

ANALYSING POLICIES TO IMPROVE AGRICULTURAL PRODUCTIVITY GROWTH, SUSTAINABLY

Draft Framework
May 2015



Foreword

A Draft Framework for analysing the role of governments in improving agriculture innovation was developed and published in OECD (2013b), *Agricultural Innovation Systems: A Framework for Analysing the Role of the Government*, OECD Publishing, <http://dx.doi.org/10.1787/9789264200593-en>.

A draft Framework incorporating insights from the application of the framework to pilot country reviews and widening the scope to analyse policy areas with impacts on the productivity and sustainability of the food and agricultural system was presented to the OECD Working Party on Agricultural Policies and Markets (APM) and to G20 participants in March 2014.

This document contains a further revised draft Framework, which strengthen sustainability aspects, and reflects additional experience from country reviews recently published in a new series: *OECD food and agricultural review: Innovation, agricultural productivity and sustainability*.

This document was discussed during the May 2015 APM meeting. It will be further revised to reflect experience from additional pilot country reviews to be implemented in 2015-16.

DRAFT FRAMEWORK: ANALYSING POLICIES TO IMPROVE AGRICULTURE PRODUCTIVITY GROWTH, SUSTAINABLY

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ANALYSING POLICIES TO IMPROVE AGRICULTURAL PRODUCTIVITY GROWTH, SUSTAINABLY: REVISED FRAMEWORK

Background

1. The food and agriculture sector is subject to a wide range of economy-wide policies as well as measures specific to the sector itself. This short note outlines a revised draft framework for systematically analysing the full range of policy incentives and disincentives that might impact agricultural productivity growth, sustainable use of natural assets such as land, water and biodiversity resources, and climate change. In doing so it draws on previous TAD work on agricultural policy evaluation, agricultural innovation and productivity, agri-environmental indicators, and green growth for agriculture.¹ It also draws heavily on policy review experiences in other economic and social policy fields, in particular those of other OECD policy communities. Further development of the Framework is expected as experience is gained in implementing it across a diversity of countries, and as additional studies provide new evidence on linkages between policies, drivers and productivity and sustainability performance.

Overview of policy impacts

2. Figure 1 provides a schematic overview of the relationship between policies and productivity and sustainability outcomes. Innovation, structural change, and access to and impact on natural resources and climate change are key drivers of productivity growth and sustainability.

3. Policies affect these drivers through four main channels or incentive areas:

- Economic stability and trust in institutions (justice, security, property rights), which are essential to attract long-term investment in the economy.
- Private investment, through a regulatory environment that enables competition, ensures sustainable use of resources, and facilitates the adoption of new technologies; trade that facilitate flows of goods, capital and knowledge; access to finance and tax provisions.
- Capacity building, including provision of essential public services, which facilitates access to markets and knowledge, and improves skills needed to innovate and improve resource use efficiency.
- Sector-specific incentives for innovation, structural change and sustainable resource use in the food and agricultural system from:
 - Agricultural policy: domestic measures, including price and income support, investment support, input subsidies, risk management, adjustment and agri-environmental measures, and agriculture-specific trade measures.
 - Agricultural innovation policy, i.e. government role in the agricultural innovation system in providing governance, funds for innovation activities, and incentives for private investment in and adoption of innovation.

4. For each policy area, the Framework considers the likely impacts of the country's policy measures on productivity growth and sustainability, through the incentives and intended or unintended disincentives they create on the three drivers of sustainable productivity growth: innovation, structural change and sustainable use of resources and climate change (Figure 1).

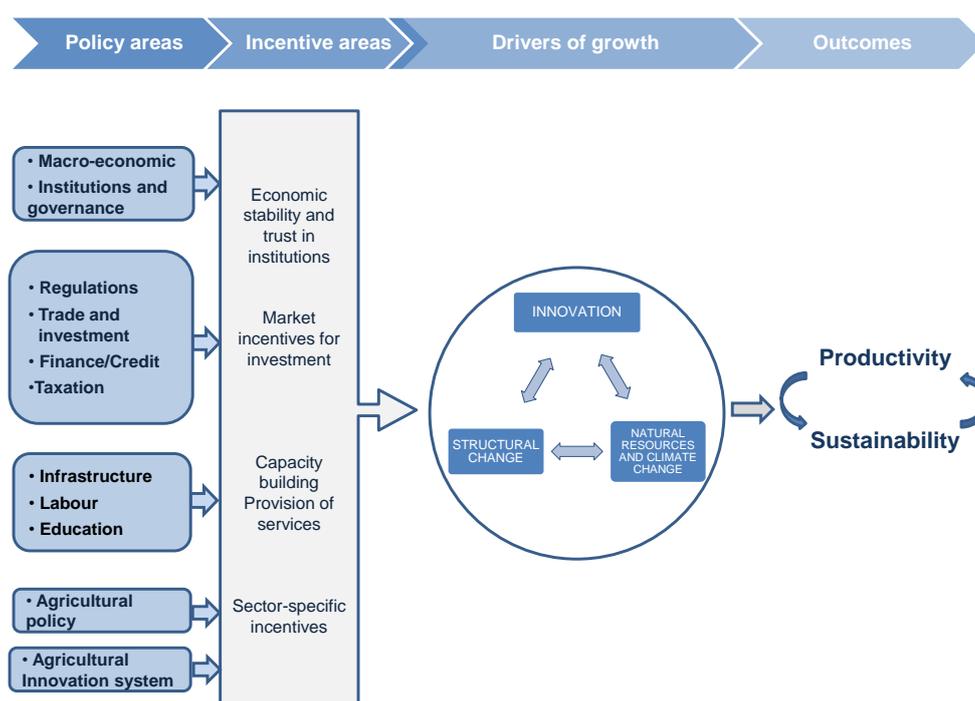
1. See references for a list of most recent TAD reports, upon which the draft framework relies.

5. The relationship between innovation, economies of scale and productivity is illustrated by Figure 2, which depicts the pathways of productivity growth: technological progress reflecting early adoption of innovation by best performers; technical efficiency change representing wider diffusion of innovation; and economies of scale. Structural change also affects the capacity to adopt scale-dependent innovations. By examining these inter-relationships simultaneously, additional complexity is added to the analysis but this is necessary in order to address the complementarities and trade-offs that policy makers confront.

6. Agricultural production relies on fundamental biological processes, which combine various natural assets, or "Natural Capital",² to other inputs (Figure 3). In the Framework, sustainable productivity refers to productivity growth compatible with the preservation of natural capital in the short and long run. Like physical capital, natural capital needs investment and maintenance to retain its productive capital in the long run. To be sustainable, productivity growth will also need to account for the projected impacts of climate change, and the associated adaptation responses, and the potential role of agriculture in the global greenhouse gas mitigation effort.

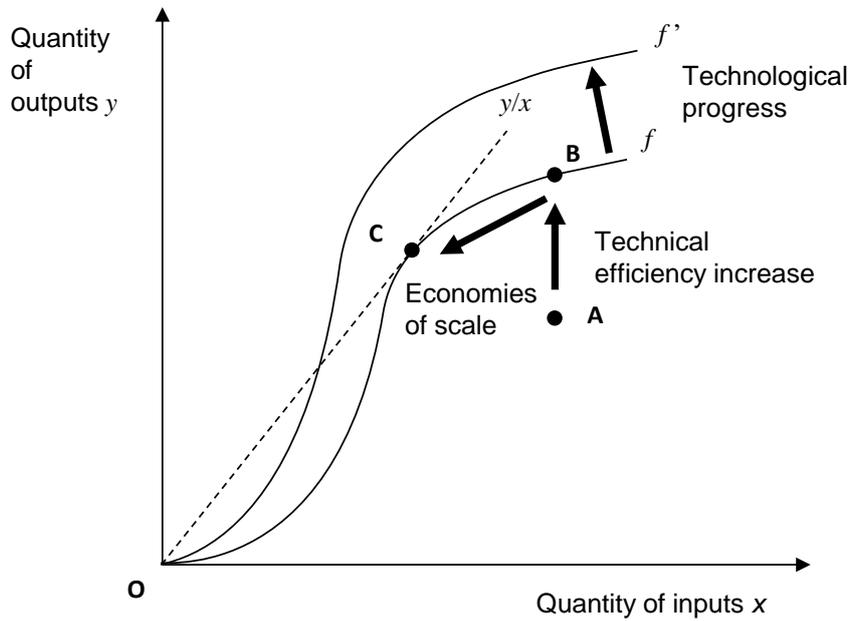
7. Table 1 illustrates the implementation of the Framework using the example of investment support. The last section discusses these linkages for each policy area, and suggests a number of questions and associated indicators or sources of information that could help identify policy incentives and disincentives and assess policy outcomes.

Figure 1. Policy drivers of innovation, productivity and sustainability in the agriculture and agri-food sector



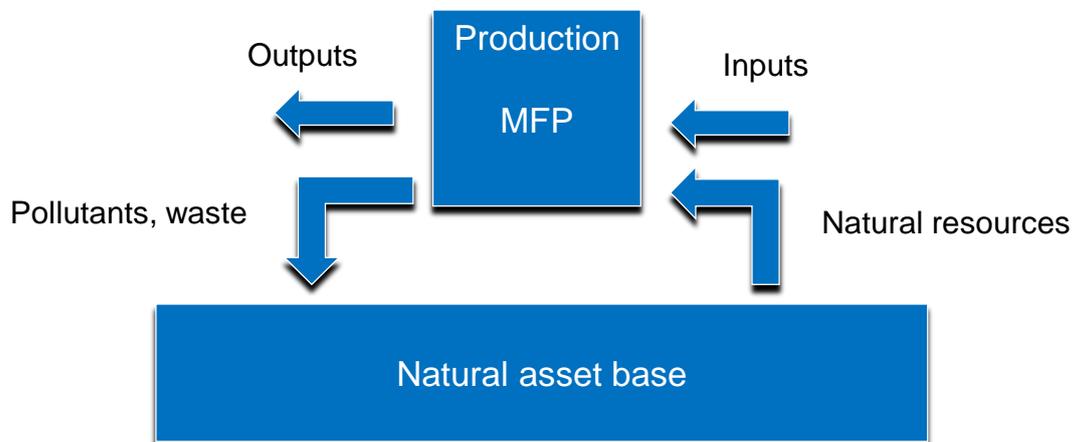
2. Natural capital has become the standard term to define the “natural assets in their role of providing natural resource inputs and environmental services for economic production” (OECD, 2015).

Figure 2. Pathway of productivity growth



Source: OECD (2011a).

Figure 3. Natural capital and multifactor productivity growth



MFP: Multifactor Productivity.

Source: adapted from OECD (2014a and b).

Table 1. The example of investment support

Policy area	Domestic agricultural policy
Policy measure	Support to farm investment
Incentive area	Reduces the cost of investment and thus facilitates:
Drivers	
- Innovation	the introduction of new technologies, allowing for innovation in production methods, products, marketing and organisation.
- Structural change	the purchase additional inputs (land, buildings), allowing for adjustment and economies of scale.
- sustainable resource use and climate change	the introduction of technologies for a more sustainable use of resources, if there are market and policy incentives to improve sustainable resource use
Outcomes	Will also depend on market and other policy incentives. Impact will be stronger if support is targeted to specific investments.
- Productivity	Innovation and economies of scale contribute productivity growth but the extent depends on the type of innovation (e.g. labour saving technologies may improve labour productivity but not total factor productivity)
- Sustainability	Some innovations can improve sustainability and climate change adaptation and mitigation. More likely to happen if support is conditional on the adoption of environmentally, climate friendly technologies and practices.

Next steps

8. Future work will draw upon a range of expertise both within and outside OECD and will follow two broad pathways: additional pilot country reviews and further analytical work intended to strengthen both the conceptual base of the Framework and its analytical capacity.

9. In addition to drawing further lessons from experiences with pilot country reviews in Australia, Brazil, Canada, and most recently the Netherlands, new pilot country reviews have been launched with Turkey and are planned for the United States and, possibly, China. The diversity of situations in these countries, as well as the expansion of the community of researchers that will be engaged, should contribute to further empirically based improvements to the Framework itself as well to identification of more widely applicable ‘policy lessons’.

10. Further analytical work is planned that should, in due course, contribute substantively to strengthening the Framework as an analytical tool, including:

- The analysis of the dynamics of farm-level productivity and its drivers has shed light on the links between structural change, policy change and the adoption of new technologies on productivity growth in the dairy farm sector [[TAD/CA/APM/WP\(2014\)37/REV1](#)]. Future work in this area could cover additional countries and commodity sectors, and further exploration of linkages between structural change, innovation and resource use, and between those drivers and productivity and sustainability [[TAD/CA/APM/WP\(2015\)11](#)].
- The policy evaluation model (PEM) evaluates the impact of different policy measures on trade and markets, through their effects on output prices, inputs prices or income. It has recently been

extended to consider the environmental impacts of Swiss agricultural policies. A note on PEM developments and plans for future work discusses possible extension of work in the area to additional countries and environmental issues [[TAD/CA/APM/WP\(2015\)14](#)]. Extending the environmental module of PEM to a wider set of countries will allow enlarging the empirical basis of the analysis of linkages between agricultural policies and environmental outcomes.

- Current work on Synergies and Trade-Offs between Agricultural Productivity, Climate Change Adaptation and Mitigation [[COM/TAD/CA/ENV/EPOC\(2015\)8](#)] may provide useful insights on the consistency of signals sent by public policies regarding agricultural productivity improvement and agriculture sustainability, with a specific focus on climate change adaptation and mitigation. The work planned encompasses i) identifying relevant institutions, regulations and policies which may affect the three objectives (productivity, adaptation and mitigation); ii) contributing to the identification and analysis of policy effects on the three objectives; and iii) contributing to assessing how policies and their interactions may lead to synergies or trade-offs between the three objectives. As part of the project, a micro-economic theoretical model will be developed to quantify the effects of a set of agricultural and agri-environmental policies on the three objectives.
- Further development of relevant performance indicators could provide additional quantitative insights; for example, indicators of farm-size distribution developed in [[TAD/CA/APM/WP\(2015\)16](#)] could be used as a proxy to track structural change; an indicator of environmental regulation stringency is being developed for the whole economy, while an agricultural-specific indicator of environmental stringency could also be developed to analyse regulatory impacts; exploratory work is underway in the area of environmentally adjusted TFP indicators; and so on.

11. The Framework will be continuously revised as work progresses and new evidence and insights are discovered.

Structure and content of policy reviews

1. Overall assessment and recommendations

12. This section provides a comprehensive picture of the extent to which the policy environment is supportive of the needed investment in innovation, the required structural changes, and the desired sustainable use of and impact on natural resources and resilience to climate change to deliver the productivity growth and sustainability performance appropriate for the country. For each policy area, it outlines main issues and develops specific policy recommendations that, over time, would improve the incentives and reduce the disincentives to an improved balance of increased productivity growth and sustainable resource use in the food and agriculture system.

2. Overview of food and agriculture situation

Food and agriculture in the overall economy

Purpose	Questions	Indicators
<p>The overall economic, social and environmental context in which the sector operates, and the natural resource base upon which it relies, are important drivers of sector performance. The structural characteristics of the sector affect its capacity to adapt to new challenges and opportunities. In the long-term, sector productivity and sustainability performance are determined by innovation, natural resources, climate change, and structural change – which in turn are influenced by a range of policies (as discussed below).</p>	<ul style="list-style-type: none"> • What are the country's main economic and geographical characteristics? • What is the share of agriculture in the economy, in the use of natural resources and in terms of pressures to the environment? • What are the main structural characteristics of farms and upstream and downstream industries? • What are the main food and agriculture outputs and markets? • What are the trends in agricultural productivity and sources of total factor productivity growth? • What are the trends in natural resource use and the state of the environment? What are the main issues regarding sustainable and efficient use of natural resources and other inputs affecting the environment? How are they measured and monitored (national/regional indicators)? • What are the medium to long term projections regarding natural resources and climate change in the country and the projected impacts on future productivity growth? 	<ul style="list-style-type: none"> • GDP per capita, population, area, agricultural land, arable land and freshwater resources (level and per inhabitant), trade exposure, multifactor productivity. • Share of agriculture and food in total GDP, employment, imports and exports. • Share of agriculture in the use of land and water. • Agro-food trade in total GDP and Agro-food trade in value-added as a % of adjusted agro-food value added. [OECD WTO Trade in Value-Added Database, 2013. http://www.oecd.org/industry/ind/measuringtradeinv alue-addedanoecd-wtojointinitiative.htm.] • Farm size, income, net worth, etc. • Composition of outputs, imports and exports, and net trade position. • Productivity growth indicators: Growth rates in yields, livestock density; Labour and Total Factor Productivity (TFP) growth in primary agriculture. • Farm-level productivity and determinants. • OECD Agri-Environmental Indicators: nitrogen and phosphorus balances, pesticide sales, agricultural

land use, agricultural water withdrawal, share of land with erosion risk, biodiversity index. Environmental pressures in absolute terms (per hectare when relevant, water stress due to agriculture; trends compared to production and productivity developments
[\[http://www.oecd.org/tad/sustainable-agriculture/agri-environmentalindicators.htm\]](http://www.oecd.org/tad/sustainable-agriculture/agri-environmentalindicators.htm).

- For non-OECD countries: FAO Agri-Environmental Indicators: fertiliser use per ha of arable land; pesticide use per ha of arable land
[\[http://faostat3.fao.org/faostat-gateway/go/to/download/E/*E\]](http://faostat3.fao.org/faostat-gateway/go/to/download/E/*E).
- Additional agri-environmental data from national statistical offices (possibly by region)
- IPPC database and national assessments on projected risks associated with climate change in the country.

3. *Economic stability and trust in institutions*

Macroeconomic policy environment

Purpose	Questions	Indicators
At the broadest level, stable and sound macroeconomic policies, leading to high growth and low and stable inflation rates, play an important role in setting a favourable environment for investment in farms or agri-food firms seeking to introduce new products, to adopt new production methods, or to undertake organisational changes that can lead to higher productivity growth and more sustainable use of natural resources. Assessment of the country's overall growth and growth potential in the short- to medium-term has implications for sector specific prospects as well. In some circumstances, macroeconomic policies and their impacts can contribute to implicit and perhaps unintended biases for or against the food and agriculture system.	<ul style="list-style-type: none"> • How does the overall economy perform; what are medium term prospects for growth? • What measures is the government taking to promote economic growth and jobs? • In what ways do macroeconomic fundamentals facilitate or discourage investment and trade, including in the food and agriculture sector? 	<ul style="list-style-type: none"> • Trends in real GDP growth, inflation, exchange rate, unemployment rate. • Trends in total government deficit and debt as a % of GDP. • World Economic Forum Global Competitiveness Index (WEF GCI): Index of macroeconomic environment [http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/].

Governance and quality of public institutions

Purpose	Questions	Indicators
<p>Good governance systems and high-quality institutions provide economic actors with the assurance that the government is accountable, transparent and predictable. They are a fundamental pre-condition both to encourage public and private investment in the economy and to enable those investments to achieve the intended benefits, both for investors and the host country. Moreover, governance systems play an important role in addressing market failure, influencing the behaviour of firms in terms of investment and compliance to regulations, as well as the efficient functioning of farm input and output markets. Finally, how the environment and natural resources are part of the institutional framework and public decision making is important in the capacity for designing efficient and acceptable policy tools.</p>	<ul style="list-style-type: none"> • To what extent are governance rules and institutions, including the regulatory process, transparent, clear and predictable? • To what extent do they protect investors, innovators, and the host society? • Do they apply equally to all regions, including rural areas, and people? • To what extent are environmental and natural resources concerns represented in the institutions and the decision-making process? • What are mechanisms to ensure policy coherence, consideration of trade-offs between policy objectives, and the balance the interests of diverse stakeholders? 	<ul style="list-style-type: none"> • World Bank (WB)'s Worldwide Governance Indicators [http://info.worldbank.org/governance/wgi/]. • WEF GCI: Index of public institutions [http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/].

4. *Investment in the food and agriculture system*

Regulatory environment

Purpose	Questions	Indicators
<p><i>Regulatory environment for entrepreneurship</i></p> <p>The overall regulatory environment establishes basic conditions within which all firms, including farms, input suppliers, and food companies, operate and make investment decisions. Competitive conditions in domestic markets, including low barriers to entry and exit, can encourage innovation and productivity growth, including through their impact on structural change. Regulations may also enable or impede knowledge and technology transfer directly, contributing to more or less innovation, including in sustainability-enhancing technologies.</p>	<ul style="list-style-type: none"> • How prevalent is the state in business ownership or control, in particular in food and agriculture? • Are business regulations clear, are there excessive constraints on business start-up and exit? • How effective is competition policy? Do general competition rules apply equally to agricultural and agri-food firms? 	<ul style="list-style-type: none"> • OECD Product Market Regulation (PMR) indicator [www.oecd.org/economy/pmr/]. • World Bank's Ease of Doing Business indicators. [http://data.worldbank.org/indicator/IC.BUS.EASE.XQ].

Regulations on natural resources

Regulations on natural resources are central to ensuring the long term sustainable use of natural resources and in large part determine access to and use of land, water and biodiversity resources. They also impose limits on the impact of industrial and agricultural activities on the state of the natural resource (e.g. water pollution, soil degradation, greenhouse gas emissions). The design of natural resources and environmental policies is important in terms of their incentives for innovation and sustainable productivity growth.

- What are the rules governing access to and use of natural resources and environmental impact of agri-food activities (pricing, ownership, management, etc.)? How are they designed and enforced? Are there specific provisions governing agriculture uses?
- Are environmental standards based on environmental impact assessments, or cost-benefit analysis? Are there specific provisions for agriculture uses?
- Are policy targets in the country defined, at regional, national or international levels, regarding environmental pressures and states? What are the state and trend on the distance-to-targets, and projections in this area?
- OECD indicator of stringency of environmental regulation
- Share of land or water under higher protection.
- Tax and subsidies on the environment and natural resources: agri-food versus other sectors (rate, transfers).
- Climate targets: Intended Nationally Determined Contributions (INDCs) [http://unfccc.int/focus/indc_portal/items/8766.php]

Regulations on products and processes

Regulations on products and processes aim to protect human, animal and plant health and can also impact on natural resource use. Environmental and health related regulations can boost innovation by building consumer and societal trust in the safety and sustainability of new products or processes, but unnecessary or disproportionate regulations can stifle innovation and technological developments.

- How are regulations and private standards affecting processes and products established and enforced? Are there specific environmental regulations for products and processes? What are recent developments?
- How are regulatory impacts assessed when developing new and reviewing existing regulations?
- Are there regulations specific to farms, input suppliers, or food companies that encourage or discourage development or adoption of new technologies and production practices?
- % of land, number of farmers, agricultural production or value-added covered by specific (organic, environmental) practices (with and without labels).

Trade and investment policy

Purpose	Questions	Indicators
<p>Trade can facilitate the flow of goods, capital, technology, knowledge and people needed to innovate. Openness to trade and capital flows is conducive to innovation as it provides a larger market for innovators, reinforces competition, increases access to new technologies, ideas and processes, including from foreign direct investment (FDI) and related technological spill-overs, and facilitates cross-country collaboration. Trade and investment openness can influence innovation throughout the food supply chain, from input suppliers to food service and retail firms. Input and output markets that operate effectively can foster productivity growth. Trade and investment openness can also facilitate the development of market mechanisms to foster more environmentally sustainable production.</p>	<ul style="list-style-type: none"> • What is the exposure to trade (imports and exports) in the economy and the food and agriculture sector? • To what extent are customs and border procedures efficient and effective? • What is the level of import (export) protection (restriction or subsidy), including for capital and intermediate goods? What measures are used? • Are there special provisions for technological goods and knowledge supporting services? For environmentally-friendly technologies? • Are the laws and regulations dealing with investments and investors clear, transparent, readily accessible? Do they avoid imposing unnecessary burdens on businesses and on society? • Are there specific restrictions on, or incentives for, foreign investment in agriculture? 	<ul style="list-style-type: none"> • WTO tariff profiles [http://tariffdata.wto.org/]. • OECD indicator of trade in value-added. [http://stats.oecd.org/index.aspx?queryid=47807] • OECD PMR indicator of regulatory restrictions on trade and investment. [http://www.oecd.org/economy/growth/indicatorsofproductmarketregulationhomepage.htm]. • OECD trade facilitation indicator [http://www.oecd.org/tad/facilitation/indicators.htm n-Indicators.pdf]. • WTO TBT and SPS Information Management System [http://tbtims.wto.org/; http://spsims.wto.org/] • OECD FDI Restrictiveness Index for all sectors, agriculture and food manufacturing [http://www.oecd.org/investment/fdiindex.htm]. • OECD data on total, agricultural and food processing FDI stocks as a % of GDP [http://www.oecd.org/corporate/mne/statistics.htm]. • OECD data on trends in total, agricultural and food processing FDI flows [http://www.oecd.org/corporate/mne/statistics.htm]

Finance policy

Purpose	Questions	Indicators
<p>Efficient financial markets are one key to enable balanced development of any economy and society. Access to financial services can be limited or unequal across regions and firms when financial markets fail or when risks are too high. Policies that improve the functioning of financial markets can facilitate productivity enhancing investments in agriculture and farm size growth. Policies may also facilitate access to funding for sustainability enhancing investments. Low cost loans and venture capital can also be an important source of funding for innovative firms with high growth sectors potential.</p>	<ul style="list-style-type: none"> • What is the supply of finance and state of competition in the formal financial sector, including in rural areas? • Do food and agricultural firms have sufficient access to credit and finance? If not, what is the nature of the constraint? • Are there government programmes to improve access to finance (grants, interest concessions, guarantees)? Are there any that are specific to agricultural and agri-food firms? • Are there any programmes that target credit for innovation or for investment in environmentally-friendly technology? Are there any that are specific to agricultural and agri-food firms? 	<ul style="list-style-type: none"> • Real interest rate levels. • Credit by the banking sector as % of GDP • Stocks traded as % of GDP • WEF GCI Financial market development index [http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/]. • National, ad hoc, survey data on access to financing of investment. • Government support to investment targeting innovation or adoption of environmentally-friendly technology, in general and for agri-food (trends and share in total support). <p>[http://www.oecd.org/agriculture/agricultural-policies/producerandconsumersupportestimatesdatabase.htm]</p>

Tax policy

Purpose	Questions	Indicators
<p>Tax policy affects innovation, productivity and sustainability in many ways: it affects the decision of firms and households to save or invest in physical and human capital, and thus the adoption of innovation; it raises government revenues, which can then finance public services, including those enabling innovation such as education and skills, R&D, and strategic infrastructure; it can also be used to provide direct incentives, for example preferential tax treatment to investments in private R&D or to young innovative companies. In addition to its economy-wide impacts, tax policy influences the conduct, structure and behaviour of farm, input suppliers and food companies. Taxes on income, property and land and capital transfer, including land, may affect structural change, while differential tax rates on specific activities (polluting or environmental friendly), resources, or input use may affect sustainability.</p>	<ul style="list-style-type: none"> • What tax arrangements apply to business that might encourage or discourage investment (income, property, sales, import and export taxes)? • Are there specific provisions for farms or agriculture related businesses? e.g. income smoothing, tax rebates on land transfer, taxes on farm inputs. • Do tax arrangements – general or agriculture-specific – have impacts – measured or potential – on the environment, the use of natural resources and the resilience to climate change? If yes, what types of incentives lead to such impacts? • Are there specific tax incentives for private investment in R&D? Are there specific tax incentives for companies adopting innovation? 	<ul style="list-style-type: none"> • OECD data on corporate income tax rates. • WB's Doing Business: Total tax burden on company profits [http://www.doingbusiness.org/] • Tax subsidy rate on investment in R&D (OECD Innovation scoreboard). • WEF GCI: Indicator of taxation effect on incentives to invest and on incentives to work [http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/]. • Tax rates in agriculture compared to other sectors: e.g. income, farmland and farm transfers, fuel tax rebates and subsidies.

5. *Capacity building and services for the food and agriculture system*

Infrastructure and rural development policies

Purpose	Questions	Indicators
<p>Investments in physical and knowledge infrastructure, from ICT to transportation facilities, are important for overall growth and development. They are vital to the delivery of and access to important services and play a critical role in linking farmers and related businesses to markets, reducing food waste, boosting agriculture productivity, raising profits, and encouraging investment in innovative techniques and products. Productive and profitable enterprises may have higher incentives to invest in sustainable practises that yield long term benefits.</p> <p>Broader rural development measures also affect sustainable agricultural development and structural adjustment. Increased off-farm income and employment opportunities mitigate farm household income risks, facilitate farm investment, and enable a wider range of farm production choices. Improved rural services, from banking to ICT, are important to ensure needed connectivity to suppliers, customers, and collaborators. Rural policy can also attract innovative upstream and downstream industries, with possible spill-over effects locally. By reducing inequalities in economic development and access to services across regions, rural development policies improve the diffusion of innovation.</p>	<ul style="list-style-type: none"> • Is physical and ICT infrastructure adequate to the needs of environmentally-sustainable economic development, in particular with respect to the food and agriculture sector? If not, what are the bottlenecks? • What are infrastructure development priorities? To what extent do they focus on agriculture and agri-food needs? To what extent do they facilitate efficient use of resources? • How is infrastructure development funded? Does the government provide incentives to private investors in infrastructure projects through, e.g. grants, tax concessions, public-private partnerships, etc. Are there specific guidelines in place that govern public-private partnerships for infrastructure projects? • What are the institutions and policy and market mechanisms managing access to infrastructure or resources? • How easy is it for producers and other actors in rural areas to access information about market developments, technical options and weather? • Are public services in rural areas sufficient to maintain/attract people and businesses? 	<ul style="list-style-type: none"> • Infrastructure expenditures as a % of GDP. • OECD and World Bank: indicators of availability of physical infrastructure: road density, railway density, container port traffic intensity. • OECD and WB indicators of ICT penetration per 100 inhabitants. • WEF GCI: Indicator of quality of transport infrastructure [http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/]. • WEF GCI: Indicator of quality of electricity and telephony infrastructure [http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/]. • Share of irrigable agricultural land (OECD agri-environmental indicators). • Irrigation infrastructure capacity.

Labour market policy

Purpose	Questions	Indicators
<p>Labour market policy influences employment composition and labour mobility, in particular by facilitating (or discouraging) labour to adapt to new circumstances. It can play an important role in facilitating structural adjustment, including farm consolidation, by assisting excess labour in farming to exploit more remunerative non-farm income and employment opportunities. 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. Structural adjustment allowing younger and better educated farmers to enter the sector, and skills improvement policies are expected to improve the adoption of sustainable practices.</p>	<ul style="list-style-type: none"> • Does labour market legislation facilitate adjustment to new opportunities? To what extent are employment and labour conditions protected? • Are there specific provisions for farm operators and workers? • Are there specific initiatives to create new jobs and assist labour adjustment from declining to growing sectors? • To what extent do migration rules ensure labour market demand is met? Do they encourage inflow of skilled labour? 	<ul style="list-style-type: none"> • OECD indicators of labour force covered by passive and active labour policies. • OECD Index of employment protection legislation. [http://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm] • OECD Labour cost indicator. • Labour productivity (Overview section). • WEF CGI: Indicator of labour market efficiency [http://www.weforum.org/issues/competitiveness-0/qci2012-data-platform/]. • Trends in immigration and migrants in seasonal labour in agriculture

Education and skills policy

Purpose	Questions	Indicators
<p>Education policy affects innovation in at least three ways: a high level of general and scientific education facilitates acceptance of technological innovation by society at large; innovation systems require well-educated researchers, teachers, extension officers, and producers to develop relevant innovations; it is generally easier for farmers and business operators with higher education and skills to adopt some technological innovations. Continuous skills development (training, re-training) is essential to improve the matching of skills demand, in an evolving agri-food sector, which needs to adopt productivity and environmentally enhancing technologies and practices.</p>	<ul style="list-style-type: none"> • What are the characteristics of the education and training system? What is the place of science in formal education? Are there programmes to promote life-long skills development and re-training? Are they successful (performance levels)? • Is agricultural education available? Is it adapted to labour market needs? Do graduates remain in the agricultural and related sectors? • Are there specific measures to address evolving labour market needs in the food and agriculture sector? • Are there specific education and training programmes dedicated to natural resources, efficiency of resource use, and environmental pressure (sustainable farm practices), and climate change (adaptation and mitigation)? Which public do they target (students, farmers, agri-food managers and workers)? 	<ul style="list-style-type: none"> • OECD data on public expenditure on education in % of GDP. • OECD data on public expenditure per student. • OECD Programme for International Student Assessment (PISA): scores in Sciences. [http://www.oecd.org/pisa/] • OECD Survey of Adult Skills (PIAAC). [http://www.oecd.org/site/piaac/] • Share of the labour force with higher education in the economy and in agriculture and the food industry. • Trends in enrolments and graduates in agriculture programmes. Enrolment in nature and environment-related courses. • WEF GCI: Indicator of higher education and training [http://www.weforum.org/issues/competitiveness-0/qci2012-data-platform/].

6. *Agricultural policy (domestic and trade-related)*

Agricultural policy framework

Purpose	Questions	Indicators
<p>Domestic agricultural and associated trade measures affect farm investments and practices through a variety of instruments, with different intended and unintended impacts on structural change, natural resource use and innovation.</p> <p>A policy instrument will affect business decisions by changing the relative prices of inputs and outputs. For example, investment support lowers the price of land and capital and could thus facilitate structural change and investment in new technologies (Table 1). The path of productivity growth and sustainability outcomes will then depend on both market and other policy incentives and disincentives.</p> <p>Sustainability outcomes are linked to the way natural capital, which is the source of service flows entering the production process, or ecosystem services, is being priced and used. In cases where public policy is deficient to address these market failures in pricing natural assets, which often have common pool, externality or public good characteristics, there is a risk that innovation systems and productivity growth in agriculture follow a non-sustainable pathway, leading to progressive depletion of natural assets, which may not be substituted by other forms of capital or by labour. In such cases, there would be a trade-off between productivity growth in the short-run and in the long-run.</p>	<ul style="list-style-type: none"> • What is the main policy framework? • What are current programmes and funding mechanisms? • Is the impact of agricultural measures on the adoption of innovation, structural change, and the state and sustainable use of resources at farm and industry level included in the evaluation of agricultural policy measures? If yes, what are the results of recent evaluations? • 	<ul style="list-style-type: none"> • Trends in overall budget expenditures.

Broad-based domestic measures

Purpose	Questions	Indicators
<p>Measures that distort markets, such as border protection, supply controls, output-based payments reduce producers' incentives to use production factors more productively. As such, they hinder structural adjustment and discourage producers to innovate to become more competitive. These distorting measures can maintain resources in the sector that would otherwise be reallocated to more productive uses; they can encourage more intensive production, sometimes on marginal or fragile land; and they can encourage production practises that do not always take adequate consideration of longer term environmental sustainability. By rising production costs for domestic food processors, they may stimulate innovation in processes and products.</p> <p>Broad-based income support decoupled from commodity production is more effective in transferring income to producers and thus increasing their capacity to invest and innovate. It also leaves more flexibility to producers to undertake new activities and switch to new products. However, even if decoupled from production choices and targeted, income support slows structural adjustment needed to facilitate economies of scale, attract new entrants and thus foster innovation and productivity growth. If conditional on the adoption of environmentally-friendly practices, this support can improve sustainable resource use.</p>	<ul style="list-style-type: none">• What instruments are used to support prices and income?• What are implementation parameters? E.g. eligibility, support rate, conditions attached to the granting of income support?• What price transfers do they generate?	<ul style="list-style-type: none">• Trends in price and income support, including payments with mandatory cross-compliance

Domestic measures targeting specific issues

Some measures aim to address specific issues in response to perceived market failures, regarding access to inputs or environmental externalities, which are not correctly valued by markets.

Purpose	Questions	Indicators
<p>Some measures are based on input use (variable inputs, capital and services). They include risk management measures, investment support, or support to (advisory, technical) services to producers.</p> <p>As illustrated in Table 1, investment support can support adjustment by facilitating investment in modern technology or additional inputs needed to increase economies of scale, and thus productivities. It can be targeted to the purchase of innovative or more sustainable technologies, but even if it is not, other market and policy incentives can guide investment in these areas.</p>	<ul style="list-style-type: none"> • What instruments are used to support variable input use, investment and services to producers? • What are implementation parameters? E.g. eligibility, support rate, conditions attached to the granting of support? • What is the share of support in farm receipts? • What support do they generate? 	<ul style="list-style-type: none"> • Trends in budgetary support for various measures, including:
<p>Agricultural producers face risks, which result in variable outcomes. Support for risk management can be considered as reducing the cost of risk for farmers. Risk management essential to improve adoption of innovation and more sustainable practices that could increase risk exposure.</p>	<ul style="list-style-type: none"> • Is the government supporting risk management tools? How? • Are there specific provisions to help farmers deal with the consequences of natural disasters? Which ones? 	<ul style="list-style-type: none"> – Support to risk management programmes;
<p>Agricultural measures that support innovation directly are likely to create stronger incentives and capacity for innovation among agricultural producers and will help structural change. Providing farmers with the skills and tools to better manage economic and environmental risks is also very important to promote the adoption of innovation, but care should be taken that risk management measures do not delay adaptation.</p>	<ul style="list-style-type: none"> • Are there specific measures to improve adoption of innovation, e.g. credit for investment in farm-level or firm-level innovation, incentives to adopt specific (e.g. green) technologies and practices, support to diversification of activities, risk management? • Are there specific measures to facilitate structural adjustment in the food and agricultural sector? 	<ul style="list-style-type: none"> – Support to investment, general, for specific purpose (innovation, animal welfare, sustainability, climate change); – Support to advisory services. – Indicator of farm distribution.
<p>Some agricultural policy measures aim to facilitate resource allocation within the sector and across sectors. They include early retirement schemes, and investment assistance for new entrant, for farm enlargement or for diversification of activities.</p>		

Agricultural policy instruments that support explicitly the adoption of more sustainable technologies or practices (agri-environmental measures) or measures to adapt and mitigate climate change, and are often associated with regulation and market-based mechanisms. They are likely to steer farmers towards innovative sustainable practices more effectively. In the long-term, they are also likely to guide the content of innovation in the direction of sustainability.

- In complement with general regulation on natural resources and environmental protection, what are the specific environmental policy instruments (tax, subsidy, etc.) in agriculture (e.g. water, greenhouse gas, biodiversity)?
- What are the characteristics of recent agri-environmental policy instruments: Scope, Coverage, Tax or subsidy rate and formula (or cap for cap-and-trade systems); Allocation of collected revenue (if any).
- What is the degree of stringency of these environmental policies?
- On which basis is the rate of environmental payment rates determined?
- What are the characteristics of policies for adaptation of agriculture to climate change?

– Support with environmental constraints

- Degree of stringency.
- OECD database on instruments used for environmental policy and natural resources management [<http://www2.oecd.org/ecoinst/queries/>]

Trade-related measures

Trade measures that restrict market access for foreign inputs and commodities, and subsidise commodity exports restrict foreign competition and affect domestic market. They contribute to maintaining domestic price support and to hindering access to agricultural inputs and services or raising their costs. They may restrict access to innovative technologies and inputs.

- To what extent do obstacles to trade affect the agri-food sector? Is foreign competition limited by tariff and non-tariff market access barriers? Do existing tariff and non-tariff barriers to trade contribute to hindering access to agricultural inputs and services or raising their costs?
- What is being done to reduce trade-related obstacles to innovation?

- WTO's agricultural tariff profile [<http://tariffdata.wto.org/>]. See trade policy section.
- WTO information on Non-tariff measures and Specific Trade Concerns (SPS and TBT) in the Integrated Trade Intelligence Portal [<http://itip.wto.org/goods/default.aspx?language=en>]
- OECD Nominal Assistance Coefficient [<http://www.oecd.org/agriculture/agricultural-policies/producerandconsumersupportestimatesdatabase.htm>].]

Agricultural support level and composition

Changes in support levels and composition provide an overall picture of developments in incentives and disincentives from agricultural support policies to productivity growth, sustainably.

- To what extent are agricultural policies supportive of productivity growth, sustainably?
 - OECD Nominal Assistance Coefficient [<http://www.oecd.org/agriculture/agricultural-policies/producerandconsumersupportestimatesdatabase.htm>].
 - OECD Producer Support Estimate (PSE) as a % of farm receipts, Including:
 - ✓ Most distorting support.
 - ✓ Support with environmental constraints.
 - OECD Composition of total support to agriculture (TSE) as a % of GDP including:
 - ✓ Most distorting support.
 - ✓ Support to innovation enhancing services.
 - ✓ Support to infrastructure services.
 - [<http://www.oecd.org/agriculture/agricultural-policies/producerandconsumersupportestimatesdatabase.html>]
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7. *The agricultural innovation system*

Actors, institutions and governance

Purpose	Questions	Indicators
<p>The economy-wide environment for science, technology, and innovation determines the underlying incentives and dis-incentives in all sectors. Agricultural innovation systems (AIS) are increasingly driven in particular by economy-wide process and organizational innovations, new developments in ICT, and the bio-economy. A well-functioning AIS can help ensure good use of public funds, improved collaboration between public and private participants, including across national borders, and a more demand driven system that is responsive to the needs of 'innovation consumers'.</p>	<ul style="list-style-type: none"> • What is the nature and scope of innovation policy across the economy? How is society reacting to the ever more rapid developments in science and technology? How does the government communicate with citizens on science? • How is agriculture integrated into the general innovation system? • What are the main actors (government, private sector, academia, non-profit organisations, producer organisations) and institutions (ministries, universities, research centres) in the AIS and their respective roles (priority setting, funding, performing, educating, facilitating, adopting, influencing, informing)? • What is the governance structure (umbrella ministries, co-ordination, funding, performing, monitoring and evaluation agencies - in the form of a flow chart) • How are priorities established and communicated? How are market and system failures identified? • How are environmental and sustainable natural resources concerns included in the decision-making process regarding AIS priorities? • How is performance measured and evaluated? At which levels (project, programme, system) and how frequently? What criteria are used? What input and output indicators are available? What tools are used for benchmarking? • Are the economic, environmental and social impacts of innovation evaluated? How (methods) and how frequently? How are evaluation results used in priority setting and decision making? 	<ul style="list-style-type: none"> • OECD Country Science and Innovation Profile [http://www.oecd.org/sti/inno/oecdsciencetechnologyandindustryoutlook2010countryprofiles.htm]

Public and private investment in innovation

Purpose	Questions	Indicators
<p>The public sector continues to be the main source of funding for agriculture R&D, whether performed in public or private organisations. A wide variety of funding mechanisms are used from direct spending on research projects, including for Public-Private Partnerships (PPPs) and “pull mechanisms”, to various forms of tax incentives.</p> <p>Business investment in R&D is normally driven by market demand, but governments also provide different kinds of incentives. Some, like R&D tax rebates, apply to the economy in general, while others are agriculture specific. In many countries, producer organisations and other non-governmental organisations also provide R&D funding.</p> <p>Knowledge infrastructure is a public good that can enable innovation; it includes ICT infrastructure and general purpose technologies as well as specific knowledge infrastructure such as databases and institutions.</p>	<ul style="list-style-type: none"> • What are priority areas for public research in agriculture? Are the issues of sustainable natural resources use, environmental protection and climate change integrated in agricultural innovation policy? What are the research priorities in these areas? • How are public funding decisions made? What is the nature of collaboration with the private sector or international researchers? • What are the trends in public expenditures on agricultural R&D? What is the share of institutional versus project- or programme-based funding? What is the share of basic versus applied R&D? What is the share of public R&D funding dedicated to sustainable technologies and practices? • What is the source of public R&D funding? Has the composition of resources changed over time? • How is knowledge infrastructure supported? What are trends in funding and structure of knowledge institutions? • Are there funding mechanisms to encourage increased collaboration between public and private researchers? What is the share of public support to agricultural R&D funding PPPs? In which areas? What lessons from recent experience? • What are the trends in private expenditures on R&D? • Are there public incentives to private investment in agricultural R&D? What is their target? • To which extent are public procurement and other ‘pull mechanisms’ used to fund research? What priority areas are targeted through this type of support? Why? • Do producers associations, industry, private sector or NGOs employ any unique mechanisms to raise funds for R&D and innovation? 	<ul style="list-style-type: none"> • Trends in public expenditures on agriculture R&D: growth rate and as a share of agricultural value added [OECD data on R&D expenditures: http://www.oecd.org/statistics/; ASTI data: http://www.asti.cgiar.org/data/]. • Share of expenditure on basic R&D; share of institutional funding; share of PPP funding. • Trends in the shares of government, private and foreign sources in the funding of public R&D. • OECD data on share of public expenditures on R&D for agriculture and in general. [http://www.oecd.org/agriculture/agricultural-policies/producerandconsumerssupportestimatesdatabase.htm]. • Share of expenditures on R&D for improved sustainability? • Trends in private expenditures on agriculture R&D [OECD data on R&D expenditures: http://www.oecd.org/statistics/].

Knowledge flows (markets, networks and adoption)

Purpose	Questions	Indicators
<i>Knowledge markets and networks</i>		
<p>Intellectual property rights (IPRs), knowledge networks, and knowledge markets are of growing importance in fostering innovation.</p> <p>Reinforcing linkages across participants in the AIS (researchers, educators, extension services, farmers, industry, NGOs, consumers and others) can help match the supply of research to demand, facilitate technology transfer, and increase the impact of public and private investments. Partnerships can also facilitate multi-disciplinary approaches that can generate innovative solutions to some problems.</p>	<ul style="list-style-type: none"> • What is the policy regarding access to knowledge? Do government agencies make information useful for innovation (e.g. gene databanks) publically available for free? Are results of public R&D available for free, and shared internationally? • What are the rules governing IPRs? How does public research handle IPRs? • What mechanisms have been developed to encourage co-operation between actors, including farmers? • How can knowledge flows between AIS actors be further developed? • More specifically, how are farmers and local stakeholders associated in the priority setting, implementation and funding of research and advisory services? What are the main institutions or organisations involved (specific farmers' associations, water user associations, cooperatives, contracts with public or private research institutes for field experiments)? What are their geographical coverage (whole country, some regions) and level of action (national, local)? Are there specific cooperation mechanisms or organisations to develop sustainable practices? Are they effective? 	<ul style="list-style-type: none"> • WEF CGI: Intellectual Property Protection Index [http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/]. • Patent Protection Index (Park, 2008) • Plant Variety Protection Indicator (Campi and Nuvolari, 2013). • Number of networks, consortia, etc. • Participation rate of researchers, farmers and representative organisations in networks, collaborative projects or consortia.

The adoption of innovation

Particular attention can usefully be paid to training, extension and advisory services that can facilitate the transfer and successful adoption of innovation. The potential benefits of innovations are only realised if effectively implemented. Given the very large number of often small farmers, extension services have a particularly important role to play. They are critical to facilitate farmers' access to technology and knowledge and contribute to facilitate farmers' effective participation in innovation networks and ability to formulate their specific demands. It is also important to support the diffusion of innovation in small agri-food firms.

- Are extension services widely available and used? Is there direct provision by the public sector? Is it targeted to specific groups of farmers, specific areas? Do farmers pay for the service? Are training programmes also provided?
- Is access to private extension services supported? How?
- Are there specific programmes to promote on farm and firm adoption of innovations and knowledge transfer? Do they target specific types of innovations, such as environmentally friendly technologies and practices?
- What are mechanisms for the commercialisation of innovation?
- OECD PSE/CSE database: Trends in public expenditures for the provision or access to extension services; Trends in public expenditures for the collection and diffusion of information. [<http://www.oecd.org/agriculture/agricultural-policies/producerandconsumersupportestimatesdatabase.htm>].]
- Share of farmers undertaking training courses. Subsidies rate.
- Share of farmers using extension services: in general, for specific advice: environmental management, business management.
- Rate of adoption of innovation in farms and in the food processing firms (surveys), by type of innovation. [e.g. Eurostat: Community Innovation Survey <http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/cis>].]

International co-operation

Purpose	Questions	Indicators
<p>International co-operation on agricultural research and development offers universal benefits. While this is generally true given the public good nature of many innovations in agriculture, it is particularly the case where global challenges are being confronted (as in the case of responding to climate change) and when initial investments are exceptionally high. The benefits of international co-operation for national systems stem from the specialisation it allows and from international spill-overs. In countries with limited research capacity, scarce resources could then focus on better taking into account local specificities.</p>	<ul style="list-style-type: none"> • What mechanisms are used to encourage cross-country, international collaboration? In which areas? • What policy efforts are there regarding exchange of staff, domestically or internationally)? • Are there any barriers to the international flow of knowledge through private mechanisms? • Which international and regional networks is your country involved in? 	<ul style="list-style-type: none"> • Share of foreign staff in national R&D and education; number of national R&D staff abroad; • Number of co-operation agreements; number of partners in cooperation agreements. • Participation in international or regional projects or networks. • Share of patents in agriculture and food sciences with foreign co-inventors. • Share of publications in agriculture and food sciences with foreign co-authors.

Overall performance

Overall progress to create and adopt relevant innovations can usefully be monitored. Proxy measures, such as the number of patents or bibliographic citations, is available from international databases, including for primary agriculture and upstream and downstream industries, and by type of innovation. But surveys can also provide a picture of the variety of innovators and innovations created by the public and private sector, and adopted by farms and firms.

- What are the main outcomes of research programmes? Including in the area of sustainable use of resources?
 - Is the impact of R&D on the sector in terms of income and productivity growth, and sustainability assessed? How?
 - Trends in number of patents on agriculture, input industries and food processing [OECD cooperation patent treaty database: <http://www.oecd.org/statistics/>].
 - Number of patents per researcher, per unit of public expenditure, registered and used.
 - Number of publications and bibliographic citations on agriculture and food sciences (as a % of all national publications and citations, as a % of world total in agriculture and food sciences).
 - Share of farms and food processing firms engaged in innovation activities (surveys). [e.g. Eurostat: Community Innovation Survey <http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/cis>].
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