Food systems and digitalization from a food sovereignty approach[1]

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Sharing knowledge for food sovereignty

This working paper seeks to support food producers' organizations and other grassroots-based organizations in the complex debate on digitalization. It highlights four critical issues when considering digitalization in agriculture from a food sovereignty perspective: (1) the practice of digitalization is not neutral but supports large-scale food production systems at the expense of small-scale and family farming systems; (2) data extracted from farming activities is treated as a commodity from which profit is generated and economic concentration is deepened in a context of a lack of regulation framework; (3) people-led digital tools are being developed by communities with a rights-based approach for local development; (4) digitalization has important environmental impacts that have to be considered.

The purpose of this working paper is not to cover the entire debate around digitalization in food systems but to provide an analytical tool to food producers' organizations regarding dangerous trends ongoing in this field, often supported by a general pro-data narrative that overlooks the negative impacts on diversified and territorial food systems. In contrast, this paper also seeks to center a bottom-up method to digitalization as a way to strengthen food sovereignty, in line with a technological sovereignty approach.

1. *Digitalization is not a neutral addition to agriculture, but biased to align the food system with large-scale industrial agriculture, positioning small producers as an obstacle in the way of this process. As a tool for large scale production models, digital agriculture worsens negative social and environmental impacts, deepening existing inequalities in the food system.*

Corporate-controlled digital agriculture – implemented by large information and communications technology (ICT), financial technology, and agriculture corporations – leads a form of digitalization that is biased to benefit these corporations; to assimilate producers into markets and supply chains, creating an environment that is compatible with the products these corporations sell.

•Digital agriculture – especially through the form of digital platforms accessible by mobile device – results in new market relationships, particularly through the introduction of e-commerce platforms. Framing smallholder producers as 'entrepreneurs', platforms (often offering microfinance services) involve the use of techniques identifiable as behavioral economics. These platforms are designed to 'nudge' individual decision-makers to a choice that is ostensibly presented in their best interest, but effectively they act to regulate the behavior of individual decision-makers rather than regulate the market itself (Brooks, 2021, p. 4). Through weakening social ties and emphasis on individual producers in place of mutuality and reciprocity, corporate-controlled digital agriculture leaves small farmers more vulnerable to the market as well as the effects of climate change.

•Within corporate-led digital agriculture platforms, agricultural partners are emphasized as the solution to problems faced by small farmers (Brooks, 2021, p. 9), pre-determined for producers rather than empowering them to make decisions by them, as default choices are encouraged and options are lessened (p. 10). By implementing an environment that encourages predictable behavior, corporate-led digitalization extracts data and profits from smallholders.

•Furthermore, digitalization in line with corporate agriculture can lead to the erosion of social ties. For example, in the effects of index-based agricultural insurance within digital platforms. Index-based agricultural insurance, targeted at smallholders, can be proposed to re-

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place government subsidies as an incentivized alternative, releasing payments to producers not in relation to losses but based on weather conditions in comparison to an index of expected conditions for different products. This has the effect of individualizing risk, shifting responsibility from government subsidy or private investors to individual farmers, while benefitting private corporations. This process erodes "informal systems of risk pooling linked to local institutions for seed saving and exchange" (Brooks, 2021, p. 15).

The collection of data involves assumptions and biases that replicate the power hierarchies of the system that they are a part, exacerbating inequalities at the rate of digital expansion. Consequently, data collection is political, and the extraction of data from small producers through a top-down perspective is not neutral nor objective.

- People make decisions and assumptions which affect data collection and digitalization. The value systems of local knowledge and agro-industry are different, and therefore require different understandings of ownership of data. Corporate digital agriculture replicates the value systems that comprise it at the expense of value systems of local knowledge. This also extends to machine learning within artificial intelligence, which has been found to take on biases through its 'training', as it 'learns' from existing information on the internet[2] (Von Braun & Baumuller, 2021, p. 93). An example of the effects of bias in decision making of data collection can be found in the data collection of crops. Peasants grow 7,000 crops, and data collection is focused on 150, demonstrating different values of importance and decision-making.
- Data collection requires statistically 'significative' numbers to be properly analysed. How and how much data is collected depends on human and structural resources which may not be universally available. A lack of the availability of these resources can lead to incomplete collection and assessment of data. 'Outlier' data at the statistical level is ignored by the justification of inconsistency, despite such data potentially containing important contextual value. The exclusion of 'outlier' data extends to traditional lifestyles, which are often treated as anomalies if they do not respond to market incentives in a predictable way (Brooks, 2021, p. 5).
- Decisions informed by quantitative data collection and analysis are flawed because they are based on static information. The use of data in digitalization is static from the point of data collection. It removes information from the local context, and cannot incorporate the dynamics of decision-making that are a part of local knowledge. In tandem, knowledge in food systems can not wholly be converted into quantitative data. Despite this, quantitative data is often considered more credible in decision-making. Qualitative data is valuable, as is the individual knowledge of producers, especially respecting small-scale producers and workers.

Reflecting wealth disparity, there is a global digital divide, which can exacerbate existing inequalities. This digital divide spreads to digital literacy, as well as the collection of data through digital means.

- A growing digital divide can widen the wealth gap, reproducing existing inequalities as digitalization develops (Hernandez & Roberts, 2018). Comparatively, fair access to digital resources requires robust public digital infrastructure.
- The digital divide disproportionally affects the most marginalized; particularly elders, women, as well as youth. There is a gender bias to the access of digital infrastructure as women, particularly those in areas of high poverty, have less access to digital infrastructure[3] (Von Braun & Baumuller, 2021, pp. 86-87).
- Public digital infrastructure is needed to avoid widening the digital divide.

2. *Digitalization of agriculture fits in to the broader digital economy, in which data is a commodity to be extracted from small producers and utilized for greater economic control. The concentration of data in digital agriculture is economic concentration. Therefore, there is a strong need for extensive regulation of digitalization.*

Condition of Digitalization

Corporate-led digitalization of agriculture is designed to benefit corporate interests, not the interests of small producers.

- Corporations are aggressively pushing for digitalization throughout the food system. This includes automation, robotization, artificial intelligence, data analysis and data processing. Digitalization developed through the corporate system is designed to favour and assimilate producers into the corporate system, resultantly leading

[2] Whose Knowledge (https://whoseknowledge.org/) acts as an example of an organization that aims to counter this existing bias by centering knowledge of marginalized communities through a range of initiatives.

[3] The digital divide is an intersectional issue, overlapping across different marginalized populations, experienced through access and but also gender norms and power imbalances. For example, while "urban women in Brazil are 2% less likely to use the mobile internet than a man, women in rural areas are 32% less likely" (Hernandez & Roberts, 2018, p. 13).

to a loss of local knowledge and de-skilling, and more decisions made that exclude those who are impacted by them.

Seeds are a paradigm for the impact of digitalization on the agriculture sector.

•The use of seeds by agro-industry acts as a model for how digitalization will be used under the influence of corporate concentration in agro-industry and ICT-industry. Seeds have been used to control producers and reduce their autonomy, pressuring producers towards industrial agriculture and standardization. By reducing the autonomy of producers, the value and use of local knowledge is diminished.

•This use of seeds as a method of control of the food system continues contemporarily through digital agriculture. Practices like seed reciprocity do not fit the model of digital agriculture firms, despite the benefits they offer in provided small producers with a diversity of seeds and maintaining informal social institutions (Brooks, 2021, p. 14).

Digital Sequencing Information and the commodification of genetic material

•Beyond seeds, it is now the genetic material which is used to make profit at the expense of small-scale agriculture. Once altered (or just described) and patented by private companies, genetic material (through Digital Sequencing Information) is marketed and taken away from local use (Kastler, Onorati, Brac, 2013)

For corporate-led digital agriculture, data is an economic commodity to be extracted and controlled. Data and knowledge grabbing is profitable for private actors and leads to economic concentration.

•The push towards digitalization coincides with increasing vertical and horizontal integration and concentration in the management of data in agro-industry, ICT-industry, and finance. This movement is indicative of potentially further cross-sector concentration. ICT-industry corporations are significantly larger than even agro-industry corporations. Concentration also extends to asset management firms that own significant shares of large agro- and ICT-industry.

•This concentration and control of power extends to infrastructure, including cloud services and satellites. Governments and the public rely on this privately owned and controlled infrastructure, as corporations have established themselves in control of digital infrastructure in the absence of public infrastructure.

-Data enables land acquisition for private firms. The implementation of precision agriculture has made agricultural land more secure and profitable than traditional commodities. The data provided by agriculture platforms acts as a valuable commodity when assessing the agricultural value of land for the finance sector. (Brooks, 2021, p. 13).

Regulation

A lack of regulation of digitalization allows the possibility of existing inequalities to be further exploited, contributing to wider power imbalances. Given that data collection and analysis is not an objective process, but a political one, a wide scope of regulation of data collection and digitalization is necessary.

•The extent of the impacts of digitalization processes in the food system are unknown, therefore regulation of digitalization and data collection should be approached with the precautionary principle.

•Regulation should be collective and include the concerns of a wide range of people and bottom-up processes to involve local communities.

•It is important to consider the motivation of data collection; for what purpose is data collected, how is it collected, and for whose benefit? Regulation is necessary to prevent further asymmetries of power, especially through the extraction of local knowledge to global value chains by agro- and ICT-industry corporations.

Corporate-led digitalization of agriculture contributes to the loss of the right to food. Corporate-led digitalization is designed with the aim to control the food system, favouring a large-scale productivist model removed from the control of the people.

•Regulation needs to protect human rights. Without regulation protecting human rights and peoples' rights, digitalization threatens to lead to increased automation and use of robotics as data is extracted. This threatens livelihoods while profits go to ICT-industry and agro-industry.

•The use of artificial intelligence and robotics (AI/R)) by corporate-led digitalization attempts to gain greater control of the food system, damaging the right to food of small producers as well as the role of small producers in the food system.

The concentration of data collection also encompasses territorial data. Territorial data, collected by largely unregulated surveillance technologies – like satellites and GPS – can be used within a process of triangulation with data collected from other sources. This data can be used to valuate agricultural land and make it more attractive for financial investment.

•Territorial data collected by surveillance technologies –

like satellites and GPS – needs to be properly regulated. This data is a resource that is significantly valuable in the data economy, and is vulnerable for extraction, particularly considering how it can be triangulated with other data collection (like that derived from digital agriculture platforms). This data can be used to valuate agricultural land, making it more attractive for private investment or susceptible to digital land-grabbing, infringing on the right to food (FIAN, 2020).

3. *Digitalization is a tool that can support different objectives. For now, it is supporting the development of the food system that it is derived from and designed for. Bottom-up digitalization therefore exists as an alternate way forward for the tool of digitalization in contrast to the corporate model. As part of a bottom-up digitalization, food producers must have control of data collection and analysis to ensure that digitalization acts as a positive force in the food system, working for producers and civil society. Horizontally, digitalization can support alliances between different knowledge bases in the food system, strengthening connections between producers to enhance a food system centered on the right to food.*

Digital technologies must be considered in the context of their development. In order to work for people, digital technologies must be produced with and by people, centering the knowledge of farmers to enhance agroecological food systems.

•The food system that needs to be supported through digitalization is one that protects the rights of peasants and other people working in rural areas, and all food producers, as included under UNDROP (Article 26 para. 1 and 3, but also articles 2, 18, 19, 20).

•As extension of the existing connections between people and within communities, digitalization led by people can enhance social institutions and the social fabric.

•Considering the negative environmental impacts of digitalization and the benefits of agroecology, agroecology - based on the centrality of food producers to guarantee their autonomy- should be centered when discussing digitalization.

•Digitalization led by people can center peasant knowledge and improve farmers' lives with adequate training and access to involve people. Decision-making for local communities can be strengthened through digital data collection, and can create tools for collective solutions to common problems. Although comparatively small to dominant digitalization from agro-industry, real examples of how data collection and digitalization can emerge from bottom-up processes exist. For example, FarmHack is a farmer-to-farmer network that facilitates the use of digital tools, applications, and the sharing of information.

Digital infrastructure and digitalization should be treated as a Public Good

•Currently, most data is produced by agro-industry, or behind paywalls. Those affected by decisions made around data need to be included in decision-making processes as well as participants in data collection and analysis of data. To ensure data quality, it is also necessary to have consistency and transparency in the collection of public data.

Community-led digitalization can potentially work to strengthen alliances between different knowledge bases in the food system.

•For example, building from the Campesino a Campesino model, the National Association of Small Farmers in Cuba with La Via Campesina International and the Komanilel Collective developed a "Multimedia Peasant School" ("Escuela Campesina Multimedia": https://agroecologia.espora.org/) with agroecology schools around the world, using virtual material that is accompanied by a range of sources available in English, Spanish, French, and Portuguese (Nyeleni, 2019, p. 6).

•Additionally, speech-to-text services have the potential to improve access to information and communication for those who may face literacy or language barriers, especially for less-common languages (Von Braun & Baumuller, 2021, p. 89), and to expand alliances built around agroecology.

•Digital platform for direct selling can be a powerful tool to enhance access to markets for small-scale food producers. The livestock farm Biobagnolese in the Biodistrict of Via Amerina e delle Forre in Viterbo province (Italy) is using this kind of platform to easily connect to consumers and manage the selling; this model allows us to easily adapt to shocks (Schola Campesina, 2020).

4. *Digital agriculture requires energy and resource extraction that is environmentally damaging. The extent of the environmental impacts of digitalization need to be assessed. Digitalization requires resource and energy extraction to operate, further contributing to climate change, and an increase of digitalization results in increased resource and energy requirements. Digitalization environmentally impacts the food system through: resource extraction and disposal, energy production, and the resultant effects of climate change, infringing on the right to food for all. As part of complex ecological systems, environmental impacts extend to the extra-local scale.*

As data transmission capabilities grow, so do infrastructure requirements; consequently, energy and resource requirements also grow, exponentially increasing environmental impacts, infringing on food systems and the right to food for all.

•Data transmission requires digital infrastructure for devices to operate, which in turn requires energy. Faster infrastructure leads to faster data transmission and more energy requirements. 5G mobile broadband in particular will facilitate the use of sensors, smart devices, and 'Internet of Things', projecting significant increases in energy and resource requirements in the future. For perspective, 5G mobile broadband has the potential to increase data volume to approximately 1000 times that of 4th generation mobile broadband (Malig, 2021, p. 24).

•Data infrastructure physically entails data centers, wireless networks and networks of fibre optic cables (including undersea cables), in addition to digital platforms, apps, and other types of software. The increase of wireless networks masks the physical requirements of these networks to operate, which have massive resource requirements, including data centers. Data centers (increasing with the prevalence of cloud computing) are warehouse-like facilities that contain 'server farms'. Data centers can hold upwards of tens of thousands of servers in a single facility for sending, receiving, and storing data. As a result, data centers require a great deal of electricity to power and cool the servers. As hardware themselves, servers require further resources to manufacture.

•Large data centers use water for cooling their servers directly, as well as indirectly for cooling of their power sources; "in 2009 Amazon estimated that a 15 megawatt data center can require up to 360,000 gallons of water a day" (~1,362,748 litres/day) (Water Calculator, 2018). This extensive water use has lead to ICT companies competing for freshwater with farmers (Water Calculator, 2018).

Energy and resource consumption and environmental pollution are a deep-rooted part of the digitalization process, and need to be fully understood to know the impacts of digitalization on the food system.

•Electronic and information technologies used for data collection and digital agriculture require significant resource extraction, in particular, rare metals. A smart phone containing 100g of metal can involve 30 kg of rock extraction (Oko-Institut, 2019, p. 45). Mining requires, and therefore depletes fresh water. Mining involves a risk of environmental damage from improper containment of acidic tailings from the mining process, which can leech into the soil and water, endangering local communities and farmland as well as water supplies. Further resources are required during production and transportation of these technologies. The environmental impact of these devices can be magnified by short life spans.

•The improper disposal and recycling of electronic waste ("e-waste") also poses a hazard and can lead to further environmental damage beyond the immediate site of disposal, leeching into surrounding areas.

•The combination of resource and energy requirements for digital infrastructure and increased digitalization threatens significant environmental impact through human-caused climate change, land use changes, pollution, biodiversity loss, and fresh water depletion. While this threat is present, the extent of the impacts of digitalization and data collection on the food system and local communities is not fully understood. Given that the corporate-led model of digital agriculture does not value collective action that underpins informal social institutions and places profit-driven solutions above complex local knowledge, digitalization can erode the adaptive capacity of small producers. The precautionary principle should be used to protect this social fabric.

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