

## *Chapter 1*

### **Overall assessment and recommendations: Innovation for agricultural productivity and sustainability in Estonia**

*This chapter introduces the framework used to analyse the extent to which Estonian policies foster productivity and sustainability in the food and agriculture sector and presents an overview of findings for a wide range of policies. It also includes specific policy recommendations for each policy area reviewed.*

## **A framework to analyse policies for innovation, productivity and sustainability in the food and agricultural sector**

Improving agricultural productivity growth to meet the growing demand for food, feed, fuel and fibre will be achieved through more efficient use of natural and human resources. A wide range of policies affect the performance of the food and agriculture sector, and these need to be considered alongside agriculture-specific policies.

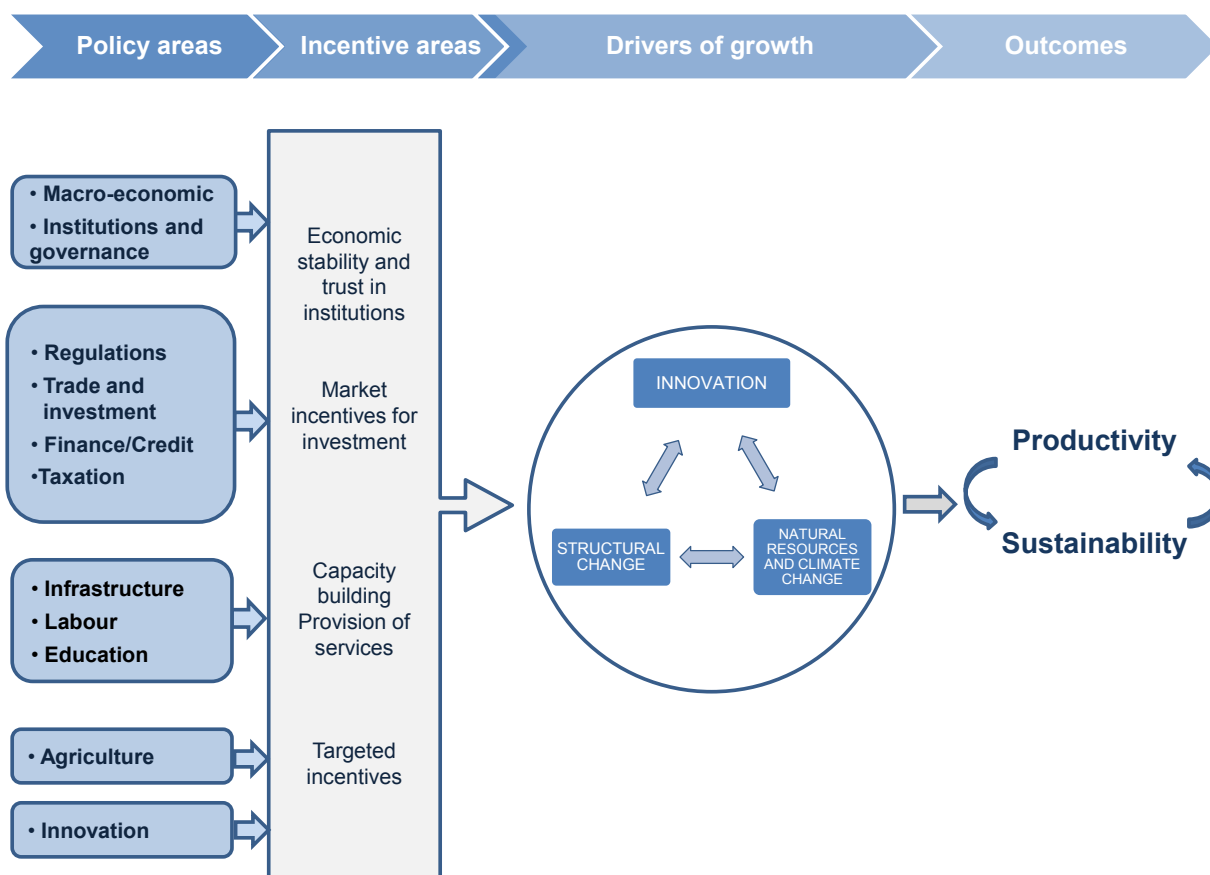
The framework applied in this review considers the full range of policy incentives and disincentives to innovation, structural change, natural resource use, and climate change as drivers of productivity growth and the sustainable use of resources (Figure 1.1).

This review begins with an overview of the characteristics and performance of the food and agriculture sector and the future challenges faced by this sector (Chapter 2). A wide range of policies is considered according to the main channels or incentive areas through which they affect drivers of productivity growth and environmental sustainability:

- Economic stability and trust in institutions (justice, security, property rights), which are essential to attract long-term investment in the economy (Chapter 3).
- Private investment, which in turn requires a transparent and predictable environment that balances the interests of investors and society (Chapter 4).
- Capacity building, including the provision of essential public services (Chapter 5).
- Agricultural policy, domestic and trade-related (Chapter 6).
- The agricultural innovation system (Chapter 7).

A policy area can affect productivity and sustainability drivers through more than one channel, and policies can have a positive or negative effect depending on the type and intensity of measures. This review draws on background information provided by the Institute of Economics and Social Sciences of the Estonian University of Life Science (EMÜ), recent OECD economic and innovation reviews, and internationally comparable data.

Figure 1.1. Policy drivers of innovation, productivity and sustainability in the food and agriculture sector



Source: OECD (2015), "Analysing Policies to improve agricultural productivity growth, sustainably: Revised framework", [www.oecd.org/agriculture/policies/innovation](http://www.oecd.org/agriculture/policies/innovation).

### Main challenges and opportunities for the Estonian food and agriculture sector

Estonia is the northernmost and smallest of the Baltic countries, which joined the European Union (EU) in 2004. The population — 1.3 million in 2015 — is relatively urban and has been decreasing since the country regained its independence in 1991, and this affects many areas of the economy, including the provision of services, the education system and labour markets.

The Estonian economy has experienced significant growth and structural changes during the last 25 years and in particular since EU accession in 2004. Gross Domestic Product (GDP) per capita has grown faster than the OECD average since 2000, but it remains 30% lower than the EU average. Estonia's economy is well integrated into global trade, and the economic, policy and regulatory environment is open to domestic and foreign direct investment (Chapters 3 and 4).

Agricultural policy and regulatory changes linked to land restitution starting in 1990 and accession to the European Union, in particular the implementation of the Common Agricultural Policy (CAP), have significantly impacted the agricultural sector. Following a contraction during the transition in the 1990s, agricultural production grew in the 2000s in response to CAP incentives to invest in agriculture, and the clarification of land property rights.

As a result of structural change in the sector and the wider economy, the share of agriculture in GDP has decreased, although not as fast as its share in employment. Compared to the EU and OECD averages, Estonia's agriculture accounts for a larger share of GDP and a lower share of employment.

Estonia's agricultural sector is dominated by milk production, but cereals, oilseeds and protein crop production has increased considerably in the last two decades. Meat production has also increased over the last two decades, though production levels have declined in the last couple of years in response to lower market prices and the outbreak of African Swine Fever (ASF).

While Estonian exports are growing, the country has a large trade deficit of agricultural and food products due to high imports of processed foods. The composition of Estonia's agro-food trade suggests the food manufacturing industry is not as developed as primary production. Estonia's imports of agro-food products are mainly for household consumption (over 70%), while the country exports a larger share of agro-food products for industrial use than the EU average. The lower processing capacity is particularly clear at the sub-sector level: Estonia is a net exporter of cereals, but a net importer of processed cereals — and a net exporter of live animals, but a net importer of meat. Strengthening the value-chain would help find new export markets and develop new products.

Estonia's agricultural sector enjoys abundant land and water resources. Arable land, including cultivated grassland and feed crop land, accounts for more than two-thirds of agricultural land. Agricultural land area has increased since EU accession, as agricultural land that was abandoned during the transition period was reclaimed to qualify for the EU single area payment scheme (SAPS). Natural resources facilitated agricultural development and could also sustain the production of biomass for energy from agriculture and forestry.

Agricultural total factor productivity (TFP) is growing fast since 2000. Strong increases in agricultural production, with more efficient input use were facilitated by economies of scale, investment in modern, including labour-saving, technologies, and seed and animal genetic improvements, for example. This reflects to some extent the catching up of the sector following the transition and uncertainties of the 1990s, stimulated by EU investment support. The large technically-efficient, input intensive and innovative farms, which dominate land use, animal numbers and production, drive TFP growth, while a large number of small farms remain. On average, farms are relatively large by EU standards and the weighted median farm size continues to increase.

The food processing sector has not adjusted as fast as agricultural production and is struggling in terms of capacity and competitiveness, as illustrated by agro-food trade flows. As the farm sector, Estonia's food processing sector is also dualistic, but large Estonian food processing companies are smaller than their foreign competitors. The dairy processing sector in particular needs to consolidate, invest in automation and increase processing efficiency to reduce costs. In the food processing sector, Estonia achieves half the EU labour productivity, as measured by value-added per annual work unit. In comparison, labour productivity in the Estonian farm sector has strongly increased since the early 1990s, but it remains 20% lower than the EU average.

Paralleling the growth in agricultural TFP and production, the use of natural resources has similarly shifted. Agricultural land area increased at a slower rate than production volume and TFP growth. Estonia's direct on-farm energy consumption and ammonia emissions also increased, raising concerns about sustainability. Eutrophication due to nutrient loads from diffuse and point sources threatens sustainable management of agricultural and water resources in certain regions. The country's phosphorus deficit has also worsened. However, higher TFP and output growth in recent years has been achieved with improvements in Estonia's nitrogen balance and lower water use, a positive trend in sustainability terms.

Environmental problems are mainly localised. Although increasing, the intensity of agriculture is relatively low and the state of eco-systems ranges from good to favourable according to the European Environment Agency. A significant share of Estonian agricultural land area is farmed under extensive and biodiversity-friendly agricultural practices, including grassland and organically-farmed area, which has almost quadrupled over the last decade. The recent development of protein crops for food and feed use also improved soil quality and thus the sustainability of agriculture. The share of land used for intensive agricultural practices is below 10%, and concerns mainly livestock farming. Moreover, some regions with fragile geological conditions need further attention in order to manage agricultural and water resources sustainably, in particular the Nitrate Vulnerable Zone in Central and North-Eastern Estonia.

Looking forward, climate change projections suggest that both grasslands and crop production may benefit from shifts in climatic conditions in the coming decades. The growing season has already begun to lengthen in recent decades, favouring the cultivation of winter crops. While such trends may continue, potential risk factors include an increase in the frequency of extreme meteorological phenomena (droughts, excessive moisture, flooding) and the spread of pests and diseases.

Overall, Estonian agriculture has seized opportunities offered by the market and policy environment, in particular EU membership, to catch up and develop further. High productivity growth, and high levels in some cases, has been achieved with relatively limited environmental issues so far. There is still scope for improvement, in particular in the smaller farms. Moreover, the sector will have to adjust to changing market, environmental, regulatory and policy conditions. The need to reduce greenhouse gas emissions for example is likely to affect livestock production and grassland. Responding to demand for diversified, healthier products can be another challenge as well as an opportunity to develop new products, and improve the competitiveness of the Estonian agro-food sector. Maintaining the recent growth rates sustainably will require further innovation and adaptation, but more careful investment, improvements along the food chain, the development of new markets and increased consideration of sustainability issues and consumer demand, as well as longer-term challenges and opportunities.

### **Improve further the supportive framework conditions for innovation and entrepreneurship**

***Macro-policies, institutions and regulations are mostly supportive of investment, but future growth depends on the ability to diversify sources of competitiveness***

Macroeconomic and institutional conditions in Estonia favour innovation and entrepreneurship. Estonia is a small, competitive economy, with sound macroeconomic fundamentals, and a well-educated and flexible labour force. The fiscal space to support growth-enhancing policies is large: gross public debt as a percentage of GDP is the lowest in the OECD area and is projected to decrease in the medium term (OECD, 2017a). According to the OECD Economic Survey of Estonia (2017a), there is scope for increasing spending on measures that boost growth potential and welfare, and considering allowing a small deficit in the government budget rule in the longer term.

Even though the overall economic performance of Estonia is good, competitive advantage is still in low-cost labour or natural resources. In addition, with wage growth exceeding the productivity growth rate in recent years, the profitability of companies has declined, partly explaining low investment. In terms of business sophistication, Estonian companies do not have broad presence in the entire value chain; rather they are involved in individual steps of the value chain (OECD, 2017b). Moreover, they do not use marketing to a large extent to differentiate their products, including in the agri-food sector. To maintain long-term competitiveness, Estonia needs to diversify its sources of competitive advantage and invest along the value-chain, including in the agri-food chain.

Estonia enjoys high quality public institutions at the national level and steps have been taken to improve territorial governance. Estonia is considered as a secure country for business, with good ethical practices, independent judicial system and transparent policies. The country is recognised for the high efficiency of government spending and low burden of regulations, though Estonia has lower efficiency of the legal and judicial system for companies in settling disputes.

The decision-making process in Estonia is very transparent, but the 2011 OECD Public Governance Review (OECD, 2011) noted some drawbacks in taking account of stakeholders' opinions. In a sector with a dual structure like agriculture, a large number of actors and multiple stakeholders reflecting diverse interests poses particular challenges. But stakeholders' involvement can help improve policy relevance and effectiveness, in particular in the agricultural innovation system. Regarding governance, OECD Economic Surveys noted that there is no institution in charge of a regular assessment of productivity challenges and of monitoring policies in the field of competitiveness and that the European Council advised to set up a national productivity board. The OECD Economic Survey of Estonia (2017a) recommends establishing an independent

body to advise on policies to raise productivity. Regarding the food and agricultural sector, this body could go beyond evaluation of agricultural policy to consider the whole enabling environment for the sector.

The 2011 Public Governance Review (OECD, 2011) also identified problems in territorial management and relations between different levels of government hindering efficient delivery of public services of equal quality across the territory. As part of the State reform, the abolition of county governments, the merging of some institutions, and the planned reduction in the number of municipalities, are steps to improve the situation. The 2017 OECD Environmental Performance Review of Estonia (OECD, 2017c) recommends a continuation of territorial reform to ease resource and capacity constraints. The expected improvements in the rural economy will benefit the food and agriculture sector.

The regulatory environment for entrepreneurship in Estonia is generally conducive to investment, including in food and agriculture. Reforms have eased regulatory barriers, which were overall lower than the OECD average in 2013. In particular, regulatory procedure is less complex and the administrative burden to start-up companies is lower than average, while the regulatory protection of incumbents is among the highest in the OECD area. Indicators for 2013 suggest there was considerable room for improvement in particular regarding the licences and permits system, and the reduction of entry barriers in service and network sectors (e.g. gas, electricity, water, rail, air passenger transport, road freight transport and telecoms). Significant progress has been made since, but some burden remains in environmental regulation.

***Natural resources, farm inputs and food products are governed mainly by EU regulations and governance rules***

Regulations on natural resources and environment in Estonia are extensive, but fragmented across multiple legal acts. This is driven in part by the increase in legislative activity — in particular, the adoption of EU regulations — during and since EU accession. For example, these laws govern the environmental monitoring system, the integrated environmental permit system and environmental liability, as well as land use, water management and biodiversity protection. Estonian regulations on the use of fertilisers have become increasingly strict in recent years. The 2017 OECD Environmental Performance Review of Estonia (OECD, 2017c) recommends to strengthen inter-ministerial co-ordination on environmental and sustainable development issues, including climate change, to better incorporate environmental concerns into strategic planning, sectoral policies and spatial planning; to encourage collaboration between local governments in all areas of their environmental competence; to consolidate legislation on natural resources and environment; and to continue developing guidelines and codes of best practices to facilitate access and understanding of regulations, and thus reduce costs and improve compliance. These actions would also facilitate enhanced sustainability and preparedness to climate change in the food and agricultural sector.

Environmental charges are also used to reduce the negative impact of economic activities on the environment. They include both natural resource use fees and pollution fees designed to decrease pollution from point sources.

Estonia also subscribes to major international and regional regulatory agreements concerning climate change and nature protection. Ensuring a clean living environment, raising the environmental awareness of the society, preservation of natural heritage and the sustainable use of natural resources is the main goal of many national and international environmental strategies, plans and agreements that Estonia has joined.

Additional incentives apply in agriculture as support is conditional on respecting regulations regarding natural resource use and protection, and the safety of food and feed products and farm inputs. This has required producers to adopt new technologies and production practices, with positive effects on productivity and sustainability.

Regulations on food safety and quality are mainly determined at the EU level and, since joining the European Union, Estonia has developed the necessary legislation and institutions to ensure compliance with regulations, including monitoring, control and information systems. This increases national and foreign consumers trust in the safety and quality attributes of Estonian agri-food products, thus facilitating access to markets and product differentiation. As the demand for products with specific attributes is growing, the

government may have a role in ensuring the policy and regulatory environment facilitates the development and marketing of new products.

***The Estonian economy is open to trade and investment, but further efforts could focus on removing remaining impediments and diversifying export markets***

As a small economy with limited capacity to produce a large range of goods and services, Estonia is open to trade, the sum of exports and imports of goods and services representing over 150% of GDP in 2016. Since joining the European Union in 2004, it is part of the Common market. However, the common trade policy imposes higher tariffs for capital and intermediate goods than in major non-EU trading partners. Lower tariffs on intermediate goods would lower the cost of specialised inputs and machinery equipment, and thus increase the competitiveness of the agro-food sector. The composition of Estonia's agro-food trade suggests that competitive advantage is in primary production, as Estonia's imports of agro-food products are mainly for household consumption (over 70%), while the country exports a larger share of agro-food products for industrial use than the EU average. These exports are mainly to neighbouring countries, main members of the European Union and the Russian Federation, although the latter have declined since the Federation introduced an import ban in August 2014. Concerted efforts along the food chain are needed to diversify agro-food exports, both in terms of adding value and partners. Moreover, despite significant progress, trade administrative procedures, such as border agency cooperation, could be further simplified. To further facilitate trade administration, the 2017 OECD Economic Survey of Estonia (OECD, 2017a) recommends completing a one-stop shop for administrative formalities, and improving access to information on trade regulation (e.g. agreements with third countries and appeal procedures). Estonia is generally open to Foreign Direct Investment (FDI), with inwards stocks accounting for a relatively high share of GDP. Few restrictions remain, mainly related to quotas on foreign workers, but some concern the acquisition of land.

***Both financial markets and agricultural policy have facilitated investment in agriculture, but better risk management will facilitate future access to loans***

Financial markets are well-developed, and a diversity of banks offer services, although competition, and alternative funding sources for innovative activities, are limited. The agriculture and food sector had access to loans to fund its development. It seems, however, that credit institutions have imposed a higher risk margin on enterprises operating in the agricultural sector. One issue may be the lack of collaterals as over 60% of farm land is rented. EU payments providing an income safety net may act as collaterals to some extent. Nevertheless, the loan balance of agriculture has doubled in the past ten years, with growth slowing temporarily at the end of the 2000s because of the financial crisis. The State Rural Development Foundation facilitates access to credit to rural companies and farms, through guarantees, direct loans and loans to credit institutions.

Co-financed by the EU Common Agricultural Policy (CAP), the Estonian Rural Development Programme (RDP) supports investment in farm modernisation and the development of diversification activities, which receive a higher share of total funds than the EU average. Investment grants from the RDP are generally targeted to investments aiming to improve competitiveness and compliance with environmental, food safety and animal welfare regulations, and with conditions attached to mandatory or voluntary payments to farmers. In recent years, farmers have faced income problems, in particular in the dairy sector, leading to an increase in payment default. Promoting risk management and strengthening risk management tools, including through tax and financing tools, would help farmers manage temporary cash flow problems.

***The tax system is being reformed, and will continue to favour investment, while enhancing sustainability***

The Estonian tax system has been so far relatively simple with few exceptions. At 20%, the tax on corporate profit is relatively modest by OECD standards, and only applies to distributed profits. As part of the revision of the taxation system in 2017, differentiated income tax rates are introduced from 2018 in the form of lower tax rates or higher deductions for smaller incomes. Considering since July 2017 that corporate costs related to accommodation and commuting costs of employees living far away from work are not fringe benefits, and thus not taxable, is expected to facilitate the mobility of employees who live in rural areas.

While the standard corporate income tax rate is modest at 20%, companies face high taxes on labour, and when all tax sources (income, property, labour, turnover, fuel) are taken into account, the tax rate is close to 50%. This tax rate, which increases labour costs, is higher than in neighbouring countries, and thus may impede competitiveness, and favour capital investment over labour use.

There are some tax exemptions for the agriculture and food sector. Agricultural exceptions include an income tax deduction for the self-employed on the sales of self-produced unprocessed agricultural products. Two other general tax deductions help farmers manage income risk and facilitate investment: the ability to deduct income losses in one year from the business income of the following seven taxation periods, and the option to save funds in a special account for future investment.

Environmental taxes and charges have been increasing since 2005. They apply equally to food and agricultural activities. A lower excise duty applies to fuel used in agricultural activities (27% of the full rate, compared to an EU average of 6%). Implementing the full tax rate for fuel used in agriculture would lead to more efficient use of energy in the sector.

Estonia is one of the very few OECD countries that do not provide tax incentives for R&D. The exclusive corporate tax system, where profits are not taxed until their distribution, acts as an economic tax incentive to investment.

The 2017 OECD Economic Survey of Estonia (OECD, 2017a) finds that financial incentives to prevent or reduce environmental damage are too low, and recommends setting tax rates on oil shale, vehicle and energy use at a level that better reflects the environmental damage they generate.

#### **Recommendations to improve incentives for private investment**

- Promote a regional approach to trade diversification in order to gain new markets for agri-food products, drawing on regional strengths (such as clean air, extensive agriculture, or organic production).
- Promote risk management, through financial tools, to facilitate farm and agro-food firm access to loans and reduce the risk premium currently applied in the sector.
- Further reduce the taxation of labour earnings, in particular of low earnings, to reduce the costs of labour and facilitate employment in food and agriculture.
- Explore the scope for using environmental and agri-environmental taxes, including an evaluation of potential benefits for the environment (OECD, 2017c). In particular, reduce gradually the tax rebate for fuel used in agriculture to reduce the use of fossil fuels, and at the same time invest in and encourage the use of renewable energy.

### **Improve the capacities and services for innovation, in particular in rural areas**

#### ***Infrastructure improvement continues, aiming to reduce the rural-urban gap sustainably***

The main challenges for the provision of infrastructure and services in Estonia are the high concentration of the population in main urban centres (over 60% is urbanised and 40% is concentrated around the capital city), and its low density in most rural areas. There are some problems with the availability and quality of infrastructure in rural areas, where agricultural and agri-food activities are located to a large extent. In remote rural areas with sparse population, facilitating the movement of goods and services, connecting people to markets and providing information and services for improved productivity and cost-efficiency requires innovative solutions, including through Information and Communication Technologies (ICTs). Increasingly, infrastructure investments in Estonia aim to improve environmental sustainability through the provision of renewable energy, or the development of resource-saving technologies, while ensuring efficiency and stability.

Infrastructure development and maintenance in Estonia have greatly benefited from EU structural funds, which cover up to 75% or 85% of infrastructure projects. The exception is the electrical grid infrastructure, which is financed from electricity transmission charges. The overall quality of physical infrastructure in



Estonia is comparable to the average of all OECD countries, but with significant differences among the type of infrastructure and in some cases regions.

With regard to transportation modes, port infrastructure is considered by business leaders to be well developed, thus facilitating international trade. Limited capacity of air and rail transport infrastructure mainly affects passengers; this is linked to the low number of international connections, and also the low speed of passenger trains. Most main-line railways have been upgraded to enable faster speed, and renovation is progressing. The availability of faster trains is not expected to affect food and agriculture directly, although reducing commuting time will help maintain rural communities, while allowing access to job markets, and thus offering off-farm income opportunities.

The unequal quality of road infrastructure increases local transport costs. Main roads are mostly in a good or very good condition, and basic roads in a satisfactory condition, but the secondary and local roads need improvement. Estonian entrepreneurs consider the condition of local roads as the worst structural impediment for their activities. In response, the Transport Development Plan 2014-20 aims to reduce the proportion of secondary and local roads in poor and very poor condition. This could be most beneficial for the transportation of perishable agricultural and food products, and to assist labour mobility.

Improving electricity supply at reasonable cost is a serious challenge in Estonia. According to local authorities, electricity capacity upgrading, poor technical quality of the electricity supply network and excessive pricing of grid connection are the main problems. Since electricity grid connection is expensive, the use of off-grid solutions or stand-alone power systems is considered for sparsely populated regions. In this context, agricultural land and activities may provide viable opportunities for generating electricity and energy using new technologies, such as windmills and biomass conversion. Food and agricultural activities in remote areas would also benefit from a more reliable energy supply. The *Estonian National Renewable Energy Action Plan Until 2030* sets the target of 50% of the energy produced from renewable energy sources in the gross final energy consumption, and 50% in electricity consumption by 2030. It contains measures that are aimed at increasing biomass availability, taking into account other biomass users (including agriculture).

The main infrastructure challenge for agriculture in Estonia is upgrading the systems for draining land of excess water. Drainage systems cover more than half of the utilised agricultural area. Most of them are over thirty years old and need reconstruction. In terms of land improvement, upgrading drainage systems is all the more important to increase productivity sustainably that climate change may lead to an increase in precipitations in Estonia. New technologies could ensure water and energy are used in a sustainable way, improving productivity and facilitating the development of new crops.

### ***Investment in ICT facilitates business activities and service provision***

Estonia invested successfully in ICT and continues to do so. Mobile telephone subscriptions are very high and internet use relatively high (80% of individuals use internet); almost all companies use computers and almost all enterprises have broadband internet connection, including farms. Since 2010, Estonia has been rapidly developing the basic broadband infrastructure (passive optical network) with EU support. The problem lies in making high-speed broadband access to the Internet network accessible to all end users. In this area, markets fail as communications operators do not have an economic interest in connecting users in remote areas. Connection issues in sparsely populated rural areas mean that there are also problems with the accessibility of e-services for both the residents and entrepreneurs. Digital Agenda 2020 aims to address this market failure.

Growing urbanisation has led to a growing regional imbalance in the provision of public and private services. Despite the worsening of the physical accessibility and the quality of services in rural areas due to increased urbanisation, the spread of internet, improvement of computer skills and the development of public e-services have facilitated access to services in rural areas. The widespread use of electronic identification (ID) makes administration practically paper free, fast and flexible. The development of the e-government, especially the elaboration of e-services for the public sector and their application by the citizens and enterprises has so far been the strength of the national ICT policy.

ICT development and everyday use of ICT technology have enabled most farmers and food processors a very good access to information concerning market developments, technological options and weather forecasts. Improving broadband Internet services in remote areas would provide local farmers and agri-food companies with better access to inputs, technologies, advice, and consumers, allowing them to take advantage of market opportunities.

***The education system is flexible and performant, but needs to be more responsive to changing skills needs***

The Estonian population has access to high quality education. Governance mechanisms give schools a high level of autonomy for resource allocation. The state sets national standards and establishes principles of education funding, supervision and quality assessment. Schools in Estonia have a level of autonomy above the OECD average, including the capacity to make decisions on the curriculum and to hire and dismiss teaching staff.

The strengths of the education system include high educational attainment, interest in sciences and technology, language skills, and gender equity. In addition, costs are relatively low compared to the OECD average. The quality of the Estonian education and training system is reflected in the high scores of students and adults population in international surveys. Basic level schoolchildren are among the best performers in reading, mathematics and science, worldwide. Estonian adults perform above average levels in numeracy and functional literacy.

A main challenge for the education system is to adjust to the smaller number of students as the number of children decreases and educational rates are already quite high. Others are to improve vocational education, respond to changing skills requirements, and offer opportunities for life-long training, as discussed below.

Estonian entrepreneurs and foreign investors consider the shortage of adequately trained personnel a key challenge in the local economic development. For example, the computer skills of employees need to be improved to meet contemporary requirements. In particular, according to the OECD Programme for the International Assessment of Adult Competencies (PIAAC) survey, the problem-solving skills in technology-rich environments of the personnel at Estonian educational institutions are almost the lowest, while the frequency of computer use at work is still among the average.

Increasing the number of doctoral graduates is a real challenge for Estonian research and innovation. The number of new doctorate holders per 1 000 population in the 25-34 age group is below the EU average. Furthermore, the number of applicants to doctoral studies may decrease in the coming years, reflecting not only the population decline, but also the lack of attractiveness of academic careers because of lower wages, and the lack of demand for PhD holders in the labour markets, as there are not enough large companies in Estonia that have the need and the opportunity to recruit PhD students and specialists with a PhD.

***Labour markets are flexible, but struggle to attract and retain talent, in particular in rural areas***

The Estonian labour market is considered as one of the most efficient among OECD countries, mainly due to the flexible employment policy. Labour mobility facilitates structural adjustment, including farm consolidation, by assisting excess labour in farming to exploit more remunerative non-farm income and employment opportunities. However, the capacity of the labour market to attract and retain talents is limited as Estonian workers are generally well-qualified, but are offered relatively low wages and salaries. As discussed below, this is particularly acute in rural areas. As illustrated by the negative population trend, this issue affects the long-term economic and social sustainability of Estonian development.

***Rural areas face labour and skills shortage***

Skilled workers are difficult to find in rural areas, as the population concentrates around urban centres, where better wages and working conditions attract younger people in particular. The labour market has been evolving in the recent decade, with the share of skill-intensive positions growing and the employment structure moving towards fully-skilled jobs. In rural settlements, more people of working age have a lower level of education than in cities, and the overall employment rate is lower.

The employment rate in rural areas has increased steadily, from 54% in 2009 to 65% in 2015. But the problem lies in the lower level of education of the rural working age population, which considerably limits their competitiveness in the labour market. Estonia has initiated a number of projects to improve skills match in rural areas. A citizen initiative “Come to live in the countryside” helps people, through a website, to find jobs and housing in the countryside, as well as opportunities for entrepreneurship. The Estonian Chamber of Commerce and Industry launched a project to bring together employers and talented young people who have gone abroad to study or work. National measures, such as training for unemployed and support for starting a business can also benefit rural employment. Estonian workers take advantage of training opportunities through the formal education system to improve the adequacy of their skills set with labour market demand (see below).

The problem is worse for agriculture, with its ageing labour force, lower than average wages, and reliance on low-cost, seasonal labour. In recent years, however, the average wages in agriculture have grown faster than the national average. An increase in the average wages and a more conscious choice of profession is expected to have a positive effect on the career choice made by younger people in rural areas.

Estonian agriculture offers seasonal jobs, which could attract workers from non-EU countries given that the remuneration is relatively low for Estonians and other EU citizens. However, the terms for recruiting temporary seasonal workers from non-EU countries are very restrictive, creating competitiveness problems, in particular for horticulture, which is a very labour intensive branch of agriculture. In particular, the annual immigration quota of non-EU citizens should not exceed 0.1% of the permanent population of Estonia per annum, and until recently, employers were required to pay them a remuneration amounting to 1.24 times the Estonian average annual wage. This wage supplement is no longer required. Together with the implementation of two EU directives on entry and residence of third-country nationals widening short-term employment opportunities, and establishing a new resident permit allowing the holder to work in another EU member state, this change is expected to facilitate non-EU employment and respond to agricultural demand for workers.

### ***Agriculture-related education and training aim to respond to the growing demand for skilled labour in food and agriculture***

Policies on skills improvement and on international mobility of human resources can also help to better match labour supply with demand, and can affect innovation and knowledge transfer through exchange of skills and skilled labour.

Agricultural education and training is available in Estonia, both through higher and vocational education programmes. Meeting the growing labour market demand for agricultural specialists is, however, a challenge for the education system in a context of decreasing number of students overall, which is expected to continue in line with the Estonian low birth rate. In higher education, the number of students enrolled in agriculture has declined over the past decade, but maintained the share of the total of students in higher education. In response to growing labour market demand, the number of students in agricultural sciences at vocational level has increased in recent years.

To increase the students’ motivation, study allowances are paid to students on the agriculture-related curricula in vocational education, specialisation scholarships are available for students in higher education and practical training support helps to improve practical skills.

Another challenge is to retain workers in the sector — a growing share of the university graduates of agriculture-related specialties (almost half in 2015) do not practice their profession, either because they study further or because they find employment in other sectors. This reflects the general increase in education levels, but also the fact that agriculture-related education and training provides skills that are valued in other, more attractive sectors. As a result, a significant number of positions are not filled in the agricultural and agro-food sector. Agricultural and horticultural enterprises find it difficult to find people with suitable skills, attitude and salary expectations, and prefer to re-train existing workers. They also train new workers with a non-agricultural educational background.

Overall, the share of adult learners entering vocational education is increasing, reflecting their willingness to adapt their skills to market requirements. Many of them will start their own business. Including adult learners in general and vocational education fosters better informed choices regarding the choice of their specialty, leading to a better match between the area of specialisation and the student's future professional career. For agricultural vocational education, the demand comes partly from agricultural education being a pre-condition for applying certain agricultural subsidies such as grants for young farmers.

To ensure the sufficient number of professionals entering the agricultural labour market, vocational and higher education institutions must be more effective and focused in promoting their speciality and profession in schools and in the society at large. This requires the elaboration of a more comprehensive and systematic outreach system at educational establishments. A more efficient and systematic involvement of employers and professionals of the specific field in curriculum development will help to guarantee that the knowledge and skills of graduates will take into account the future needs of the labour market and meet the expectations of professionals.

More general efforts to guide skills development include the establishment of a system to monitor and forecast labour market future skills requirements (OSKA). The system will contribute to the development of curricula, which takes into account the needs of the labour market. OSKA includes the establishment of a cooperation platform for employers and educational and training institutions. It makes a comprehensive analysis of the development opportunities and needs of different economic sectors in Estonia, and studies labour market training requirements based on various activities or professions. Training plans are developed at different levels of education and for a variety of educational institutions, including retraining, in-service training and refresher courses. The OECD Economic Survey of Estonia (OECD, 2017a) welcomes recent steps, but outlines that more needs to be done to provide career guidance leading to good job opportunities in basic education, where the quality of counselling services remains poor. The survey also recommends improving on-the-job training and apprenticeships. They can provide valuable skills in line with labour market needs, and thus improve matching quality on the labour market. The main recommendation to that effect is that Vocational Education Training (VET) institutions may allocate to companies up to 50% of the funds paid to the school for the study place.

#### **Recommendations to improve capacities and services for innovation**

- Continue to work on the last mile to improve Internet access with private providers.
- Explore the scope for diversifying sources of funding for new infrastructure and services, including through joint public and private agreements, and user fees.
- Develop green energy to increase the reliance on sustainable sources of energy, as foreseen in the Estonian National Renewable Energy Action Plan 2020, including from biomass on land currently not used for agricultural production.
- Efforts to upgrade drainage were successful, but maintenance remains an issue. Facilitate cooperation among land owners and farmers to improve the maintenance of the drainage system, and thus improve productivity, sustainably, and reduce production risk. In the light of climate warming and an increase in precipitation, it is important to support the farmers in the reconstruction and renewal of drainage systems.
- To attract and maintain people in rural areas, improve infrastructure connection, and services, and more generally living conditions, and establish long-term plans for the maintenance of those services.
- Provide information on employment opportunities, and facilitate relocation.
- Strengthen linkages between education institutions and the agri-food business community, offer practical training opportunities, and increase the financial incentives of employers to invest in lifelong learning. Monitor the effectiveness of efforts to reduce labour market imbalances may include forward looking discussion on employment and skills requirements between workers, education and employers.
- Attract foreign students in agriculture-related topics to compensate the decline in Estonian students, by offering more courses in foreign languages and adapting them to demand. Foster exchange of students among Nordic countries. Identify knowledge that Estonian students need to acquire abroad. Joint study programmes or curricula could be developed that combine both students and teachers from Nordic and Baltic and possibly other countries.

## **Strengthen further agricultural policy incentives targeting the adoption of sustainable technologies and practices**

### ***Agriculture policy has contributed greatly to the modernisation of Estonian agriculture, leading to high gains in productivity***

The EU Common Agricultural Policy (CAP) has greatly contributed to the spectacular development of Estonian agriculture. Within the EU framework, Estonian implementation of the CAP generally supported productive investment to increase productivity and reach EU standards, while limiting market distortions.

The CAP provides most of the support to Estonian farmers. Most Pillar 1 Direct Payments are implemented as a flat-rate per-ha payment (Single Area Payment Scheme and greening payment). This suggests there is no distortion among commodities, but may reduce incentives to productive investment as illustrated by the area of agricultural land not used for production. Commodity-specific payments, which influence production choices and thus distort markets, are limited to less than 5% of the total envelope.

Payment rates are lower than in most EU member states for two main reasons: the initial national entitlement of direct payments, and the limited (or no) use of optional national complements. In addition the share of Direct Payment is particularly low by EU standards because of lower initial entitlements and part of Direct Payments being used to fund the Estonian Rural Development Programme (RDP). However, payments per ha are planned to increase with the planned convergence of payment rates within EU member states and the recent introduction of a national complement (the Transitional National Aid). This will increase farmers' income but may give them the wrong signals about the long-term competitiveness of their operations.

Cross-compliance ensures minimal requirements on sustainable farm practices covering all agricultural land. Greening has offered farmers incentives to increase the area of legumes, with beneficial effects on both productivity and sustainability. The greening requirement constraining the conversion of grass land into crop production, however, may prevent moving to more efficient activities, without significant benefits for the environment, as grassland is already abundant and a large share of land is farmed rather extensively in Estonia. For example, support for organic farming and market signals have contributed to the expansion of land farmed organically and organic production over the last decade. As organic farming expands, it would be important, however, to ensure the development is economically and environmentally sustainable.

Policies provide a range of risk management tools. Livestock producers have used the subsidised insurance scheme available to them but the size of the scheme is small. The need for more effective risk management tools should be explored in the context of future policy discussion.

### ***The EU Rural Development framework offers further scope for targeting innovation, sustainability and competitiveness along the food chain***

As part of Pillar 2 of the CAP, the Estonian RDP allows for a better targeting of national objectives. Within the EU framework, Estonian choices reflect government emphasis on investment support to primary agriculture with a view to acquire up-to-date technology and increase sustainable productivity growth. Investment support also facilitated farm consolidation and the emergence of technically efficient farms. Increasingly, it is also expected to attract a new generation of well-trained managers. As a member state, Estonia can also use some RDP measures, alone or in complement with structural funds, to fund infrastructure investment and the development of rural activities.

Within the EU framework, RDP measures can also be used to address specific gaps, for example upgrading on-farm drainage systems sustainably, adding further value along the food chain, and diversifying activities. During the 2014-20 programming period, new measures facilitate access to high quality advisory systems, and cooperation and networking activities for the development of innovative solutions to current and future challenges, such as adaptation to climate change and to regulations aiming to reduce the impact of greenhouse gas (GHG) emissions.

Estonia relies on a number of domestic policy instruments to encourage sustainable technologies and practices; preliminary evidence suggests positive impacts on agri-environmental indicators in recent years.

For instance, environmental taxes are used to encourage the efficient use of environmental resources and pollution reduction in Estonia. The CAP also offers Estonian farmers payments for voluntary agri-environmental commitments. Current support schemes are associated with several positive trends in environmental impacts (such as point source pollution, soil fertility) and the adoption of good agricultural practices.

It is crucial for agricultural policy to provide a long-term vision for the sector, which recognises the need to improve environmental performance while maintaining productivity growth. In this regard, Estonia's planning horizon is often linked to EU financial frameworks and programming cycles of seven years. There is a clear continuity in policy choices between cycles so far, within the EU framework.

The information base and analytical tools to continuously monitor progress in productivity and sustainability, evaluate agricultural and innovation policies and guide farmers' decisions should be maintained and even developed. The government has an important role to play in the collection of information, which allows for the formulation of evidence-based policy, improved through monitoring and evaluation. It is particularly important to identify the determinants of the adoption of specific types of innovation and to strengthen the capacity of farmers, or farmers' organisations, to formulate their needs, and participate in knowledge networks.

#### **Recommendations for an agricultural policy more conducive to innovation**

- Continue to develop support targeting specific objectives, including the adoption of innovative and sustainable technologies and practices, as done with transferring funds from broad-based Direct Payments to RDP measures.
- Phase out national complements to Direct Payments that were introduced recently in response to a crisis, to avoid giving the wrong signal that no adjustment is needed. Instead, promote innovation, sustainable productivity growth, risk management and strengthen risk management tools, and continue to limit the provision of coupled payments, and thus distortions in the allocation of resources, leading to sub-optimal productivity and sustainability outcomes.
- Strengthen efforts to reduce nitrate pollution in more fragile areas, and continue to address the phosphorus deficit, and ammonia emissions, by providing targeted advice on sustainable technologies and practices.
- As organic production develops, monitor environmental impacts to ensure the development is environmentally sustainable, in particular regarding the management of livestock effluents.
- Explore options for reducing GHG emissions from agriculture, in particular grazing livestock, to contribute to COP21 engagements, and facilitate farmers' adaptation and relevant research. Alternative use of grassland and land under good agricultural and environmental conditions (GAEC) for biomass could be envisaged as suggested above. More generally, raise awareness of opportunities and challenges from climate changes.
- Strengthening the value chain would help find new markets and develop new products. Help the sector identify where good commercial prospects are, and develop a competitiveness strategy accordingly. This could include measures to upgrade technology, technical and management skills, and facilitate the development of high value-added chains, including in organic food. Adapt competition policy to take account of the small national market size.
- Stakeholders need to develop a strategy for responding to specific market demand (e.g. organic products, bio-based products) and for strengthening technological, organisational, and marketing innovation. Make use of the opportunity given by the CAP to recognise Producer and Branch Organisations and support the participation of farmers or farmers' organisations in knowledge networks. Use RDP to fund networking activities and knowledge flows, also to strengthen food processing and rural activities.
- Better evaluate consumers and citizens expectations towards agriculture
- Develop further Information Technology (IT) solutions to collect and manage data, reduce control costs and implement more targeted policies, and to improve traceability along the food chain. Explore the scope for using output-based agri-environmental measures with the help of ICT for monitoring outcomes.
- Strengthen further the information base and analytical capacity to monitor progress, evaluate policies and guide farmers' decisions, with specific attention to innovation adoption and environmental practices.

## Foster an agricultural innovation system with stronger interactions between actors

### *Estonia has a strong public research system, but weak innovation in firms*

The strengths of the Estonian innovation system are the conducive business environment; a government strategy integrating innovation and economic growth objectives, with investments targeting smart specialisation high-growth areas, including ICTs; a relatively strong public research system, with high public R&D expenditure and strong performance in journal publication and international cooperation; good skills base in the population, in particular young performers in science; and society's positive attitude to science and technology.

Demand side innovation policy is widely discussed, but supply-side innovation dominates with relatively little input from, or ownership by, the business community. This is particularly the case in agriculture, where the major part of innovation, as in other countries, is driven by input suppliers.

The shortcomings of the system are mainly related to low R&D and innovation in firms, partly linked to the relatively small size of Estonian companies. The most innovative companies in Estonia are the subsidiaries of foreign companies and foreign-owned companies. In particular, industry-science linkages are not strongly developed, although programmes have been implemented recently to facilitate public-private cooperation in R&D and to better connect education and skills to labour-market needs.

### *The government plays a strong role in governance*

The strategic framework for innovation policy is clear, but there is an abundance of strategic documents, action plans, policies programmes and projects, which does not facilitate coherence. The decision has been taken to develop 18 strategies, including one for agricultural, food and fisheries growth, related to the bioeconomy (covering agriculture and forestry) and health strategies, while the overall innovation strategy will continue to cover agriculture innovation. Innovation priorities have changed between 2004-14, where the focus was on infrastructure, capacity, and entrepreneurship, and 2014-20, when horizontal innovation, risk and acceptance of innovation is emphasised. The agricultural innovation strategy, as all sectoral innovation strategies, is fully integrated into the nation-wide strategy.

Innovation policy and the impact of other policies on innovation are regularly evaluated. The evaluation of EU programmes is based on input and output indicators defined at the EU level, which describe and analyse the dynamics of the Estonian research, development and innovation system based on the framework of EU policies and objectives. Indicators have thus been used for monitoring, in particular the use of public money, but without evaluation of impact to guide public choices.

The governance and implementation of innovation policy is mainly top-down, based on a linear approach to innovation from basic research, followed by applied research and the implementation of the new practical solutions in industry and the economy. The 2017 OECD Economic Survey of Estonia (OECD, 2017a) notes that “*business representatives are not involved enough in the design of innovation policy, in particular at early stages. Regular feedback on policy instruments is organised via committees in which businesses are represented, but remains weak. Scope for changes once measures are approved should be made more flexible. A new industrial policy green paper that focuses on digitalisation of traditional industries has been initiated by the business community. This is welcome and it will be important to maintain the link with the business community while designing concrete policy measures to implement it.*” Agricultural innovation systems are characterised by a particularly large number of diverse stakeholders. This makes consensus difficult to reach although consultation mechanisms are in place. When preparing new programmes, consultation is quite active but less during implementation. More active participation of stakeholders at all stages of the innovation process would make the system more efficient and more responsive to needs.

***Agricultural research is well integrated in the general system, but public actors are even more dominant***

Agriculture is well-integrated in general innovation, and the agricultural innovation system shares the same strength in public research and governance. The Estonian University of life Sciences (EMÜ) carries out most agricultural-related research in Estonia, while two other universities are engaged in environmental sciences and biotechnology and food sciences, and a research institute under the Ministry of Rural Affairs is specialised into crop research. It also shares the general weakness of private research but to a much larger extent as companies lack the capacity to perform or fund research.

***Public expenditures on R&D for agriculture trend upwards but fluctuate strongly***

Public expenditure on agricultural research has increased since 2000, in particular as a share of agricultural value-added. There are large fluctuations, as illustrated by the EMÜ research budget, due to the dominance of project-based funding, and the dependence on EU sources, which follow seven-year programming cycles. In fact, the share of project-based research funding, including in food and agriculture sciences, is very high at about 80% of total public funding. This share is planned to decrease to ensure more stability for research institutions.

Research infrastructure has been one of the main targets of EU structural funding, following a period of underinvestment between 1990 and the mid-2000s. Since 2010, research infrastructure roadmaps guide long-term investment decisions, identifying the infrastructure items of national importance that are new or require modernisation, and updating the list every three years.

Overall, recent infrastructure investments have helped compensate previous underinvestment, but some facilities still need upgrading and further investments from EU structural funds are planned for 2014-20, representing one of the largest investment areas. By continuing to modernise R&D infrastructures, the government aims to achieve the sustainable funding and maintenance of R&D infrastructures to support their effective use and sharing (OECD, 2017a).

***Collaboration between agri-food private companies and R&D institutions is limited***

While Estonian agri-food companies are considered as innovative users, they have little capacity to carry out research activities and their contribution to the funding of agricultural research is estimated to be minimal (less than 1% of total expenditure). The most innovative companies are foreign-owned companies or their subsidiaries in Estonia, so research is done abroad. The most common form of collaboration is participation of representatives in steering committees and networks.

Incentives are in place to facilitate public-private collaboration. Intellectual Property Protection (IPP) is in place in Estonia and the IPP Index increased over time to reach the OECD average level. Competence centres have been recently established as an important source of collaborative innovation, but as private participation is generally from foreign companies, the focus is often on international issues as opposed to topics that can benefit the domestic agriculture sector. Three of the current six national competence centres are related to food and agriculture, as well as a regional Centre and a consortium.

Noting that the innovative capacity of Estonian firms is limited, and that collaboration between academia and businesses is too low, the 2017 OECD Economic Survey of Estonia (OECD, 2017a) recommends the Estonian government to give more weight to cooperation with the private sector when allocating funds to public R&D institutions.

International cooperation is facilitated through participation in EU research programmes, projects and networks, and incentives for research mobility such as grants and conditions favouring international experience in project allocation and nominations.



### ***Farms and agri-food firms are innovative in a conducive environment***

Innovation activities are taking place in food and drink processing industries, mainly related to upgrading of equipment and product design. Farms have also invested in modern technology allowing them to reach high technical efficiency.

Open access to knowledge, optimal knowledge circulation and transfer through the application of digital European Research Area (ERA) is a priority of the ERA concept that Estonia follows. Farmers are granted free access to the research information on the website of the Estonian Agricultural and Rural Advisory Service.

The advisory system has helped the diffusion of knowledge on technologies and practices among farms. A number of different Estonian organisations provide training and advisory services, including cooperatives, input providers, and education institutions. The Advisory Centre of RDF is currently in charge of the publically funded advisory system, providing advice to farmers and rural entrepreneurs for a minimal fee. The focus of this advice is on meeting EU regulations and conditions for receiving agricultural support.

### ***Better information on challenges and opportunities for the sector is essential to guide private investment and policy decisions***

The government has an important role to play in providing information systems needed to share information, reduce information gaps to better guide private investment decisions, monitor economic and environmental performance of the sector, identify market and policy failures, and improve policy design, implementation, monitoring and evaluation. Better information and analytical tools are also needed to monitor and evaluate the performance of the whole agricultural innovation system. Individual policies and institutes are regularly evaluated, but so far, there is no systematic mechanism in place to evaluate the agricultural innovation system and the information to do so is fragmented.

#### **Recommendations to strengthen direct incentives to innovation**

- Consolidate innovation and growth strategy documents to improve clarity, as the abundance of strategic documents, action plans, policies programmes and projects does not facilitate coherence.
- The policy framework is driven by supply-side measures, with relatively little input from, or ownership by, the business community. More involvement of the private actors in policy dialogue on R&D and innovation policies at an early stage, and facilitate networking to better reflect users' needs, and thus improve adoption.
- Facilitate discussion among and between producers and the industry to enable them to contribute more effectively and efficiently to the agricultural innovation system, including through participation in networks or formulation of demand.
- Continue improving the stability of R&D funding. The reduction in the high share of project-based funding should contribute, as well as the development of longer-term, larger scope project funding as planned for 2018. The consolidation of programmes would make them more attractive for the industry to take part.
- Focus public funds on areas generating high value-added for the Estonian sector, building on specificities, niche-markets, collaborate on more general innovation, and import other technologies. Build on local and regional assets to develop innovation and development projects, including in partnership with other countries. The principles behind the “small advanced economies” initiative could help in that regard.<sup>1</sup>
- Facilitate access to diverse sources of funding for research and explore ways to complement public funding, for example from foundations or agricultural levies.
- Maintain research infrastructure and improve further in areas lagging behind such as the crop sector, and focus efforts in areas where Estonia has comparative advantage, as it is essential for future progress and to maintain excellence and collaboration capacity at national and international levels. Explore further opportunities to share public infrastructure with the private sector, including foreign companies.
- Identify areas where local companies and researchers could collaborate, e.g. through public-private partnerships, to develop local or niche products and innovation. Give more weight to cooperation with the private sector when allocating funds to public R&D institutions. Encourage academics to participate in private sector innovation and research activities as a part of their curricula.

**Recommendations to strengthen direct incentives to innovation (cont.)**

- Explore ways to generate new (break-through) ideas to overcome current constraints, for example through demand-driven mechanisms, including to develop technologies and systems allowing for a better management of natural resources and improved resilience to risks.
- Encourage a diverse supply of advice that is accessible, including through ICT, and responsive to market demand, and goes beyond technical issues towards management, marketing, environment. Collect information on innovation practices and needs, e.g. using surveys. Provide incentives for farm managers and employees to upgrade skills (replacement, stronger link with support). Demonstrate the benefits of improved technology and practices. Focus support on advice for cross-compliance and public good aspects (e.g. promote innovative solutions to sustainability challenges, while farmers are expected to pay for private advice to support farm development).
- Continue ensuring farm advisors are well-trained professionals with up-to-date skills, by facilitating retraining and development of new skills that are needed to adapt to the new environment. Attract highly-skilled professionals in the system, using economic incentives. Encourage them to participate more actively in innovation projects, and to draw on knowledge from abroad to improve advice to Estonian farmers.
- Include activities related to knowledge and innovation in research evaluation and funding to make research more responsive to demand and facilitate adoption.
- Continue developing information systems, including market intelligence (big data) and research results, as innovation and policy evaluation become more complex and require a wealth of information. In particular, continue to monitor innovation adoption and environmental performance in surveys, in addition to economic performance, to better understand determinants and policy impact. Use and share innovative methods to reduce collection costs and improve farm and firm participation.
- Be proactive in developing indicators and tools to evaluate the performance of the agricultural innovation systems and innovation policy regularly, taking longer term effects into account, possibly in collaboration with other EU member states.

1. Small advanced economies website: <http://www.smalladvancedeconomies.org/>.

## References

- OECD (2017a), *OECD Economic Surveys: Estonia 2017*, OECD Publishing, Paris, [http://dx.doi.org/10.1787/eco\\_surveys-est-2017-en](http://dx.doi.org/10.1787/eco_surveys-est-2017-en).
- OECD (2017b), “Estonia”, in *OECD Science, Technology and Innovation Outlook 2016*, OECD Publishing, Paris, [http://dx.doi.org/10.1787/sti\\_in\\_outlook-2016-58-en](http://dx.doi.org/10.1787/sti_in_outlook-2016-58-en).
- OECD (2017c), *OECD Environmental Performance Reviews: Estonia 2017*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264268241-en>.
- OECD (2015), “Analysing Policies to improve agricultural productivity growth, sustainably: Revised framework”, [www.oecd.org/agriculture/policies/innovation](http://www.oecd.org/agriculture/policies/innovation).
- OECD (2011), *Estonia: Towards a Single Government Approach*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264104860-en>.



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