



Securing Europe's food system: Innovation, resilience and the common agricultural policy

European View

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journals.sagepub.com/home/euv**Thia Hennessy¹**

Abstract

This article examines the competitiveness and resilience of the EU agri-food sector amid growing geopolitical, environmental and economic pressures. Using the Draghi framework, it evaluates the sector's performance across innovation, decarbonisation and strategic autonomy. While the EU remains a leading agri-food exporter, productivity growth has slowed, and dependence on imported inputs increases vulnerability to external shocks. The article highlights the rising importance of food security and identifies key investment priorities for the post-2027 common agricultural policy, including digital innovation, climate-smart practices and reduced input dependency, in order to strengthen long-term competitiveness and resilience.

Keywords

Competitiveness, Innovation, Resilience, Decarbonisation

Introduction

The common agricultural policy (CAP) has been a cornerstone of European integration since its establishment in 1962. Founded on the principles of increasing agricultural productivity, ensuring a fair standard of living for farmers, stabilising markets, guaranteeing food supplies and providing affordable food to consumers, the CAP has evolved significantly over the past six decades. While initially focused on production and market support, successive reforms have broadened its objectives to encompass environmental

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sustainability, rural development, climate action and social cohesion. Today, European agriculture faces a considerably different operating environment. Geopolitical instability, supply chain disruptions and international conflicts have highlighted the strategic importance of food production and the need for greater autonomy. Simultaneously, more frequent extreme weather events linked to climate change have exposed vulnerabilities within agricultural systems and increased concerns about resilience and long-term food security. Alongside these challenges, the question of European competitiveness more generally has moved to the centre of policy debate. Recent discussions, including those stimulated by the Draghi report on European competitiveness (Draghi 2024), have emphasised the need for stronger productivity, innovation and investment across strategic sectors, including agriculture. Ensuring that European farming remains economically viable while meeting environmental and social objectives represents one of the principal policy challenges of the coming decade.

Against this backdrop, this article examines the competitiveness and strategic independence of European agriculture and assesses the opportunities presented by the impending CAP reform. Further, it identifies priority areas for investment to strengthen the sector in the years ahead.

How competitive is European agriculture?

Before examining the competitiveness of the European agri-food sector, it is first useful to define what we mean by competitiveness. Competitiveness is a multidimensional concept that has no universally accepted definition or measure but is typically understood as the ability of a sector to sustain productivity growth, maintain or expand market share, and remain resilient in the face of external shocks (Cele et al. 2022). Traditional definitions emphasise price and cost competitiveness and productivity measures, such as total factor productivity, which are widely regarded as the central determinants of long-run economic performance (OECD 2023). Another approach, following Balassa's (1965) framework, focuses on revealed competitiveness through trade outcomes, including export shares and revealed comparative advantage. Reflecting Porter (1990), other approaches incorporate innovation capacity, institutional quality and structural factors such as human capital and firm organisation. More recently, competitiveness has also been conceptualised in terms of resilience and strategic autonomy, particularly in sectors exposed to geopolitical and climate-related risks, such as agriculture. The European debate on competitiveness has been strongly influenced by the Draghi report, which defines competitiveness through three strategic pillars: closing the innovation gap, aligning decarbonisation and growth, and enhancing security and reducing dependencies (Draghi 2024). Applying Draghi's approach to EU agriculture implies that competitiveness must be assessed not only in terms of cost efficiency and trade performance, but also in relation to innovative capacity, environmental sustainability, and food security and sovereignty.

Total factor productivity (TFP) is an indicator of agricultural competitiveness. It is an aggregate index that measures the amount of agricultural output produced from a given set of inputs, including land, labour and capital, from technical and resource inputs to

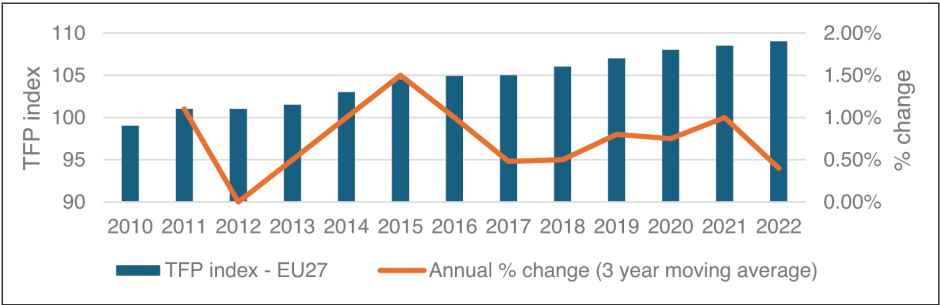


Figure 1. EU TFP 2012–22 in per cent (3-year average, 2010 = 100) and annual change.
Source: Data from Beck et al. 2024.

production. According to Beck et al. (2024), TFP growth in the EU is positive although the growth rate has been slowing since 2015 (see Figure 1). It has been driven mainly by labour productivity growth rather than technical efficiency. EU TFP growth remains slightly above the OECD average, but is well below that of Canada (2.7%), Brazil (2.2%) and China (1.7%) (Beck et al. 2024). It is concerning that productivity growth in the EU, a leading competitiveness indicator, is lagging behind other major international agricultural nations.

Revealed comparative advantage is another widely used measure of international competitiveness that infers a country’s comparative advantage from observed export patterns (Cele et al. 2023). Beck et al. (2024) reviewed a number of studies of EU agri-food trade flows and concluded that while the EU is a net exporter of agri-food products, with its trade surplus driven primarily by exports of higher value-added processed foods and beverages, it is a net importer of primary agricultural commodities, and the trade balance for these products has steadily deteriorated, reaching its lowest level in 2022. Although agricultural exports have continued to grow, the overall trade balance has weakened, reflecting declining competitiveness in primary production. EU agriculture also depends heavily on imported inputs, particularly protein-rich feed, fertilisers and plant protection products.

How food secure is Europe?

The Food and Agriculture Organization of the UN (FAO) defines food security as existing when ‘all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life’ (FAO 2009, 1, footnote 1). While Europe remains one of the most food-secure regions globally, the FAO estimates that 11.5% of people in Europe and Central Asia experienced moderate or severe food insecurity in 2023, compared with a global average of 28.9%, highlighting overall resilience but also a growing vulnerability within certain population groups (FAO 2024). Climate shocks such as droughts and floods, alongside Russia’s invasion of Ukraine, have exposed the EU’s dependence on imported

fertilisers, feed and energy inputs, increasing volatility in food production costs and availability. Recent EU monitoring also highlights that high input prices and extreme weather are now among the most significant risks to food supply stability (European Commission 2023). The European Commission highlights that the EU remains structurally dependent on imported agricultural inputs, including approximately 30% of its nitrogen fertilisers and 70% of its phosphate fertilisers, with additional reliance on imported natural gas, soy and potash, leaving EU food production exposed to global price and supply shocks. In response, EU policy has increasingly shifted towards using the language of ‘strategic autonomy’, reflecting a desire to reduce critical dependencies rather than pursue full self-sufficiency. This marks the growing emergence of food sovereignty in EU discourse, which emphasises control over food systems, the resilience of domestic production and reduced reliance on volatile global markets rather than simply ensuring adequate food availability.

Opportunities for the CAP (2028–34)

The CAP is entering a major reform phase as the EU prepares the post-2027 framework, aligned with the 2028–34 Multiannual Financial Framework. This transition comes at a time of profound change in the global policy environment, requiring a reassessment of priorities in agriculture and food systems. Increased geopolitical risk, disruptions to global supply chains and more frequent extreme weather events are all disrupting agri-food markets and affecting the availability and affordability of food. At the same time, the next CAP is likely to be constrained by the availability of funding. The EU faces competing demands on its long-term budget, including those for defence, the energy transition, the digital transformation and industrial competitiveness. Early European Commission communications on the post-2027 CAP have highlighted the importance of resilience, competitiveness and sustainability as the three guiding pillars of future agricultural policy. Rather than relying primarily on income stabilisation through direct payments, the CAP is expected to shift further towards incentivising investment, innovation and risk-management tools.

A central theme emerging from these communications is the need to invest more strategically in agriculture. This includes directing funding towards productivity-enhancing technologies such as precision farming, digitalisation and climate-smart agriculture, as well as strengthening supply-chain resilience. There is also increasing emphasis on reducing critical dependencies, particularly in fertilisers, protein feed and energy inputs, which have been exposed as structural vulnerabilities in recent years.

Overall, the next CAP reform is increasingly being framed as a balancing act between competing objectives. On one hand, it must ensure food security and food sovereignty in an uncertain geopolitical environment. On the other hand, it must drive long-term competitiveness and resilience, enabling EU agriculture to remain globally competitive while adapting to climate and market pressures. So the key question for policymakers is how best to allocate a declining budget to boost the resilience and competitiveness of EU agriculture.

How to boost the competitiveness of European agriculture

The competitiveness of European agriculture can be assessed through the analytical lens proposed by Draghi (2024), who argues that Europe's future prosperity depends on three strategic priorities: closing the innovation gap, aligning decarbonisation with competitiveness and economic growth, and enhancing security by reducing strategic dependencies. These pillars provide a valuable framework for considering the future direction of the CAP and the investment priorities needed to strengthen the sector. The first pillar, closing the innovation gap, highlights the importance of investment in research, technology, digitalisation and knowledge transfer to drive productivity growth. The second, aligning decarbonisation with competitiveness, emphasises that the transition to more sustainable production systems should reinforce, rather than compromise, economic performance. The third, enhancing security and reducing strategic dependencies, recognises the growing importance of resilient food systems, secure supply chains and reduced reliance on external inputs in an increasingly uncertain geopolitical environment. Collectively, these priorities provide a robust basis for evaluating the future competitiveness of European agriculture and the evolution of the CAP.

Closing the innovation gap in agriculture

Draghi emphasises that Europe's productivity slowdown is driven less by a lack of invention than by weak commercialisation, insufficient scaling, and uneven technology diffusion across regions and sectors. These structural weaknesses are particularly evident in agriculture, where productivity-enhancing technologies exist but remain unevenly adopted across farm types and member states. Empirical evidence suggests that digitalisation and precision agriculture offer significant productivity and sustainability gains. Technologies such as sensors, artificial intelligence (AI), satellite monitoring and farm management platforms can improve input efficiency, reduce environmental pressures and enhance climate resilience. However, adoption is highly uneven, with larger and capital-rich farms disproportionately benefiting due to high upfront costs, limited digital skills and infrastructure constraints in rural areas. According to Tur Cardona et al. (2025), around 85% of EU farms report adequate Internet access, and most have basic digital devices, but their use is mainly limited to communication rather than advanced applications. While 93% of farms use at least one general information technology tool, adoption of specialised precision technologies remains low (about 3%–23%) and is heavily concentrated among larger farms and in intensively farmed regions. As a result, closing the innovation gap is increasingly understood not as an innovation creation problem, but as a diffusion and adoption challenge within the European agricultural system.

According to the report by Tur Cardona et al. (2025), digitalisation policy should focus on targeted support for smaller and older farmers, alongside stronger investment in digital skills, training and advisory services. Policy should also focus on improved rural connectivity and interoperability through integrated data spaces and stronger innovation and extension systems. Clear, transparent data governance is needed to address concerns over privacy, security and farmer control. Finally, adoption should be driven by delivering

clear benefits such as efficiency gains, tailored advice and reduced administrative burdens. EU initiatives such as SmartAgriHubs (smartagrihubs.eu) demonstrate that networked innovation ecosystems that link farmers, researchers, agri-tech firms and advisory services can significantly enhance the uptake and scaling of innovation across heterogeneous farming systems.

Apart from technology adoption, regulation also plays an important role in promoting innovation. While regulation can stimulate demand for new technologies by setting environmental and sustainability standards, it can also slow adoption when it is complex, fragmented or slow to adapt. Evidence from the European Commission's assessment of CAP administrative burdens shows that compliance requirements and administrative procedures can impose significant costs on farms, with smaller farms often facing disproportionately high burdens that may constrain the resources available for investment and innovation (European Commission 2019). Similarly, regulatory complexity and uncertainty can reduce incentives for experimentation and slow productivity-enhancing investment. For example, the Farmer's Horizon survey (CropLife Europe 2025) found that 57% of farmers report that administrative burdens hinder innovation, highlighting frustration with overlapping or complex rules. Furthermore, delays in the approval of certain inputs can hamper innovation. A clear example is the lengthy EU approval process for biological crop protection products, such as microbial-based biopesticides, which can take several years under Regulation (EC) no. 1107/2009, despite such products being available more quickly in other regions such as the US or Brazil. Similarly, uncertainty and compliance requirements around data use under EU rules such as the General Data Protection Regulation may slow the rollout of digital and AI-driven precision farming technologies, delaying innovation uptake in European agriculture. Policy literature therefore increasingly supports 'smart regulation' approaches, including simplified CAP compliance, faster risk-based approval systems and regulatory sandboxes to test new agri-technologies (Klerkx et al. 2019).

Aligning decarbonisation with competitiveness and economic growth

Draghi emphasises the need to align decarbonisation with competitiveness. The objective is to ensure climate and environmental transitions enhance, rather than reduce, productivity, profitability and long-term resilience. In agriculture, this means prioritising investments that jointly deliver emissions reduction, productivity growth and competitiveness enhancement, ensuring that the environmental transition becomes a source of long-term economic strength rather than a constraint. This is reflected in EU policy, including the European Green Deal, the Farm to Fork Strategy and the CAP Strategic Plans Regulation (EU) 2021/2115, which integrates environmental performance through eco-schemes, agri-environment-climate measures and climate-related investment support.

A first investment priority is climate-smart production systems, particularly technologies that improve input efficiency and reduce emissions intensity. Precision agriculture, variable-rate application systems, methane-reducing livestock technologies and improved nutrient management systems can simultaneously lower environmental

impact and increase productivity by reducing waste and input costs (Merlo et al. 2026). In particular, AI technologies can play a role. For example, precision farming tools use machine learning and satellite data to optimise fertiliser application, lowering nitrous oxide emissions and input costs. In livestock systems, AI-enabled monitoring and smart feeding technologies improve feed conversion efficiency and reduce methane intensity per unit of output. AI-based advisory platforms also support climate-smart decisions on irrigation, planting and soil management, enhancing resilience and productivity. Across supply chains, AI improves logistics and carbon tracking, reducing transport emissions and food waste.

A related investment priority is regenerative agriculture, including soil health restoration, improved water management and biodiversity-enhancing practices. These practices can strengthen long-term productivity and resilience by improving the underlying natural resource base while supporting environmental and climate objectives (Kriek et al. 2025). These technologies are central to decoupling output growth from emissions growth, a key requirement of the EU's 2050 climate neutrality objective.

Finally, investment in renewable energy integration and circular bioeconomy systems is also required. On-farm renewable energy production, anaerobic digestion and waste-to-energy systems reduce dependency on fossil fuels and improve farm-level income diversification. For example, anaerobic digestion of livestock manure can reduce methane emissions by up to 80%–90% compared with conventional slurry storage, while also producing renewable energy equivalent to 10%–20% of a farm's total energy demand (European Environment Agency 2023). These investments also support rural energy resilience and reduce exposure to volatile input markets, particularly investments in fertilisers and energy. The European Environment Agency (2023) has identified a number of barriers to the decarbonisation of agriculture, including high capital costs for infrastructure, limited farmer training on emission mitigation, a lack of younger farmers to drive change in the sector and low digital literacy. The Agency recommends expanding communal facilities and providing startup grants for farmers for infrastructure investments.

Enhancing security and reducing dependencies

Draghi also calls for the enhancement of security and the reduction of dependencies. In European agriculture these can be achieved by strengthening resilience and strategic autonomy by reducing reliance on imported inputs, stabilising supply chains, and improving the sector's capacity to withstand geopolitical and climate-related shocks.

A first investment priority is reducing dependency on imported fertilisers and critical inputs. The EU remains heavily reliant on imported nitrogen fertilisers derived from natural gas, primarily from external markets. Priority should therefore be given to technologies and practices that optimise fertiliser use, alongside the development and scaling of alternative fertilisers produced within the EU that can reduce reliance on imports. Precision nutrient management systems and digital fertiliser optimisation tools can

reduce overall input demand while improving efficiency. AI developments make these tools particularly effective. The EU should invest in the development and deployment of such tools across the farming community.

Ammonia is a key ingredient in most synthetic fertilisers. Traditionally, it is made using natural gas, which is carbon intensive and ties fertiliser prices to volatile fossil fuel markets. Green ammonia, produced using renewable electricity rather than natural gas to generate hydrogen, offers a low-carbon alternative to conventional nitrogen fertiliser production while reducing dependence on imported fossil fuels. However, deployment in the EU remains at an early stage, with most projects still at pilot or early commercial scale and current production accounting for only a very small share of total ammonia output. Policy initiatives such as REPowerEU and the Net-Zero Industry Act are expected to accelerate investment in development and scaling over the coming decade. Bio-fertilisers provide an additional alternative to synthetic fertilisers by using natural organisms such as nitrogen-fixing bacteria and microbial inoculants to enhance soil fertility and nutrient availability. Unlike conventional chemical fertilisers, they can reduce reliance on imported mineral inputs while improving soil health and supporting more sustainable production systems. However, their effectiveness is often crop- and site-specific, meaning wider adoption depends on further investment in research, farmer knowledge and tailored agronomic support.

Apart from fertiliser, the EU's reliance on imported soy and protein for animal feed exposes livestock systems to global price and trade shocks. A clear example is soybean meal imports from Brazil and the US, which are a core input for EU poultry and dairy production systems but subject to climate shocks, export restrictions and currency fluctuations, creating instability in feed costs and farm margins. Investments in expanding domestic protein-crop production, innovating plant-based feed systems, and supporting alternative feed sources such as insects and algae could reduce strategic vulnerabilities while enhancing sustainability. Emerging alternatives such as insect-based feed proteins (e.g. black soldier fly larvae) are being scaled in countries such as France and the Netherlands, offering a lower-land-use, lower-emissions substitute for imported soy. Investment in expanding domestic protein crops such as peas and fava beans under EU protein diversification initiatives could further reduce dependence while improving soil fertility through nitrogen fixation. Together, these approaches support both strategic autonomy and sustainability in livestock production systems.

Reducing dependencies also requires sustained investment in the resilience of the European food system to enable it to better withstand both geopolitical and climate-related shocks. The increasing frequency of extreme weather events requires stronger investment in insurance schemes, climate-risk tools and adaptive infrastructure such as water storage and irrigation systems. While the CAP already provides a suite of risk-management instruments, adoption is inconsistent and often constrained by administrative complexity and limited awareness, suggesting the need for simplification and stronger incentives (Beck et al. 2024). Furthermore, enhancing resilience requires investment in digital early-warning systems, such as satellite-based drought-monitoring

platforms, which can provide near-real-time climate and soil moisture data to support decision-making. Coupled with climate-smart advisory services, these tools enable farmers to respond proactively to shocks, adjust production strategies and reduce exposure to volatility.

Conclusions

European agriculture faces a number of critical challenges, and its future success will depend on the ability to reconcile productivity growth, environmental ambition and strategic autonomy. The EU's lagging TFP relative to global competitors is not just a concerning technological issue, but also reflects deeper deficiencies in innovation diffusion, investment priorities and system-wide resilience. The Draghi (2024) framework provides a useful lens through which to reorient policy and identify key areas for investment, highlighting three interdependent pillars: closing the innovation gap, aligning decarbonisation with competitiveness and reducing strategic dependencies.

Delivering on Draghi's framework requires investment in accelerating the uptake of digital and biological innovation, supporting climate-smart productivity-enhancing technologies, and strengthening circular and renewable input systems to reduce reliance on external fertiliser, feed and energy markets. Furthermore, regulatory design will play a crucial role. While standards and environmental rules can sometimes drive innovation, overly complex, fragmented or slow-moving regulation risks constraining investment and slowing diffusion, which results in lagging productivity growth. A shift towards 'smart regulation' is essential and could be delivered through simplification, faster approval pathways for low-risk innovations, and greater policy coherence across CAP, environmental and innovation frameworks. Finally, further investment in risk-management tools and resilience capacity will also be critical to ensure that farmers can adapt to increasing climate and geopolitical volatility without compromising output. As with innovation and technology, the investment should not just focus on the development of new solutions but should also prioritise implementation through incentives, training programmes and investment in agricultural advisory services.

Ultimately, enhancing EU agricultural competitiveness is not about choosing between productivity, sustainability and security, but about designing policies and investments that deliver all three simultaneously. The next phase of the CAP will be critical in determining whether European agriculture regains its productivity leadership and secures its role as a resilient, innovative and globally competitive sector.

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