What if intensification of farming could enhance biodiversity?

Could introducing more precision agriculture in Europe allow us to obtain food resilience, while ensuring sustainability and jobs, and taking into account the EU's wide agricultural diversity?

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Precision agriculture (PA), or precision farming, involves using technology to improve the ratio between agricultural output (usually food) and agricultural input (land, energy, water, fertilisers, pesticides, etc.). PA consists of using sensors to identify crop or livestock needs precisely (in space or time), and then intervening in a targeted way to maximise the productivity of each plant and animal, whilst minimising any waste of resources.

These technologies will play a key role in agricultural development in the coming decades. By 2050 the global population will be over 9.5 billion – we will require 70-100 % more agricultural output to feed the world. In the EU, PA could help sustain this growing population, even with low yields gains and a declining area of agricultural land. PA already offers technologies for producing more agricultural output with less input. For instance, sensor-based monitoring systems provide farmers with better information and early warning on crop status, and improve yield forecasts. Another promising aspect of PA is its ability to reduce the agricultural sector's negative impact on the environment. According to Eurostat, agriculture is responsible for about 10 % of the EU's greenhouse gas emissions. In addition, the overuse of fertilisers and pesticides, as well as soil erosion, cause considerable concern. PA could help a great deal in addressing these problems.

PA does not only use satellite navigation systems, but also a wide range of other technologies. These include:

- Automated steering systems, which can take over specific driving tasks such as auto-steering, overhead turning (from the end of one row to the start of the next), following field edges and avoiding fertiliser or pesticide application overlaps. Automatic steering systems reduce human errors, and contribute to effective soil and site management. For instance, automated headland turns could already save up to 10 % fuel consumption.
- Geo-mapping, which is used to produce maps identifying quantities of interest, such as soil properties and levels of nutrients for particular fields.
- Remote sensing, collecting data from a distance, to evaluate soil and crop health, and measuring parameters such as moisture, nutrients, compaction, and crop diseases.
- Agricultural robots in the future will be autonomous and able to reconfigure their own architecture to perform various tasks, offering enormous potential for sustainability:
  - Minimising soil compaction due to heavy machinery.
  - Requiring less work and resources, while robots will most likely provide a greater output, as is already the case in the dairy industry.
  - Optimising inputs used by farmers (e.g. fertilisers, pesticides, insecticides) and reducing the impact on soils and water tables.

However, when considering PA in the EU, we also have to consider that the farming business across the EU-28 is very heterogeneous in many aspects, as demonstrated in a recent overview of agricultural production in the EU and the analysis of the business models of farming in Europe. This diversity is represented in business models, production sectors, farming practices, employment as an absolute number and as a ratio of the working population, education and skills of the farmers, and farming output.

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Potential impacts and developments

PA can actively contribute to food security and safety:

Producing more agricultural output with less input with PA technologies might include, for instance, sensor-based monitoring systems. These provide farmers with better information and early warning on crop status and improve yield forecasts. PA also plays a major role in animal husbandry, with precision milking and feeding robots providing a good example.

PA technologies will also contribute to food safety. PA makes farming more transparent, by improving tracking, food traceability and documentation. Crop and livestock monitoring will more accurately predict agricultural product quality. The food chain will be easier to monitor for producers, retailers and customers.

PA supports sustainable farming and has the potential to reduce costs:

Sustainability is another central pillar of the STOA study on PA and the future of farming in Europe. Optimising chemical spraying has a range of impacts. Not only is there an environmental gain, but farmers also save money when they need to use less chemicals or other fertilising products. Drones can also monitor crop needs.

PA requires learning new skills, and can boost education levels in rural areas:

Like every new technology, the introduction and uptake of PA will require that farmers learn new skills. The general assumption that globalisation has transformed our economies into knowledge economies is also valid for agriculture. Various technological, environmental and managerial skills are required for farming using PA. Young farmers need to be equipped with the right mix of both job-specific and cross-cutting core skills to be able to access PA technologies. In modernising in this way, the farming profession might become more attractive to young people. In addition, PA technologies could boost the education level in some rural areas.

PA could trigger societal changes along with its uptake rate:

PA related service industries could serve other sectors and citizens. Local electricity production could grow, including independence from the main grids. The availability of wireless internet in rural areas, combined with drone-based delivery services could, for instance, slow the exodus of people from rural to urban areas, as some of the main reasons for moving to cities – the availability of assistance, products and services – could vanish.

The diverse impact of PA in the EU:

Farming in Europe, as explained above, is far from homogeneous. Each Member State could profit from PA in different ways. For instance, countries could use precision farming techniques to increase total agricultural output, with GDP-raising potential. Another possibility is that increasing the yield per hectare will make more land available for non-agricultural purposes, such as 'nature purposes', stimulating greater biodiversity.

Anticipatory policy-making

The wide diversity of agriculture throughout the EU, particularly regarding farm size, types of farming, farming practices, output and employment, presents a challenge for European policy-makers. European policy measures should therefore differentiate between the Member States, taking into account that opportunities and concerns vary considerably between countries.

Irrespective of what the economic context might be in the next decades, PA will be needed by EU farmers to improve their yields because less arable land will be available.

Shifts from the common agricultural policy (CAP) for 2021-2027 to enhanced research and development in agriculture could be envisaged. More research and development could be invested in cutting-edge technologies such as biosensors, robotics, spectrographs, and imagery.

The EU could enhance efforts on rural development policy, financing innovation, and covering programmes on PA technologies (e.g. drone services) to serve other societal goals in addition.

Another possible policy option is to set up a third pillar within the CAP (2021-2027), dedicated to the environment and sustainable technologies.

This 'What if ...?' publication is a product of the Scientific Foresight Unit (STOA) of EPRS. More information on the unit's activities can be found at http://www.europarl.europa.eu/stoa/ and http://epthinktank.eu/author/stoablogger/