Chapter 6. General policy environment for food and agriculture

This chapter consider the extent to which the general policy environment facilitates or impede innovation, structural change, and sustainable use of resources in food and agriculture. It covers policies that can facilitate investment, such as regulations, trade, finance and tax policies, as well as policies that foster infrastructure capacity, skills and education and thus facilitate innovation, structural adjustment and more efficient resource use in food and agriculture. Finally, the chapter identifies main knowledge gaps and consolidates recommendations to strengthen the general policy environment in key areas made in country reviews.

- Good public governance and trust in institutions facilitate innovation, yet even with less-than perfect conditions, it is taking place when profitable.
- Transparency and accountability, and consultation with stakeholders facilitate policy reforms and trust in regulations.
- Regulatory burden remains an issue in most countries, but several governments have started to modernise regulations to improve transparency and efficiency, and harmonise across jurisdictions and countries. Timely response to new regulatory issues remains a challenge.
- Core environment and resource regulations are needed for agriculture sustainability and productivity. The degree of sophistication of natural resource governance differs by country, with some facing significant weaknesses limiting the effectiveness of regulatory systems. Environmental regulation stringency is difficult to measure, in particular for agriculture.
- In most reviewed OECD countries, trade policy does not generally restrict access to modern technologies and farm inputs, but some farm commodity sectors are heavily protected from foreign competition in some countries. Tariffs for capital goods and intermediate goods are generally higher in emerging economies than OECD countries. There has been significant progress in trade facilitation since 2012. There are few restrictions to foreign direct investment in reviewed countries, except for agricultural land in a few of them.
- In most OECD countries, the banking sector and financial markets are well developed, and credit is accessible for food and agricultural firm that want to innovate, although access had become more difficult in the years following the 2007 financial crisis.
- In addition to supporting investment in private companies, most reviewed countries implement specific programmes to support investment in agriculture, and sometimes the food industry and the development of value-chains.
- Total tax rates as a percentage of profit range from 20% to 70% in reviewed countries, mainly due to differences in labour taxes and contributions. Farm income can be taxed as personal income or corporate income, depending on legal status. In a few countries, agricultural income benefits from special treatment, such as the option to smooth taxable income over time, or taxation based on sales or a lump sum. Fuel for agricultural uses benefits from lower tax rates in some countries.
- Countries increasingly use tax instruments rather than direct support to stimulate R&D in firms.
- Rural infrastructure and services are crucial for the competitiveness of the agri-food sector, but provision is a challenge in remote regions with low population density, in particular in very large countries but not only.
- Matching labour and skills demand from food and agriculture is a growing issue in many countries, which labour, immigration and education policies can help respond to.
- Agriculture-related education can contribute by becoming more attractive to students, anticipating new skills demand and adapting courses accordingly, offering long-life training to all workers in the sector.

Facilitating investment

The country reviews consider the extent to which the general policy environment facilitates or impede innovation, structural change, and sustainable use of resources, and is forward looking.

Good public governance and trust in institutions are important to facilitate policy changes, the acceptation of regulations and innovation, the development of contracts for marketing, the protection of property rights and the respect of rules regarding access to natural resources, the quality and safety of farm inputs and food products.

A number of reviewed countries achieve good public governance and trust in institutions, yet even in countries with less-than perfect conditions, innovation is taking place when profitable. Transparency and accountability, and consultation with stakeholders facilitate policy reform, as illustrated by the experience in Australia.

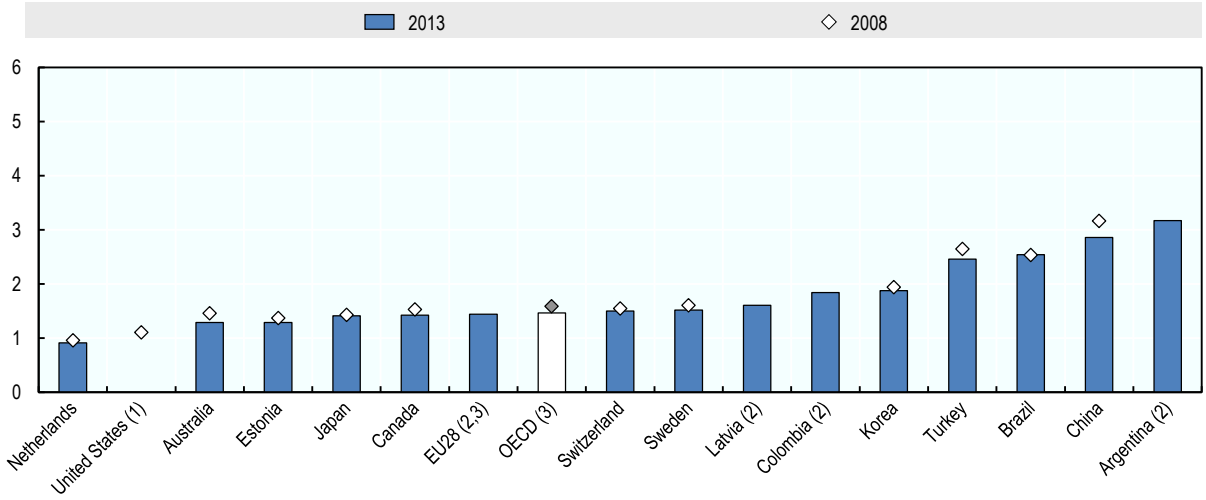
The general business environment, including sound macroeconomic fundamentals, clear regulations, competitive conditions in domestic markets, open trade policy, access to finance, and a tax system promoting investment, affects the competitiveness of both agri-food companies and farms. In most OECD countries, the overall policy framework is generally supportive of innovation, but country reviews identified some areas for improvement.

Regulatory burden is an issue for the agri-food sector in most countries, in particular regarding the complexity and timeliness of regulatory procedures for the approval of farm inputs, and food safety requirements. Business regulations have generally become more supportive of innovation over time. In particular starting a business has become easier in many countries (Figure 6.1).

Coherence between national and regional regulations is an issue in federal countries. For example, many natural resource and environmental regulations are under sub-national responsibility in Australia, Canada and the United States, often comprising very different approaches within the same country. Incoherence between local, regional and national level governance systems can be particularly problematic in the case of water as observed in the People's Republic of China (hereafter "China"). Transboundary conflicts around common resources across states or provinces can take a long time to resolve.

Figure 6.1. Product Market Regulation Index: Integrated index, 2008 and 2013

Scale from least (0) to most (6) restrictive



Notes: 1. For the United States, 2013 data are not available.
2. For Argentina, Colombia, EU28 and Latvia, 2008 data are not available.
3. Indices for EU28 and OECD are the simple average of member-country indices.
Source: OECD (2014), OECD Indicators of Product Market Regulation Database, www.oecd.org/economy/reform/indicators-of-product-market-regulation/.

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Environmental and resource regulations may impact agriculture productivity and sustainability, but there is no consistent effort to characterise how this is done. The OECD developed an environmental policy stringency index, but it does not reflect policies that may affect the agriculture sector.

Core natural resource regulations are however necessary to ensure that agriculture is productive and sustainable. In particular, robust water resource allocation regimes, which rely on a system of regulations defining water property rights, are necessary for a sustainable management of water resources in agriculture in regions and countries where agriculture relies on irrigation (OECD, 2010; 2015a). They contribute to the sustainability of the productivity of agriculture under climatic events like droughts or floods (OECD, 2016; 2017a). Recent promising initiatives have been introduced in reviewed countries to improve the management of water, including for agriculture (Box 6.1).

The degree of implementation of the regulations depends on the quality of resource governance systems. In particular, if some countries have more advanced and sophisticated water governance systems (Australia), others present gaps and inconsistencies in rural areas (China), limiting the impact of (even well designed) policies in the agriculture sector.

Land regulations also condition productivity and sustainability in agriculture. Depending on the overall land constraints, reviewed countries have set regulations to restrict agriculture land expansion to forested areas (Brazil, Colombia), to discourage agriculture land fragmentation (Turkey), or to prevent agriculture land conversion to urban use (Japan, Korea). While introduced for different purposes, these different regulations can all support sustainability objectives: forests provide a range of essential ecosystem services that

surpass those generated by agriculture, but agriculture production will also provide ecosystem services that surpass those associated with urban development.

Box 6.1. Examples of promising water policy initiatives to improve water management in agriculture

High-level policy calls have highlighted the need for agriculture to improve their management of water resources. In 2017, G20 agriculture ministers adopted a declaration and an action plan entitled "Towards food and water security: Fostering sustainability, advancing innovation" which includes a number of significant commitments to improve agriculture's water use and reduce its exposure to water risks.

Reviewed countries have recently introduced several promising programmes or regulations to improve their managements of water resources with particular emphasis on agriculture. These initiatives have combined sound policy choices with efforts to have effective policy processes.

As part of broader revision in the federal water governance system, following the 2014 major drought in the South, Brazil initiated steps to bolster the use of water charges for hydropower facilities and agriculture users. The water charges aim to help improve water allocation while helping recover regulatory agency recover charges. Following an extensive consultation with stakeholders, within states and with interstate river basins, it has initiated a gradual plan to implement higher water charges that will depend on river basins, supported by financial and transparent plans, focusing on large water users.

In 2014, amidst the most intense drought ever recorded, the US State of California introduced its first ever regulation of groundwater, the Sustainable Groundwater Management Act. This reform aims to address groundwater depletion, which is largely driven by irrigators, by 2042, while reducing other pumping related environmental damages. The regulation requires the formation of groundwater sustainable agencies (GSA) in each groundwater body. These agencies are charged with setting up plans to manage their groundwater. GSAs in defined medium or high priority groundwater bodies that do not set up and apply a plan in consistency with the legislation can face probationary actions by the state agency, which can temporarily take responsibility for the management of the groundwater body (setting plans etc.).

In 2018, the government of Canada and the government of the province of Ontario launched the Canada-Ontario Lake Erie action plan to address phosphorus pollution responsible for algal blooms and hypoxia zones in the lake. This programme, which aims at reducing Canadian phosphorus loadings by 40%, involves multiple approaches and advanced data assessments to arrive to a result. The plan is organised as a multi-partner programme, involving a wide range of actors in the basin, embedding regular evaluation of progress, continued engagement with stakeholders and allowing adjustment of the plans as needed.

Source: G20 (2017), "G20 Agricultural Ministerial Action Plan 2017- Towards food and water security: Fostering sustainability, advancing innovation", www.bmel.de/SharedDocs/Downloads/EN/Agriculture/GlobalFoodSituation/G20_Action_Plan2017_EN.pdf?__blob=publicationFile; Gruère et al. (2018), "Reforming water policies in agriculture: Lessons from past reforms", https://doi.org/10.1787/1826beee-en ; OECD (2017b), *Water Charges in Brazil: The Ways Forward*, http://dx.doi.org/10.1787/9789264285712-en; Gruère and Le Boëdec (2019), "Navigating pathways to reform water policies in agriculture", https://doi.org/10.1787/906cea2b-en.

Reviews of EU Member States show that common environmental regulations can trickle down differently and lead to different approaches. Accession to the European Union contributed to the fragmentations of environmental regulations in Estonia. The Netherlands has used incentives to complement environmental regulations to increase their

sustainability performance, but also had to abandon an innovative policy to reduce fertilisers due to incompatibility with EU competition rules. Sweden has implemented regulations that are more extensive and complex than those in other EU Member States. National regulations tend to set norms and standards for environmental and animal welfare well above EU requirements in the food and agriculture sector, particularly in relation to the types and permitted uses of pesticides, and the use of antibiotics in animal production, as well as animal welfare such as housing, space and husbandry practices. The EU accession process has also encouraged environmental regulatory development in Turkey although implementation, monitoring and assessment still need to improve.

Regulations on products and processes that aim to protect human, animal and plant health can also affect natural resource use. Other process regulations, like those governing organic farming, provide consumers with assurance of certain production practices and influence investment decisions.

In many countries, government bodies responsible for the implementation of regulations on agricultural chemicals and veterinary products, are different from those overviewing regulations on food products and processes. In countries with a federal structure, differences remain across states and between federal and state-level regulations, but there have been efforts at harmonisation. The Canadian review reports that the process of harmonisation between countries (e.g. the Canada-United States regulatory co-operation in Box 4.1 of OECD, 2015b) provides an opportunity to revisit internal differences. At the time of the review, Canada was also discussing the adoption of a Bill expanding the use of a regulatory tool, "incorporation by reference", that allows easier incorporation of standards and requirements created by an international standard setting body or adopted by another jurisdiction. This would help to avoid duplication and promote jurisdictional harmonisation.

EU Member States implement regulations that are mainly determined at the EU level. The Dutch review suggests using innovative approaches to reduce regulatory costs for governments, including partnering with the private sector in the management of sanitary and phytosanitary (SPS) regulations to build an interface between private voluntary standards and compulsory compliance regulation. The length of time for the approval of new products on the market differ widely among reviewed countries. For example, it takes 6 months in the United States and 4 to 5 years in the European Union (OECD, 2015c).

The principle that regulations should be science-based is widely shared, but some countries also take account of social and economic impacts, and consult stakeholders. Most countries have developed specific regulations for genetically modified (GM) products, generally based on the OECD risk assessment process, but authorisation procedures vary significantly. In Australia, the Gene Technology Regulator makes decisions on the development and use of GM organisms based on health, safety and environmental considerations, but the states regulate the commercial and marketing arrangements of GM crops. Since 2015, a Directive gives EU Member States flexibility to decide on the cultivation of GM crops on parts or all of their territory, under certain conditions, and either during the authorisation procedure or after the GM crop has been authorised at the EU level. In the United States, the Coordinated Framework for Regulation of Biotechnology aims to use existing statutory authority and agency expertise for a regulatory approach aimed at ensuring the safety of biotech products. A key regulatory principle is that biotechnology products should be regulated according to their characteristics and unique features, and not according to their production method — that is, regardless of whether they were created through the use of genetic engineering techniques. This framework also applies to products

generated by gene editing technologies,[1] which introduce very precise modifications. In the European Union, these products are regulated as GM products. At an OECD Conference on genome editing applications to agriculture, Argentina also presented a recent framework to assess these products.[2]

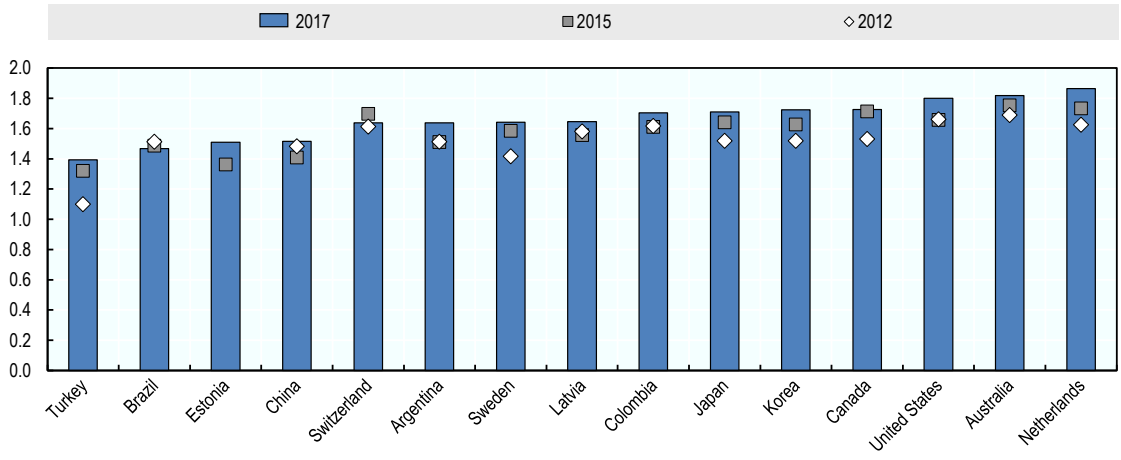
Trade policy does not generally restrict access to modern technologies and farm inputs (in particular in OECD countries), but in reviewed countries, some farm sectors are protected from foreign competition. In emerging economies like Brazil and China, tariffs for capital goods and intermediate goods are higher than in most OECD countries. This increases the cost of capital, inputs and machinery equipment needed to innovate, and thus affects the competitiveness of the agri-food sector.

In most countries, there have been progress in trade facilitation since 2012 (Figure 6.2). However, a deterioration in scores for information availability and involvement of trade community resulted in a decrease in the overall index for Brazil between 2015 and 2017.

According to the OECD index, regulatory restrictions on foreign direct investment (FDI) in food and agriculture are generally low in most reviewed countries (Figure 6.3). However, they are relatively high for agriculture in Korea and Brazil. In the latter, the restriction relates to the acquisition of rural land by foreign legal or physical persons. In particular, the share of land rented or operated by foreigners cannot exceed 25% of total rural area by municipality. While a net exporter of FDI and embedded knowledge in food and agriculture, the Netherlands is also very open to FDI.

Figure 6.2. OECD Trade Facilitation Indicators, 2012, 2015 and 2017

Scale from lowest (0) to highest (2) performance



Note: Arithmetic average of indicators on Information availability, Involvement of trade community, Advance rulings, Appeal procedures, Fees and charges, Formalities – documents, Formalities – automation, Formalities – procedures, Border agency co-operation – internal, Border agency co-operation – external, and Governance and impartiality.
Source: OECD (2017c), Trade Facilitation Indicators, www.oecd.org/trade/facilitation/indicators.htm.

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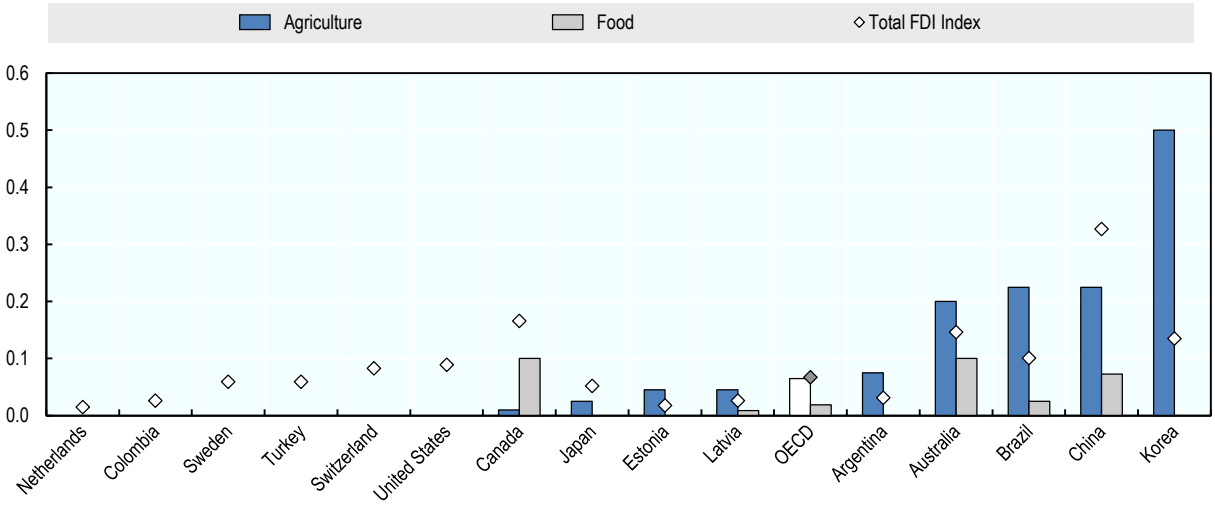
Figure 6.3. OECD FDI Regulatory Restrictiveness Index, 2016

Scale from least (0) to most (1) restrictive.



Notes: Four types of measures are covered by the FDI restrictiveness index: 1) foreign equity restrictions, 2) screening and prior approval requirements, 3) rules for key personnel, and 4) other restrictions on the operation of foreign enterprises. Indices for OECD are the simple average of member-country indices.
Source: OECD (2017d), "OECD FDI Regulatory Restrictiveness Index", OECD FDI Statistics (database), www.oecd.org/investment/fdiindex.htm.

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While OECD countries usually have a well-developed banking sector and financial market, **access to finance** has become an issue after the crisis. In some countries, farms have preferential conditions or investment grants (but not in the United States until recently), sometimes without a clear identification of market failure in credit market (clear market failure in Brazil). Some farm investment support is for the adoption of modern technology/building (Europe in relation to respect of EU regulations; Canada). Surveys may report difficulties in accessing loans, which are often linked to low income and profitability, and high debts, not necessarily market failures. Some countries provide investment support to farmers, and sometimes food processing companies. Credit mainly comes from traditional sources such as banks.[3] Some countries mention efforts to develop venture capital for innovative firms but the extent to which it benefits agri-food firms is not clear.

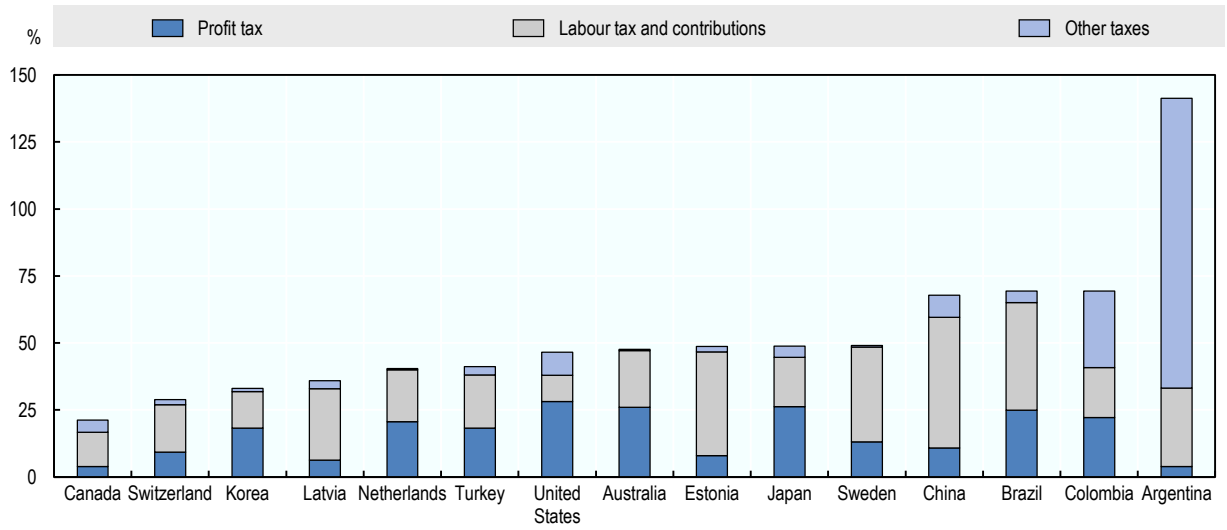
The **tax system** affects agri-food companies and farms in many ways. Total tax rates as a percentage of profit vary from 20% to 70% in reviewed countries (Figure 6.4). Some countries have reduced rates for smaller enterprises (e.g. Canada), which apply to many food processing firms and farms. Many countries have specific provisions for farmers, usually to reduce income tax, allow for income smoothing, and to facilitate farm transmission. Reduced rates for taxes on fuel used in agriculture are also common. In Brazil, agro-food exports benefit from tax preferences as all exports of raw material and semi-processed products destined for exports.

Several countries undertook changes in taxation systems in recent years. The Australian tax system has been undergoing significant changes since 2010; some with possible implications on investment in the agricultural sector. In Estonia, the use of environmental taxes and charges has been increasing since 2005. As discussed in Chapter 5, many

countries have increased R&D tax incentives in the last decade, and Estonia is one of the very few OECD countries that does not use this type of incentives.

Figure 6.4. Total corporate tax rate, 2017

As a percentage of profit



Note: The evaluation uses a concept of a "case study company" defined on the basis of a set of criteria, including the legal form of business (limited liability), start date of operation (January 2012), geographic location (country's one or two largest business cities), origin of ownership (100% owned by domestic natural persons), type of activity (general industrial and commercial), size (own capital amount, number of employed, turnover, etc.). The total tax rate is the sum of taxes and contributions payable after accounting for allowable deductions and exceptions related to commercial profit of businesses before all taxes borne. The groups of taxes covered include: profit or corporate income tax; employer's social contributions and labour taxes; property taxes; turnover taxes and other (such as municipal fees and vehicle and fuel taxes).
Source: World Bank Group and PwC (2017), Paying Taxes 2017 - The Global Picture, PwC, World Bank and IFC, www.doingbusiness.org/data.

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Developing capacities and services

Good **infrastructure** is crucial for the competitiveness of the agri-food sector, as it reduces costs and facilitates marketing. It is a major issue for large countries. The most serious issues are in Brazil, but also Turkey and parts of Australia and Western Canada, where large production areas are far away from consumption and export places. Water management infrastructure (irrigation or drainage) is the main agricultural-specific infrastructure. The reviews suggest assessing future demand for infrastructure, taking climate change and water constraints into account.

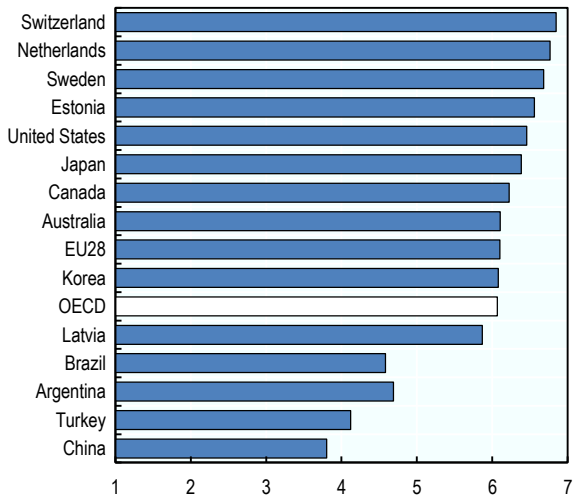
Providing adequate infrastructure and services in remote rural areas remains a challenge in most countries, as costs per user are high in these areas with low population density. Technological and organisational innovations can help, such as faster trains helping connect rural areas to job markets, on-line work, new energy sources able to operate independently of the electricity grid, E-services and joint services). Information and Communication Technologies (ICTs), including digital technologies, offer promising solutions to deliver services in rural areas, connect people and markets, and facilitate

traceability along the food chain. While ICT use is very high in some OECD countries, it is less widespread in emerging economies (Figure 6.5).

Government's effort to revitalise rural areas in Korea are summarised in Box 6.2. In Estonia and Latvia, EU structural funds contributed to a large part of investment to improve rural infrastructure. Other countries like Brazil consider Public-Private Partnerships (PPP) to help finance much needed infrastructure investments. Canada developed PPP Canada, a Crown corporation working with all partnerships to support greater adoption of PPPs in infrastructure procurement. In this country, a large number of federal and provincial ministries and government agencies contribute to rural development so a number of mechanisms have been put in place at the Federal level to ensure coherence across policy areas that have an impact on innovation in food and agriculture. They include FTP government committees, interdepartmental reviews and regional-federal councils.

Figure 6.5. Global Competitiveness Index: Total index of Information and Communication Technology (ICT) use, 2017-18

Scale from lowest (1) to highest (7) quality



Note: Total index of ICT use is the aggregate of the following indicators: Individuals using Internet refers to the share of individuals using the Internet; Fixed-broadband Internet subscriptions refers to the fixed-broadband Internet subscriptions per 100 population; International Internet bandwidth refers to the international Internet bandwidth (kb/s) per Internet user; Mobile-broadband subscriptions refers to the active mobile-broadband subscriptions per 100 population. All indicators were converted to 1-to-7 scale using a min-max transformation. Indices for EU28 and OECD are the simple average of member-country indices.
Source: World Economic Forum (2017), *The Global Competitiveness Report 2017-2018: Full data Edition*, http://reports.weforum.org/global-competitiveness-index-2017-2018/.

StatLink https://doi.org/10.1787/888933998842

Box 6.2. Comprehensive rural development policy and household income statistics in Korea

A balanced regional development has been a major policy issue in Korea as the economic growth has concentrated on urban areas and the manufacturing sector, increasing the income gap between rural and urban households.

Rural development policy in Korea evolved from the participatory community based programme in the 1950s (The Saemaeul Movement) to a nationwide comprehensive programme, widening the scope from agriculture to non-agricultural industries.

The Saemaeul (new village) Movement was implemented as a nationwide comprehensive development project including improvement in rural infrastructure and residential environment as well as income generation activities such as the introduction of cash crop production and building factories. The important aspect of the Saemaeul Movement was a co-operation of the government and the rural residents using both government budget and private funds.

In the 1980s, rural development policy shifted to a more state led comprehensive rural development framework. Increased government budget in the 1980s and 1990s enabled the central government to develop roads, communication facilities, and water sources in rural areas, and to improve educational, medical and welfare systems. The major goals of the rural development policy during this period were to improve the living conditions in rural areas and to increase the rural income through creation of off-farm activities.

In the 2000s, the paradigm of the rural development policy was extended from agricultural production to settlement and recreation. The government focused on enhancing the amenity functions of rural areas, boosting environmental protection, and emphasising agriculture's role for preservation of the national land. The government has promoted an autonomous development strategy that strengthens local competencies and utilises local resources through projects. The government enacted the Special Act on Improving the Quality of Life in Rural Areas and Rural Development Promotion in 2004 to attract human resource and economic activity in rural areas.

According to the action plan in 2016, investment and financing were focused on the projects such as revitalisation of rural hubs, village maintenance, housing maintenance, water use improvement, and safety management of rural areas. The National Standards for Rural Area Services set comprehensive and concrete policy targets in many areas (health and welfare, education, settlement condition, economic activity and job, culture and leisure, and safety) to guarantee a high quality of life for rural residents. The assessment of policy achievement in 2016 shows that most areas still fell short of the standards except for emergency service and broadband convergence network..

Another important policy aspect to assess the achievement of rural development policy is the development of statistics of farm household including both farm and non-farm income. The Farm Household Economy Survey, which was originally established in 1953, provides a complete income structure of farms and provides basic information for policy makers to assess the farm household income situations.

Source: OECD (2018a), *Innovation, Agricultural Productivity and Sustainability in Korea*, https://doi.org/10.1787/9789264307773-en.

Ensuring the **labour and skills** supply meets the demand of the food and agriculture sector is a widespread issue. In primary agriculture, the farm population is decreasing and ageing in many reviewed countries. Wages are generally lower than in other sectors for equivalent skills, and rural areas often lack attraction for young people. At the same time, challenges

for the sector such as uncertainty about future policies and market developments, stronger regulatory constraints, increasing competition, and concerns about low profitability prospects may discourage new entrants. Low wages and hard working conditions also cause labour shortages in companies along the food chain, such as abattoirs. Finally, some activities, such as fruit and vegetable picking and processing, require seasonal labour. Shortage of labour reinforces interest for labour-saving technologies, including digital ones, which are developing fast in countries with a competitive-agricultural sector like the Netherlands and the United States, but also China and Japan.

In response to seasonal needs, most reviewed countries except Argentina and Brazil have less protective regulations on temporary forms of employment than on regular employment. Immigrants make a significant part of seasonal labour, but increasing general restrictions on immigrations in many countries have limited access to this source of cheap labour, and thus threatened the competitiveness of some farm sectors (horticulture). Reviewed countries have implemented specific provisions for seasonal immigration. They include temporary immigration schemes allowing employers to hire foreign nationals when qualified citizens are not available (Canada and the United States), schemes providing for sponsorship of employers for foreign workers, including skills training components (Australia), regional programmes to attract newcomers in regions with shortages, and the removal of impediments regarding labour costs for employing foreign workers (Estonia).

At the same time, skills needed in the food and agriculture system are changing and becoming more diverse, and sometimes less specific to the sector (e.g. digital and management skills). This requires retraining existing staff (or recent immigrants like in Sweden), and working with the education community to adjust education programmes to industry demand. An Estonian programme encourages talents, who study or work abroad, to come home. As skills needs are changing fast, it is important to offer and facilitate life-long training.

More generally, the food and agriculture sector benefits from systems improving job placement, offering training opportunities and improving information on job offers and requirements, whether general or sector-specific. Programmes supporting business in rural areas, providing incentives to locate in rural areas with labour and skills shortages or facilitating relocation should benefit employment in rural food and agriculture activities. In Turkey, a programme supports entrepreneurship and training for women in rural areas.

Agriculture or green education has an important role in improving future skills match. In reviewed countries, agriculture education is generally an integral part of the general education system, even when under the umbrella of the ministry in charge of agriculture or concentrated in specific agricultural institutions. It means that it shares the strengths and weaknesses of the general education system. This suggests the relevance of OECD information on general education and skills for the sector. In addition, the importance of sciences in national education is a good indicator of innovativeness and society's acceptance of innovation, which is relevant for agricultural innovation.

Even when the education system is modern and performant like in Australia, Canada, the United States, the Netherlands, Sweden and Estonia, attracting national students in agriculture-related topics is a challenge, although these countries attract foreign students. In emerging economies, however, agricultural studies remain attractive, especially in countries with a large agricultural sector like Argentina and Brazil.

In addition to improving sectoral competitiveness, suggestions to improve attractiveness include the promotion of agro-food careers that emphasise the opportunities for high-

skilled and knowledge intensive jobs, as outlined in the Australian review. In the Netherlands, demonstrating the job opportunities and emphasising the link to food security and nature management, beyond primary agriculture helped attract non-traditional agricultural students. As the sector requires a wider set of skills (such as nature management, food and health, digital technologies, management and accounting), agriculture education interests a broader range of students that do not have a rural background. The US review suggests promoting agricultural vocational education among non-traditional students from more urban background.

At all levels, another challenge is to retain students in the sector (as mentioned in Estonia, Australia and Canada) as agricultural skills can be transferred in other sectors that offer better salaries and are as diverse as mining, forestry, construction, accounting or marketing.

Finally, agriculture education needs to adapt to industry's needs and students' choices. Discussion with the industry and other education organisations helps understand and plan future needs, as done in the Netherlands with the Top Sector and the Green Table. A common finding is the benefit for innovation of strengthening management and marketing courses, alongside more technical topics.

Main knowledge gaps

A number of composite indicators score and rank countries' policies and regulations enabling the business environment. They include the World Economic Forum (WEF) Global Competitiveness Indicators, the World Bank Group (WBG)'s Ease of doing Business indicator, and the OECD Product Market Regulation indicators. More recently, the WBG developed an Enabling the Business of Agriculture, which reflects mainly the situation in developing countries. Similarly, the OECD and IFPRI developed for a number of developing countries Agricultural Growth Enabling Index (AGEI) (Diaz-Bonilla et al., 2014), which the OECD then updated and refined (OECD, 2017e).

While the OECD developed an environmental stringency indicator, it does not take account of all dimensions of environmental issues related to agriculture. Discussion on the development of agriculture-specific environmental stringency indicators have started in the OECD, raising methodological issues regarding the scope (e.g. would agri-environmental policies be included?), and aggregation method, including the determination of weights for different environmental aspects.

Country reviews report several components of these indicators as a basis for evaluating specific framework policy areas. But they do not necessarily reflect the extent to which the general policy or regulation affect positively or negatively drivers of food and agriculture performance. Even at the national level, this issue in not well documented.

It is also difficult to evaluate which are the most binding constraints. Some countries conducted surveys on impediments to investment, in which respondents rank the main obstacles.

As for other sectors, the impact of competition on innovation in food and agriculture is not well documented, although the US review discusses the impact of concentration in input industries and the exemption of co-operatives from anti-trust laws on competition and prices. OECD (2018b) explores increasing concentration in markets for seed and GM technology and its impact on prices and innovation. Overall, there is no strong evidence that concentration in these markets is detrimental for innovation.

Regarding regulations on products and processes, some explicitly restrict specific innovation (in particular regarding production methods), but other regulations (e.g. on food safety and traceability; environmental constraints) stimulate the innovation system to find solutions.

The rationale for maintaining agriculture preferential treatment is not regularly evaluated. In recent years, the impact of taxation on agriculture has not attracted much interest in governments and academic circles.

The development of rural areas is an important objective in many countries, but it was beyond the scope of these reviews to have in depth analysis of this complex and multi-dimensional topic.

The OECD has a lot of information on education and labour but none is specific to agriculture. There is however good information on agricultural education at the national or institution level. Boundaries of agriculture education may, however, differ by country. One issue is to better understand the performance of agricultural students in the job market.

Recommendations to improve the general policy environment

This section consolidates the recommendations made in country reviews for various non-sectoral policy areas, and which are included in the country notes of Annex B. These policies aim to facilitate investment, and improve human and infrastructure capacity, and thus enable innovation, adjustment and sustainable resource use in food and agriculture leading to productivity and sustainability improvements.

Improve information on the link between general policies and agriculture to guide decisions

- Policy improvement requires more efforts to measure and assess the impact of general policies on food and agriculture. This concerns the development of appropriate data and methods. For example, methods for measuring environmental sustainability metrics need improvement.

Improve the policy and regulatory processes to facilitate investment

- Continue improving governance and policy coherence, and building trust in institutions. This includes defining strategic plans that ensure co-ordination between policy areas, and clarify responsibilities across levels of government and organisations; consulting with stakeholders; developing systematic evaluation procedures; and improving communication about policy action. If this is an issue, strengthen the enforcement of contracts and IPR.
- Modernise regulations to make them clearer, transparent, easily accessible, more coherent across jurisdictions. They should also become more flexible and responsive to industry and consumer needs, and anticipatory of science and technology development, and changes in public perception. Explore the use of more outcome-based regulations. Review progressively current regulations to minimise compliance costs and time, by reducing unnecessary burdens, e.g. reduce length and simplify procedure, ease regulatory burden for start-ups, reduce entry barriers.
- Strengthen regulatory services to business: build a platform, single desk containing all relevant information.

- Strengthen regulatory collaboration between and within countries to reduce regulatory heterogeneity.

Ensure non-sectoral polices improve the functioning of agri-food markets and trade

- Reduce tariff protection on industrial goods and capital to facilitate investment and innovation. Implement effective competition policy, including in the food chain. In particular, ensure fair competition between co-operatives and other providers of inputs and services.
- Explore export opportunities and in small countries, promote a regional approach to trade diversification.
- Review the scope for trade facilitation, e.g. using digital technologies.
- Promote risk management and ensure tools are available.
- Improving market transparency and efficiency for products would improve competitiveness and thus investment.
- Improve the functioning of input markets, thus improving access to innovative technologies, by removing distortions and impediments, enforcing competition policy and identifying market failures (e.g. in credit, land or water market) and working with input providers and users to identify supply, demand and constraints, and design solutions.
- Remove impediments to farm transmission.
- Facilitate access to capital by placing information on support programmes on a single platform, simplifying programme architecture, and exploring options for non-traditional sources of financing, such as venture capital and PPPs.
- Focus public support to investment in areas where financial market fail to provide funds, and in areas contributing to overall innovation and economic objectives (e.g. climate change, bioeconomy).
- Simplify taxation, in particular indirect taxation, to improve transparency, and fairness, and facilitate compliance. Ensure taxation is not so high that it discourages investment and participation in labour markets. Ensure reduced tax rates to small businesses do not prevent them from growing. Ensure taxation does not impede farm transmission.

Align policies and regulations towards sustainability improvements

- Evaluate environmental regulatory stringency for agriculture to assess the role of regulations and their effectiveness.
- Realign policy incentives towards environment and resource sustainability, removing environmental harmful subsidies such as fuel tax rebates, and using taxation or market mechanisms to meet environmental objectives.
- Improve the governance and management of natural resources, by strengthening environmental laws and regulations that define responsibilities and rights, identify and tackle local conflicts. Improve compliance, including using modern technology

but also by providing enough financial and skills capacity to agencies in charge of monitoring compliance.

- Target investment support to innovation, sustainable outcomes.

Develop rural infrastructure and services to improve connection

- More effective and forward-looking planning and strategies for development and maintaining rural infrastructure, drawing on assessment of (future) needs and evaluation of past policies. In particular, integrate environmental and climate change consideration in these plans (both ways), e.g. irrigation, production changes, mode of transport, contribution of agriculture to climate change mitigation.
- Simplify governance and improve co-ordination between ministries and levels of government.
- Improve connectivity in rural areas, in particular by increasing access to digital technologies.
- Develop green energy and facilitate the development of bio-based products, when opportunities exist.
- Develop innovative ways to deliver services. Facilitate co-operation among rural dwellers to maintain infrastructure systems (irrigation and drainage in particular) and maintain rural attractiveness.

Address labour and skills need in food and agriculture

- Implement more responsive and flexible labour and immigration policies to facilitate labour force moving in areas with strong demand.
- Ensure training and re-training programmes respond to needs (including immigrants, women, but also innovation skills). In particular, facilitate access for seasonal workers. Provide services for job placement and relocation.
- Set-up targets for agriculture education that reflects needs (skills, population trends) at the national and international level when relevant.
- Implement mechanisms to make agriculture education more attractive and responsive to changing skills needs in the labour market, and students' choices. These include reviewing needs regularly in consultation with all stakeholders and across education institutions, adapting curricula and creating new ones, integrating better new topics, such as management and accounting, digital technologies, animal welfare, health, climate change, and building bridges with non-agricultural education.
- If not already done, increase exposure of agricultural science specialists to social sciences as they are increasingly important to improving the relevance of food and agricultural innovation, and to ensuring that research leads to economically useful and ethically acceptable innovations.
- Promote agriculture education to change traditional public perception, and be more proactive in reaching non-traditional agricultural students. In some countries, ensure wider access. Modernise vocational training. Facilitate industry funding of

training and education. Adjust public funding to reflect objectives based on estimated needs.

Notes

[1] Genome editing refers to a set of techniques in which specialised enzymes have been modified and can insert, replace or remove DNA from a genome with a high degree of specificity.

[2] The OECD Conference on Genome Editing: Applications in Agriculture, Implications for Health, Environment and Regulation, was organised in Paris, 28-29 June 2018 to explore the safety and regulatory considerations raised by genome edited products, with the aim to favour a coherent policy approach to facilitate innovation involving genome editing (www.oecd.org/environment/genome-editing-agriculture).

[3] See Survey of food processing firms in the Canada review (OECD, 2015e).

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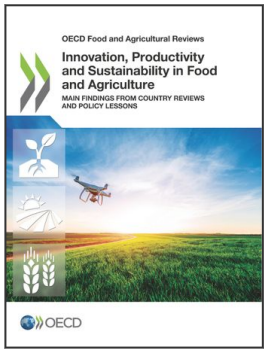

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