and producing food that is beneficial to consumers, producers, and the environment.

More broadly, however, participants questioned how success is framed in relation to agricultural technologies. They stressed that technology development should be driven by specific needs and problems in agroecological farming, rather than starting with technological possibilities and then looking for problems that they can solve. Such development processes need to be sensitive to the farming context, including both the practical setup of the farm and the values and conditions under which farming is undertaken.

Participants stressed that success itself is contextual, rather than being an inherent quality of a technology, and depends on how and where a technology is used. Success should also be considered beyond just the setting, taking a system-level view on resulting outcomes, for example in terms of changes to the wider food system.

This context-sensitive perspective also raised questions about what kinds of technological innovation are valued by policymakers, funders, and developers: Participants argued that successful innovation in an agroecological context might involve the use of older technologies rather than new, or simpler rather than more complex technologies, whether digital or not. This reflected longstanding debates about the role of 'appropriate technology' in agriculture.[4]

One area that was considered potentially useful was the development of a greater diversity of metrics, both for the goals that agroecological farmers valued (such as on-farm biodiversity) and for measuring the extent and success of technological innovation itself relative to agroecological values.

What kinds of networks and collaborations produce successful technologies?

Effective networks and collaborations were considered to be important to the success of technologies for two reasons: Firstly, to facilitate the direct participation of farmers and other stakeholders in the development of technologies in order to provide input on the motivating problems, farming context and appropriateness of proposed solutions (a process sometimes known as co-production); and secondly, to facilitate access to information and knowledge about technologies and how they might be used. The latter was seen by participants as a sometimes neglected but critically important area in facilitating independent, on-farm experimentation and innovation.

Workshop participants shared a broad consensus about how such networks should be organised: They should avoid hierarchies in favour of horizontal forms and be driven by collaboration rather than competition. Leadership should optimally come from farmers, although the participation of research institutes in 'hybrid' networks was valued. Participants highlighted the need to recognise that change resulting from such networks can be incremental rather than rapidly transformational, and that farmers will be operating with a range of dependencies, on each other as well as on external factors.

No single organisational model was identified by participants as being optimal, but a number of different research and knowledge exchange networks in the UK and internationally were identified as successful examples. These included the Innovative Farmers network managed by the Soil Association in the UK and the 'centre without walls' model of the International Centre for Research in Organics Food Systems (ICROFS) in Denmark. Despite these successes in dedicated networks, the status and extent of support available for agroecological farming in broader networks, such as Innovate UK's Business Connect, was perceived to be uncertain.

Another theme raised by participants was the need for effective and open communication within collaborations, in which different views could be voiced (indeed were actively invited) and disagreements addressed without sinking into polarisation. This required active commitments to listening, as well as the development of a common language for discussion.

What do we need to steer technology towards agroecology?

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[4] Schumacher, E. F. (2011). *Small is beautiful: A study of economics as if people mattered*. Random House.

Following discussions of criteria for success for technology development and use, workshop participants were asked to identify what would be necessary to realise such success at a larger scale.

As a priority, participants asserted that accessible and appropriate funding opportunities were needed for agroecological farmers to engage with digital technologies, whether experimenting with available technologies or participating in development processes. Appropriate in this case included recognition that many actors in the agroecological space are smaller and do not have the resources or networks to apply for larger grant opportunities. In addition, a need for more public-interest research institutes that could tackle related areas of research was identified.

More broadly, participants identified a need for policymakers, funders and technology developers to take a more problem-driven approach that was based on direct engagement with agroecological farmers. That may require greater collaborative knowledge production with farmers, rather than simply for them.

Developers of new technologies also need to account for the constraints under which agroecological farming operates, especially the tight financial constraints of agroecological farms and the high costs and consequences of failure. Funding opportunities that are low risk and low regret and allow farmers to experiment with new technologies in a 'trial and error' manner would greatly increase the accessibility of digital technologies for agroecology. Development of digital technologies that are low cost would similarly increase their accessibility to agroecological farmers.

In addition, participants saw a need for greater alignment of funding and development processes with agroecological values. This included in areas such as intellectual property rights, where exclusive ownership and competitive advantage is less valued than sharing and collective learning, and in the pathways from research to on-farm use, where models of commercialisation do not necessarily align with the way that technologies and knowledge circulate in agroecological networks.

On the responsibility of the agroecological community, participants identified several cultural changes that were necessary, including more willingness to engage in problem solving and stronger leadership around engaging with technology and deciding what technologies were or were not appropriate. What is meant in discussions of technology requires greater clarity (for example, whether 'low tech' solutions are included alongside digital technologies), and more collective consideration needs to be given to what technologies are considered to be compatible with agroecological values and commitments.

What can agroecology contribute to digital technology?

Through its emphasis on slow, communally developed approaches to innovation that fit within wider systems of ecology, climate and society, agroecology provides a very different model to dominant, market-driven approaches to technology development. Moving away from assumptions that farming is a passive receiver of information and technology from researchers and developers, workshop participants were asked to reflect on whether

agroecology could provide lessons, models or other contributions that might positively reshape digital technology development and use.

A major contribution highlighted by participants was real world problems for technology developers to engage with. Within funding structures, this might involve agroecology practitioners setting challenges and participating in the review of applications. Similarly, there was an opportunity to reframe agriculture as an object of research and development interest for its environmental value, as a field that can positively contribute to ecology and landscape, a perspective that has tended to be neglected in comparison to seeing agriculture and related technological opportunities in terms of economic and productivity value.

A second contribution highlighted by participants was the potential to change expectations around innovation processes and purposes. While not necessarily at the cutting edge of technology, agroecology is marked by innovation and experimentation. This often subverts dominant models of innovation that assume innovation is linear and should be rapid: Instead, successful technologies in a given context may be old technologies, and incremental changes may be more successful than trying to implement rapid transformations. Similarly, agroecological farming is frequently organised around alternative business models such as direct-to-consumer selling in which personal relationships are valued and prioritised. Participants suggested that there may be value to thinking with these models in comparison to existing models focused on commercialisation.