

# Tailored Digitization for Rural Development <sup>†</sup>

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**Abstract:** The widespread use of many digital technologies along the food supply chain might have negative effects on rural development and on small and medium farms. One conclusion of this paper is that in order for rural areas to exploit all the benefits from digitization, avoiding the associated risks, there should be more agricultural extension services to farmers and more open data portals and platforms. This is in order to develop technologies specifically tailored for the economic, natural and social environment of rural areas, and therefore to be able to promote their modernization without giving up their cultural heritages.

**Keywords:** rural policy; innovation; food chain; digitization

## 1. Introduction

Goals of rural development (RD) policies include: reducing economic and social disparities with respect to urban areas (as regards income, education, modernization, and access to new technologies); fighting depopulation; fighting unemployment; and maintaining all the public goods and positive externalities provided by rural areas such as cultural heritage, landscape, environmental services.

Over the last years, increasing emphasis has been put on agriculture digitization as the main instrument through which to promote rural development. In recent years, the appeal to digitization has become one of the cornerstones of the rural development programs proposed by the main international institutions working in the field of development and agri-food policy [1–3].

The aim of this work is to shed light on some possible risks and shortcomings of an excessive emphasis on digitization benefits. The paper focuses on the EU case. A list of digital technologies are tentatively assessed towards their possible role in achieving EU RD goals and some suggestions are provided in order to make agriculture digitization more suitable for RD.

## 2. Methodology

The qualitative assessment of the role of digitization for RD was performed by cross-referencing the information and opinions gathered from the European Union documents on RD strategies, and some recent articles and reports drawing attention to the possible risks of agriculture digitization.

In the EU, RD policies are set within the Common Agricultural Policy (CAP), which is renewed about every seven years. The new CAP programming period is scheduled from 2021 to 2027 (with a current one-year delay due to the COVID pandemic). The new CAP proposal indicates nine key objectives [4], which are built around the three key words found in the presentation of the new CAP: 1—modernization through digitization; 2—simplification through digitization, 3—compatibility with the 10 priorities of the Commission, among which “a connected digital single market” and “A Europe fit for the digital age” [1].

These three key words clearly indicate the importance given to digital innovations for the pursuing of CAP goals, as has been furthermore stressed through the signature of



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member states to the Declaration “A smart and sustainable digital future for European agriculture and rural areas”, launched in Brussels on 9 April 2019 [5]. According to the Declaration “digital technologies such as artificial intelligence (AI), robotics, blockchain, high performance computing (HPC), Internet of Things (IoT) and 5G have the potential to increase farm efficiency and improve production, and also to contribute to making farming systems more sustainable from an economic, social and environmental point of view, as it is the case in other sectors”.

Besides the new CAP goals, agriculture digitization has been already promoted by the EU research policy. Over the last years, through Horizon 2020, more than €200 million for research and innovation were allocated to the deployment of digital technologies for the agricultural sector.

Risks and shortcomings of agriculture digitization [6,7] have been associated with at least three characteristics of the digitalization processes observed so far: (1) the disproportionate innovation benefiting large farms and intensive conventional agriculture with respect to small farms and alternative agricultural practices; (2) the processes of consolidation along the food supply chain induced by digitalization, with unprecedented concentration of economic power, monopolization and increased power imbalance throughout the chain; and (3) security and political issues associated with data access and property rights.

- (1) Most digital innovations available so far (such as guidance systems, semi- autonomous tractors and harvest robot) have been developed for large-scale industrial farming. Agricultural technologies are affected by economies of scale, creating disparity between large and small-scale farmers, with a corresponding inequality between developed and developing countries [3]. Transformative digital innovations and technologies are often not designed for the scale at which smallholder farmers operate. Moreover, the currently proposed digital innovations might negatively affect alternative agricultural systems, such as agroecology and organic farming. Digital innovations might marginalize the cultural and ecological knowledge of small-scale farmers, with their knowledge being replaced by data analytics and/or AI. The main risks from digitization for alternative agriculture practices reside in the possibilities for small farmers of losing their knowledge and skills, as well their right to repair their equipment or access sensitive data.
- (2) Since most applications suit large farmers and intensive agriculture, digitization may push toward further consolidation in the food system. Agriculture digitization favors not only concentration at horizontal level, but also vertical coordination architectures along the food supply chain characterized by strong power imbalances, so that a few powerful actors are able to exploit the whole added value of the supply chain. In other terms, it fuels chains of oligopolies (and double marginalization inefficiencies) possibly associated with monopsonies and imbalanced marketing channel structures. Agrochemical industry has been the first to ramp on digital power followed recently by the largest internet companies which have started to integrate agribusiness apps in their platforms [8,9].
- (3) Security and political issues are associated with the absence, so far, of a clear and effective regulation on data protection and exploitation rights in presence of data harvesting and processing practices led by the biggest world’s internet and agribusiness MNCs. For farmers, key issues include who controls access to, and sharing of, data that are generated on and about farms, and how the value that is created from that data is re-distributed [10]. One concern is due to the fact that farmers do not own their data, which limits the ability of farmers to transfer historical data between technology providers, or to choose who services their machinery. Table 1 resumes the risks associated with the main digital innovations.

**Table 1.** Digital innovations in the food supply chain and associated risks.

Digital Innovations		Risks			
Sector	Applications	Not Benefiting Small Farmers	Hindering Alternative Agricultural Practices	Fostering Consolidation and Power Imbalances	Data Governance Concerns
1 Agricultural inputs	Financial services	<i>Very Likely/but some opportunities</i>	<i>Very Likely/but some opportunities</i>	<i>Likely</i>	<i>Very likely</i>
	Genome-edited seeds	<i>Very likely</i>	<i>Very likely</i>	<i>Very likely</i>	<i>Very likely</i>
	Smart tractors and sensors	<i>Very likely</i>	<i>Very Likely/but some opportunities</i>	<i>Very likely</i>	<i>Very likely</i>
	farm robotics	<i>Very likely</i>	<i>Very likely</i>	<i>Very likely</i>	<i>Very likely</i>
	Farm management platforms	<i>Likely/but some opportunities</i>	<i>Likely/but some opportunities</i>	<i>Very likely</i>	<i>Very likely</i>
2 Primary commodity trade	Digital marketplaces	<i>Likely/but some opportunities</i>	<i>Likely/but some opportunities</i>	<i>Likely</i>	<i>Likely</i>
	Digital freight management	<i>Likely</i>	<i>Likely</i>	<i>Likely</i>	<i>Likely</i>
3 Food processing	robotics	<i>Very likely</i>	<i>Very likely</i>	<i>Very likely</i>	<i>likely</i>
	3D food printing	<i>Likely</i>	<i>Likely</i>	<i>Likely</i>	<i>Likely</i>
	Smart packaging	<i>Very likely</i>	<i>Very likely</i>	<i>Very likely</i>	<i>likely</i>
4 Food distribution	Quality sensors and analytics	<i>Likely</i>	<i>Likely</i>	<i>Likely</i>	<i>Likely</i>
	Automated warehouses	<i>Likely</i>	<i>Likely</i>	<i>Very likely</i>	<i>likely</i>
	Smart shopping—E-commerce platforms	<i>Very Likely/but some opportunities</i>	<i>Very Likely/but some opportunities</i>	<i>Likely</i>	<i>Very likely</i>
5 Food chain organization and regulation	Digital tools for commodity chain traceability and transparency	<i>Very Likely/but some opportunities</i>	<i>Very Likely/but some opportunities</i>	<i>Likely</i>	<i>Very likely</i>

### 3. Discussion and Conclusions

A sustainable development of rural areas includes the following objectives: the diffusion of agricultural practices with low environmental impact; maintaining a fabric of efficient small and medium-sized enterprises; the maintenance of traditional knowledge that links production activities to the specific environmental and socio-cultural needs of a territory. The results of the analysis summarized in the table show how the digitization of agriculture can hinder the pursuit of these objectives, as it: (1) creates competitive disadvantages for small farms, which risk exiting the market; (2) hinders the spread of alternative agricultural practices such as organic farming and agroecology, and consequently destroys the agronomic knowledge related to them, often based on adaptation to the particular pedoclimatic conditions of a territory; and (3) supports further concentration at each stage of the food chain, increasing power asymmetries.

Given the risks of digitization with respect to the sustainability of RD, there is the urge by government bodies to carry out interventions aimed at managing the risks while creating opportunities for better outcomes of digital innovation. Risks of excessive concentration and power imbalances should be tackled by fostering competition policies, either using the current legislation, either by designing new forms of interventions also in an

international cooperation framework (therefore through international bodies, treaties and agreements). Data governance concerns should urgently be addressed by implementing effective interventions in the field of privacy norms, intellectual property rights, data access democratization and public data management services. Discussions about data governance should entail a whole-of-government and multi-stakeholder approach, where the perspectives of all stakeholders and sectors are properly represented. As highlighted in the table, small farmers and alternative agricultural practices might benefit from digitization with respect to two main domains: the possibility to directly and effectively approach those socially responsible customers who are interested in local traditional products, short supply chains and sustainable production; the possibility to better communicate their commitment to sustainability to such customers through transparency and traceability; the possibility of adapting farm management platforms as to benefits agronomic innovations consistent with principles of organic farming and agroecology. Obstacles to the exploitation of such opportunities reside in: the lack of digital skills; the high costs in accessing digital services due to high costs of software as well hardware and communication networks; the ill-designed public platforms for accessing governmental administrations, which do not take into account the organization diversity between small and large farms; the scant supply of apps and digital services specifically addressed to small farmers and alternative agriculture (since such products are designed in a way as to fit conventional agriculture and large farmers). State interventions useful to overcome such obstacles could be: public agricultural extension services; public research investments in organic agriculture and agroecology; public research investments in digital innovations tailored for small farms and alternative agriculture; grants to small farms to cover costs of digitization; simplifications of procedures for accessing online administrative services by small farms; and public digital skills training aimed at small and alternative farmers so they can learn to assess and implement the best practices and technologies for their farm business.

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