CAP beyond the EU

Precision agriculture: for whom precisely?

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The development and diffusion of precision agriculture might speed up since fresh money could become available through eco-schemes under the new CAP Strategic Plans. How does the EU support precision agriculture and what does it mean from a global south perspective? This article looks at the case of Rwanda and suggests technological developers and policy makers to proceed with caution to avoid widening inequality between smallholders and commercial farms, privacy breaches or undesired data dependency on tech giants like Google.

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Introduction

The new CAP reform post 2022 opens the doors to publicly fund the uptake of precision farming or precision agriculture (PA) by EU farmers. The National CAP Strategic Plans 2023-2027 are still under development, but precision agriculture is likely to be supported through various interventions, like rural development investments (e.g. machinery), farm advisory services and trainings, or eco-scheme payments, just to name a few examples.

Besides questioning the real public value and concrete socio-ecological achievements of precision agriculture in the EU, this article explores the implications of PA-technologies from a global south perspective, namely Africa and Rwanda. Previous research on digitalization, land and human rights has raised the need to study private and publicly funded precision farming not only in terms of actual performances (e.g input savings), but also through a de-colonialization and just transition research framework.

This article is based on expert interviews from the EU and Africa involved in digital farming. Besides raising a number of issues connected to *publicly funded adoption* of *privately developed and exploited* precision farming technologies (e.g. widening inequality between commercial farms and smallholders, or threatening data privacy for farmers), this article emphases the need to carry out ex-ante evaluations of CAP Strategic Plans from a global south perspective in line with the ambitions, initiatives, and targets of the European Green Deal.

Rwanda: an evolving context

Rwanda is called the land of a thousand hills for a reason. The Bahimba Valley, just northwest of Kigali, is surrounded by lush, green mountains. Slopes are covered with small houses, the valleys lined with fields of tea, banana plantations and well-kept maize.

Since 2017, most farming communities in the valley produce maize for a newly established consortium in Kigali called Africa Improved Foods (AIF) – set up by the Dutch chemical and foodstuffs giant DSM in cooperation with the Rwandan government. Revenues have quadrupled since then, several farmers told me when I was traveling Rwanda in 2018.

The quick development is the result of strict state planning. The ministry of Agriculture and Animal Resources (MINAGRI) in the capital city Kigali has introduced production targets in return for freely distributed plots of land and chemicals. Traditionally, Rwandan farmers mainly grow sweet potato or bananas. To become a food exporter onto the East-African market, the governments envisioned a switch to more lucrative crops like maize or tea.

The policies implemented by MINAGRI are in turn part of a comprehensive development masterplan called Vision 2050 – according to which agriculture would become one of the five pillars of economic transformation in Rwanda. "*In 2050, agriculture in Rwanda will be market-led and high-tech, driven by professional farmers with large farms on irrigable lands*," the plan reads. It will in part be driven by research and development "*to help farmers optimize their efforts and take up modern technologies*" while "*digitalization of the sector will link producers to profitable markets in real-time. Leveraging advances in biotechnology, smart phones, digital and spatial technologies, will further increase productivity*".

The move towards Precision Agriculture

After being ripped apart by a gruesome genocide in 1994, grinding poverty and lingering ethnic conflicts, the tiny African nation has unexpectedly become a development champion. Led by the dictatorial but forward-thinking regime of former rebel army leader Paul Kagame progress is visible all over urban areas as well as in the countryside. Year after year, the World Bank recorded economic growth figures surpassing seven percent, while Kigali transformed from a dusty slum city into a business hub for international companies trying to gain a foothold in the Eastern Africa.

The central government has made the UN Sustainable Development Goals (SDGs) a guide for policy priorities; village after village is being connected to a reasonably functioning electricity grid and the entire country is reachable through a modern highway network. Polluting diesel cars are not allowed into the country and, streets are kept spotless and clean while plastic pollution is banned; litter was a major cause for degradation of precious soils in the densely populated country.

Recently, precision agriculture (PA) has also become more common in Rwanda. MINAGRI did not respond to several inquiries by the author about more detailed specifics about PA-projects in Rwanda. But the Food and Agriculture Organization (FAO) of the United Nations in 2017 listed being involved in the testing of several mobile applications targeted at livestock feeding, marketplace monitoring and weather and crop apps, all part of a broader FAO-project to implement precision and digital agriculture initiatives around Africa.

Early 2018, another project was launched in Rwanda revolving around drones gathering remote data for precision agriculture, while in 2020 MINAGRI has launched a brand new project (funded by the Bill and Melinda Gates Foundation – BMGF) using high-resolution geographic information systems (GIS) and mobile soil testing equipment to develop location-specific interventions for farmers and updating Rwandan soil maps.

For the development of precision agriculture in Africa, developments in Rwanda right now could prove very beneficial, Mrs Bongani Ncube of Cape Peninsula University of Technology in South Africa thinks:

"*What is really for the implementation of precision agriculture is that proper policies are established on how to set up information and ICT-systems for the benefit of small farmers. The Rwandan government is renowned for making it their business to know everything. So in this case it could become an example of how to set up policies in a way that works for Rwandans. You see, most precision agriculture technology is developed outside Africa. Precision agriculture developed in the European Union could be a chance for farmers here, but might also prove problematic when the technology is not accompanied by capacity building on the ground. Neglecting the farmers themselves could mean your nice precision irrigation project in small town Mozambique collapses fairly quickly after the donor retreats*."

The intended benefits

Mrs Ncube works as a senior lecturer and researcher in Cape Town. In her work, she focuses on drought impacts on agriculture, soil fertility and water resource management. In 2018, she co-authored a chapter for the Scientific Journal Systems Analysis Approach for Complex Global Challenges about precision agriculture and food security in Africa. In the paper, PA is defined as "*an integrated crop management system that attempts to match the kind and amount of inputs with actual crop needs for small areas within a field' through 'agricultural production practices that use*

information technology either to tailor input use to achieve desired outcomes or to monitor those outcomes".

The research team charted the impact of crop, soil and positioning sensors, including global positioning and remote sensing applications to detect crop stress, monitoring variability, soils, weeds, and diseases. 'In Africa,' they conclude. "*The benefits of precision agriculture include improved food security through increases in water and nutrient use efficiency, and timely management of activities such as weed control. PA has saved costs of inputs in both commercial and smallholder farming in Africa. Pollution control of ground and surface water sources has slowed down where fertiliser and agrochemical applications are now more efficient*."

A major challenge for PA in Africa lies in obtaining sufficient funding to develop the technology. And even if that issue would be resolved, the success will heavily be dependent on the availability of data. "*PA is especially important for smallholders because chemicals can get quite expensive. Traditionally such farms just maximize the grammes of fertilizer used per hectare. Applying nutrients in a sophisticated way and avoiding excess could save a small farm a lot of money*," Ncube explains. "*One if the biggest problems is that the data gathered, about soil conditions, weather patterns or plant needs, can become very, very expensive. In South Africa, it's already a big problem that commercial farmers can access certain technology and data while smallholders can't. If PA is not developed in such a way that it is not easy for smaller farms to get a hold of them, the gap will remain*."

The EU role in the digitalisation of African agriculture

When it comes to farming and innovation, and despite clear benefits, little EU or Member State's money supports agroecology in Africa. On the other hand, agricultural research funding continues to be limited to supporting industrial agriculture and/or increasing its efficiency via targeted approaches such as improved pesticide practices, livestock vaccines or reductions in post-harvest (Biovision Foundation for Ecological Development & IPES-Food, 2020).

To learn more about how Europe could contribute to developing digital technologies fit for African farmers, the EU-funded Technical Centre for Agricultural and Rural Cooperation (CTA) delivered a flagship report in 2019. In the 241-page document, CTA identified 400 different digital agricultural solutions with 33 million registered farmers: just a fraction of the 2.3 billion African farmers active across the continent.

According to the CTA-report, most PA-projects in Africa are financed by state donors like UKAid, the UN World Food Programme, the German development foundation GIZ (*Deutsche Gesellschaft für Internationale Zusammenarbeit*), the World Bank, the European Commission directorate-general for International Cooperation and Development (DG DEVCO) or through private donors such as the Rockefeller Foundation and BMGF.

CAP: Eco-schemes and Precision Agriculture

New opportunities might arise now that the European Commission has put PA on the list of eco-schemes practices eligible for funding under the new Common Agricultural Policy (CAP). The new CAP-deal agreed on in June 2021 maps out how a total of 270 billion euros will be spent on European farms until 2027. The negotiators have agreed that 25 percent of all direct payments to farmers during that period will be allocated to eco-schemes aimed to greener agricultural practices. "*Eco-schemes are a new instrument in the CAP to support this transition*," the EC writes in its communication accompanying the list of agricultural practices eligible for funding. "*Member States will set eco-*

schemes in their CAP strategic plans. The Commission will assess and approve them as key tools for the CAP to deliver on the Green Deal targets."

Beside several organic farming practices, mechanical weed control, the use of pest-resistant crop varieties, letting land lie fallow for biodiversity purposes or crop rotation using legumes, precision farming techniques – however vaguely defined – can be eligible under eco-schemes payments: e.g. nutrients management plans, innovative approaches to minimise nutrient release, circular agriculture, precision crop farming to reduce inputs (fertilisers, water, plant protection products) and improving irrigation efficiency.

For instance, Ireland is proposing a payment for the use of GPS controlled fertiliser spreader to apply chemical fertilisers. Italy is proposing a payment for farmers to collect data on the use of antimicrobials in livestock, using the classify farm platform. After a first proposal of ecoschemes put forward before the summer 2021, a new draft published in October 2021 shows that Spain has removed precision farming among the list of practices eligible under eco-scheme payments. In the Netherlands, precision farming as such is not a self-standing or separate eco-scheme. However, the list of proposed practices does leave the funding open to various ways to 'the decrease in herbicides and pesticides'.

"*Digital agriculture offers enormous untapped potential worldwide*," says Sander Janssen of the Digital Agrihub at Wageningen University & Research (WUR). "*Smart technology developed in the Netherlands could be transferred to countries in the developing world. Redirecting CAP-money to digital solutions could accelerate that process. But we would have to proceed with caution, because what works in the Netherlands does not necessarily produce the same results in Africa or India*."

Exporting precision farming

In the rural heart of the Netherlands, the internationally renowned Wageningen University and Research has in December 2020 taken over the work of the CTA and started a project dubbed Digital Agrihub. Through the project, WUR wants to expand monitoring of digital tools, such as platforms for advisory services, market linkage, supply chain management, or emerging technologies like drones and robots, to developing countries worldwide. A lot of forms of digital agriculture at this point still take the form of advisory services to farmers about how to irrigate crops more effectively, how to get access to state of the art weather reports or how to use digital technology to increase efficiency and decrease pressures on the environment. Such services are often coupled to smart technologies developed in the EU, ranging from artificial intelligence, blockchain, precision application of chemicals, pesticides, hybrid seeds, Janssen says: "*Right now, the development of all such precision agriculture technologies is largely donor driven. In Africa circumstances can be quite harsh, so scaling up applications is difficult and investments in it are not very interesting for the corporate sector*. *Key question here is: who is going to pay for the development of PA-technology when the market is not yet there?"*.

This is where national and EU-policies come in. Between 2013 and 2018, the Dutch government has run a tender program called G4AW to develop precision agriculture in the developing world – financed mainly through the Ministry of Foreign Affairs. The Dutch Ministry of Agriculture, Nature and Food Quality (LNV) is currently also scoping out an International Strategy Sustainable Agriculture of which PA-technology would also be a part. Such initiatives are a proven way to take over initial development costs associated with risky investments in countries where it is difficult to generate profits on technological innovation for poor farmers. Making even more money available through eco-schemes under the new CAP might reduce funding gaps for PA-development and global uptake

because the technology can be developed and implemented inside the EU first, Bongani Ncube thinks.

Developing PA through official Dutch governmental channels means data from, for example, the EU earth observation program Copernicus are available – providing data African farmers can easily access using apps or smartphones. But funding technology development through subsidies might also quickly increase the role of the private sector and profit motives that not always in line with the interests of small farmers, Ncube says: "*Precision agriculture transferred to Africa works well in some cases, but it might also be dangerous when you focus on big projects only, funded by big companies, and mainly developed in Europe in public private partnerships. The EU should recognize that African scientists are also developing technologies and for precision agriculture to be tailor made for smallholders here they must work together*."

CAP eco-schemes for precision farming

Whether more funding for the uptake of PA-technology becomes available in the EU during the new CAP-period will highly depend on what member states choose to put in their respective National Strategic Plans (NSPs). The Dutch government in The Hague plans to send its NSP to the European Commission in December 2021. The draft document is co-authored by the ministry of Agriculture, Nature and Food Quality (LNV), three provincial governments and the union of water authorities ('*Waterschappen*') and puts a lot of emphasis on innovation, connecting farmers to guarantee quicker implementation of new technology. But it also explicitly states no fresh money will be made available for precision and digital farming – leaving PA to market parties.

The Dutch NSP defines precision agriculture as "*innovative development in agri- or horticulture, that brings together different fields of technology and knowledge, such as digitalization, artificial intelligence, robotization, agronomy and ecology*". In a letter sent to parliament on 28 September 2020, the Minister of Agriculture, Nature and Food Quality Carola Schouten (of the conservative ChristenUnie), however, does pledge to invest in 'experiments and actions aimed at spreading (or adaptation)' of precision agriculture and, in cooperation with WUR-researchers, has formulated a National Agenda for Precision Agriculture (NAP) in which bottlenecks for the implementation of PA-methods are defined.

Furthermore, in July 2021, the Dutch government opened up a new investment package aligning with the Green Deal, making available subsidies for farmers who want to invest in precision farming, digitalisation, and circular agriculture. "*For now, precision agriculture is not an eco-scheme in the Netherlands*," a spokesperson from the ministry says. "*The European Commission has included PA in the list of possible eco-schemes because it might contribute to the optimalisation of nutrient use and pesticides. The current list of proposed eco-schemes in the Netherlands would contribute to that same goal, but we're not proposing precision agriculture as a separate eco-scheme. Nevertheless, PA is indeed stimulated in the Netherlands*."

It appears then, that whether via eco-scheme or other approaches, the Netherlands will support precision farming as an approach, and as a solution to agri-environmental problems.

Behind the technology – the missing public dimension

If we look at the private and/or public dimension of PA-technologies (e.g Big Data, sensors, software, data value extraction), it is worth remembering the EU-failure to introduce a publicly funded system of digital farming as conditionality for all the CAP beneficiaries (i.e. GAEC 5). At the outset of the CAP reform post-2022, the FaST tool aimed to create a **dynamic data infrastructure** to provide farmers,

paying agencies, and farm advisors with a set of digital functionalities like the fertilization advice, weather forecasts, integration of static data about the farms (e.g. soil data, location, size) and more. For a number of issues concerning EU agriculture (e.g. data availability about the use of external chemical inputs like fertilisers or pesticides), precision farming and more specifically its underpinning data infrastructure need to consider aspects like running costs, independency (e.g. from commercial interests), or data ownership and value capturing (e.g. for private interests or public goods provision).

During the co-legislative procedure of the CAP reform post 2022, the FaST tool was removed from the list of conditionalities that farmers must meet in order to receive a per-hectare subsidy for income support. Was this publicly-owned precision agriculture's tool a lost opportunity or an avoided risk? As matter of fact, the EU agriculture is moving fast towards data-driven farming systems, so as this model is being pushed also beyond the EU borders. However, considerations on the public role of data and farming are often neglected or downgraded in the ongoing agricultural innovation pathway towards digitalisation.

From a global south perspective, for instance, when PA-development shifts from donors to corporates, new dangers arise, the 2019 CTA-report warns. Expectations are that after the entrance onto the PA-market of big tech players like Microsoft, Google and the Chinese firm Alibaba, or agricultural conglomerates like Bayer-Monsanto, fertilizer giant Yara or John Deere, scale and scope of digital farming could change. "*Their presence will bring increased financial, human and technological resources to the sector, and may be accompanied by major investment in important underlying infrastructure*," the report reads. "*Still, their entry does not replace the need for strong local talent. The capabilities of big tech should complement organizations on the ground that are well positioned to design products that can serve the needs of farmers in their region and business models that will work given local conditions*."

Friends of the Earth Europe (FOEE) also warns in a 2020 report that the data needed for precision agriculture could increasingly concentrate in the hands of a few global companies who are also consolidating amongst themselves. The 2018 merger of Monsanto and Bayer has put PA-technology, biotechnology, seeds and chemicals all in the hands of one conglomerate that is integrated across the whole agricultural value chain in an unprecedented way. "*This new form of vertical integration allows corporations to extract data from farmers and then use this to direct their product choices, locking farmers into the company's value chain and making them technologically dependent*," FOEE writes. "*In this fast-moving world of mergers across sectors, what is missing from the political debate is what digital farming should aim for, what should be protected, what promoted, what the actual needs of farmers and the environment are, and what society's red lines should be*."

Final considerations

The conjunction of new EU-funding possibilities under the CAP, increasing interest in PA-technologies from big tech and other corporates, and associated dangers of creating undesirable dependencies among African farmers, is acknowledged by Sander Janssen at WUR: "*Big companies like Microsoft or Google are eyeballing precision farming, they are charting out a position in this potentially huge market as we speak. How data will be stored and who can have access to it differs country by country. Legislation will be key to make sure PA will not have any detrimental effects*."

The CTA-report also emphasizes the need for good data stewardship, registry guidelines, governments working in conjunction with regional bodies to develop privacy, security and consumer protection laws, while a 2017 report on the social, ethical and legal implications of digital farming and the future CAP by the Research Service of the European Parliament in Brussels, also notes that collection and aggregation of farm data carries the risk of misuse leading to "*anti-competitive practices including price discrimination and speculations in commodity markets that may affect food*

security' and issues a warning that 'information related to yields and performance contained in this data can hold incredible value and could provide a market advantage to seed and fertiliser companies".

While funding of PA-uptake under newly developed eco-schemes in EU member states could bridge the funding gap limiting important technological developments in the EU and African countries, national and international legislation or code of practices would have to be developed in parallel too. How will the big data collected by each precision farmer be made open and available for policy analysis of public good provisions and failure (e.g. statistics on pesticides and antimicrobial use)? Who is protecting farmers from commercial use of data? Janssen feels: "*In many African countries, it can get a bit murky what is actually allowed and what isn't. Rwanda manages such affairs in a much more centralized way than a business-minded country like Kenya. What they may lose in speed because of that is made up with the level of oversight the government in Kigali can retain on what is going on in the country*."

Finally, this article calls on researchers, policymakers, and technological providers to explore the commercial and ethical dimension of publicly funded development and adoption of precision farming technologies, from both an EU and global south perspective.

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