

CAP SPECIFIC OBJECTIVES

...explained

– Brief No 2



INCREASING COMPETITIVENESS: THE ROLE OF PRODUCTIVITY

This is part of a series of Briefs summarising the facts and addressing the policy relevance around the 9 proposed specific objectives of the future CAP.

KEY MESSAGES

- ✓ *Pressures on the EU agricultural resource base have increased due to growing food and industrial demand, which is driven by demographic and disposable income changes. On the supply side, there is growing competition for the same production factors (land, labour, capital) and growing pressure on the use of natural capital (with impact on environment and climate);*
- ✓ *Increasing agricultural productivity in a sustainable way is essential to meet the challenges of higher demand in a resource-constrained and climate uncertain world;*
- ✓ *EU agricultural productivity is already high, partly due to increased labour productivity. However, stagnation in recent years is associated with challenges that both the agricultural sector and EU civil society have to face, such as food prices, climate change, or loss of biodiversity;*
- ✓ *A number of drivers and policy tools are available to trigger productivity gains in EU agriculture, such as research and innovation programs, new technologies, rural development and infrastructure, efficient advisory systems and continuous training for farm managers.*

This brief is based on contributions from Barthélemy Lanos, Koen Mondelaers, Gesa Wesseler, Alexia Rouby. Although competitiveness covers many aspects of the CAP, this analysis focuses exclusively on one of them – productivity.

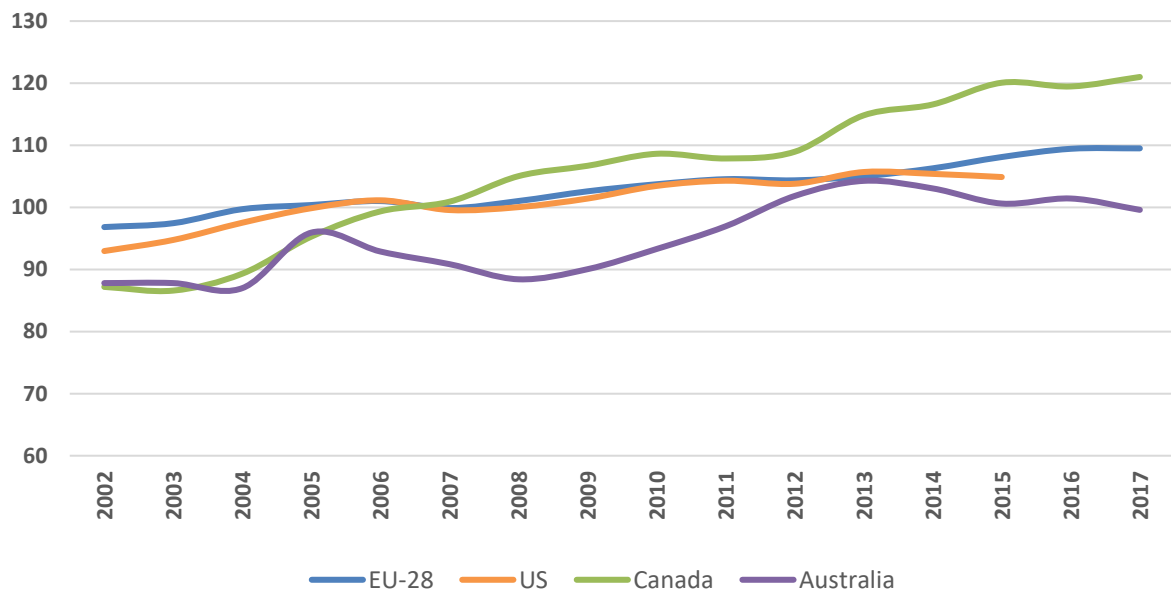
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1. The facts about EU farm productivity

a. Agricultural productivity grows, but at slower rate than in the past

Although agricultural productivity is increasing across the globe, in the EU and other parts of the developed world total factor productivity (TFP) growth has slowed down (Figure 1). TFP growth, as presented in Figure 1, is calculated as an index, but data and methodology behind each country's calculations are different. It is therefore difficult to draw any conclusion in terms of inter-country comparability. Still, it appears that the US, Canada and Australia are also experiencing a slowdown in their productivity growth. An on-going work, led by the OECD, is gathering international experts to discuss data and methodology issues and gain a firm handle on inter-country variability.

Figure 1. Agricultural productivity growth (3-year average, 2005=100)



Source: European Commission, USDA ERS, Agriculture Canada, Australian Government

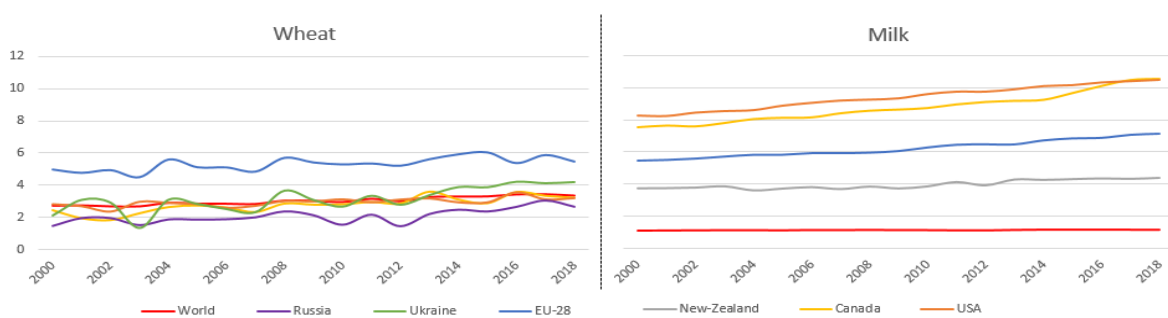
What do we mean by TFP?

TFP stands for **Total Factor Productivity**, which is the main indicator to measure changes in productivity for a sector. It encompasses different partial productivity indicators, such as land, labour, intermediary inputs and capital. TFP growth, expressed in index form, can be defined as the ratio between the change in production volumes over a period and the corresponding change of inputs to produce them. In short, an increase of TFP reflects a gain in output that does not originate from an increase of input use.

While TFP is a composite productivity indicator, partial productivity indicators, such as **land** productivity i.e. yield, are also often used given their more straightforward interpretation. In this field, the EU has had significantly higher results compared to its main producing competitors, thanks to high-quality inputs management as well as farm restructuring. This is particularly true for wheat production (Figure 2) and field crops in general.

Nevertheless, productivity in the EU dairy sector is lower than that of other main producing countries, such as the US or Canada, due to structural differences (lower farm size on average in the EU) and production systems (more grazing in the EU).

Figure 2. Wheat (ton/ha) and milk (kL/cow) yield, main world producers



Source: DG Agriculture and rural development, based on the OECD-FAO outlook¹

b. Labour outflow is the main, but not exclusive factor of EU TFP growth

While significant gains in productivity characterised a long period of growth in the EU agricultural sector, Total Factor Productivity growth across the EU has slowed down recently, to 0.6% annually during 2015 to 2017 (last data available), down from a 1.5% annual growth from 2013 to 2015.

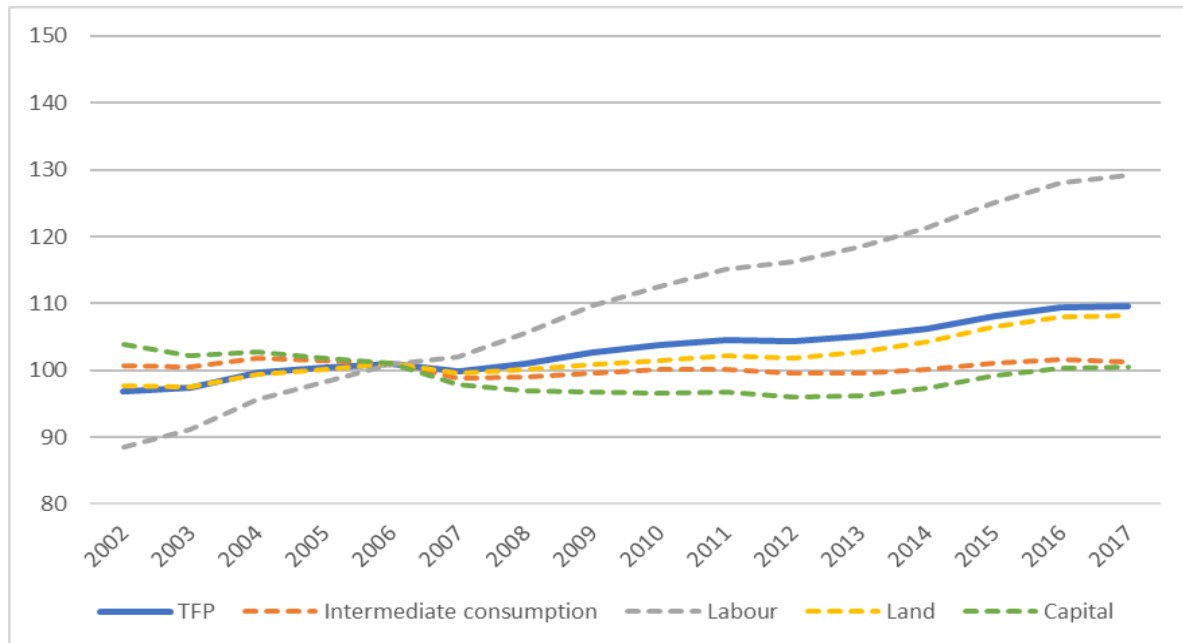
Several factors play a role in this development (including climatic factors). Therefore, a closer look into partial productivity indicators could provide more details on the factors affecting aggregate TFP developments.

From all these factors, growth in **labour** productivity stands out as the main driver of TFP growth in the EU. Developments in the agricultural labour force, and more generally jobs and economic growth in rural areas, one of the main areas of policy focus for the CAP, are addressed in detail a separate Brief.² Taken together, these developments result in demographic trends that explain the great influence of the restructuring of the agricultural sector in the EU, with the replacement of labour by capital leaving its mark on TFP growth (Figure 3).

From 2012 to 2017, rural areas lost around 5 million active people (from 15 to 64 years-old) and, solely in agriculture, the decrease amounted to more than 400 000 people. During this period, the value added of the EU agricultural sector increased by a modest EUR 10.7 billion (or 3 %).

While some commodity prices went up during that period, the increase in value came mainly from changes in the volume of agricultural goods produced within the EU. Thus, it was mainly the decline in agricultural workforce, combined with an increase in output value, which boosted the growth in labour productivity.

Figure 3. EU agricultural productivity (2005=100) (3-year average)



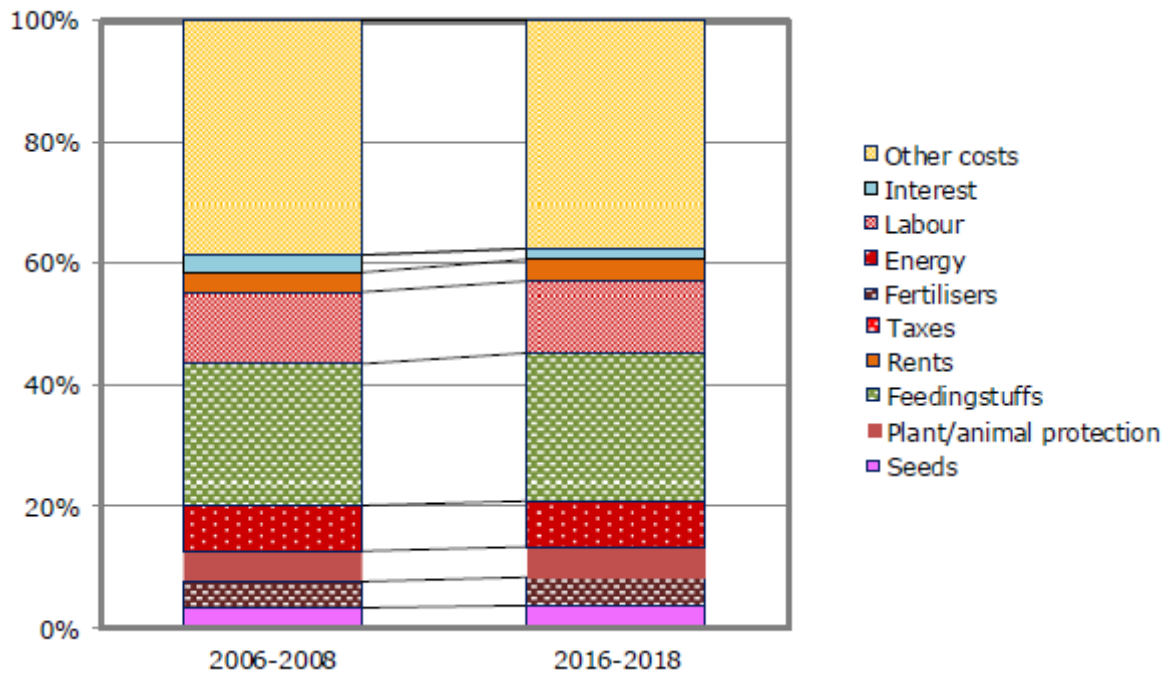
Source: DG Agriculture and Rural development, based on Eurostat

Capital productivity in EU's agriculture followed a divergent path during the past two decades. It declined from 2002 until the aftermath of the commodity crisis of 2010, but recovered in recent years. With capital investments increasing, productivity per unit of capital decreases. Since investments played a major role in increasing total agricultural value and replacing labour, changes in the rate of capital investment affected the speed of TFP growth.

Land productivity increased significantly in the EU. Driven by yield growth and a very limited decline in land, it remains high when compared at global level (see previous section), and constitutes the second strongest factor of TFP growth after labour.

Intermediate consumption also affects productivity. It includes energy costs, the use of fertilisers and plant protection products, as well as feeding and veterinary expenses. Its productivity has been relatively stable over the years, driven by the often-volatile developments in energy oil prices.

Since intermediate consumption and land productivity are proxy indicators for the intensification of production, a closer look into their impact on costs of production, and thus on farm profitability is pertinent. Figure 4 in the following page differentiates the various components of costs in EU agriculture and compares their changes between 2006-08 and 2016-18.

Figure 4. Evolution of the composition of the costs of production in the EU

Source: DG Agriculture and Rural development, based on Eurostat

The above graph depicts changes that occurred in the cost structure of EU agriculture during this period. The most notable changes relate to the increase in the share of feeding costs and energy costs (both driven by an increase in commodity prices), and the decrease in the (much smaller share) of costs related to interest payments.

Feeding costs are the most important component in the costs structure of EU agriculture, representing a quarter of all costs. Although this share could differ among MS, in all of them feed costs, together with energy costs are the two most important components of costs.

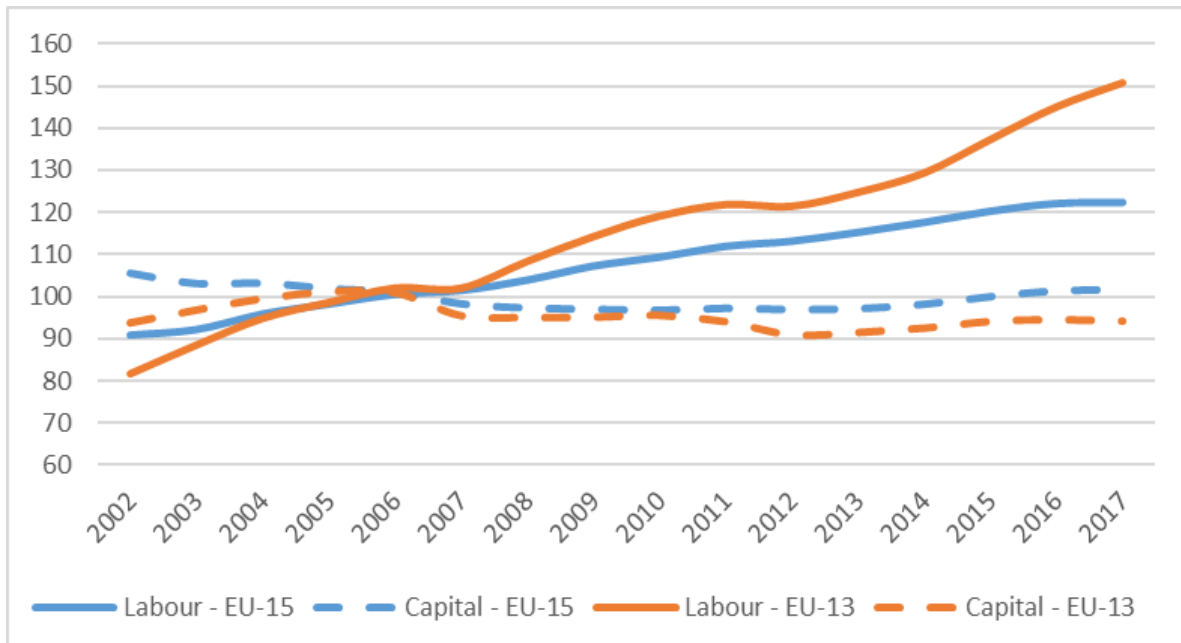
Since only aggregates are presented here, it is important to keep in mind that aggregates hide the very significant differences in cost structures not just among, but also with MS and between sectors. These differences are evident in the publically available statistical factsheets of MS.³

a. Productivity growth patterns differ in different regions of the EU

Another area where aggregates mask differences is in TFP growth across the EU. In the case of productivity, such differences reflect the different starting point of MS. This evidenced by the slower growth in EU-15, where TFP was significantly higher, as compared to EU-13, mainly as a result of the on-going restructuring of the agriculture in the latter.

The steady labour outflow from the agricultural sector of EU-13 and the shift towards a capital-intensive agriculture with improvement in managerial capacities led to faster TFP growth. The side effect of this development is that EU-13 capital productivity grows at a lower rate than in EU-15 (Figure 5).

Figure 5. Labour and capital productivity index (2005=100) (3-year average)



Source: DG Agriculture and Rural development, based on Eurostat

Productivity and its (missing) link to the environment

Agricultural production is a natural capital-intensive process. The use of natural biologic processes is central in producing food, whether it is photosynthesis or conversion of vegetal to animal proteins. To enhance the efficiency of these processes, a number of practices are available to the sector, some of which, if misused, can be damaging to the environment.

Current measures of agricultural productivity are not fully integrating the consumption of this natural capital into the agricultural production process, thus ignoring a crucial source of inputs. To a certain extent, the growth in agricultural productivity was realised at the expense of natural capital, but methodologies on TFP calculations differ quite significantly between countries and research institutes. To add the environmental dimension of the consumption of natural capital, a high-level group of experts gathered at the OECD is working to agree on a common approach.

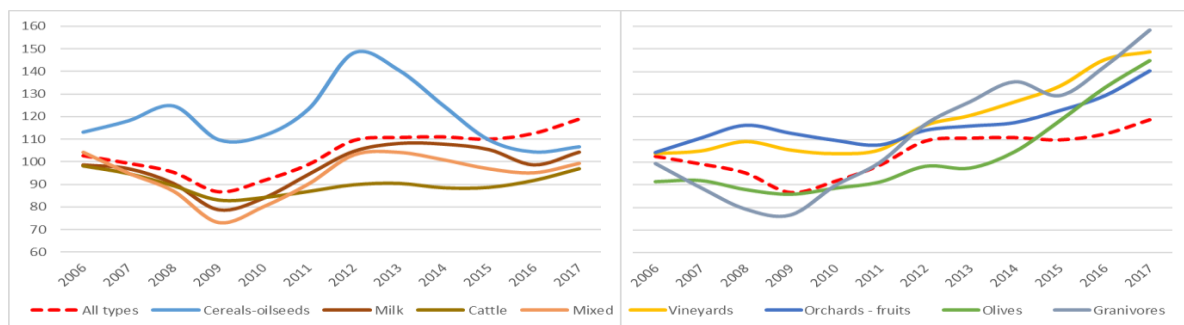
While the increase of labour productivity is the main driver for TFP growth, both land and capital productivity indicator contributed to the positive trend. In some countries, as in Denmark, high capital investments at the beginning of the period have triggered economic growth and resulted in productivity gains. In some other Member States, such as Sweden and Poland, the growth of land productivity, through R&D and more efficient farming practices, also contributed to the growth.

d. Productivity also differs among sectors

Data on labour productivity and yields allowing sectoral comparisons are easily available through the FADN database.⁴ Labour productivity is assessed with farm net value added by working unit as proxy (the dotted red curve in Figure 6). This is very much dependent on prices, as evidenced by its volatile path.

After the economic crisis in 2008-2009, labour productivity decreased, but recovered steadily since then. Yet among sectors, the pace of labour productivity growth differs. For a number of agricultural sectors (for example in cereals, oilseeds, and milk production systems), labour productivity increased significantly in the aftermath of the economic crisis, benefiting from relatively high prices in 2011 and restructuring. In other sectors (as displayed by the graph on the right-hand side of Figure 6), the increase in labour productivity started with a certain lag, between 2012 and 2014, as it the case for olive and fruit production as well as vineyards, but grows at a faster pace.

Figure 6. Farm net value added per annual working unit (EU-28, 2005=100), (3-year average)



Source: DG Agriculture and rural development, based on the Farm Accountancy Data Network

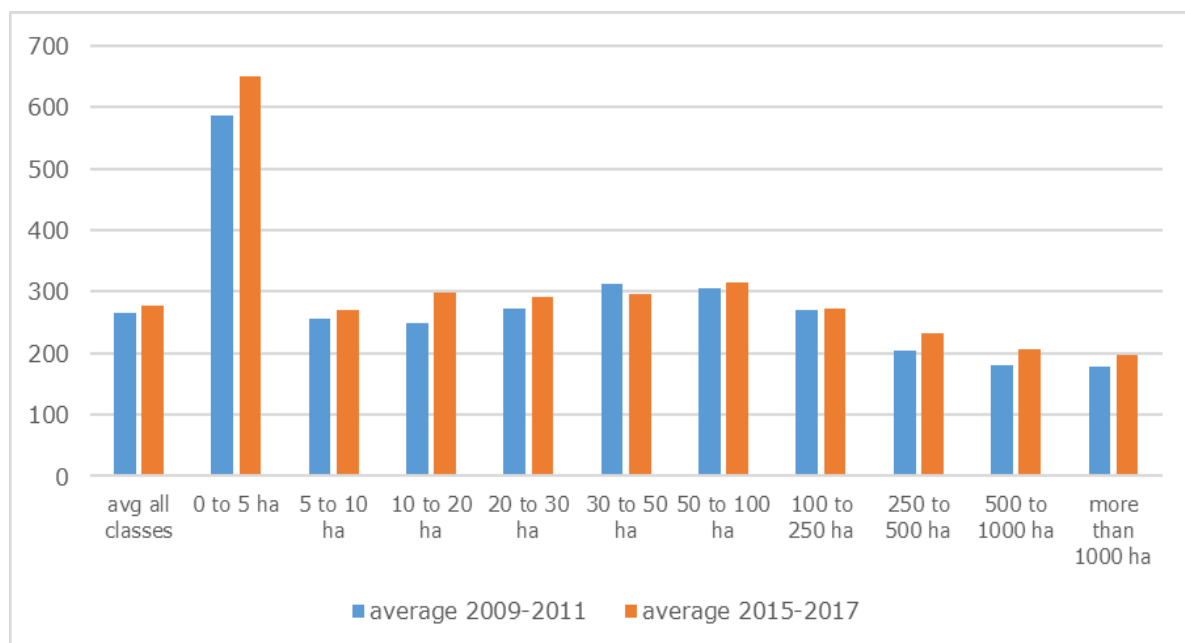
According to the same data source, farms with diversified crop production were subject to less productivity gains. Based on the sample of farms of the study, specialised farms can more effectively reduce their persistent economic inefficiencies, driven by the more efficient use of labour and economies of scale. Economies of scale is also very much driven by the price environment, which, when favourable, incentivizes farmers to produce. However, this conclusion comes with the limitation of the absence of environmental indicators in FADN, which could provide a more complete picture (see box above and the FLINT project).⁵

Interestingly, mixed farms with crop and livestock production are found to be better off in terms of labour productivity gains. This could be due to economies of scope, which can be generated when producing an aggregate of outputs is more efficient than when a single output is being produced. In this context, positive non-marketed externalities can contribute to biodiversity and environmental benefits (but again, this would require concrete data to allow further analysis).

Finally, productivity growth is also linked to farm size. Growth in the economic size of farms is an indicator for on-farm investments and possibility for scale economies. While a global TFP calculation is difficult due to a lack of data, partial productivity indicators such as labour or land productivity can be assessed thanks to the FADN database.

Gross investment per hectare (Figure 7), calculated from the FADN database, is also a good proxy to understand capital productivity. Gross investments represent the financial amount made available for investments. In recent years, investments have generally increased across the EU and across different farm types. More particularly, smallest farms (in the FADN database) are commonly very intensive farms, and generate high revenue (typically greenhouses). Generally, gross investments increased with farm size resulting in intensification. However, after reaching a certain size level, investments per hectare decline, reflecting an extensification of production systems (Figure 7).

Figure 7. Gross investment by hectare (€/ha) and EU area farm-size classes



Source: DG Agriculture and rural development, based on the Farm Accountancy Data Network

Note: small farms (0-5 ha) in the FADN represent only a certain category of farms whose economic size is above a certain threshold (which depends on the country). Consequently, the sample of small farms is not representative of all small farms in the EU.

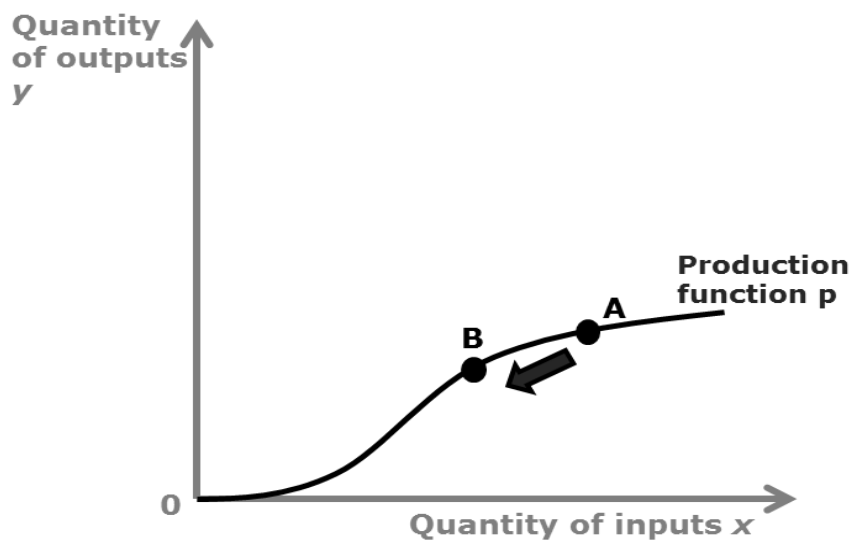
2. The dynamics of productivity drivers

a. Supply constraints and demand shifts impact on productivity drivers

Climate change and environmental commitments stemming from the Paris Agreement on Climate Change (COP21) and Sustainability Development Goals (SDGs) reflect real constraints on the manner by which farming can respond to future food supply needs.

Meeting these commitments increases short-term production costs, thus shifting supply lower if production methods do not change. At farm level, both input and output levels move to the left of the production frontier (Figure 8, point A to B).

Figure 8. Reduction of input use constrains the production development



Source: DG Agriculture and rural development

The vicious cycle of low productivity and profitability

Low productivity growth compared to the rest of the economy puts the agricultural sector under pressure. In addition to its inherent constraints linked to its natural process, the sector faces fierce competition at the global level, and increasing societal demands to meet legitimate but costly environmental and climate objectives. Since those working in the farming sector receive an income that is significantly below the overall wages in the rest of the economy, finding ways to increase the sectors productivity and break the vicious cycle of low profitability leading to low productivity is crucial.

The overarching regulatory environment plays a major role in the potential of the agricultural sector to overcome the pressure on costs and result in productivity gains in the agricultural sector. First, Research and Development credits and funds essential to promote fundamental academic research but also to enhance the development of concrete applications on the ground. So is the framework within which new technologies are developed and approved, as it determines prospects for the industry to take-off and allows the mainstreaming of new technologies.

Second, the regulatory environment to limit the impact on the environment (as is the Water Framework Directive) or to regulate some of the characteristics of production systems (as in the case of animal welfare) also plays a role in productivity development. The introduction of cross-compliance under the Common Agricultural Policy also played a role in supporting the farming sector to meet with basic environmental standards and stimulated the sector to engage in farming practices and the use of new technologies that allow meeting these standards.

New societal demands translate into rapidly shifting consumer preferences and tastes, requiring tremendous efforts from the agricultural sector to adapt in order to meet this demand. Furthermore, consumer preferences are also putting additional pressure on the production side, increasingly asking for a lower environmental footprint. These concern mainly, but not only, GHG emissions, biodiversity, water and soil pollution... These production requirements to satisfy consumer demand are also shifting production lower, and require that farmers need to adapt their business models.

b. ...but new technologies facilitate the production of more with less...

New challenges always come with new opportunities. Farm business models can adapt, with a certain effort, in order to grasp the economic potential of such an evolution. Once more, Research & Development is pivotal, covering the wide range of topics linked, or not, with biological processes, food chain innovations as well as digital economy applications and remote sensing technology.

This requires better focus in the understanding of the biological processes underpinning the development of new decision-support tools for farmers. In this way, the long-term effects of results from research could also have an impact on TFP development (as, for example, in improving the organic matter content in the soil or reversing the biodiversity decline linked to the adaptation to climate change).

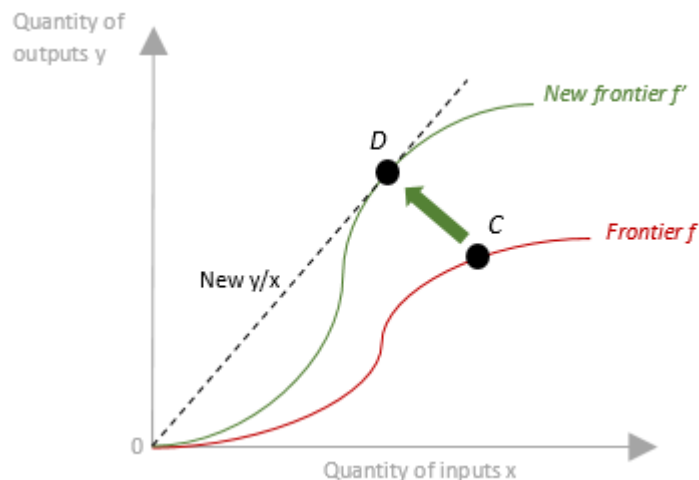
This process is a prerequisite for the subsequent capital investments, as well as the significant human capital effort needed to implement a new production line, integrate new equipment and machinery, etc., all of which imply a lot of innovative thinking, sometime training, as well as extra-working time for farmers.

Since the widespread adoption of new technologies and/or new farming practices usually takes some time, knowledge sharing from farmer to farmer, but also between communities of farmers, is essential. The support of third parties, such as local civil society organisations, the private sector, or public authorities, are often very useful and helpful when it comes to generating a virtuous cycle.

In this process of adoption, Farming 4.0 could play a pivotal role. The term refers to the technological revolution characterising the modern farming sector based on the extensive exchange of digital technologies, smart farming, and knowledge-based production methods. Building on the digital economy, smart farming allow farmers to monitor and target their needs with a large panel of new tools, as for instance, through apps.

There is tremendous potential in this technology, as these tools can be applied to a great variety of farming systems and require lighter financial investment compared to heavy machinery or equipment. Improved technology further increases the quantity of outputs in relation to the quantity of inputs, and shifts the “technology frontier” (Figure 9, from point A to point D), that is the maximum level of output that can be produced with a given technology. This shift results in greater productivity.

Figure 9. Supply demand improves with new technology



Source: DG Agriculture and rural development

c. ...if new technologies can be assimilated through knowledge exchange

A certain effort is required to manage the transition period towards the wider adoption of new technologies, both in economic terms and in knowledge management. Several gaps might hinder the adoption of productivity-enhancing and input-saving technologies. The knowledge gap might be the most problematic issue.

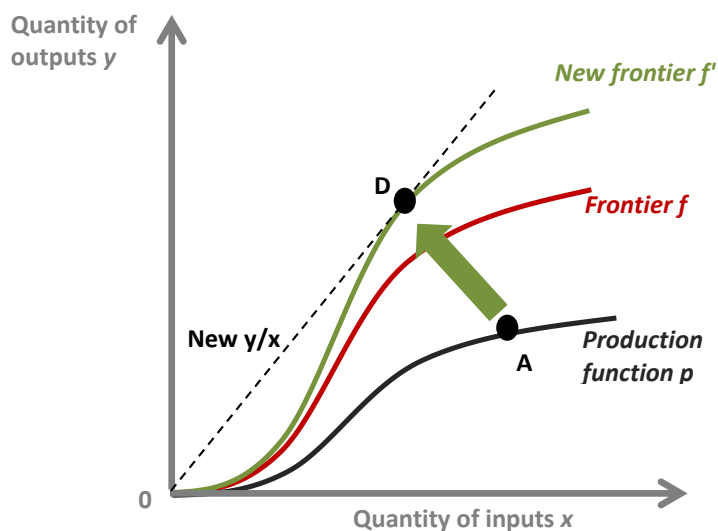
Most farms do not operate on the production frontier, which can be associated to their specific business environment, but also to the managerial capacities. Adopting new technology can thus be more challenging.

Firstly, negative perceptions can often surround new technologies due to a lack of familiarity and the uncertainty of transition. Risk aversion thus plays a major role in the adoption process of new technologies, so it is important for farmers and stakeholders to understand the full range of benefits that new technologies can bring. Secondly, it is crucial to have a good understanding of the applications of the technology and of how it can be used to its full potential. To this end, extension services and a well-functioning AKIS-system are essential.

Good management practices are also fundamental in terms of developing technical efficiency, thus further improving the technology frontier (expressed in the shift from A to D in Figure 10).

Although partial, proxies such as age and continuous training can give some enlightenment to when it comes to understanding the effect on productivity. The effect of age can be twofold, as young farm managers are often less risk-averse as regards to change, and are generally better educated and more continuously trained, but on the other hand are less experienced than older farmers.

Figure 10. Knowledge exchange and management support improvements



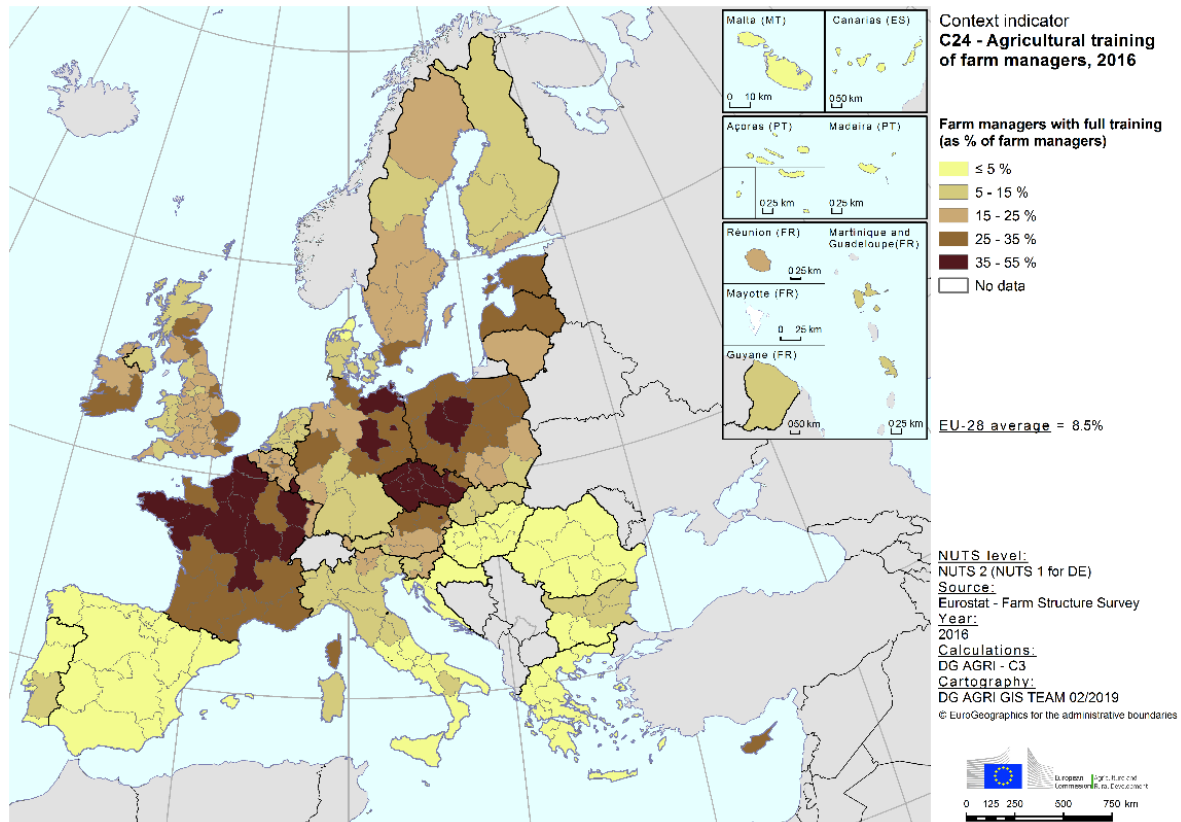
Source: DG Agriculture and rural development

A dedicated brief on the challenge of generational renewal in the farming sector provides a comprehensive approach on this particular issue.⁶ Concerning training for farmers across the EU, 8.5% of farmers benefitted from a full training in 2016 (Figure 11).

The business environment in rural areas, as well as along the value chains, is also vital for enabling productivity gains in agriculture and rural infrastructure.

This would allow increasing connectivity between rural and urban or peri-urban areas, as well as among rural areas themselves, enabling both physical mobility and digital accessibility, as well as access to the internet.

Figure 11. Agricultural training across the EU



Source: DG Agriculture and rural development, [context indicators](#)

Physical mobility is central for vibrant rural areas to allow knowledge spreading and efficient advisory services. Internet access also allows access to a wealth of information and training (through Massive Open Online Courses, for instance) , as well as a number of decision-making support systems for farmers, from agricultural practices to broad market information (on prices, food innovations, etc.).

3. Policy tools to facilitate transition

a. Role of Rural Development Programs

The Impact Assessment of the CAP addressed the effect of policy instruments relevant to improving productivity. Rural Development Programs were revealed to be efficient, e.g., by providing support for investment, training and advice and on-farm innovation, as well as for supply chain organisation and the development of new business model.

A recent JRC-study suggests that regions receiving higher Pillar II payments for physical capital investments, human capital development or agro-environmental measures, experience an increase in productivity.⁷ On the other hand, payments related to the development of rural areas do not seem to have a significant impact on productivity. The results do not change among the Member States, date of access to the European Union (i.e. EU-15 or EU-13 Member States), spatial characteristics (i.e. being in the south, north or east) or size of the countries (i.e. big or small economies).

During 2014-2020, investment schemes and business development support focused on restructuring and modernising farms. The link between investments and improved resilience is evident and confirmed by national evaluations of the EAFRD investment measure. These evaluations provide evidence that investment grants helped to scale up and speed up farm modernisation and restructuring (evaluation in Sweden) and that farms receiving investment grants performed 300% better in terms of income development compared to a control group (evaluation in Austria).

Although investments are shown to have a positive effect on on-farm and off-farm incomes (depending on the nature of the investment project), the effectiveness of the instrument on the overall productivity of the EU farm sector is hampered by the fact that it is not widely available. In the 2014-2020 period only 2.5 percent of EU farms can expect to receive an investment grant. The effectiveness of the grant in generating farm-based growth potential could also be impeded by the lack of integration with business development advice.

Access to finance for restructuring and modernisation could be increased by a further development of new and innovative financial instruments. This is in line with both recommendations in the Cork Declaration and the Commission priority to boost investments in the real economy.

b. Role of Farm Advisory Services

Economic resilience is also closely linked to increasing knowledge and innovation on farms, with the latter helping farmers to control costs and improve business planning. RDPs support training, peer-to-peer learning, advisory sessions, and exchange schemes. The tools are there but allocation of budget to these activities remains a constraining factor and interlinkages are missing. To illustrate this, the EAFRD target is to support 1.3 million advisory sessions over seven years. Even if we assume that these will only be farms, this translates into only benefiting 2% of all farms on an annual basis.

c. Role of Research & Innovation

The European Innovation Partnership for "Agricultural Productivity and Sustainability" (EIP-AGRI) aims to promote resource efficient, economically viable, productive and competitive agriculture and forestry sectors by funding innovative projects, networking activities and expert groups (focus groups).

The EIP-AGRI creates synergies between policies by linking the 'operational groups' funded under the CAP at regional or national level with Horizon 2020 'multi-actor' transnational projects and networks, as well as by embedding research and innovation needs from practice in the programming of Horizon 2020 calls and enhancing knowledge exchange through networking.

All EIP-AGRI projects use the interactive innovation or "multi-actor" approach in which scientists, producers, advisors and other actors collaborate to develop innovative solutions for practical needs. The analysis of needs from practice are tackled by various operational groups and focus groups to identify common challenges. Addressing these challenges on an EU-wide scale helps to reduce costs and duplication, enhance cross-fertilisation and create spill over effects.

Some examples in Member States have shown how supportive interactive advisory services can be for the EIP-AGRI activities. However, the obligation to apply public procurement rules for funding advisory services under Rural Development at the start of the programming period has discouraged the use of EU funding for advisory services and weakened the provision of advice. Advice also suffers from structural deficiencies and limited technical and social skills of the advisors, including when it comes to enter into interactive processes.

Despite being a new and voluntary measure, 27 Member States include support for the EIP-AGRI under 98 RD programmes. The EIP evaluation study assesses the EIP-AGRI's bottom-up and farmer-led approach as "*truly distinctive and highly appreciated by farmers and stakeholders. The flexibility of the EIP-AGRI allows it to be shaped to widely different circumstances in countries*".⁸

The European Commission has tabled proposals for the 'Horizon Europe', programme for research and innovation for the 2021 – 2027 period, which will allow continuing and strengthening synergies with the future CAP. EUR 100 billion are allocated to the funding of the programme to reach three objectives - strengthen the EU's scientific and technological bases, deliver on citizens' priorities and sustain our socio-economic model and values, and boost Europe's innovation capacity, competitiveness and jobs. In this proposal, EUR 10 billion is ear-marked for research and innovation on food and natural resources, which include agriculture, forestry and rural development. This will boost innovations for farmers and rural communities that enhance competitiveness and sustainability, such as resource-efficient and climate-smart practices, innovative value chains, digital innovations and improved knowledge sharing and training systems.



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Endnotes

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³ Factsheets by Member States of the European Union. https://ec.europa.eu/info/food-farming-fisheries/farming/facts-and-figures/markets/production/production-country/statistical-factsheets_en

⁴ FADN database. https://ec.europa.eu/agriculture/rica/database/database_en.cfm

⁵ FLINT project. <https://www.flint-fp7.eu/>

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