IMPROVING INNOVATION FOR A MORE PRODUCTIVE AND SUSTAINABLE FOOD AND AGRICULTURE SYSTEM: POLICY INSIGHTS FROM COUNTRY REVIEWS

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OECD
BETTER POLICIES FOR BETTER LIVES

Innovation is key to meet future food and agricultural challenges and opportunities

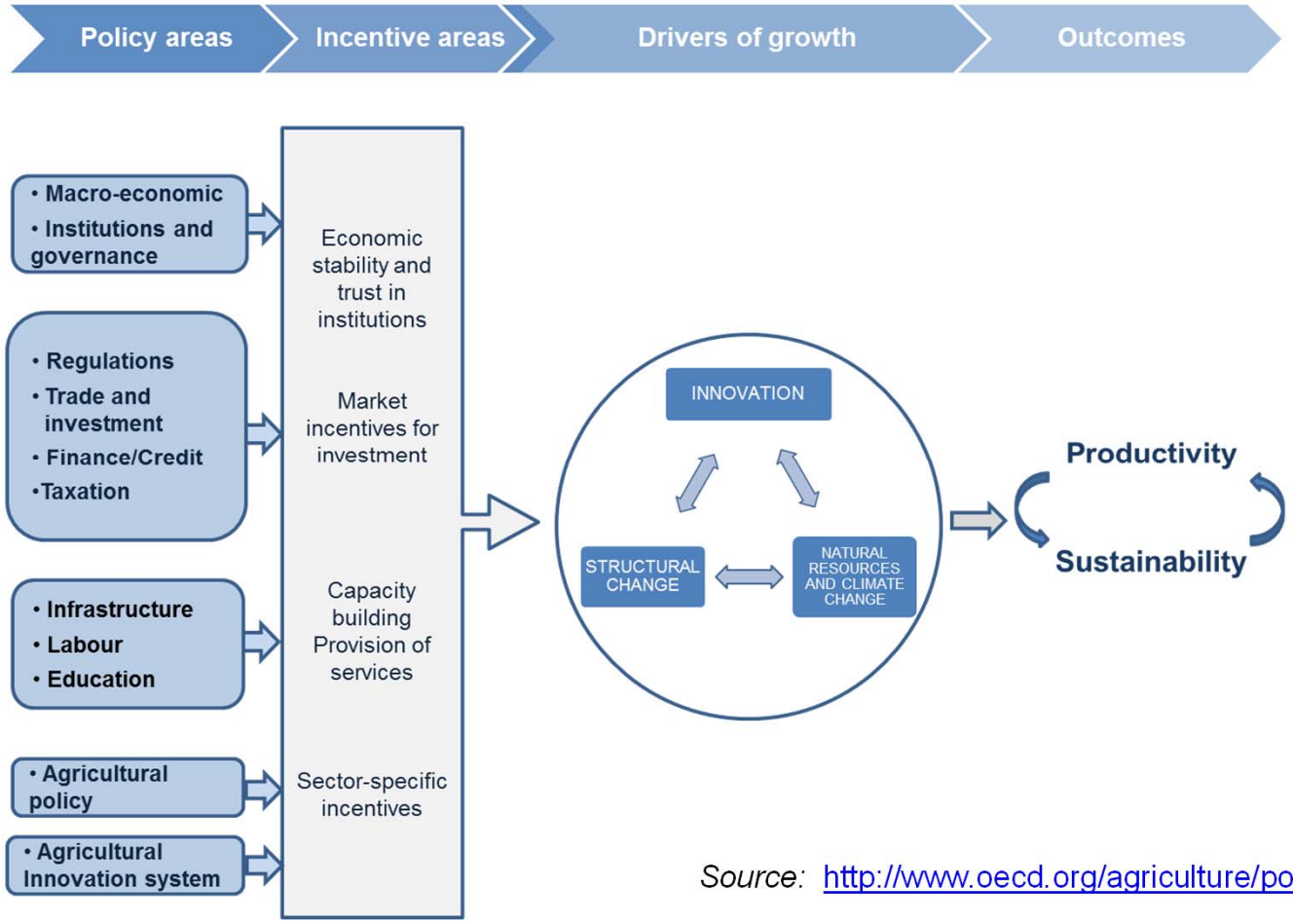
- Improving long–term productivity and sustainability along the food chain is essential to respond to growing and changing demand, add value, to fare stronger export competition and take advantage of agri-food market developments.
- Agriculture has to face the challenges of increased competition for alternative uses of natural resources, in particular land and water, while contributing to preserving biodiversity, restoring fragile ecosystems and contributing to mitigating climate change.
- Agriculture will also have to adapt to climate change which may bring higher average temperatures, more extreme and more frequent extreme events.
- Innovation offers options and opportunities for the sector (bioeconomy, digitalisation)

Outline

- OECD Framework used to review the whole policy environment for innovation in food and agriculture
- Reviewed country characteristics and performance
- Innovation as a driver of productivity-sustainability
- Agricultural policy to facilitate innovation
- Agricultural innovation system and innovation policy
- Wider enabling environment
- Next steps

The whole policy environment matters

- General and sector-specific policies affect innovation, structural change and natural resource use, which drive productivity and sustainability.



Source: http://www.oecd.org/agriculture/policies/innovation

11 country reviews

Countries	Implementation	Report for discussion	Report for declassification	Publication release
Australia, Brazil, Canada	Pilot countries to test the framework started mid-2013	May 2014	November 2014	Mid-2015
Netherlands	Stronger focus on sustainability issues	May 2015	May 2015	Nov. 2015
Turkey, United States	Climate change added, started mid-2015	May 2016	May-September 2015	Late 2016
China	Focus on specific issues	March and May 2017	November 2017	Early 2018
Estonia	Background report in October 2016	May 2017	November 2017	Early 2018
Sweden	Launched in October 2016	November 2017	March 2018	Mid 2018
Korea	Launched in February 2017	March 2018	May 2018	Later in 2018
Latvia	To start mid 2017	March 2018	November 2018	Early 2019

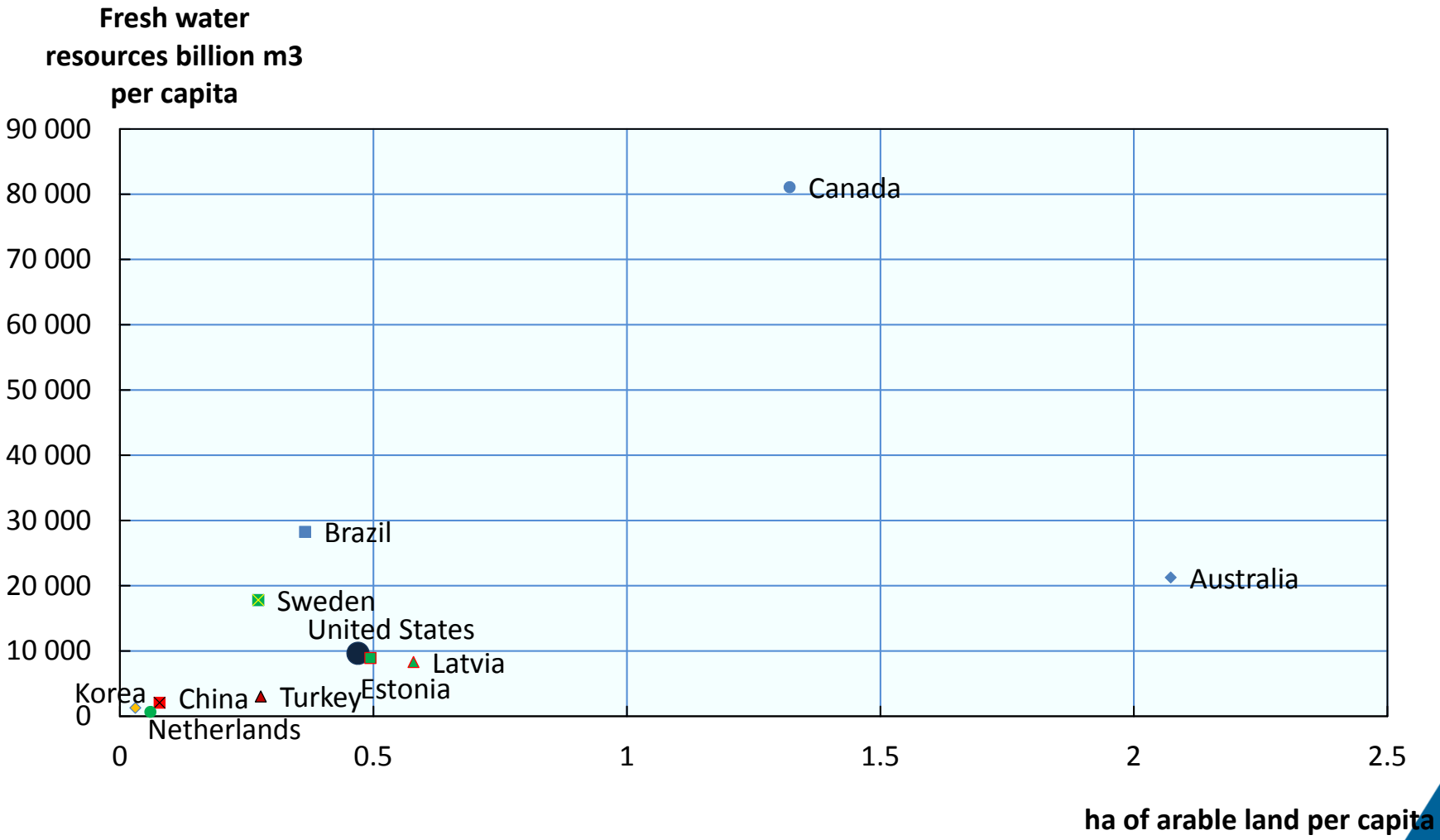
Also looked at the AKIS in Colombia and SEA;
Switzerland commissioned its own review

Diversity of countries

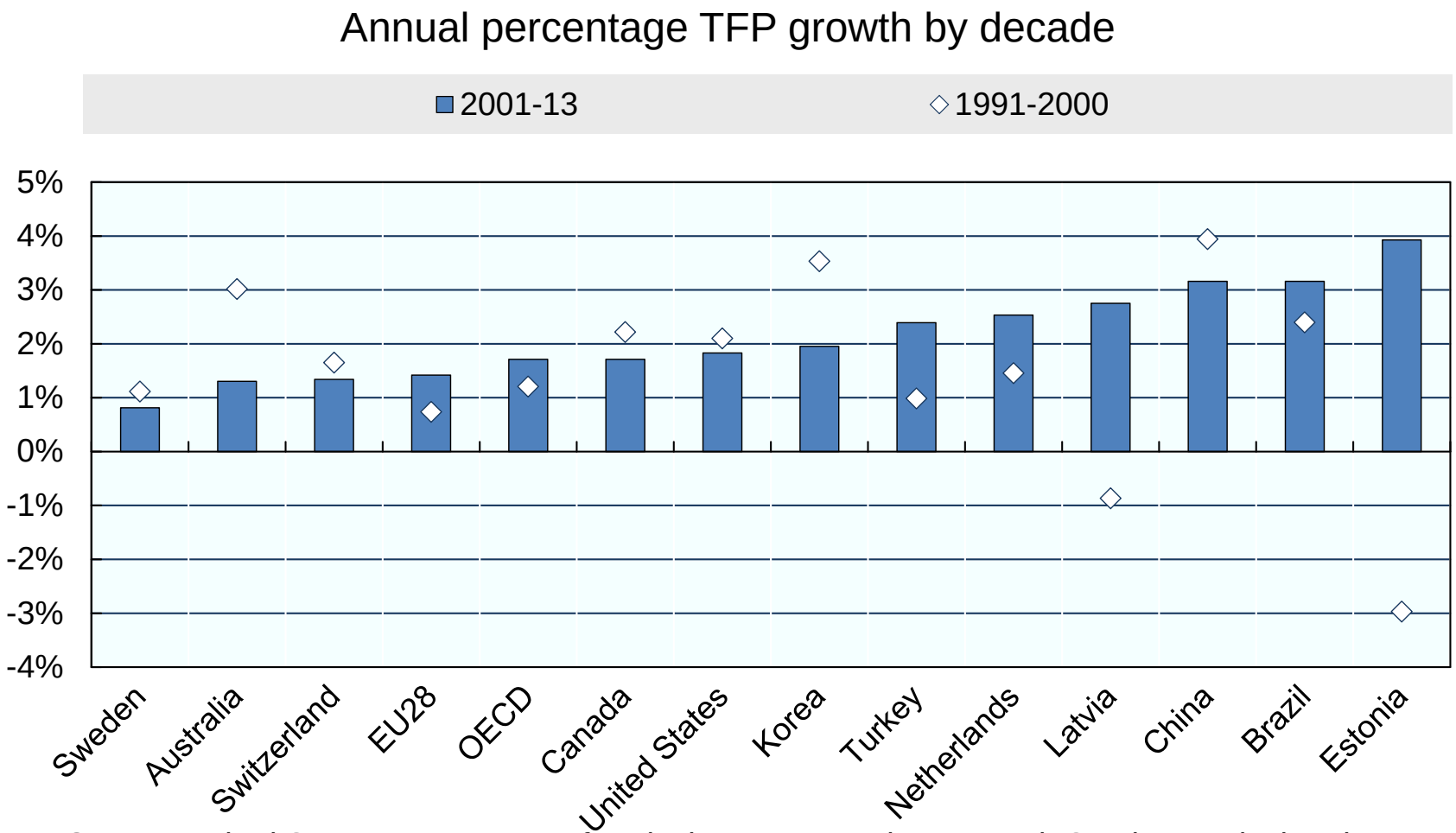
Country	Location[1]	Population	Land	GDP per capita	Ag net trade position
		Million	'000 km2	PPP USD	
Australia	Oceania	24	7 682	45 821	EXP
Brazil	S. America	201	8 358	15 065	EXP
Canada	N. America	36	9 094	44 284	EXP
China	E. Asia	**1 402**	**9 425**	13 171	IMP
Estonia	Europe	**1.3**	42	28 067	IMP
EU28	Europe	509	4 238	37 691	EXP
Korea	E. Asia	51	97	34 518	IMP
Latvia	N. Europe	2	62	24 294	IMP
Netherlands	N. Europe	17	**34**	48 472	EXP
Sweden	N. Europe	10	407	46 419	IMP
Turkey	O. Asia	78	770	19 917	EXP
United States	N. America	321	9 147	55 798	EXP
OECD		1 272	34 341	39 976	

1. Missing Africa and large EU members.

Natural resources: land and water



Agricultural productivity growth decreases in large countries, but not EU and OECD averages



Source: United States Department of Agriculture, Economic Research Service, Agricultural Productivity Database, 2017, www.ers.usda.gov/data-products/international-agricultural-productivity.aspx.

Agri-environmental performance generally improves in OECD countries

Trends in the decoupling agriculture productivity from resource and environmental pressure

	Resource	Environment
Absolute decoupling	Water use: AUS, NLD, EST, KOR Land use: NLD, KOR	N and P balance: EST, KOR,SWE, USA, TUR Ammonia: NLD, SWE, USAGHG emissions: NLD, TUR Pesticides: NLD, USA, KOR
Relative decoupling	Water use: CHN, TUR, USA Energy use: USA, EST	GHG emissions: USA, EST
Deterioration	Energy use: Turkey	Pesticide use: Turkey; GHG emissions: KOR

Relative decoupling refers to a decline in the ecological intensity per unit of economic output.
Resource-absolute decoupling refers to a situation in which resource impacts decline in absolute terms.
Time periods are not identical for each country, more recent date on agri-environmental indicators might alter this assessment
Source: Based on OECD AEI indicators.

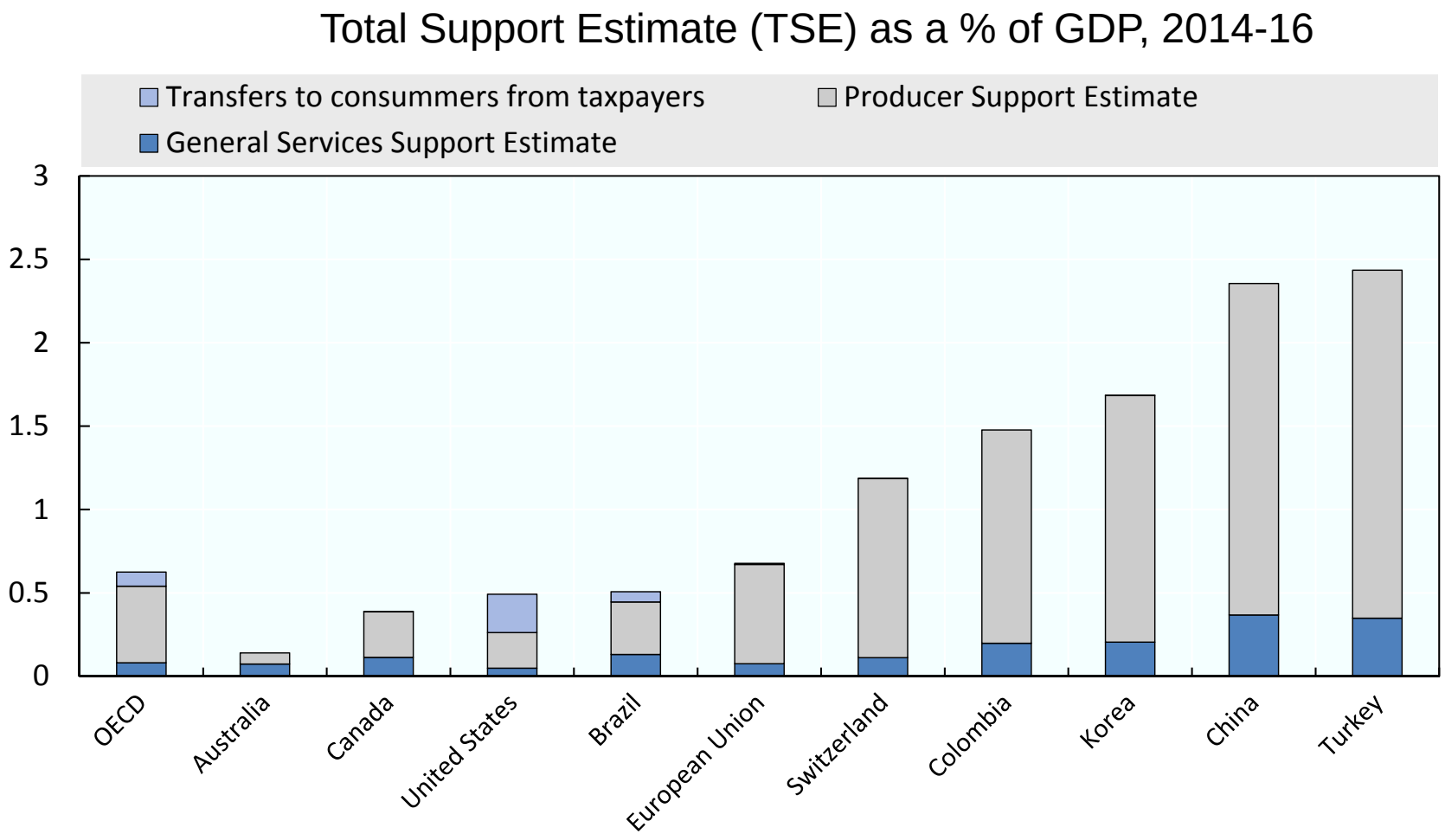
Innovation as a driver of productivity and sustainability

- Main driver of total factor (TFP) growth is higher labour productivity, linked to larger farm size and adoption of labour-saving technologies, including ICT
- also buildings and machineries allowing energy saving, better risk management, lower waste
- adoption of more sustainable practices (lower input)
- better management, production and marketing strategies
- and genetic improvement
- Innovation also led to more sustainability, with appropriate incentives, and increased traceability
- Adoption of innovation is to increase profit but also to respond to consumer demand and to policy and regulatory incentives

Agricultural policy to facilitate innovation

- Facing budget constraints, governments need to invest in areas that yield longer-term benefits, such as infrastructure, education, research and extension, exploiting synergies with the private sector.
- Remove impediments to investment (structural adjustment)
- Provide tools for better risk management
- Remove distortions in input and output markets to allow farmers to exercise choice of input mix, production systems and output
- Provide more targeted incentives to innovation, sustainable practices
- Facilitate access to information

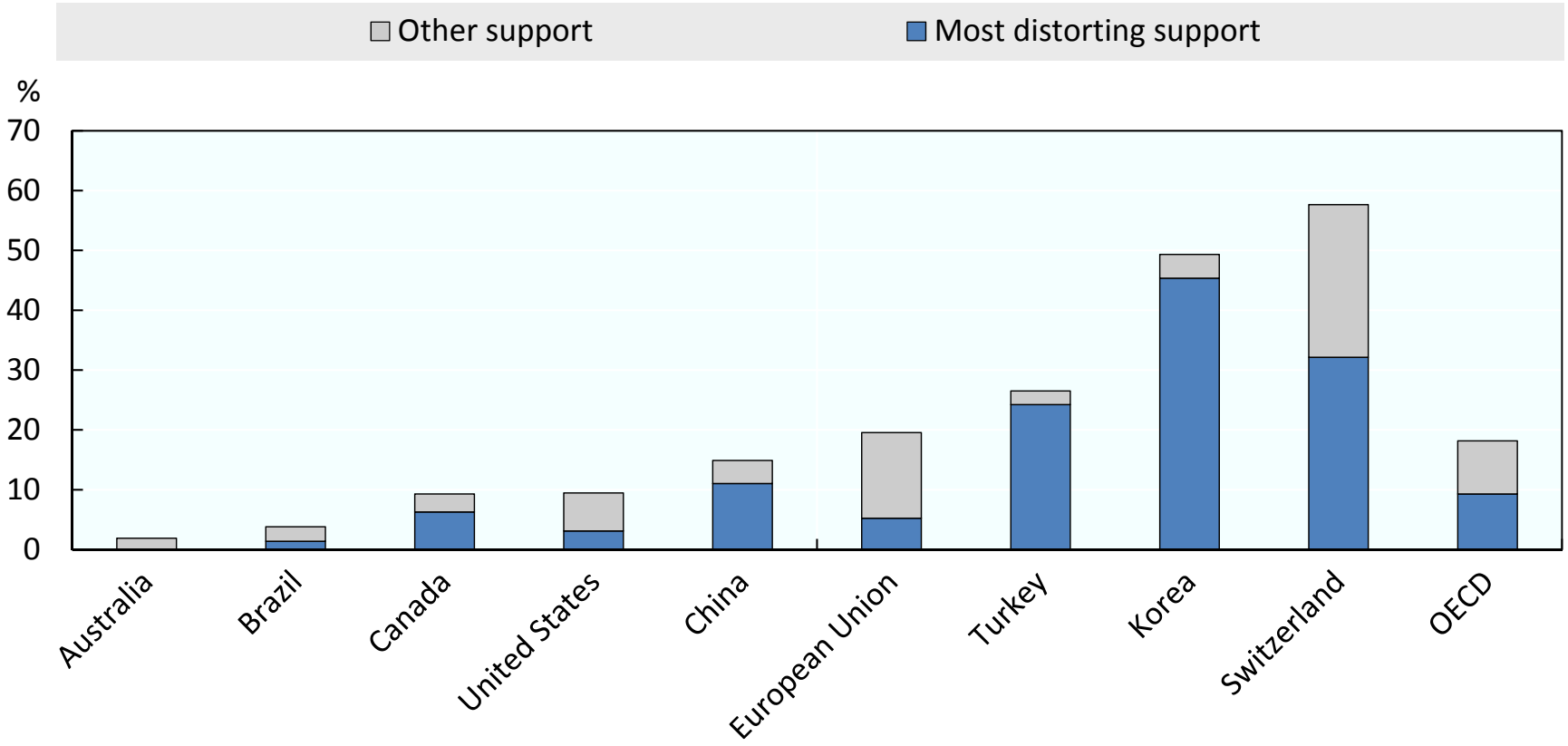
Most support to agriculture goes directly to producers



Source: OECD (2017), "Producer and Consumer Support Estimates", OECD Agriculture statistics (database). http://dx.doi.org/10.1787/agr-pcse-data-en

Differences in support levels and composition

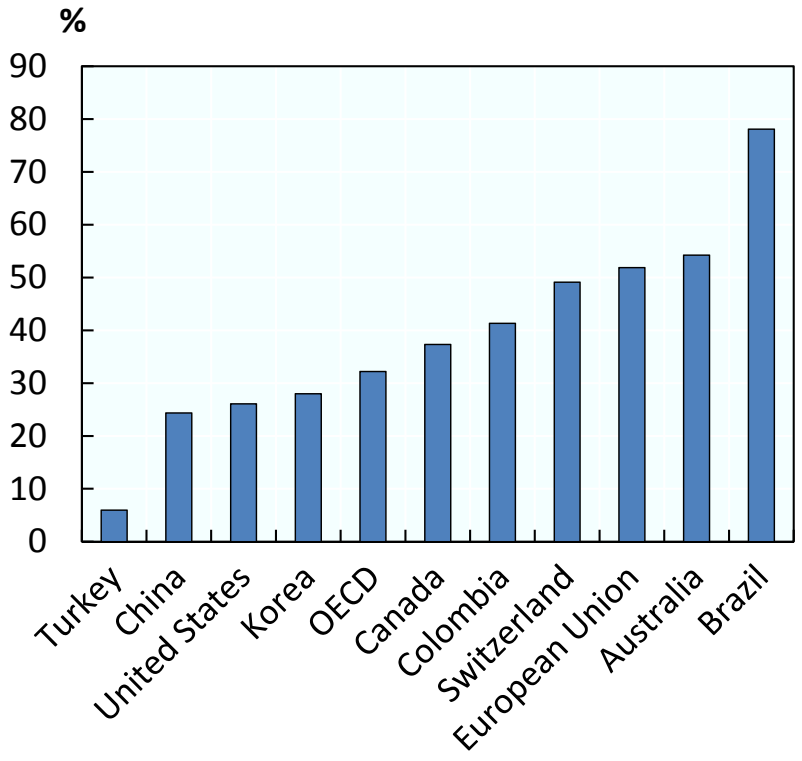
Producer Support Estimate (PSE) as a % of gross farm receipts, 2014-16



Source: OECD (2017), "Producer and Consumer Support Estimates", OECD Agriculture statistics (database), http://dx.doi.org/10.1787/agr-pcsedata-en.

Differences in public spending on innovation

Expenditure for innovation as a % of general services, 2014-16



- Large majority for innovation and education in Brazil
- Majority in Australia, EU, Switzerland, but also infrastructure in the first two
- Innovation and infrastructure in Colombia
- innovation and inspection in Canada
- Mainly infrastructure in Turkey and China (but also stockholding in China)

Source: OECD (2017), "Producer and Consumer Support Estimates", OECD Agriculture statistics (database), http://dx.doi.org/10.1787/agr-pcsedata-en.

Variety of agricultural policy measures

- Price support and input subsidies remain important in some countries (CH, KOR), general decline in OECD countries but not China
- Different focus and instruments for producer support:
  - land-based support in the EU MS using les distortive options, Pillar 2 focuses on few measures with emphasis on young farmers, environment, innovation and local development
  - risk management in US and Canada, with stronger emphasis on investment and innovation in Canada
  - support to credit increases in Brazil, some environmental measures (zoning), specific support to small family farms, including insurance and guarantee prices
  - Drought policy includes income support and loans, more emphasis on general services in Australia.
- Trend towards the development of targeted incentives for adoption of innovation (Canada) and sustainable technologies and practices (EU).

Policy coherence

- In some cases, agricultural policy compensates for deficiencies in other policy areas, such as competition, access to loans (Brazil)
- Agri-food not necessarily benefits from general policies (rural development, innovation, support to companies, tax credit) because of size and lack of capacity
- But evidence of market or policy failure not revisited (investment support, input subsidies)
- Better understanding of trade-offs and synergies is essential to meet different policy objectives

Agricultural Innovation System

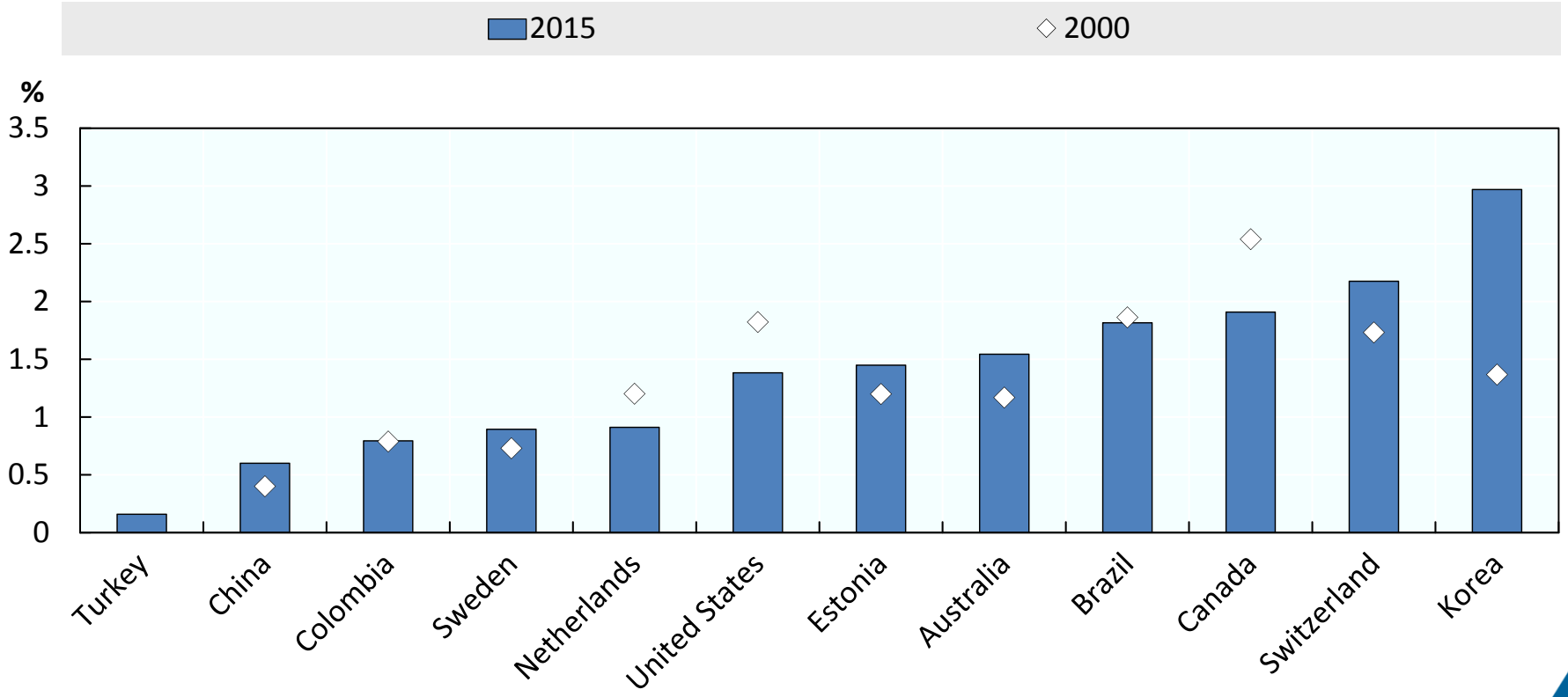
- The innovation process comes from interactions between a variety of actors: government, research, education, extension, companies, producer groups, farmers, NGOs, markets (consumers)
- With different roles: Guidance, funding, creation from basic to applied, knowledge transfer, adoption, enabling policies, monitoring, feed back
- The challenge is to make the system more responsive to needs, forward looking, and more cost-effective

Governance is key

- Very diverse institutional structure of public research and number of actors, some very fragmented (Canada), others more concentrated (WUR, Embrapa, ARS)
- Efforts to improve governance:
  - Setting priorities: Longer-term priorities, dialogue with stakeholders (clusters in Canada, NLD triangle), policy coherence (growth and innovation in Estonia). Stronger governance of extension systems often needed.
  - Evaluation: little evaluation of systems, more systematic evaluation of policies (EU, Australia, Canada, US) or upon request but focus on effort and outcomes, little on impact and mainly economic. Examples of good evaluation from research institutes themselves (Embrapa, SCIRO, INRA, ARS, universities).
- And guide investment according to agreed priorities:
  - Public investment in R&D with public good aspects (cf. US review)
  - Targeted incentives to private investment in innovation: IPR, targeted investment support (SMEs, specific topics)
  - Funding mechanisms:
- A role for the government is to provide clear information on programmes and regulation, market conditions, available technology, etc.

No clear trend in agricultural research intensity

Share of budget expenditures on agriculture R&D as a percentage of agricultural value-added, 2000, 2015



Source: OECD R&D statistics and ASTI database.

Trends in agricultural research funding

- The government is the main funder:
  - high private contribution in the US and the Netherlands but private investment also receives government support
  - producer levies in Australia (and Sweden), but no more in the Netherlands
- Lack of comparable data, in particular for private expenditure
- Change in delivery:
  - More project-based, competitive mechanisms, but sometimes a too high share creates instability (Estonia)
  - Demand-driven funding for agricultural research mainly explored
- High number of funders in some countries (US, Sweden)
- Complexity increases the difficulty to trace where the money goes

Improving collaboration is a widespread objective

- Good knowledge infrastructure attracts partners (may become an issue in countries where public funding decreases or is subject to private participation, improvements in Estonia)
- Wide recognition that facilitating knowledge flows (open data, staff) helps
- Incentives to private investment in innovation: IPR generally good in OECD countries, targeted investment support is not agricultural-specific (except Canada)
- Facilitate collaborative approaches (public-private, across sectors, multidisciplinary), e.g. funding mechanisms (PPP, projects) networks, competence centres, sharing infrastructure and information etc. Study on agricultural specific issues for PPPs
- Strengthen cross-country cooperation for cross-border issues and sharing costs: enhance knowledge flow, facilitate staff exchange (Labex), attract foreign students, participate in international efforts (GRA on GHG emissions, G20 initiatives, EU programmes, etc.)

Main findings on cooperation

- In all countries, various steps are taken to foster innovation and research collaboration between public and private actors, including through financing mechanisms.
  - While the Dutch innovation systems is based on collaboration between research institutions and agri-food companies, agricultural applied research
  - Significant in the US because of strong private companies
  - R&D and extension in Australia is co-financed by farmers.
  - Brazilian research is led by a government agency (Embrapa),
  - The system include a large diversity of actors in Canada, with good coordination mechanisms.
  - Involvement of private companies difficult, especially when the sector is dominated by SMEs.
- Cross-country collaboration: best in the NLD because of capacity, EU membership and size. Good in Canada and Brazil (Labex), less so in Australia because of the nature of R&D, size effect in the US.

Issues regarding adoption are widespread

- Main driver of innovation is the market and motivation to increase profit, save on costs (labour): Improve the "enabling environment" (US example)
- The share of innovators and followers varies: issues with smaller farms in Brazil, Estonia despite high aggregate TFP performance
- Non-adoption often linked to capacity and incentives (knowledge, viability, size, regulatory constraints, high support)
- Efforts to facilitate adoption through:
  - education, training, and extension: different systems and actors;
  - matching and adapting skills is a challenge everywhere: best practice in the Netherlands, improvements in practice everywhere, but some countries struggle to attract and retain skills (competition with other sectors).
  - facilitating knowledge flows
  - fostering an innovation culture and society's acceptance
  - agricultural policy (e.g. risk management, agri-environment, conditions)
- Government role in extension systems: Governance, public goods

Enabling environment

- Improving the policy and regulatory environment for business; removing impediments to adjustment and distortions to input and output markets
  - Stability, property rights
  - Further streamline and harmonise regulations within and across countries, anticipate regulatory needs, single desk
  - Trade facilitates access to new technology and innovation flows
  - Address market failure in input (financial) markets
  - Taxation incentives: Tax support for R&D: better targeting with direct support, in particular to companies which would otherwise not invest.
- Infrastructure improvement (and rural development)
  - to reduce transport costs and facilitate the marketing of agricultural products labour adjustment, more efficient use of natural resource
- Labour, education and skills:
  - improve attractiveness of agriculture-related education, interest in science
  - attract labour with relevant skills in the sector, and
  - Anticipate skills demand, discuss with industry, market better agricultural education.
  - Life-long training. Include management and fund-raising skills.

Next steps

- Development of a synthesis report in 2018
- Additional country reviews in 2009-10
- Revisions to the framework end of 2018
- Additional analytical work: Impact of agricultural policy on the environment, Policy trade-offs, Drivers of farm-level performance, Taxation policy.

For more information

- Visit our website: **www.oecd.org/agriculture**

www.oecd.org/agriculture/policies/innovation

- Contact me: **catherine.moreddu@oecd.org**

- Follow us on Twitter: **@OECDagriculture**

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Implementation method

Countries	Coordination	Provision of background information
Australia	ABARES	ABARES
Brazil	Embassy in Paris	Ministry and consultants
Canada, United States	Ministry in charge of agriculture	Ministry in charge of agriculture
Netherlands	Ministry in charge of agriculture	Consultant report for the government
Turkey	Ministry in charge of agriculture	Ministry and consultants Visiting partner
China, Korea	Research Institute	Consultants
Estonia, Latvia	Ministry in charge of agriculture	Research institute of the University
OECD provided the framework questionnaire, common indicators, and general policy information, synthesised the information, and developed overview and recommendation section. Switzerland used consultants.		