



AGRICULTURE INNOVATION AND FOOD AND NUTRITION SECURITY

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Focus of the presentation

- Clarify the various relationships between agriculture, innovation and food security,
- Focus on increasing food supply, through innovation and productivity growth, sustainably
- Looking at institutions and policies, not technical solutions
- Provide an overview of trends in agricultural innovation systems,
- Discuss the role of governments in improving the creation and adoption of innovation in agriculture



Basic concepts: “innovation”

- **Innovation** is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations (Oslo Manual, OECD and Eurostat, 2005).
- **Broad definition:** an innovation can be new to the firm/farm, new to the market or new to the world.
- Innovation is more than R&D, but **R&D** is important
- **All types of innovations** -- product, process, marketing and organisational innovations – along the supply chain.



Agriculture innovation

- Boundaries between sectors are not so clear
- Definition of agriculture R&D activities in the Frascati Manual (OECD, 2002).
- **Agriculture as field of sciences:** agricultural sciences
- **Agriculture as a socio-economic objective** covers all research on the promotion of agriculture, forestry, fisheries and foodstuff production: inputs, environmental impact; food productivity and technology.
- But not research on pollution reduction; rural development, buildings, recreation amenities, agricultural water supply, energy measures and for the food industry.
- The Frascati Manual is being revised.



Basic concepts: “food security”

- **Food security** exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO World Food Summit, 1996).
- **Four dimensions** of food and nutritional security:
 - Global food availability
 - Access & affordability
 - Utilisation (nutrition, health, education)
 - Stability



Food security challenges and agricultural innovation

- “Supply side” challenge of feeding a world population that is expected to exceed 9 billion by 2050
- “Demand side” challenge of eliminating poverty and hunger
- How agriculture and fisheries, and agriculture innovation can contribute to meeting both challenges?



Ways of increasing global food availability

Increasing food supply	Limiting food demand
Improved agricultural productivity (more efficient use of inputs, such as labour, land and water)	Modified tastes and preferences (including less meat consumption, reduced over-consumption)
Expansion of land area	Reduced consumer waste
Reduced supply chain (especially post-harvest) losses	
Climate change adaptation	
Less diversion of crops to non-food uses (e.g. biofuels)	



Huge range of inter-linked factors

Supply (availability)	Sustainability	Poverty / hunger (access & affordability)
Yields / technologies		Income growth in rural areas
Area	Location of production	Farm systems Role of smallholders
Land use change	Deforestation, biofuels	Land tenure systems ("land grabs")
Waste	Post-harvest losses	
Water use / irrigation		
Consumption patterns	Meat consumption	Nutrition
		HIV / Aids; women



Agriculture innovation important for both availability and access

- Innovation is key to improving productivity growth in the agriculture and agri-food sectors,
- thus contributing to production (and economic) growth,
- higher competitiveness and farm family income, and
- ensuring lower food costs for consumers in the long-term.
- Innovation also help improve sustainable use of natural resources, e.g. water management, no-till agriculture,
- and adaption to climate change, e.g. drought or heat resistant varieties
- Innovation reduce losses along the food chain (storage, ICT, improved adaptation to demand),
- and help improve nutritional attributes of food (GR) and ensure food traceability and safety (nano, ICT)



But not sufficient

- For agricultural development
 - Need to provide good infrastructure services in rural areas to improve access to farm input and output markets, and labour markets,
 - Good education and health services, etc.
- And reduction of poverty is a much wider issue
 - Develop alternative employment opportunities for farm and rural family members

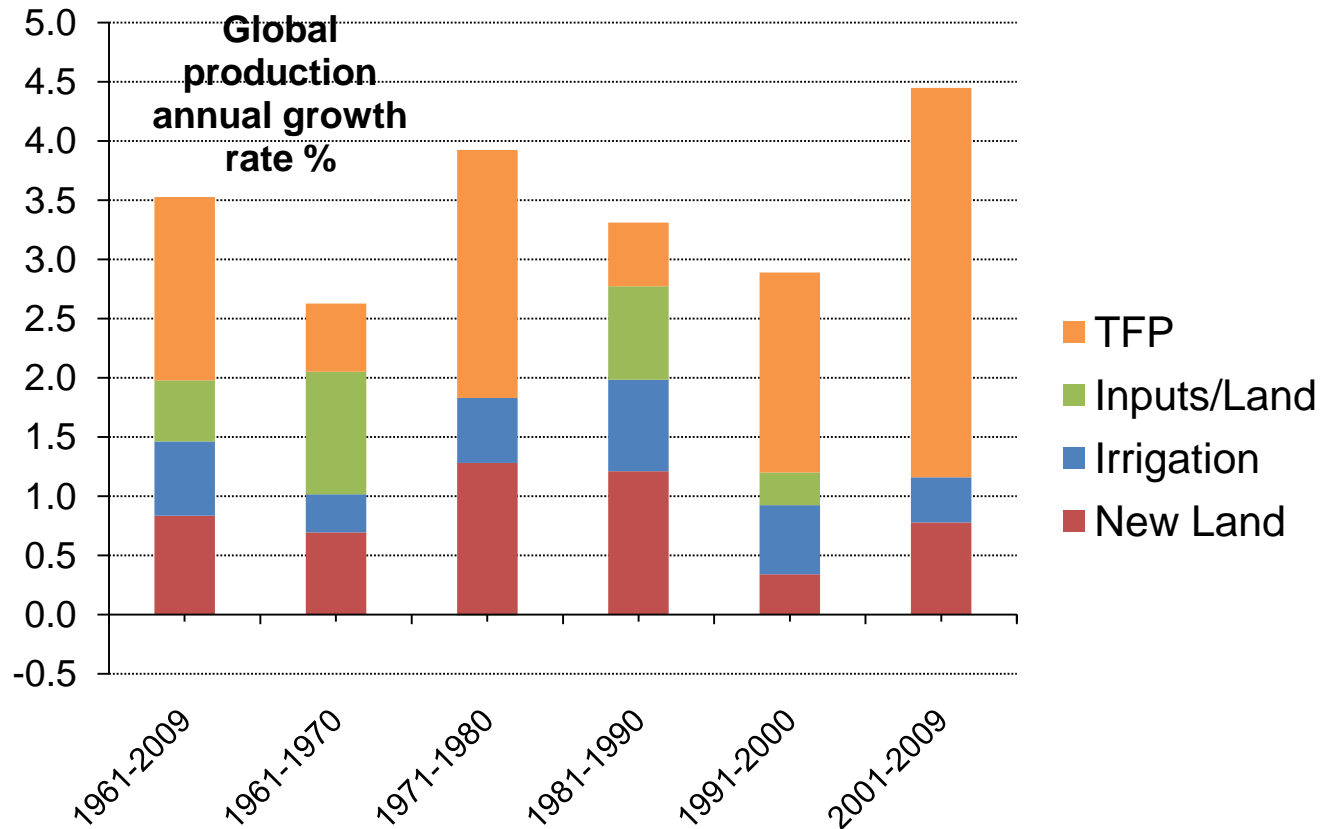


Improving productivity growth, sustainably (G20)

- Resources are limited so higher productivity growth needed
- Innovation ensures long-term productivity growth
 - it pushes out to production possibility frontier (innovators): Large returns to R&D, especially when accompanied with extension, but long time lags for basic research
 - Better farm management practices to move closer to the frontier (followers)
- Economies of scale, efficient farm structures
- Need to act on the three aspects, including reducing productivity (yield) gaps, i.e. the difference between potential and observed productivity



TFP growth is the main source of global agricultural production growth



Source: Data provided by Keith Fuglie, cf. Fuglie, Keith O.(2012). "Productivity Growth and Technology Capital in the Global Agricultural Economy." In: Fuglie K., Wang, S.L. and Ball, V.E. (eds.) Productivity Growth in an international perspective, CABI.



Agricultural innovation challenges

- Agricultural innovation systems (AIS) being reformed to:
 - Improve responsiveness to demand
 - Increase diffusion and rates of adoption
 - Better use human and financial resources



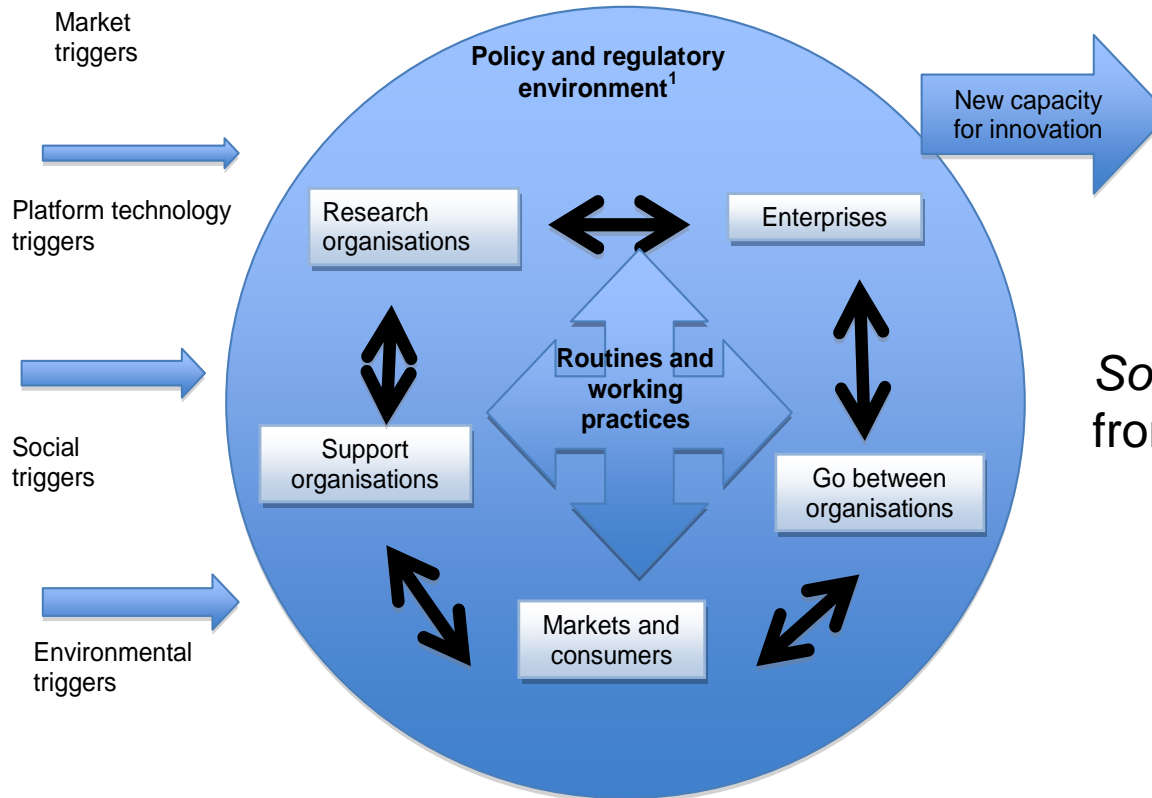
Drivers of AIS changes

- Change in agricultural policy priorities leads to changes in research agenda, e.g. environmental, social issues, global challenges (food security and climate change)
- More complex issues: different kinds of knowledge and disciplines, local diversity
- Change in farming and industry structure: consolidation and dualism
- Changes in public management and budget constraints: accountability, public/private roles
- Globalisation increases pressure for competitiveness: Poles of excellence, PPPs, cross-country collaboration



New approaches to agricultural innovation

- More interactive approach, with more diverse actors



Source: Adapted from Hall (2012)

- Systems approach to influence long-term changes (more sustainable) production and consumption systems

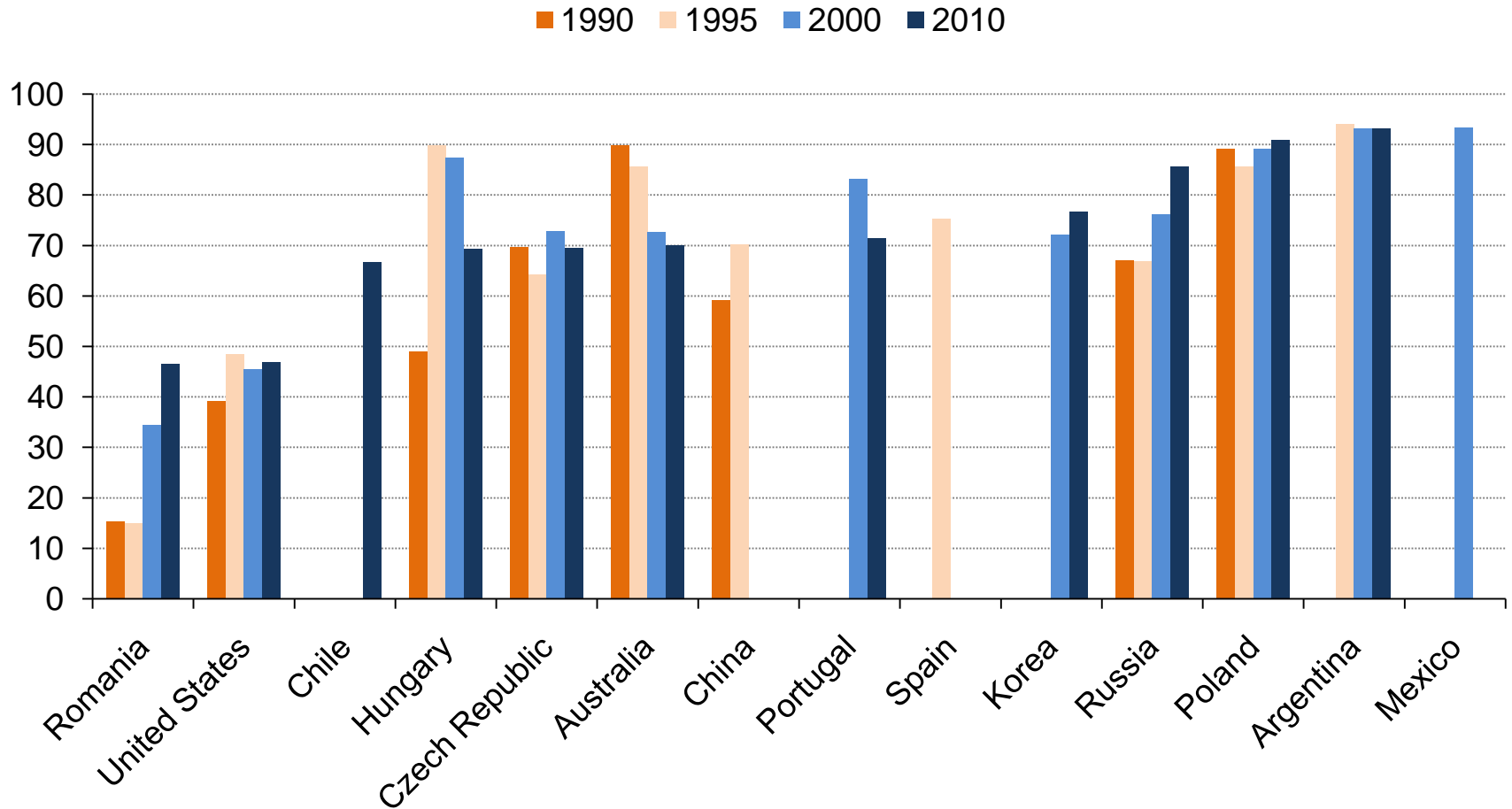


R&D main features and trends

- Stronger and more inclusive co-ordination within AIS
- Stronger integration of agriculture in general innovation systems
- Stronger governance: strategic thinking, monitoring and evaluation
- More project-based, competitive funding
- More private sector involvement, including through Public-Private Partnerships (PPPs)
- But public funds still dominate
- Development of cross-country co-operation
- Harmonisation of IPR rules and standards?



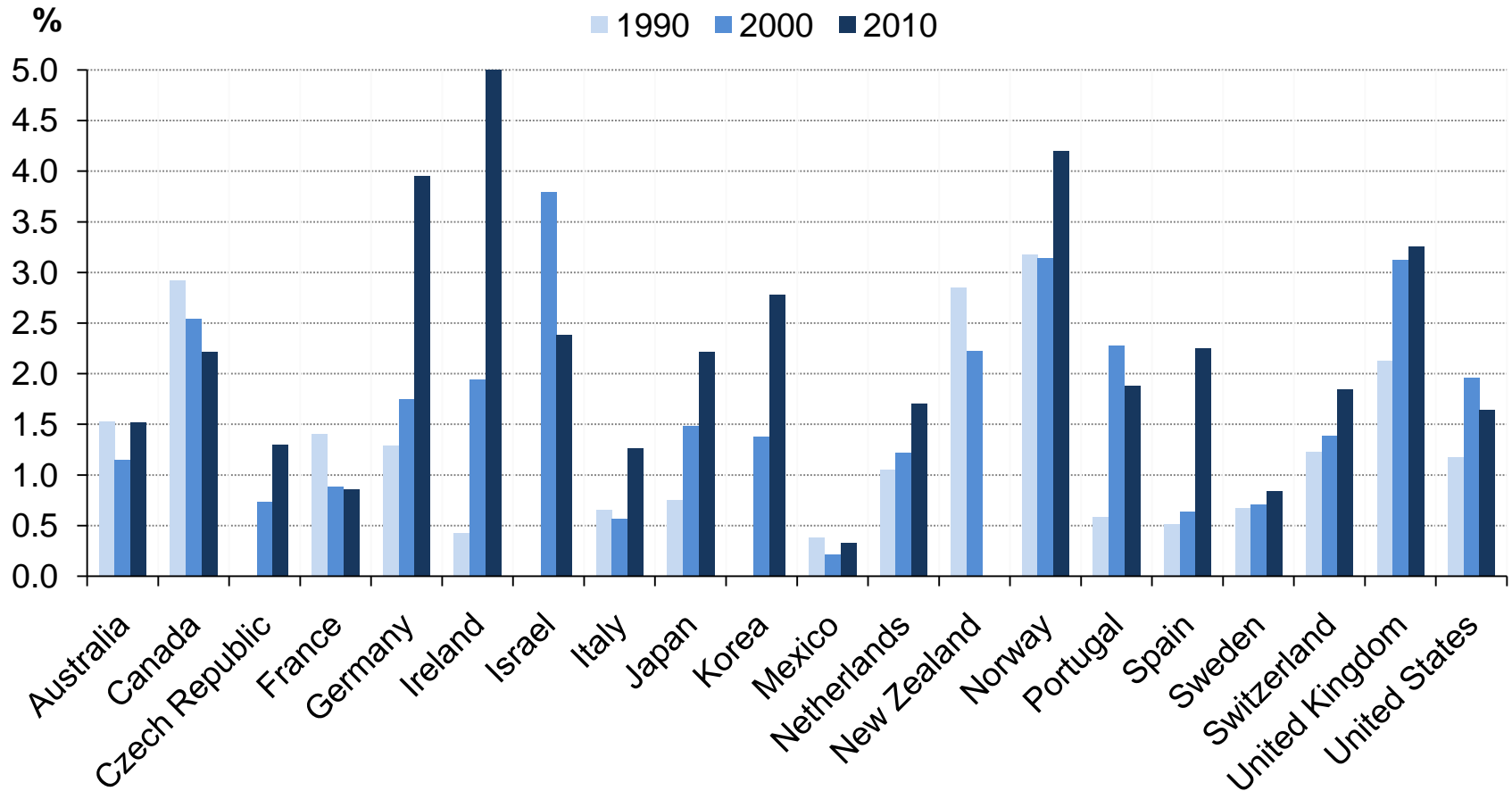
Share of public funds in total expenditures on agricultural R&D



Source: OECD R&D indicators.



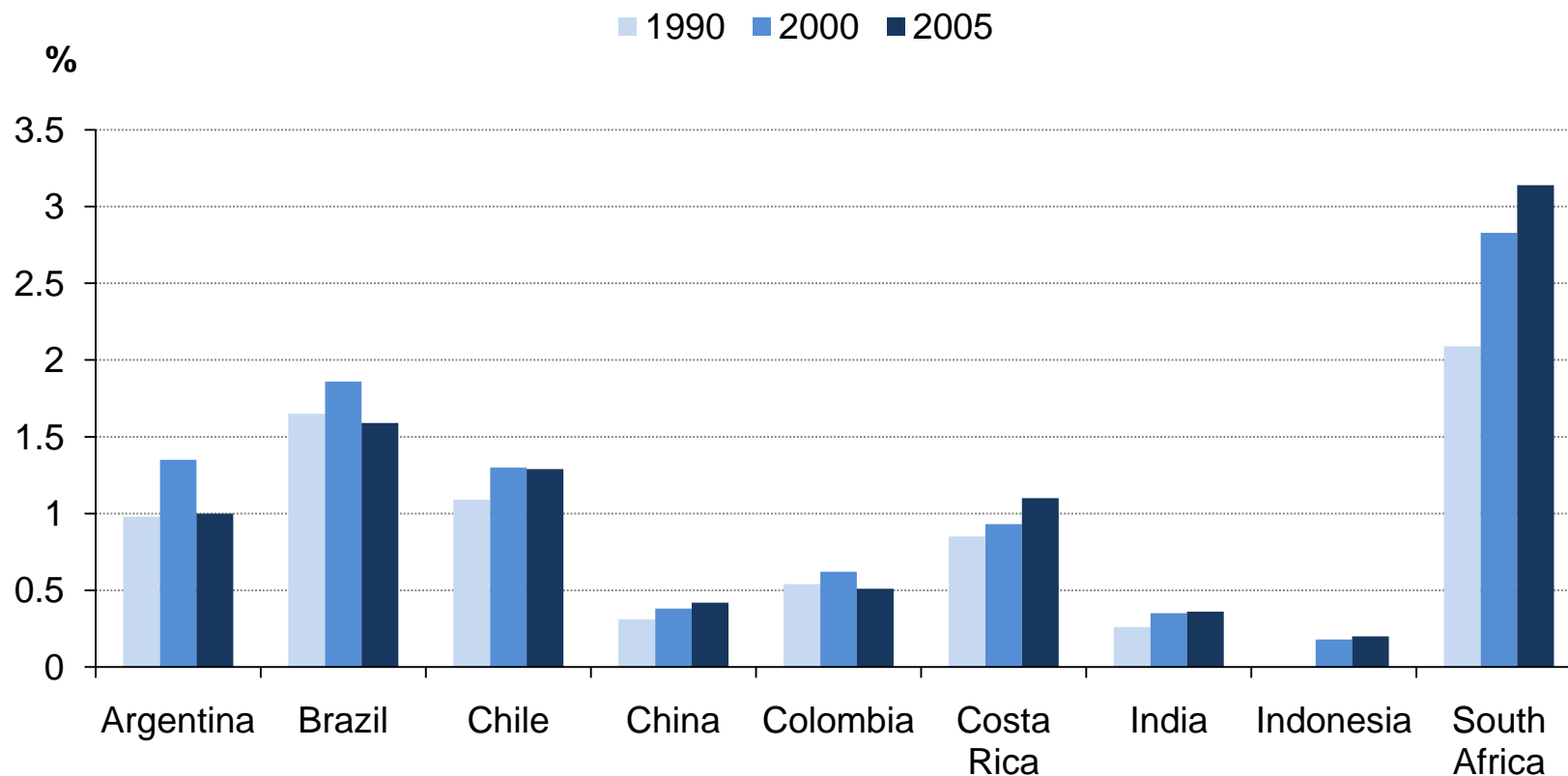
Budget expenditures on agricultural R&D as a share of agricultural value added



Source: OECD R&D indicators.



Share of public funds in total expenditures on agricultural R&D



Source: ASTI database.



Education, training and extension

- Efforts to make agricultural high level education more attractive, more adapted to labour market demand
- Very diverse extension systems across countries (see table)
- Government less involved in direct provision, but may fund access to services (except from the industry)
- More diverse services, e.g. technical assistance for implementation of agricultural policy, environmental issues



Advisory services in OECD countries

	Main institutions	Source of funds	Countries
State-run	Public organisations at regional and national level	Wholly financed from public funds	Belgium, Italy, Greece, Slovenia, Sweden, Germany's Southern regions, Spain, Portugal, Luxembourg, Japan, United States
Public Private Service	Increasingly provided by private consultant firms	Farmers partly or wholly pay for services; centralised and decentralised	Canada, Ireland, Czech Republic, Poland, Slovak Republic, Hungary, Estonia, Australia, Chile
Farmers Organisations	Farmers' organisations	Membership fees and payments by farmers	Austria, France ¹ , Denmark, Finland, North-West regions of Germany, Norway
Commercial	Commercial firms or private individuals	Payment through project implementation or grants	England, Netherlands, North-East regions of Germany, New Zealand

Source: Adapted from Laurent et al. (2006), using response to OECD questionnaire (www.oecd.org/agriculture/policies/innovation)



Government role in improving innovation and productivity growth

- Government affect the creation and adoption of innovation in agriculture a wide range of policies
 - Pay attention to framework conditions (enabling environment)
 - Move away from agricultural market and income support to invest in innovation and long-term competitiveness
 - Strengthen national agricultural innovation systems, increase cross-country co-ordination, improve governance and drive policy coherence



Framework policies are important

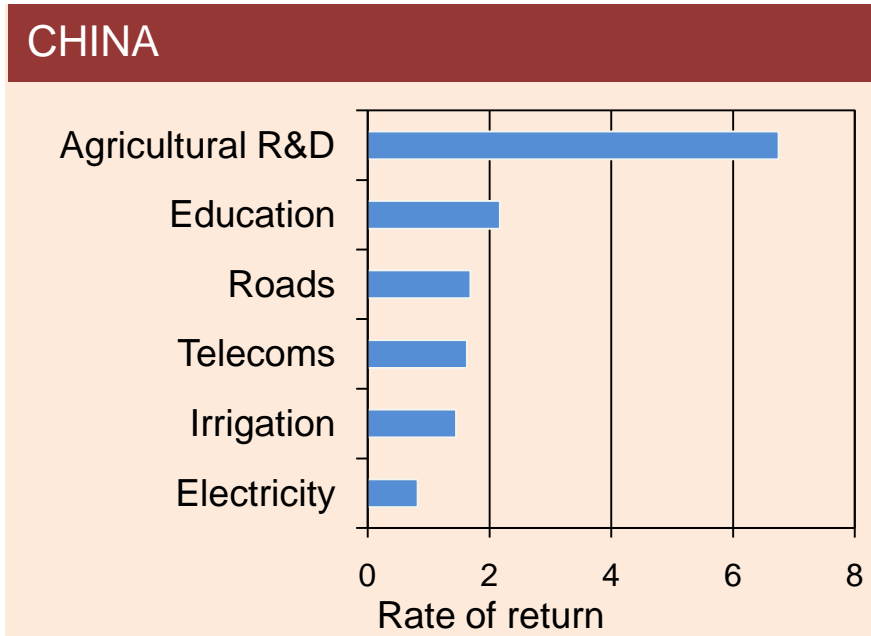
- Stable macro-economic conditions (e.g. low interest rates)
- Good governance (e.g. contract enforcement)
- Financial markets: access to credit
- Infrastructure investment: roads, ports, ICT, etc.
- Trade and competition policies, Business environment
- Well functioning trade and markets, including labour and land markets
- Tax policy: e.g. R&D tax rebates
- Regulations, e.g. food safety, environment
- Human capital: health and education policies
- General environment and innovation policies
- Information systems



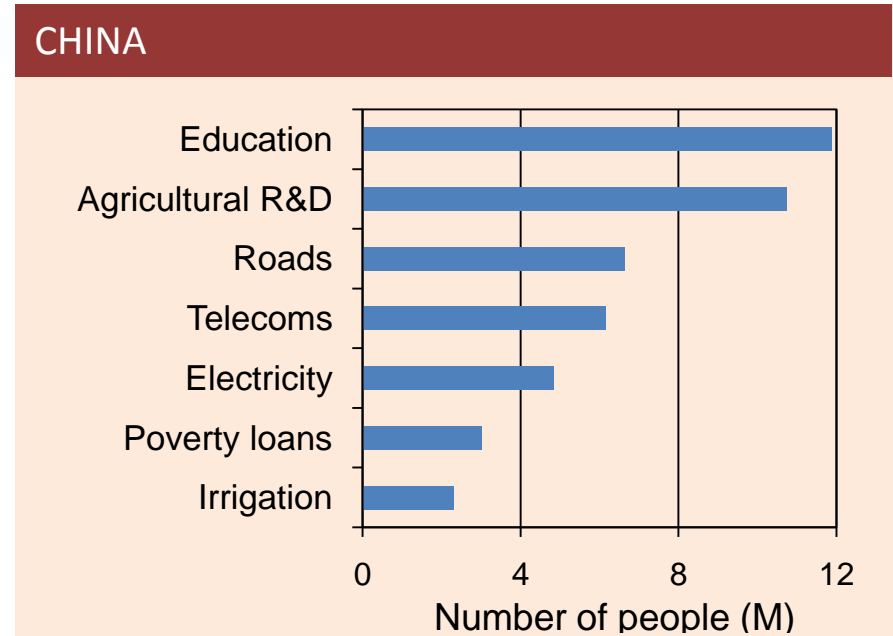
Public investment

Impact of public investments in terms of:

Agricultural performance



Poverty reduction



The impact on performance is measured as returns to one monetary unit of different types of public spending in terms of increased agricultural GDP. Poverty reduction is the reduction in the number of poor people per 10 000 yuan spent.

Source: FAO, SOFA 2012.



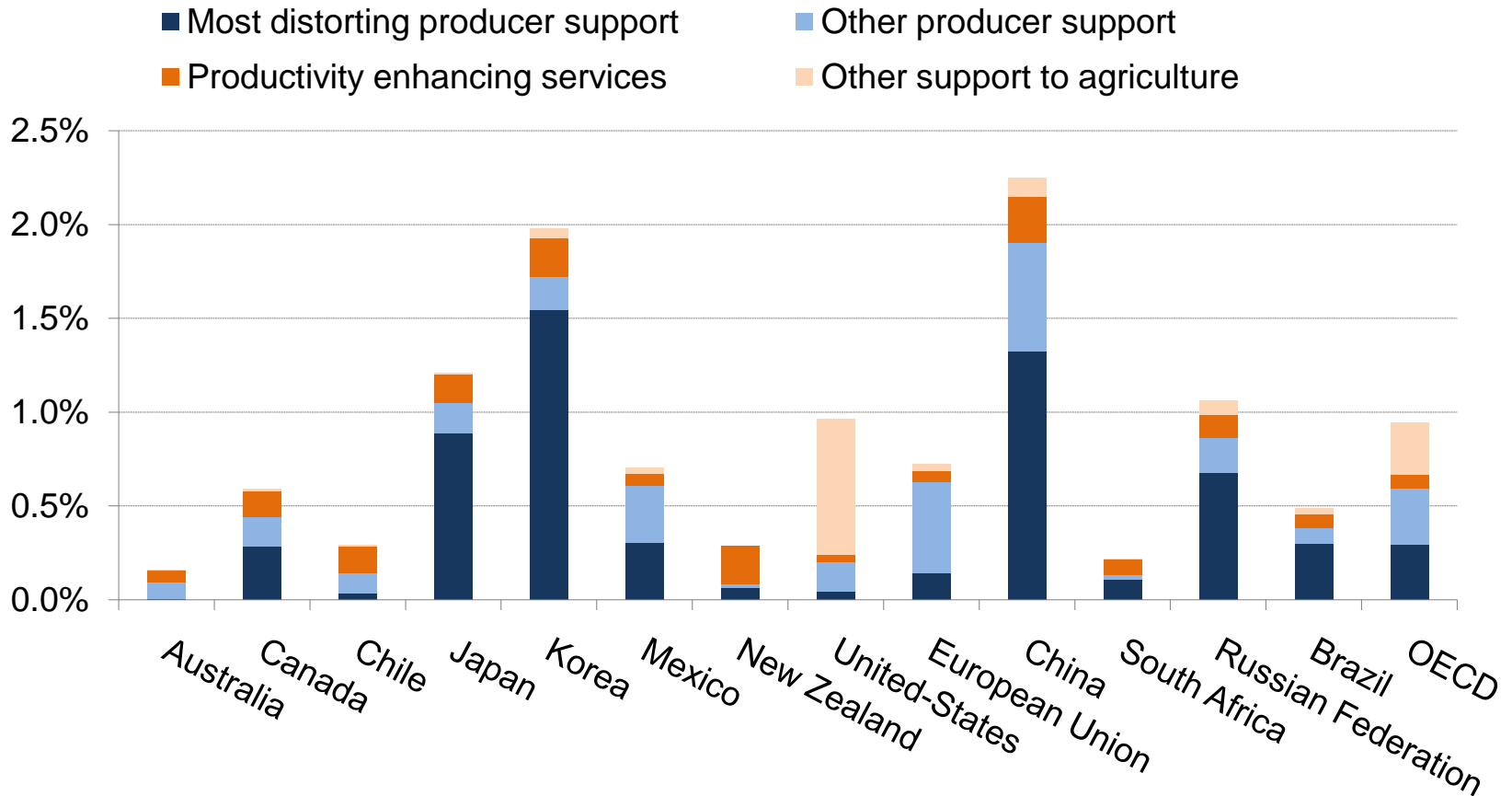
Agricultural policies need to allow farmers respond to market demand

- Facilitate access to information, reduce bureaucracy
- Remove obstacles to structural change (e.g. land sale and lease)
- Provide an effective framework for risk management
- Use a range of instruments adapted to specific situations to improve the long run sustainability of agriculture
- Allow farmers to exercise choice of input mix, production systems and output (**remove distorting support**)
- Move away from market and income support to invest in innovation, e.g. R&D, education, extension, rural and marketing infrastructure (roads, ICT)



Composition of support to agriculture

TSE as a % of GDP





Government role in innovation

- Funder and performer of R&D, technology transfer and farm advisory systems
- Governance of Agricultural Innovation Systems (AIS): strategy, evaluation
- Knowledge markets: IPR
- Knowledge infrastructure:
 - General knowledge: ICT, biotech, nanotechnologies
 - gene banks, biodiversity, databases, models, labs, centres of technology convergence



Foster national AIS

- Define clear strategic priorities to guide public and private investment;
- Develop and facilitate access to information systems: databases, modelling tools, gene banks, etc.
- Make agricultural education more relevant
- Foster competition in extension services and focus public efforts on public goods aspects, smaller farmers
- Focus public funds on basic research and public good issues and increase private sector involvement
- Improve regulations to facilitate innovation (such as IPR, standards, SPS)



Reinforce linkages within AIS

- Provide platforms for partnerships
- Facilitate the development of partnerships between public and private research, including with food companies
- Use a combination of institutional and project funding
- Introduce some competition and output-driven projects



Strengthen cross-country co-operation

- Global challenges (food security, climate change, price volatility, water scarcity) require international co-operation
- Research requiring high cost infrastructure
- Increase participation in and support to international efforts such as CGIAR, GFAR, Global Research Alliance on GHG, etc.
- Regional co-operation also important, in particular for cross-boundary issues such as pests and diseases, and technologies adapted to a region.
- Facilitate exchange of and access to information and knowledge (banks of research results, gene, data etc.)



Improve policy coherence and governance

- Align incentives for the agricultural sector and the innovation system to policy priorities
- Pay more attention to framework conditions, such as trade and market, infrastructure, regulations, services, investment policy, etc.
- Improve the governance of AIS
 - need for better information on innovation efforts and outcomes (research results), and impact, and on agricultural performance
 - develop longer term perspective on policy priorities and forward looking analytical tools to guide decisions
 - Develop evaluation methods



Recent and on-going work at OECD

- Interagency report to the Mexican G20 Presidency: “Sustainable productivity growth and bridging the gap for small-family farms”. June 2012
<http://www.oecd.org/tad/agricultural-policies/50544691.pdf>
- Agricultural innovation systems: Framework for analysing the role of the government
- Review policy impacts on innovation and productivity growth: Pilot phase with Australia, Brazil and Canada
- Comparison across countries to benchmark performance



For more information

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