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Public-Private Partnerships for Agricultural Innovation

LESSONS FROM RECENT EXPERIENCES

Catherine Moreddu

OECD

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Abstract

PUBLIC-PRIVATE PARTNERSHIPS FOR AGRICULTURAL INNOVATION: LESSONS FROM RECENT EXPERIENCES

Catherine Moreddu, OECD

Public-Private Partnerships (PPPs) are increasingly used in agricultural innovation to leverage public funds, enhance efficiency, and improve the adaptation of innovation to demand so as to foster wider and faster diffusion. For governments, PPPs for innovation are but one policy option, whose costs and benefits need to be compared with those of other options. Governments have put in place a policy and regulatory environment to facilitate the development of PPPs for innovation, including financing mechanisms and Intellectual Property (IP) protection. Most programmes are not specific to the food and agriculture system, but apply to the economy-wide innovation system. The main *a priori* conditions for forming a successful partnership between public and private participants are existence of common objectives, sharing of mutual benefits, and complementarity of human and financial resources. Institutional arrangements need to be clear, but the degree of formality can vary. Elements of good governance include setting clear objectives and rules, and implementing regular monitoring and evaluation that use well-established, open and competitive processes to select PPPs for public participation. Transparency is desirable at all stages of implementation. Improving partners' capacity to design, manage and participate in PPPs is an important factor of success, and is particularly relevant for agricultural innovation.

JEL classification: 031, 038, Q16

Keywords: Public-Private Partnerships, agricultural innovation, research funding, governance

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Executive summary

Cooperation between various public and private actors in the agricultural innovation system is essential to increase the efficiency with which public funds are used, and improve the adaptation of innovation to demand leading to wider diffusion. Public-Private Partnerships (PPPs) are an interesting option to facilitate cooperation, but governance and implementation issues need to be carefully considered to ensure success.

PPPs have been widely used for infrastructure development and are increasingly used to create and diffuse innovation. Bringing together diverse actors is particularly useful to address specific issues requiring a value-chain approach, and complex issues of national or global importance, requiring different fields of expertise, as is increasingly the case in food and agriculture, and in particular in the bioeconomy area. In the agricultural innovation area, PPPs are very diverse in terms of scale and objectives. Although issues do not fundamentally differ from those in the general innovation system, a challenge is to cover the diversity of farming and agro-food systems, and include farmers and small agro-food companies as major stakeholders.

For governments, PPPs for innovation are not a panacea but a policy option, whose costs and benefits need to be compared with those of other options. They respond to failures in the efficient delivery of appropriate innovation by public or private suppliers alone. In addition to increasing returns from public funds through cost and risk sharing, PPPs for innovation help secure contributions that are more adapted to both public and private needs. Longer-term benefits include their contribution to fostering links and understandings between public and private researchers, but also between the research and business-farm community, which facilitate future cooperation and networks; and to improving inter-ministerial or federal-provincial coordination on innovation issues, and thus policy coherence. Increasingly, PPPs for innovation are also considered as a strategic tool to help foster structural change, productivity growth and competitiveness.

In view of these benefits, some governments have put in place a policy and regulatory environment, including financing mechanisms and Intellectual Property (IP) protection, to facilitate the development of PPPs for innovation. Most programmes apply to the whole innovation system, and are not restricted to the food and agriculture system. They include mechanisms like the Top Sector Policy in the Netherlands, the Cooperative Research Centres in Australia, the Strategic Centres for Science, Technology and Innovation (SHOK) in Finland, the Carnot Institutes in France or the Cooperative Research and Development Agreements (CRADA) in the United States. Other programmes and mechanisms, such as Agri-Science Cluster support in the Canadian AgriInnovation programme of Growing Forward 2, are specifically designed for the food and agricultural sector. In most countries, these programmes and mechanisms can be used flexibly to develop and fund partnerships, when there is common interest. In the Netherlands, however, most public research is funded through PPPs.

The main *a priori* conditions for forming a rational partnership are common objectives, mutual benefits, and complementarity of human and financial resources. For every actor, the balance of costs and benefits should guide the participation decision. Practical recommendations to ensure successful PPPs, once these conditions are met, cover all stages of design and implementation, with a focus on governance and incentives. The OECD has developed good practices for the general innovation system, which are broadly relevant to PPPs for agricultural innovation.

Good governance and public leadership are essential to ensure success. These include setting clear objectives and rules, implementing regular monitoring and evaluation. Evaluation procedures in particular need to be well-established and include impact analysis. Transparency, consultation with stakeholders and the establishment of dispute settlement and exit strategies are also important. Institutional arrangements need to be clear, including the sharing of costs and benefits, but the degree of formality can vary. In particular, the terms governing the sharing of benefits from Intellectual Property Rights (IPRs) between partners needs to be clearly established *ex ante*.

Once government has determined its priority areas, PPPs should be selected using a transparent, open and competitive process. While value for money is the main criteria for selecting PPPs for the provision of public services, PPPs for innovation should be chosen according to the importance of common aims, mutual benefits and complementarity.

Transparency is desirable at all stages of implementation. Improving partners' capacity is an important factor of success for PPPs, and is particularly relevant for agricultural innovation. Providing specific education, training and advice to improve skills for PPPs management would help in this regard.

1. Context and purpose

The societal challenges of the coming decades are considerable and neither the government nor the private sector will be able to solve these alone. This is in particular the case in research and innovation, which increasingly requires cooperative and network-based approaches.

The food and agricultural sector faces the global challenge of providing enough food, feed, fuel and fibre to meet growing and changing demand. The agricultural innovation system needs to develop and diffuse innovations able to enhance productivity and sustainability along the supply chain, while helping the sector cope with climate change issues. Cooperation between various public and private actors within and across national agricultural innovation systems is essential to improve the tailoring of innovation to demand, and thus ensure wider diffusion and impact. It can also increase the efficiency with which public funds are used.

Public-Private Partnerships (PPPs) are an interesting option to facilitate cooperation between innovation actors at national and international levels (OECD, 2010a, 2010b, 2013). Stakeholders differ depending on the domain of innovation: primary production technology, processing, distribution and marketing of agricultural products, or rural development. In some cases, PPPs are better adapted than policy instruments such as subsidies and tax credits (OECD, 2014). For both the public and private sectors, the benefits from PPPs come from the pooling of resources and the complementarity of capacities, but governance and implementation issues need to be carefully considered to ensure success.

This report aims to identify good practices in facilitating and implementing PPPs for agricultural innovation, based on experiences in countries and international organisations. It first reminds the rationale for engaging in PPPs and discusses challenges and opportunities for PPPs conceptually and as applied to agricultural innovation. It then outlines government actions to facilitate PPP approaches, whether sector-specific or not. It also identifies conditions for successful implementation, and concludes with considerations for policy makers adapted to the specificities of PPPs for agricultural innovation.

This report draws on the findings of OECD and other recent studies on the implementation of PPPs in different areas, as well as on evidence presented and discussed at a 2014 meeting of the food chain analysis network (FCAN) dedicated to PPPs for agricultural innovation, which aimed to identify the specificity of PPPs in agriculture and discuss specific governance and implementation issues drawing on concrete examples.[1]

PPPs have been widely used for infrastructure development and have now become an increasingly popular method for delivering various public services in OECD countries and emerging and developing economies. As a result, experience from a wide range of PPPs has accumulated and lessons have been drawn from case studies, and countries' experience. Drawing on in-depth examination of selected member countries' experience, the OECD, in particular, has developed principles for public governance of PPPs (OECD, 2012), identified good practices in the design and management of PPPs in the Science, Technology and Innovation (STI) area (OECD, 2004), and reviewed recent trends in OECD countries, including the development of strategic PPPs in the STI area (OECD, 2014). Looking at various types of PPPs, other international organisations have also provided recommendations for the selection or the design of PPPs (e.g. World, Bank, UNECE, IFPRI). Annex A1 briefly describes the purpose and content of selected studies reviewed to prepare this report.

There are many forms of PPPs, depending on the type and number of partners, and the purpose, scope and time-length of the project. The literature offers various definitions of PPPs and includes diverse classification systems, some specific to agricultural innovation (Annex A2). They are broadly defined as arrangements between public and private partners with a common purpose and the sharing of

1. Material presented at the meeting, including agenda, list of participants and summary record, is posted on the Food Chain Analysis Network website: www.oecd.org/site/agrfcn/6th-oecd-food-chain-analysis-network-meeting-october-2014.htm.

risks. Box 1.1 provides the definition of PPPs for innovation used in the OECD and discusses its relevance for PPPs for agricultural innovation.

Box 1.1. Public-Private Partnerships for agricultural innovation: Definition and main features

In OECD work on science, technology and innovation (STI), **PPPs for innovation** are defined as "*any formal relationship or arrangement over fixed-term/indefinite period of time, between public and private actors, where both sides interact in the decision-making process, and co-invest scarce resources such as money, personnel, facility, and information in order to achieve specific objectives in the area of science, technology, and innovation*" (OECD, 2004). To distinguish PPPs from pure contract research or purchase of services and equipment, additional characteristics are that these collaborative research or innovation efforts are carried out jointly, co-financed by public and private partners, and may or may not be institutionalised in a designated entity.

There is a large variation among PPPs for innovation, ranging from a bilateral or multi-lateral contractual relationship with multiple members and stakeholders that may overlap with structured institutional research partnerships (i.e. research centres). Organisationally, they may range from small-scale ad hoc (temporary) projects (usually university-industry partnerships or even at an individual level (e.g. academic consulting) to large-scale, high risk, high cost projects. PPPs in the STI area are increasingly used for strategic, long-term, large-scale, high-risk and multidisciplinary projects that involve diverse stakeholders (OECD, 2014).

The OECD definition of PPPs for innovation suits the purpose of studying **PPPs for agricultural innovation**. But a sector-specific issue, which is not specific to PPPs, is to define the boundaries of agricultural innovation, given the linkages with other fields of research such as social sciences, Information and Communication Technology (ICT), biotechnology, nanotechnology, ecology, water management, climatology or health.

Compared to PPPs for innovation in other sectors, PPPs for agricultural innovation can include a wide range of actors: government agencies, education institutions, upstream and downstream industries, non-governmental organisations (NGOs), consultants and farmers' organisations, which bring different skills, but also have very different capacity. Participation of farmers is growing, but presents specific challenges (Alston and Gray, 2013). PPPs for agricultural innovation are generally used for pre-competitive research, for the provision of public goods and services, and to facilitate the adoption of innovation.

A number of typologies have been proposed, based on purpose, but also degree of formality, institutional arrangements or type of actors, but the extent to which they help analysing the functioning of PPPs and drawing lessons on conditions for success is not always clear. For example, the typology of agricultural innovation PPPs proposed in Hartwich et al. (2005) is based on three criteria: the nature of the research (basic, strategic or adaptative), the part of the food chain (inputs, primary production, post-harvest) and the degree of participation of the private sector.

More examples of definitions and typologies are provided in Annex A2.

2. Opportunities and challenges for Public-Private Partnerships

An approach for mutual benefits

When markets for the delivery of innovation fail, generally at the early stage of research, for the provision of social and environmental services or at the stage of adoption, governments may consider different policy alternatives, such as public investment, policy instruments such as subsidies or tax incentives, and a PPP approach. The decision for the government to adopt a PPP approach to pursue a given objective should be guided by the balance of costs and benefits, compared with other alternatives, as participation in PPPs should be for all innovation actors.

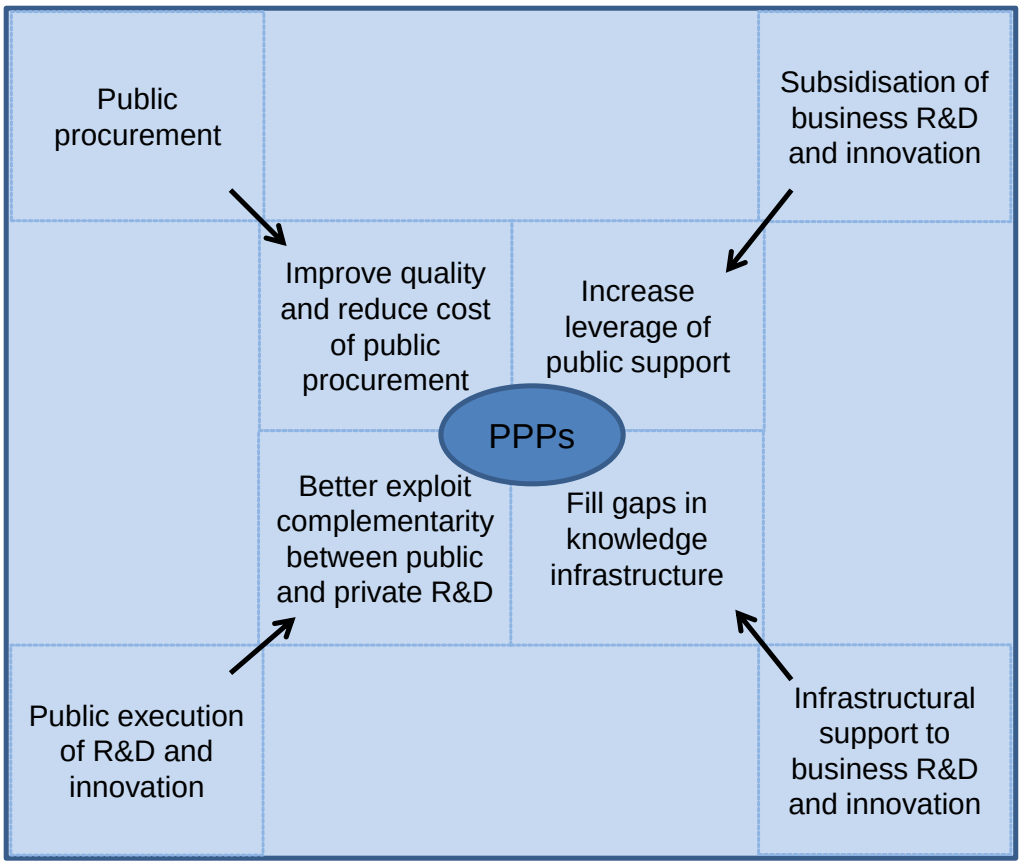
The fundamental rationale for public and private actors to join forces in a PPP arises when individual actors alone cannot produce the same service or output, or do it at a higher cost.

For both the public and private sectors, the benefits from PPPs come from the pooling of resources and the complementarity of capacities, while risks and costs are reduced because they are shared. Compared to subsidies, PPPs help avoid impeding further development, and allow for the development of integrated solutions. Two cost-related issues need, however, to be considered with respect to PPPs: transaction costs and risk of failure.

As depicted in Figure 2.1, the rationale for the government to engage in PPPs for innovation is to increase economic and social benefits from investments in public research by:

- "improving the leverage of public support to business Research and Development (R&D) through cost and risk sharing
- securing higher-quality contributions by the private sector to government mission-oriented R&D and opening new avenues for commercial spillovers from public research
- fostering the commercialisation of results from public research
- upgrading knowledge infrastructures" (OECD, 2004, 2014).

Figure 2.1. Expected benefits from a Public-Private Partnerships approach to innovation policy



Source: OECD (2004) http://dx.doi.org/10.1787/sti_outlook-2004-5-en.

Public research, most often of a basic and fundamental nature, is interested in partnering with the private companies closer to technological development, which will develop the technologies for the industry. For business, partnering with public research can offer solutions to problems, develop new markets or generate value through cooperation and co-production (OECD, 2014).

Improving the transfer of knowledge from public research institutions is often a main motivation for the public sector to engage in PPPs in agricultural innovation systems. Leveraging scarce public research funding is another driver. As private investment typically concentrates in areas where the private returns on investment are high, PPPs can be used to re-orient innovation efforts towards areas with public good aspects, long time horizons and more risks.

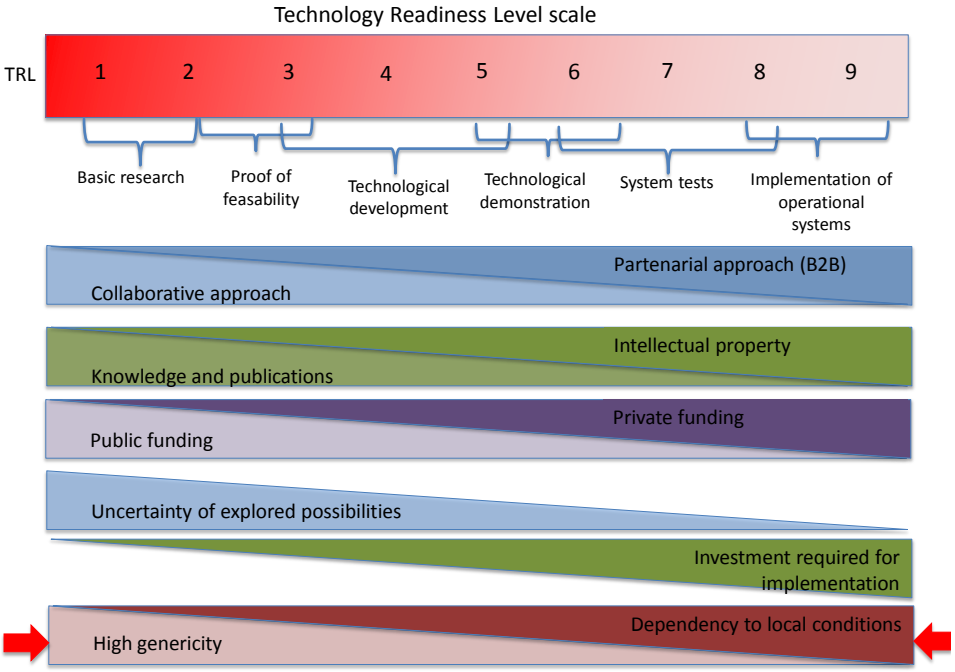
Innovation actors are increasingly using PPPs to enhance vertical coordination in the value chain. The emphasis in this case is less on the joint creation of new knowledge, than on the efficient dissemination of existing knowledge to firms which can utilise such knowledge for integrating global

value chains and competing on world markets. In the agri-food sector, non-public partners range from input suppliers and farmers to processors, retailers, NGOs and consumers' representative. The inclusion of a wide representation in partnerships is expected to facilitate adoption and consumers' acceptance of innovation.

The division of labour between the public and the private sectors vary along the Technology Readiness Level (TRL) scale starting from basic research and ending with implementation of operational systems (Figure 2.2). It depends on the technology readiness, uncertainty, and whether research is generic or dependent on local conditions. Public funding focuses on early stages and research with high genericity and uncertainties. At these stages, knowledge and publications are the main output. The share of private funding and the theoretical scope for partnerships increase along the TRL scale.

There are also cases when joining forces is the only alternative. As innovation processes become more complex and social needs evolve, PPPs respond to the partial failure of other policy instruments to achieve objectives. In some areas, PPPs are the only way to obtain social benefits, for example to pursue global challenges that require concerted action and new strategies, such as climate change, biodiversity, ageing farmers, food security, to build very expensive physical and knowledge infrastructure, or to deal with complex problems and strategic challenges such as green growth, requiring multiple skills and sometimes multidisciplinary approaches.

Figure 2.2. Technology Readiness Level and public-private roles



TRL: Technology Readiness Level.

Source: Huyghe (2014), www.oecd.org/site/agrfcn/meetings/6th-oecd-food-chain-analysis-network-meeting-october-2014.htm.

In addition to policy and market failures, the rationale for PPPs in the area of innovation also include coordination failures, although other policy instruments could be used to address them (e.g. tax credits for collaboration in R&D). The general rationale for public intervention in innovation such as skills development, network development, or the ability to join in global innovation networks are also

cited as reasons for PPPs in this area (OECD, 2014). PPPs help build new innovation capabilities, improve connectivity between national innovation systems and provide compatible incentives to all stakeholders.

Fostering links and understandings between public and private researchers, but also between the research and business/farm community, can be particularly useful in: 1) lowering transaction costs between players, facilitating thus future cooperation; and 2) improving knowledge transfer, where a smaller organisation or country lacks capacity to fund the critical mass necessary to enable spill-in of knowledge.

Longer-term relationships also help improve inter-ministerial or federal/sub-national coordination on innovation issues, and thus policy coherence. Increasingly, PPPs are also considered as a strategic tool to help foster structural change and competitiveness.

Current approaches to industrial policy consider PPPs in innovation as a tool to help countries foster structural change. A number of OECD countries are mobilising strategic PPPs to restore or create industrial competitiveness through investment in innovative and industrial projects (OECD, 2014). PPPs for innovation are also considered as a means of orienting public investments into strategic PPPs, and strengthening innovation systems.

Evidence from case studies

Drawing on the lessons from four country case studies – Australia, Austria, France and the Netherlands – OECD (2004) finds PPPs to be a useful tool to promote research cooperation and to build innovative networks in new multidisciplinary research fields. In addition, the study identifies broader benefits of PPPs for innovation, listed in Box 2.1.

Considering PPPs for agricultural innovation in Latin America, Hartwich (2005 and 2007) identify expected private and social benefits from agricultural innovation and from a PPP approach to innovation (Table 2.1). Some of them are general, while others are more specific to the developing country context.

Box 2.1. Broad benefits from Public-Private Partnerships for innovation

- **Input and output additionality.** Cost sharing arrangements and industry leadership within PPPs translate into high leverage of public support on business R&D and innovation.
- **Behavioural additionality.** PPPs have a long lasting impact on the behaviour of public and private researchers, contributing to building trust and personal networks which facilitate further formal and informal cooperation.
- **Improved R&D procurement.** PPPs can be a more effective way than R&D contracts to mobilise private financial resources and competencies in pursuing government missions (*e.g.* in areas such as health and environment) when the contribution of public research organisations are key to success.
- **New avenues for commercial spill-over from public research.** PPPs provide participating firms with easier access to public research outputs, and facilitate the creation of new technology-based firms, especially spin-offs from public research, as well as the mobility of human resources between the public and private sectors.
- **Linking Small and Medium Enterprises (SME) with scientific research.** PPPs can play the role of effective bridging institutions to establish contacts between SMEs and universities or research agencies.
- **Improved inter-ministerial coordination on innovation issues.** PPPs can provide opportunities and incentives for improved inter-ministerial coordination but their design and operation may suffer from inter-ministerial competition.
- **Increased synergies between regional innovation systems.** National PPP programmes can enhance the cooperation between different local innovative clusters in order to ensure critical mass and better exploit complementarities.

Source: OECD (2014) http://dx.doi.org/10.1787/sti_outlook-2014-8-en.

The FAO review of PPP projects for sustainable agricultural development in 15 countries identifies the respective roles of public and private actors and the main benefits they derived from partnerships (Rankin, 2014; FAO, 2015). Overall, more than half of PPPs were for value-chain development and close to a quarter for innovation and technology transfer. Public partners were primarily responsible for defining the public benefits to be achieved through the adoption of PPP projects and identifying priorities in line with national socio-economic development plans. They also created the enabling environment for agri-PPPs through the provision of supporting rural infrastructure, financial incentives for firms to participate and regulations to protect important aspects such as land rights and intellectual property. Private partners generally led the implementation of projects on the ground by securing financing and markets for value-added agriculture and innovation products. The role of the NGOs revolved around ensuring inclusion of smallholders and SMEs, organising producers into groups to reduce transactions costs, and providing technical support. Producers acted as both beneficiaries of PPP projects (i.e. adopters of innovations) as well as private partners through their role as suppliers of raw materials.

Benefits from partnering for the public sector included the potential to leverage investment, access new technology and improve management skills (soft skills). For the private sector, firms were able to enter into new markets with lower risk, access local genetic material and trial new technology with greater protection of intellectual property rights.

Table 2.1. Expected benefits of Public-Private Partnerships

Social benefits from innovations	Social benefits from partnering
Increased agricultural production and productivity for small farmers Sufficient food supply for the poor Poverty levels reduced in portions of the society Import substitution and export opportunities State income from royalties	Joint learning Improved relevance through contact with real problems Maintaining research infrastructure and capacity Complementary (private) funding Reduced time lags in the adoption of technology
Private benefits from innovations	**Private benefits from partnering**
Increased farm production and productivity Cost reduction Increased income from sales and profits for various actors Development of new products Employment opportunities	Joint learning Complementary (public) funding Access to knowledge and technology Publicity

Source: Hartwich et al. (2005) www.ifpri.org/sites/default/files/publications/isnardp01.pdf.

Governance and implementation challenges

The potential benefits of PPPs for innovation in food and agriculture explain why they are increasingly used at local, national and global levels. They pose, however, specific challenges in terms of policy choice, governance and implementation.

The main challenge with PPPs is to identify when they are a better policy approach for the government, and clearly define the respective roles of the public and private sectors to avoid distorting markets. Conversely, the government needs to identify when they are not possible or desirable.

There are also other types of limitations: For example, when considering PPPs for research and innovation, the difficulties related to pursuing common interests through networks including private firms has been noted in the literature (Goulet, 2013). Meeting different interests (farmers want solutions to increase their income, researchers new topics for work, and private companies a technology generating sales) may lead to the exclusion of more performant options, in particular from an environmental point of view.

According to the World Bank (2012), while collaboration is expected to help attain efficiency gains, mobilise resources and investments, develop innovative solutions and reduce risk, PPPs present a number of challenges for policy-makers:

- They blur the boundary between public and private roles, and run the risk of distorting markets if the respective roles of public and private partners are not clarified and public funding subsidises private benefits.
- They require appropriate public institutions and legislative arrangements, and do not compensate for lack of government capacity.
- To ensure sustainability, the interest of private partners to generate revenue should be factored in.
- They may undermine the capacity of public research to pursue basic research needed for long-term public interest.

While partnership diversity in terms of economic size, regional scale, objectives, field of expertise and culture can be enlightening, it also creates additional coordination challenges. Strong governance mechanisms are needed to ensure transaction costs and risks of failure are kept at minimum.

Evidence from case studies

The transaction costs of entering into partnerships involve the costs of negotiating the partnership; funding, governance, and legal aspects of the partnerships; and the redistribution of benefits. Costs also arise from communication during the partnership, meetings to report on progress and discuss additional actions, monitoring of activities, evaluation of intermediate results, and administration of the partnerships (Hartwich et al., 2005).

Implementation challenges also come from differences in objectives, skills and culture between partners, and from lack of clarity on objectives, resources, and the sharing of costs, risks and benefits (see, for example, Box 2.2). For longer-term objectives such as sustainability in particular, it is important for the government to understand the motivation of other partners to provide balanced and critical guidance needed to maintain the cap, and to make sure vested interests do not redirect public funds for their own benefit at the expense of other partners in the group. Institutional arrangements (and external audits) can help guard against capture by special interests.

Box 2.2. Generic problems observed in agricultural innovation Public-Private Partnerships for development

- Bureaucratic procedure on the part of the public sector
- Different working styles and reward structures
- Lack of business culture in the public sector and limited experience of working in commercial settings.
- No tradition or experience of working with the private sector or even in partnership more generally
- Lack of trust
- Complex Intellectual Property Right (IPR) issues, especially where multiple public and private partners are involved operating in a number of countries
- Weak negotiating and IPR skills in the public sector.
- Private sector concerns that unpredictable policy changes may affect partnership agreements
- Fragmentation of public scientific resources across different ministries and weak communication channels even within the public sector.
- PPP that involve Northern partner collaborating with public research partners in the South often do not lead to useful outcomes because of a failure to partner with the local private sector

Source: Hall (2006) http://arno.unimaas.nl/show.cgi?fid=4482.

3. Governance and implementation of Public-Private Partnerships for innovation

In addition to enabling PPPs, governments have an important role in the governance of PPPs to ensure that public funds are well used and that the PPP approach is the best option to meet government objectives. Governance covers a range of areas from the selection of projects and participants, the organisation and management of PPPs, and the evaluation of outcomes.

In addition to general governance principles, specific implementation issues are important to ensure successful PPPs. They include the formality of the arrangement, practices on the sharing of risk and costs, management of Intellectual property rights, exit and adjustment strategies, and participation of small enterprises and farmers. An important issue for innovation partnerships in agriculture, for example, is to improve the capacity of small enterprises and farmers to participate in PPPs.

This section reviews existing guidelines and summarises findings from the literature on conditions and good practices to ensure successful PPPs. It discusses the extent to which they apply to innovation in the food and agricultural sector or need to be adapted.

Good practices in the design and management of Public-Private Partnerships for innovation

The OECD principles for public governance of PPPs (OECD, 2012) consider value for money as a basic principle for adopting a PPP approach to fund public services. The first set of recommendations concerns the institutional framework, which should include clear and predictable mandates, resources and regulations, as well as active consultation with all stakeholders. The second set concerns the rationale (value for money) and procedures (competition) for selecting PPPs, while the third set is to ensure transparent budget procedures (Box A4.1).

These principles are equally relevant for PPPs for innovation, but require some adaptation to reflect the specificities of innovation activities. In particular, the purpose of PPPs for innovation may be broader than value for money: finding innovative solutions to complex problems may require the pooling of different public and private skills. Besides, the benefits of innovation can take a long time to materialise. Moreover, innovation partnerships have a broader range of stakeholders, and the distinction between private and public status and activities can be blurred: private research institutes and universities can perform research with public good aspects. Another difference is that many of the public assets in innovation are intellectual assets such as Intellectual Property, databases, human capital, software with particular characteristics. PPPs for innovation thus require different financing and governance rules for sharing and developing these intellectual assets. Finally there is increasingly an international dimension to PPP for innovation. These differences create a higher level of complexity in their management (OECD, 2013).

While identifying good practices, OECD (2004) suggests the following as critical factors for success in the implementation of PPPs for innovation:

- **Long-term commitment** from both government and industry, based on a shared vision.
- **Achieving critical mass of resources** and embedding in the National Innovation System, at national, regional and local levels.
- **Building on existing networks** but without neglecting areas where potential actors are still dispersed (e.g. multidisciplinary research) and/or inexperienced in accessing government support.
- **Implementing efficient steering mechanisms** that ensure sustainable balance between public and private interests.

In reviewing national experience in five OECD countries (Annex A1), the choice of an appropriate topic for collaboration was found a major challenge in designing and managing PPPs. Four steering mechanisms that are key to cope with this challenge were identified: 1) competitive selection of projects and participants; 2) optimal financing; 3) efficient organisation and management; and 4) rigorous evaluation. Good practices were developed in each area (Box 3.1).

Box 3.1. OECD Good practices for the selection of Public-Private Partnerships for innovation

1. Selection of projects and participants

- ***A stringent competitive process*** where proposals have to compete based on the quality of their scientific content, their industrial relevance and the soundness of their business plan. There are two options:
  - A pure bottom-up approach for the choice of technological areas. One drawback is that if one can ensure that each selected centre addresses a well-identified market failure in an important research field, from both a private and public perspective, nothing guarantees that, collectively, they cover all the areas with the highest strategic importance for the country.
  - A mixed approach where top-down criteria are used to pre-determine some of the areas where PPPs are promoted. Selecting close-to-market research areas entails the risk of capture by private interest or of failures in "picking the winners." Engaging industry in public good types of cooperative research (e.g. in areas such as health, environment, security) requires efforts to make tangible private benefits possible, for example through spin-offs or other forms of commercialisation of research results.
  - Each approach has both advantages and drawbacks, much depends on specific national conditions.
- ***International openness*****.** Not only PPPs should be opened up to foreign firms, but also to foreign universities and public labs when these hold critical complementary competencies.
- ***Participation of small firms*****.** SMEs are key actors in some research areas (e.g. biotech, multimedia, etc.). In others their participation should be facilitated but not at the expense of the overall efficiency of PPPs (e.g. consortium of SMEs, separate diffusion centres), taking into account the heterogeneity of the SME population and the associated variety of policy approaches to their support.
- ***Prior agreement on intellectual property rights*** **(IPRs).** Government should not impose more than broad principles. Detailed contractual provisions should be left to partners. But the existence of a clear agreement among would-be partners should be made a necessary condition for government support.

2. Optimal financing

In theory, an optimally designed financing mechanism should help: 1) ensure efficient selection of private partners; 2) secure the desired amount and quality of R&D at least cost to the government; and 3) avoid opportunistic behaviour by either the government or the private partners, especially the risk of partnerships attracting second-rate projects and less qualified research teams or a drift in the research agenda towards either pure basic research or off-shore corporate research. The following good practices have been identified:

- ***Leverage.*** The cost-sharing arrangements should ensure high reciprocal leverage. This is the key in ensuring sustained commitment from both public and private partners.
- ***Long-term commitment.*** Support from government should be guaranteed for a sufficient long period (e.g. at least 4-5 years, up to 7 years)
- ***A ceiling to government subsidy.*** Its share should not exceed 50%, and that of industry should be set at a minimum (e.g. at least 20%). The contribution of public research organisations is often mainly in-kind; increased cash contribution could improve the overall governance of PPPs.
- ***Flexibility.*** The arrangements might be different from the start according to the technological field, and evolve over time as PPPs mature. Some flexibility in financing arrangements so as to find a better match between them and the specific mission of different types of PPPs is required as follows:
  - When a PPP aims at mobilising the competencies of the private sector to improve government mission-oriented R&D, it will have to be supported permanently.
  - The same may apply to PPPs for pre-competitive research, but with a lower rate of support.

- When a PPP aims primarily at improving the leverage of public support to business R&D, the rate of subsidisation should be even lower, with a sunset clause.
- For PPPs whose main objective is to open new avenues for commercial spillovers from public research, different financial arrangements might be applied to different stages (e.g. launching stage, mature stage, commercialisation stage), with an effort to involve venture capital as soon as possible.

3. Efficient organisation and management

In the five countries examined (Austria, Australia, France, the Netherlands and Spain), the government imposes only minimum requirements for the organisation of PPPs. While some take the form of central institutes, others are virtual networks, with a lean organisation at the core and research being done at the participating research institutes. Participants in PPPs that build on pre-existing networks usually choose to organise as virtual institutes. Each organisational model has advantages and disadvantages and the following good practices have been identified:

- ***Customization*.** Different organisational arrangements (*e.g.* network versus cooperative research institute, or mixed form) may be warranted, depending on technological areas and preferences of partners.
- ***Autonomy and strong industry involvement*.** A large degree of autonomy should be left to partners in defining the detailed research projects portfolio of individual PPPs. Industry should generally be given the majority votes in governing boards.
- ***Legitimacy and leadership*.** PPPs should include all leading enterprises and public research centres in the relevant technological fields, and their managers should be well-known/respected figures that have a broad experience and good links with both academia and industry.
- ***Efficient knowledge management*** is vitally important to minimise the risk of opportunistic behaviour and to motivate partners.
- ***Involvement of end-users*.** It is important that the organisational features of a PPP maximise interaction not only among the researchers directly involved in a project but also between them and the end users of research results in participating firms.
- ***Visibility*.** The institutional form of PPPs should help them acquire visibility at both nationally and internationally. This helps them position themselves within international networks, and creates continuous "peer pressure" for improvement from "competing" forms of public-private relations.

4. Evaluation

Evaluation of Public-Private Partnership programmes is not a straightforward task, especially because the costs and benefits of partnerships are inherently hard to measure. Benefits may be more indirect than direct, and the existence of multiple stakeholders may give rise to conflicts in terms of the objectives of evaluations. Another difficulty is the often very long timeline of expected impacts. The following good practices have been identified:

- ***Ex-ante, interim and ex-post evaluation*** are all necessary.
- ***Assessing behavioural additionality*** is needed since one of the objectives of PPPs is to promote long-lasting changes in the attitudes of both the public and private research communities.
- ***The involvement of foreign scientific, technological and business experts*** is usually required, given the limited pool of national expertise, possible conflict of interests, and the global nature of markets for end-uses of research outcomes.
- ***The evaluation has to be systemic.*** The portfolio of PPPs, and not only individual PPPs, need to be evaluated. The interaction with other policy instruments ought to be taken into account.
- ***Evaluation should be closely linked to all decision and learning processes.*** Evaluation shall not only inform policy makers about the economic impact of such use of budget resources, but also be inspiring for the managers of PPPs.

Source: OECD (2004) http://dx.doi.org/10.1787/sti_outlook-2004-5-en.

These good practices are particularly relevant for large and ambitious projects in Science and Technology but can be applied flexibly to the wide diversity of PPPs for innovation in food and agriculture. In particular, some requirements such as long-term commitment and international openness may not be essential for PPPs with a limited and applied purpose, as found in agriculture.

The industry is also developing recommendations for PPPs in the food and agricultural innovation area, which concern all relevant actors. Among them, the need to ensure coordination along the food chain stands out as a specificity of the food and agricultural sector (Box 3.2).

Box 3.2. Public-Private Partnerships for agricultural innovation and productivity: Views from the private sector

Recognising that innovation and productivity are central priorities for the food and agriculture sector, partnerships offer a valuable means to harness both public and private resources for mutual gains. But partnerships only work if the right conditions are in place. It must be clear what sort of partnership is actually being referred to, which enabling factors are needed, which parts of the food chain are concerned, and what aspects of the partnership require careful attention in order to enhance effectiveness and mutual trust.

Four main recommendations:

- Be clear on the different definitions of partnerships.
- Build an enabling environment conducive to partnerships.
- Ensure coordination along the entire food chain.
- Promote good practices for partnerships and share lessons learned: Ensure there are mutual benefits; Develop clear contracts; Identify obstacles; and Build an appropriate level of transparency.

Source: BIAC (2014) and Annex A5.

Lessons from PPPs on innovation for agricultural development

Most reviews of experience with governance and implementation of PPPs for innovation in the food and agricultural area concern PPPs in emerging and developing economies. However, most recommendations are also valid in developed economies, although some aspects, such as the need to improve the capacity of all partners and evaluate societal impacts, may involve different approaches adapted to local context.

The World Bank Investment Sourcebook (World Bank, 2012) identifies five guiding principles for PPPs for agricultural innovation:

- clarity of political objective
- sufficient potential mutual benefits
- additionality (additional benefits from public funds because of PPP)
- competition and transparency in the selection of partners
- sharing risks and responsibilities.

The Sourcebook also outlines the importance of selecting the right partners with the right capacities, and identifies steps needed to implement successful PPPs contracts, exit strategies and sustainability, capacity building and monitoring and evaluation (Box 3.3).

Box 3.3. World Bank best strategies for successful Public-Private Partnerships for agricultural innovation

Selecting the right partner with the right capacity: the public sector is to assess prospective partners using minimum criteria related to their financial strength, management capacity and demonstrated ability to deliver the kind of public good required. Farmers are likely to need assistance to be effective partners. Farmer organisations perform better if they have a clear and narrow interest (e.g. grazing associations).

Laying the ground for partnership:

- Define a clear objective.
- Define clearly the criteria that a private partner must meet to participate.
- Specify the contribution expected from each partner (financial and human resources, risk-sharing arrangements, sharing of innovations, access to internal information).
- Provide transparent information on modes of public financing and decision making (amount, procedures and time constraints).

Establishing a contract, with the following minimal requirements:

- Definition of each expected outcome, the corresponding indicators and time-bound targets.
- Specification of respective resource commitments, with a detailed financing and implementation plan.
- Monitoring framework including specific arrangements, and contract supervision by a third party.
- Definition of exit strategies and follow-up arrangements.

Exit strategies and sustainability: The provision of public goods may require long-term public support or can become part of a marketing concept, in which case withdrawal of public support needs to be anticipated. For innovation PPPs, exit strategy is based on transferring and adopting the innovation. It usually includes arrangements for the sharing of technology and information. PPPs that shift public good provision to private partners require institutionalising partnership arrangements, e.g. for collecting user fees.

Capacity building: Farmers participation requires them forming an organisation, and training to skills in various areas, such as management, agricultural production and processing, quality standards, testing technology, and providing environmental services, as required.

Monitoring and evaluation at several levels:

- project or subproject level: a third party is to compare outcomes with objectives, using pre-agreed procedures and indicators;
- programme level: to examine the effectiveness and efficiency of the PPP programme in terms of aggregate achievements and usefulness to targeted users; and to monitor the use of funds;
- policy level: to examine impacts on the economy, or parts of it, and wider social and environmental implications.

Source: World Bank (2012) https://openknowledge.worldbank.org/handle/10986/2247.

In 2004, CGIAR[2] conducted an inventory study of a wide range of partnership projects with private charitable foundations, private research organisations, producer associations, and domestic companies, leading to a number of IFPRI reports (Hartwich et al., 2005 and 2007; Spielman et al., 2007). The study

2. CGIAR is a Global Agricultural Research Partnership. The institutional structure consists in the CGIAR Consortium, an international organisation that, together with the CGIAR Fund, advances international agricultural research for a food secure future by integrating and coordinating the efforts of those who fund research and those who do the research. It integrates research carried out in 15 research centres. www.cgiar.org/who-we-are/

included PPP projects for different purposes: resourcing, contracting, frontier research, or commercialisation.

The reports include a number of recommendations to ensure PPPs generate mutual benefits (Box 3.4). As in many other studies, clarity of objectives is considered as the first condition for success. As in the World Bank Investment Sourcebook, evaluation and capacity building are found important at all levels.

Box 3.4. Ensuring PPPs for agricultural innovation generate mutual benefits

- Improve public planning and priority setting and provide researchers with clear strategic guidance if they enter into specific research areas to be pursued through PPPs.
- Develop an evaluation framework to assess the social benefits of PPPs. This goes beyond protection of intellectual property rights to examine evaluation criteria regarding the socioeconomic and environmental costs and benefits of a potential innovation. Such an evaluation framework should be practical and allow for rapid appraisals under conditions of limited data availability.
- Set up outreach units in research organisations, universities, and governments to help apply planning and evaluation procedures and to support public agents in negotiating partnership arrangements, setting them up, and ensuring their functioning. In fact, public and private sectors alike will need to raise their profile in negotiating, designing, and executing partnerships.
- Revise the funding strategies of public funds to avoid supporting pseudo-partnerships in which only one partner benefits (while the other has a representational role).
- Raise awareness and build capacity among private entrepreneurs and public researchers concerning the benefits of partnerships and what is required to make them successful.
- Further train those who can provide leadership for partnership development — not only research leaders and administrators, but fund managers and representatives of organisations that promote innovations.

Source: Hartwich et al. (2005) www.ifpri.org/sites/default/files/publications/isnardp01.pdf.

In addition to usual considerations for entering partnerships such as common interest, benefits higher than costs for each partner, synergy through collaboration, and benefits proportional to investments of partners, Hartwich et al. (2005 and 2007) mention the absence of conflict of interest (including externalities).

Six elements of success were identified in the reports:

- Building platforms to identify opportunities, assign roles and responsibilities
- Committing resources to both the project activities and coordination efforts
- Designing mechanisms to facilitate knowledge exchanges and resolve conflicts
- Developing benchmarks and decision-points to evaluate progress and choose to continue or terminate
- Creating formal and informal strategies to manage and mitigate project risks
- Conducting explicit analysis of the impact pathways through which projects affect poverty (Spielman et al., 2007).

Hartwich et al. (2007) offer specific and practical options to improve the functioning of PPPs. For example, they suggest the formation of a steering committee to oversee the planning of the partnership may help identify a common interest. Similarly, they find that successful partnerships have a formal legal basis, which can be a contractual agreement, a temporary association or the creation of a new legal

entity. They also outline the importance of the organisational design (operating team, representation committee, managing committee or manager model) to facilitate decision-making.

The importance of business management skills (particularly to deal with IPRs) and the need to learn more on how to manage and mitigate risk in partnerships are emphasised. In the design of the partnerships, understanding poverty impacts should remain central and continue during the evaluation of the goals of collaboration. While there were a wide range of projects covered, the scale of investment in the CGIAR study tended to be modest with the exception of technology projects. These technology projects with commercialisation potential also needed more formal agreements for ownership and marketing of final products.

A recent FAO review of PPP case studies found that in Latin America and Asia, PPP programmes tended to be better designed than those in Africa with pre-defined bidding and vetting processes for private partners supported by feasibility studies and business plans (Rankin, 2014; FAO, 2015). PPPs for innovation and technology transfer projects addressed food security concerns, pest and disease problems, climate change effects, environmental degradation and rural poverty and unemployment. Traditional models tended to be oriented toward seed production and commercialisation. Other models observed involved the commercialisation of small scale technologies for adoption by SMEs.

Success factors included a clearly defined purpose for the partnership driven either by the need to solve a pressing market problem, or to subsidize technology for social benefit until proof of concept had been achieved. Other factors included completing partnership negotiations within a short timeframe to maintain private sector interest, and ensuring well designed contracts that clearly specify financial contributions, management responsibilities, expected outputs and outcomes, explicit ownership arrangements for intellectual property and dispute resolution mechanisms.

Taking an innovation system perspective, Hall (2006) emphasises the need to build trust between partners and understanding of each other's cultures, and advises the involvement of private sector actors as part of public advisory committees and other governance structures as a way of starting to build bridges. He also outlines the importance of the learning process in building PPPs and of adapting to changes.

Main findings on the design and implementation of successful PPPs for agricultural innovation

A number of recommendations concern the **selection** of PPPs, which should be transparent and based on a competitive process, once government has determined its priority areas in consultation with stakeholders. OECD good practices also outline the importance of international openness for public and private partners. While value for money is the main criteria for selecting PPPs for the provision of public services, PPPs for innovation should be chosen according to the importance of mutual benefits and additionality. Different approaches can be used to facilitate participation of small firms, while ensuring costs remain below benefits.

Regarding **governance** issues, most studies mention the need for clear objectives and rules regarding for example the sharing of costs, benefits and risks, the management of IPRs, and the resolution of disputes. IPR arrangements are specific to innovation PPPs, and are crucial, requiring clear contractual agreement between partners on the sharing of benefits. Multiple arrangements are possible depending on partners' strategy and the type of innovation. PPP success depends on the quality of public management, and they do not compensate for government failure in leadership.

Experts also recommend regular **monitoring and evaluation** using pre-agreed procedures and indicators, which encompass all socio-economic and environmental impacts. Transparency, consultation with stakeholders and the establishment of dispute settlement and exit strategies are also shared recommendations. Early involvement of all stakeholders, for example, is mentioned as a factor of success. Some studies also mention the importance of public leadership and steering mechanisms. Institutional arrangements need to be clear, but the degree of formality recommended varies. For the World Bank and the OECD, a contract between partners is crucial, but not a new institutional structure.

In terms of **funding**, commitment is important, as well as flexibility. The importance of long-term financial commitment depends on the purpose: it is considered as important for PPPs for innovation with longer-term undertakings, but not necessarily in all contexts. OECD considerations on optimal financing for innovation PPPs also include recommendations on the respective size of public and private financial contributions, depending on the relative importance of public benefits, and on the need to customise financial arrangement to the stage of the research. Rules should also govern the transfer of risk between participants. They are qualified in terms of "equitable transfer of risk" or 'fair returns for risk takers'. Other experts outline the need to fund specifically coordination efforts.

Transparency is desirable at all stages of **implementation**. Aspects mentioned specifically in the context of innovation are the recommendations to build on existing networks, to customise the arrangements, and to include mechanisms to adapt within the implementation period, although predictability is also important.

Improving partners' **capacity** is an important factor of success for PPPs, in particular for agricultural innovation, but not only. This applies to government and public partners as well as private ones. Soft skills in leadership are also relevant for all actors. In particular, it is important that partners build common understanding, understand challenges and anticipate problems.

4. Enabling Public-Private Partnerships for innovation: Roles of the government and other actors

Policies and regulations affect incentives to innovate in various ways. Stable macroeconomic conditions, trust in institutions, clear regulations, well-functioning markets and trade that ensure access to good quality inputs and financing at reasonable price and offer market opportunities for agricultural products, good infrastructure and rural services facilitate investment in new technologies and new products. Labour and education policy can ensure the timely supply of skills needed to innovate. Agricultural policies affect the adoption of innovation in the food and agricultural sector. A well-functioning agricultural innovation system ensures the creation, development and adoption of technologies and practices meeting the sector's need, at least cost (OECD, 2013).

Within the agricultural innovation system, policy measures that facilitate collaboration more widely will enable participation in PPPs. They include:

- Institutional arrangements such as coordination mechanisms, centres of competitiveness or excellence and networks.
- Regulations in areas such as Intellectual Property Rights (IPR), the legal form of partnerships (new legal entity or contract between partners) and the mandate of public research institutions.
- R&D funding supporting public research infrastructure and projects.

Governments can specifically facilitate the development of PPPs, where appropriate. Direct incentives to PPPs include funding mechanisms – for example public funding conditional on private co-financing. Similarly, other sources of funding, such as producer levies or donations, may include provisions to encourage partnerships. IP protection encourages private investment in innovation, including through PPPs. The handling of IPRs from public research can also provide incentives to partnerships with the private sector. Improving information, knowledge flows and networking also facilitates the development of PPPs, as a means to identify opportunities and partners.

In choosing the instruments for government support in establishing PPPs, it is important to identify the causes of market failures, the phase of innovation, the expertise needed and which parties can implement the innovation. The response will be different whether: the aim is to find a new solution to a new problem; knowledge is available, but the technological feasibility is not known; or innovation is too costly, for example due to the limited scale of diffusion.

Table 4.1 provides examples of PPP programmes in the STI area in selected countries. They are mainly cooperative research centres, which can be used for agriculture-related research. There are also agricultural-specific mechanisms in some countries. This section provides selected examples of how governments have set up strategies, R&D funding mechanisms, innovation support and arrangements to encourage and incentivise PPPs.

Table 4.1. Public-Private Partnership programmes in the STI area in selected countries

Country	Name	Duration	Responsibility	Type
Australia	Cooperative Research Centres (CRCs)	Since 1990	Ministry of Industry	Competence Centre
Austria	Competence Centres for Excellent Technologies (COMET) programme	Since 2006	BMVIT and BMWFW; Research Promotion Agency (FFG)	Competence Centre
Canada	National Centres of Excellence (NCEs)	Since 1989	NSERC, CHIR, SSHRC	Network
Estonia	Competence Centres Estonia	2004-07	Ministry of Industry	Competence Centre
Finland	Strategic Centres for Science, Technology and Innovation (SHOK)	Since 2006	TEKES; Ministry of Employment and the Economy	Competence Centre-Cluster
Norway	Centres for Research-based Innovation Schemes (SFI), Centres of Excellence Schemes (SFF)	2006-14	Research Council of Norway	Competence Centre
Sweden	VINN Excellence Centre	2003-18	NUTEK/STEM/ VINNOVA	Competence Centre
United States	Engineering Research Centres Industry-University Cooperative Research Centre	Since 1985 Since 1979	National Science Foundation	Competence Centre

BMVIT: Austrian Ministry for Transport, Innovation and Technology; BMWFW: Austrian Ministry of Science, Research and Economy; NSERC: National Sciences and Engineering Research Council, CHIR: Canadian Institutes of Health Research; SSHRC: Social Sciences and Humanities Research Council; NUTEK: National Board for Technical and Industrial Development; STEM: Swedish Energy Agency; VINNOVA: Sweden's innovation agency.

Source: Table 1 in Koschatzky et al. (2015) www.isi.fraunhofer.de/isi-wAssets/docs/p/de/arbpap_unternehmen_region/2015/ap_r2_2015.pdf.

The Top Sector policy in the Netherlands

While PPPs for innovation have been frequently used in the Netherlands in the last decades, the R&D strategy introduced in 2011 - the Top Sector policy - places them at the heart of innovation for economic competitiveness (OECD, 2015a). This strategy subjects the granting of public funding to participation in PPPs within top sectors and gives industry a leading role in setting innovation agendas. Public funds have to be matched with an equivalent contribution from the private sector (50-50), which can be in kind (access to facilities) or financial, in which case it can benefit from public support (investment or tax rebates). Box 4.1 presents the main steps in the implementation of top sector policy.

Nine key sectors have been identified with strong market positions. Two Top Sectors are dedicated respectively to the export orientated agri-food sector, and the horticulture and propagation materials sector.

They are capital and knowledge intensive sectors, which accounted for over 80% of business R&D in 2011. The motivation for the Top Sector policy is to concentrate scarce public funds in export-oriented sectors facing increasing competition from emerging economies, where innovation would help maintain international competitiveness (OECD, 2014c).

Box 4.1. Implementation of the Top Sector policy

In the Top Sector policy the business community sets the agenda for R&D investments in its field. The government does not make its own proposals for the sectors, but invites businesses and scientists to draw up action plans, which serve as a base to develop concrete lines of actions. More and better PPPs are expected to increase the innovative power of businesses, thereby generate new products and services to face the grand challenges of the future.

Each top sector has created one or more **Top Consortia (TKI) for knowledge and innovation**, where entrepreneurs and researchers work together in innovative products and concepts. Three strategic goals concerning the knowledge infrastructure were defined:

- Increasing cooperation between knowledge institutes, business and government to strengthen the international strength of the sector concerned.
- Facilitating PPPs for R&D.
- Giving a structural financial base to public private partnerships in the knowledge system.

Every TKI has a board with members from all three parties; government, business and knowledge institutes. Programming is done by calls to tender leading to a number of identifiable projects since 2012. The activities of top sectors are regularly monitored through TKI's reports.

The basis for the implementation of innovation activities is the **Innovation Contract**. Each Top Sector draws up an Innovation Contract, in which researchers, entrepreneurs and the governments (represented in the so-called Top Team) agree on measures (mix of fundamental research, applied research, valorisation), plans to develop innovative products and services, and financial contributions.

Source: www.government.nl/issues/entrepreneurship-and-innovation/investing-in-top-sectors.

One original objective was to leverage business-sector R&D and increase the applicability of public research. While companies participating in top sectors already invested in innovation, public co-funding focussing on pre-competitive research was expected to reinforce their contribution in this area. Early findings suggest companies, including multinational ones, increased investment in pre-competitive research, but that total private expenditures did not increase overall (OECD, 2015a).

The policy was also expected to promote closer cooperation between knowledge institutes, public authorities and business. In the food industry, they improved cooperation between the processing and retail levels, as cooperation already existed among other components of the chain. All top sectors have a human capital agenda meant to strengthen the linkages between education institutes (from vocational training to university) in order to meet the needs of the sector itself.

The PPP approach is also to facilitate the marketing and adoption of innovation, and reduce the technological gap between small and large companies through knowledge transfer, as quality systems become more complex.

Using the example of a long-term PPP aiming to improve the energy efficiency of greenhouses, Box 4.2 outlines implementation arrangements and achievements so far.

Box 4.2. Innovation and Action Programme "Greenhouse as Source of Energy"

The greenhouse sector in the Netherlands is a major user of gas and electricity, with energy representing 20% to 25% of production costs. Improving energy efficiency in greenhouses is therefore very relevant to reduce supply insecurity due to the price volatility of fossil fuels, the need to produce less CO_2 and other environmental issues.

"Greenhouse as Source of Energy" is a PPP launched in 2005, which includes the Dutch Horticultural Growers Association (*LTO Glaskracht Nederland*) and the Dutch Ministry of Economic Affairs. It aims to make new greenhouses climate neutral and near-independent of fossil fuel by 2020, and a source of sustainable energy supply by 2050, by developing solutions that are economical affordable and ensure profitability. The main target is to reduce CO_2 emissions by more than half compared with 1990, and reduce energy use per unit of product by 2% every year. As a result 20% of the energy consumed in Dutch greenhouses will come from sustainable energy sources.

The project governance is headed jointly by the Board of *LTO Glaskracht Nederland* and the ministry. The management team is the chairman of this board and a representative of the Ministry of Economic affairs. The project team consists of members from the producer organisation and the ministry. In addition, the advisory group and the growers group provide feedback on research proposals. Common principles guide the governance through a shared vision and a frontrunners strategy, which consists of a smaller group that can share results from achievements. Research management is demand-driven with equally shared financing between the public and private sector. Control is shared between the growers' organisation and the ministry. It was noted that leadership from the producers organisation was found to be instrumental.

A range of policy instruments facilitates this PPP, including support to R&D transfer and communication, laws and regulations, loan guarantees (for geothermal projects), subsidy on investment, tax reduction for energy saving investments and an exploitation subsidy for renewal energy.

Results of this work as of 2014 have shown that energy efficiency has doubled since 1990, more geothermal energy sites are up and running, and more closed or semi-closed greenhouses are in use among growers. Diffuse glass[1] has a proven effect on CO_2 reduction, Starting new innovations include new greenhouses that are climate neutral, new dehumidifying options, hybrid LED options and photosynthesis sensors.

Combined heat and power systems (CHPs) can produce electricity as well as heat from natural gas. Moreover, CO_2 that is emitted in industry can be used by growers in their greenhouses to stimulate growth. A pipe has already been laid between the Botlek area to greenhouses in the Westland and other areas for this purpose. Furthermore, growers use the CO_2 that is emitted from their own CHPs and heating boilers as much as possible.

1. The aim of using diffuse glass in a greenhouse is to produce more scattered light which can then penetrate deeper into the crop canopy. This will then allow the plant to use more of the available light for production.

Source: Mourits, J. (2014), www.oecd.org/site/agrfcn/6th-oecd-food-chain-analysis-network-meeting-october-2014.htm and www.energiek2020.nu/fileadmin/user_upload/energiek2020/docs/Algemeen/Leaflet_Engels.pdf.

US Department of Agriculture's experience

Since 2006 growth in private expenditure for agricultural R&D has been strong in the United States, particularly in the areas of crop seeds and biotechnologies, reflecting high expected returns on investment (ROI) from an individual company perspective. At the same time, the US public sector is investing in a broader portfolio of research areas including nutrition and climate change where there are socially important knowledge spill overs. These differences can create opportunities for PPPs as each sector can bring complementary skills and knowledge to the partnership.

Changes in economic, political, and legal factors are creating new opportunities to form PPPs. A number of agriculture-specific legal mechanisms and arrangements for innovation partnerships such as grants and consortia are in place in the United States (Box 4.3).

Box 4.3. Public-private research cooperation arrangements in the United States

The Small Business Administration offers two programmes to foster PPPs:

- The Small Business Innovation Research (SBIR) is a programme for small business to engage in Federal R&D – with potential for commercialisation. It accounts for 2.9% of the extramural research budget (FY 2015 ~ USD 2.0 billion in summation) for all agencies with a budget greater than USD 100 million per year, growing to 3.2% by 2017 (www.sbir.gov).
- The Small Business Technology Transfer (STTR) is a sister programme to facilitate cooperative R&D between small business concerns and US research institutions – with potential for commercialisation. It accounts for 0.35% of the extramural research budget (> USD 250 million) for all agencies with a budget greater than USD 1 billion per year, growing to 0.4% by 2017.

A Cooperative Research and Development Agreement (CRADA) is a written agreement between a private company and a government agency to work together on a R&D project. A CRADA allows both parties to keep research results confidential for up to five years under the Freedom of Information Act. It allows the government and the partner to share patents and patent licenses and permits one partner to retain exclusive rights to a patent or patent license. The Office of Scientific and Technical Information (OSTI) is responsible for preserving the scientific and technical information generated through a CRADA and making this information readily available to the scientific community as well as the public (www.usgs.gov/tech-transfer/what-crada.html).

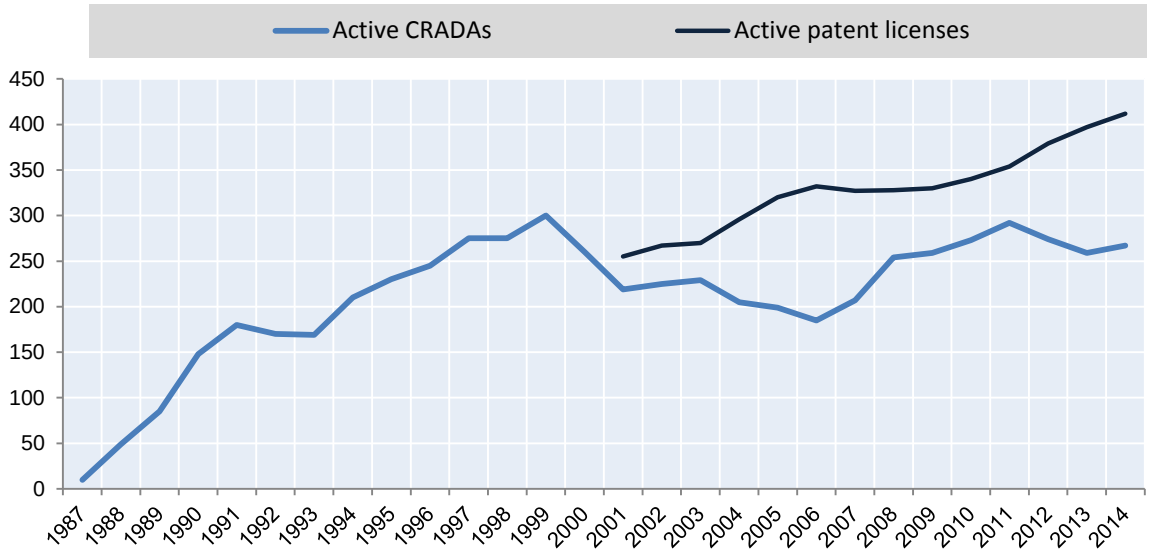
Administrative data show that public sector collaboration agreements are generally increasing even though public spending for agricultural R&D has remained stable, which suggests a greater emphasis on collaboration with private co-funding (Figures 4.1 and 4.2).

In 2012, the Agricultural Research Service (ARS), the US Department of Agriculture (USDA)'s primary in-house research agency, was participating in 257 active Cooperative Research and Development Agreements (CRADAs) and had 384 active patents licensed to private firms (Fuglie and Toole, 2014). The US focus is on R&D partnerships to address major challenges such as climate change, bioenergy, food security, pests, and water use.

There is little evidence of the performance of US arrangements. SBIR grants appear to help small companies “bridge” the financing gap between idea and attracting other private sources of finance. CRADAs do not appear to divert public resources toward private objectives. The Genetic Enhancement of Maize (GEM) project is an example of agricultural consortium. Established in 1994, it had 60 members by 2010. Public institutions develop “exotic” germplasm, share with private partners who share with each other after crossing with in-bred lines. It has helped overcome incentive problems for highly uncertain, long-term research (Toole, 2014).

Evidence suggests the need to move past structures for collaboration to better deal with the substance of enabling and developing partnerships that lead to outputs. Among the political and legal factors, the US Agriculture Act of 2014 created the **Foundation for Food and Agricultural Research (FFAR)**, modelled after the Foundation for the National Institutes of Health which raised nearly USD 59 million through contributions in 2012. The FFAR is an independent, board-driven, non-profit organisation created to foster collaboration between government, university, industry, and non-profit researchers. It has a budget of USD 200 million, distributable only with an equal amount of non-Federal matching funds (Toole, 2014).

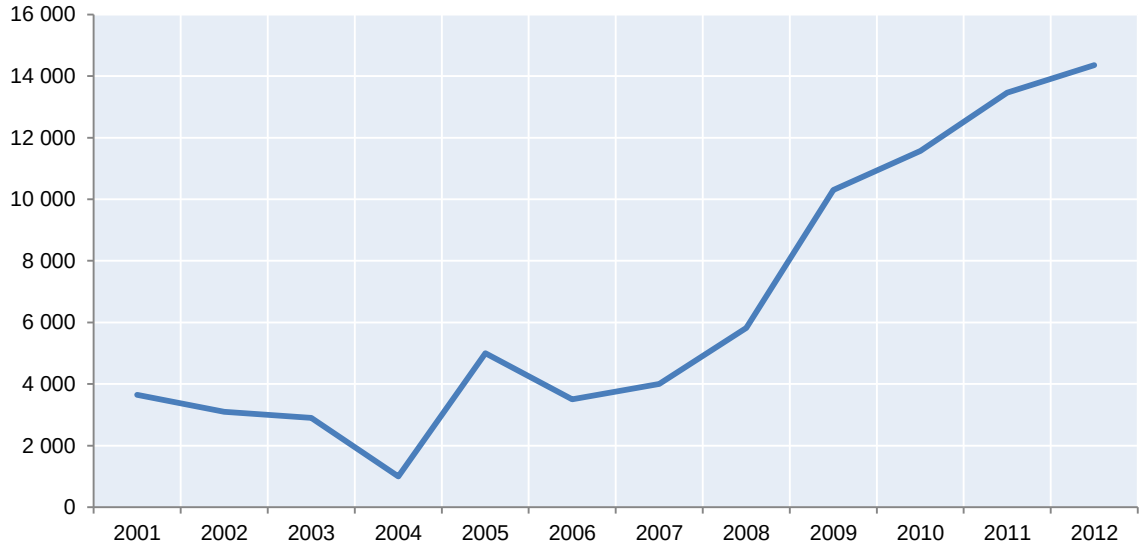
Figure 4.1. Trends in USDA collaboration with private industry



CRADA: Cooperative Research and Development Agreement.

Source: Fuglie and Toole (2014) http://dx.doi.org/10.1093/ajae/aat107.

Figure 4.2. Number of USDA R&D Partnership Agreements



Source: US Department of Agriculture Annual Report on Technology Transfer, various issues. www.ars.usda.gov/AboutUs/Docs.htm?docid=24718.

Arrangements for agricultural PPPs in France

The French innovation system seeks to mobilise actors across ministries, academic research, agro-industry, and technical institutes to work on a range of sector issues. The National Agency for Research (ANR) funds both thematic and non-thematic projects on all fields of science on a competitive basis (ANR, 2015). Specific instruments are dedicated to national and international collaborative research projects. Among them, "collaborative research projects – entreprises" (PRCE) fund projects in which

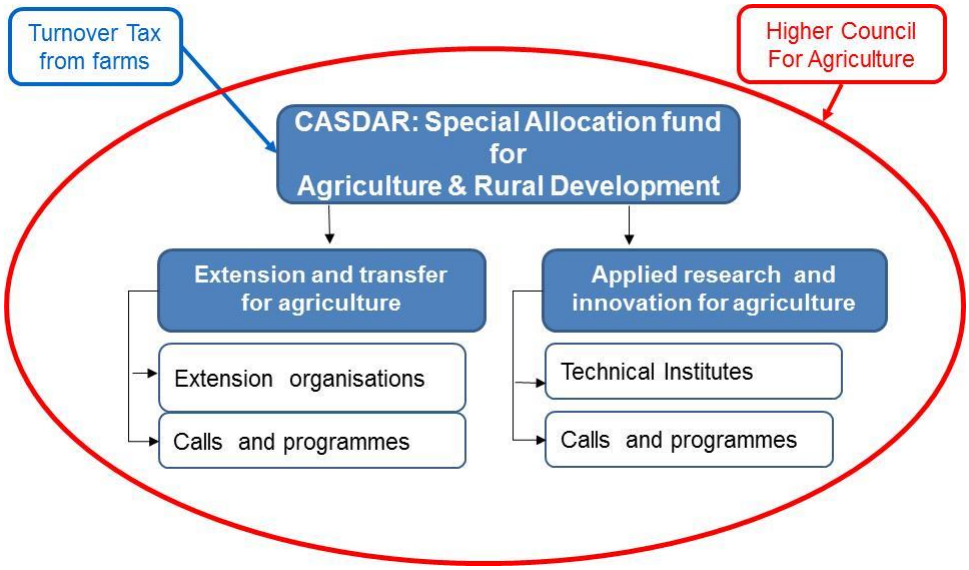
academic or public laboratories and companies collaborate to obtain research results of mutual benefits, namely PPPs.

The ANR also provides annual funding to **Carnot Institutes** with the aim to promote research partnerships between public laboratories and private companies. The Label is granted to existing institutions for five years and may be renewed. One condition to obtain the label and associated funding is to conduct research in partnership with socioeconomic benefits. The label has been granted to 34 various institutes, which represent 27 000 full-time equivalent researchers (including 8 000 PhD students); EUR 455 million annual turnover from private contracts (more than half of public R&D funded by private companies in France); EUR 50 million annual turnover from Intellectual Property (IP); and 65 spin-off per year. A number of Carnot Institutes are in the bioeconomy field, notably the IRSTEA: sciences and technologies for the environment and agriculture (900 persons); 3BCAR: Bioenergies, Biomolecules, Biomaterials (600 persons); ICSA: Animal Health (800 persons); Qualiment: agri-food innovation (400 persons); EDROME: Oceanic Resources (200 persons); PolyNat: Innovative biobased materials with high added value (200 persons); LISA: Fats for Industry and health (100 persons).

Other arrangements encourage education partnerships with technical institutes and academia to address specific issues. Through competition clusters, supported through a Single Inter-ministry Fund, which bring partners together (education, research, trade unions and private sector), opportunities for agricultural innovation are available as well.

From the Ministry of Agriculture, **CASDAR** (Special allocation fund for Agriculture and Rural Development) is the principal funding tool for applied agricultural research and extension. It is co-managed by the Ministry and producer organisations. Programme allocations are aligned with the objectives of the National Programme for Agricultural and Rural Development as established by the High Council on Agriculture (*Conseil supérieur d'orientation de l'agriculture*) in coordination with the Ministry of Agriculture and agricultural organisations. These arrangements highlight policy alignment within government as well as with producers (Figure 4.3). The CASDAR fund can in particular finance Joint Technological Networks (JTN), which group public and private research actors (notably technical institutes) as well as higher education institutions. Research proposals are developed within JTN, then be submitted to CASDAR for funding requests.

Figure 4.3. CASDAR funding arrangements



CASDAR: Special allocation fund for Agriculture and Rural Development.
Source: Bitault (2014); National Programme for Agriculture & Rural Development (2014).

Australia's experience

The rural Research and Development Corporations (RDCs) are the most significant mechanism to foster PPPs for investment in rural R&D. The RDCs procure rural research and development (R&D) using funds collected from primary producers via statutory or voluntary levies, together with matched funding from the Australian Government. There are 15 RDCs which cover virtually all agricultural industries, as well as fisheries and forestry. Many RDCs conduct whole-of-value chain research (OECD, 2015b).

The Cooperative Research Centres (CRC) programme is another mechanism to support medium and long term end-user driven research collaboration between the public and private sector. Administered by the Department of Industry, the CRCs are partnerships between different research funders, suppliers and end-users formed to undertake R&D in specific areas, with a particular emphasis on applied R&D. They must include a university and an end-user, with other possible partners including a Research Development Corporation (RDC), the Commonwealth Scientific and Industrial Research Organisation (CSIRO), industry representatives, or government organisations. CRCs receive public funding, through the Industry, Innovation and Research portfolio, which must be matched by participants' cash and in-kind contributions, for a period of up to ten years via a competitive merit-based selection process (OECD, 2015b). CRC-Projects (CRC-P) are a new initiative which will run over a shorter time frame (three years) with a smaller budget (AUD 3 million maximum),with more specific industry goals to encourage research partnerships between small to medium enterprises and government for shorter-term research (Department of Industry and Science, 2015a). In 2015/16, there were 33 CRCs operating, six6 of which are agriculture ones (Department of Industry and Science, 2015b).

The CRC programme is only suited to longer-term arrangements. The Productivity Commission (2007), suggested the need for complementary options for business collaboration with public sector research agencies and universities that could provide more nimble, less management-intensive, arrangements, and thus allow smaller-scale and short-term collaborations between groups of firms either independently or with universities and public sector research agencies.

The Australian state and Northern Territory governments, rural R&D corporations, CSIRO, and universities are jointly developing the **National Primary Industries Research, Development and Extension (RD&E) Framework**[3] to encourage greater collaboration and coordination between the rural RD&E participants (including the Australian and state governments, rural R&D corporations, the CSIRO and universities); strengthens national research capabilities to better address sector and cross-sector issues; and focuses RD&E resources so they are used more effectively, efficiently and collaboratively, thereby reducing capability gaps, fragmentation and unnecessary duplication in primary industries RD&E (OECD, 2015b).

Brazil's experience

The Brazilian legal framework includes funding mechanisms to facilitate PPPs. The "Innovation Law" of 2004 introduced new concepts to foster public and private cooperation in research, such as minority participation by government institutions in the capital of the established corporations. The law also provides for incentives to build international networks for technological and research projects, as well as establish technological entrepreneurship and the creation of innovation areas, such as incubator companies and technological parks (Brunale, 2006). The "Good Law" of 2005 established tax incentives for companies that conducted R&D of technological innovation, which allow bringing together companies with universities and research institutes. More specifically, the "Rouanet Research Law" of 2007 introduced a tax exemption for companies that act in partnership with scientific and technological institutions (German House of Science and Innovation, DWIH, http://dwih.com.br/en/brazil-research-funding).

3. See framework website at: www.npirdef.org/framework

In general, state and federal laws in Brazil authorize the sharing of Institutes of Science and Technology laboratories by incubated companies and national companies. These laws also facilitate the licensing of patents and transfer of technologies developed by the institutes.

R&D funding mechanisms for universities, private companies, and scientific and technological institutions can be used for collaborative projects, including PPPs (See OECD, 2015c for more information on R&D funding mechanisms).

There are also state foundations, based on tax deductions at state level, to support research projects in science and technology. These mechanisms are used in the agricultural sector, especially by universities, and some of these research foundations finance R&D projects involving centres of excellence and private companies.

There are examples of public-private consortia and partnerships for agricultural research. For example, the coffee research is currently supported by tax deductions and Embrapa is managing a national research consortium supported by the coffee fund (FUNCAFE). This fund was created in 1986 based on a coffee export tax, replaced in 1989 by a tax based on government stock sales of coffee. Research partnerships are often with foreign multinational companies as R&D in the national private sector is still weak.

The private sector often works in partnership with public research for exchange of genetic material given the high relevance of the national germplasm bank, which is still a public institution. For example, Monsanto, Basf, Abrazem, Dupont and Syngenta are carrying out research in biotechnology with Embrapa. There are also R&D contracts for seed production with non-profit organisations such as Unipasto and Sul Pasto, and with Foundations (Meridional, Triângulo, Cerrado, Bahia, and Goiás).

In 2012, Embrapa signed more than 300 contracts with the private sector, including agreement for technology transfer of material (in particular, seeds) and contracts for technical cooperation.

Collaborative research between the public and private sectors is growing in Brazil, especially in the state of São Paulo, where the R&D state foundation is promoting links between universities and private companies (Pray, 2013). Experts find, however, that the share of agricultural R&D projects funded by the public and private sectors together is probably below its potential (Contini and Andrade, 2014). A constraint is that public money needs to benefit society and, thus, the result of research conducted with some public funding cannot be for the exclusive benefit of one company.

Canada's experience in agricultural innovation programming

The general innovation system includes institutions and mechanisms, such as the National Research Council (NRC) and its programmes, which facilitate collaboration between innovation stakeholders and support the commercialisation of innovation, including in the food and agriculture sector. The **Network of Centres of Excellence (NCE)**[4] is jointly administered by Canada's three granting agencies: The Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council (NSERC) and the Social Sciences and Humanities Research Council (SSHRC). This is done in partnership with Industry Canada and Health Canada. The NCE helps mobilise multi-disciplinary research capacity, create large-scale, academic-led research networks, engage partners from multiple academic institutions, industry, government and not-for-profit organisations, work with end-users to facilitate the application of knowledge, and develop other collaborative approaches (OECD, 2015d).

Natural Sciences and Engineering Research Council of Canada (NSERC) helps Canadian businesses through targeted partnership offerings that connect them to experts at Canada's universities and colleges. For example, NSERC provides grants for Strategic Networks related to Bovine Mastitis.

4. Network of Centres of Excellence: www.nce-rce.gc.ca/.

In addition, the Canadian agriculture system has a number of institutional and financial arrangements that foster collaboration and cooperation to increase knowledge flows and dissemination among key stakeholders in the sector.

As part of the policy framework for the food and agriculture sector covering 2013-18, **Growing Forward 2**, the AgriInnovation programme contributes to Agriculture and Agri-Food Canada (AAFC)'s objective to improve the agricultural sectors access to science through partnerships in research and development; and promote technology transfer working with the science, academic and business communities.

Growing Forward 2 allocates CAD 698 million to further accelerate innovation and uptake through government-led research, industry-led research and complex collaborations. Of this total, two-thirds is available to fund industry-led projects. Different instruments address issues along the innovation continuum (Box 4.4). The **Agri-Science Clusters** illustrate collaborations that are commodity based or horizontal where it addresses an issue relevant to multiple commodities. As of December 2014, twelve clusters organised along commodity lines have been funded. Agri-Science Projects, which are less comprehensive than Clusters, may also involve collaborations.

Box 4.4. AgriInnovation

The federal-only **AgriInnovation** Program of Growing Forward 2 addresses the three stages of the innovation continuum: from research, to technology transfer, to the commercialisation and adoption of innovation. It contains three streams of innovation initiatives:

- The AAFC-led **Research Acceleration Innovation stream** addresses emerging science-based requirements of the sector through research development and knowledge transfer activities to identify and mitigate risks to production, keep pace with sustainability considerations, improve productivity and capture market opportunities. It targets far-from-adoption, cross-cutting research.
- The Industry-led **Research and Development stream** supports pre-commercialisation research, development and knowledge transfer for innovative agriculture, agri-food and agri-based products and processes. The Stream may provide financial support to approved applicants, and/or support in the form of collaborative assistance given by AAFC research scientists and experts for knowledge transfer. It provides support to two types of projects: Agri-Science Clusters and Agri-Science Projects
  - **Agri-Science Cluster** support aims to mobilise and coordinate a critical mass of scientific expertise in industry, academia and government. Funding is available to not-for-profit and for-profit applicants (the latter under certain conditions); partners can include AAFC researchers/resources (under a Collaborative Research Agreement). It is national in scope, industry-led, and addresses components of the sector's applied science plan under a single application. Maximum funding, in the form of a non-repayable contribution, is CAD 20 million over five years and requires industry contribution.
  - **Agri-Science Projects** are less comprehensive, but available for a single research project or a small set of projects. Their scope may be national, regional or local, and for profit and not-for-profit organisations are eligible. Maximum funding, in the form of a non-repayable contribution agreement, is CAD 5 million and requires industry contribution.
- The Industry-led **Commercialisation and Adoption stream** aims to facilitate the demonstration, commercialisation and adoption of innovative agri-based products, technologies, processes or services. This stream provides support to approved industry-led pre-commercial demonstration, commercial or adoption projects.

These federal initiatives are complemented by cost-shared programmes with provinces and territories, which are designed to reflect the innovation requirements unique to different provinces and territories to address the broader innovation objective of the country.

Source: www.agr.gc.ca/eng/?id=1354301302625.

AAFC has a Collaborative Policy Framework for reviewing proposals from the perspectives of scientific merit and management criteria to determine if it is an appropriate role of government and whether the specific collaborative efforts leverage and build capacity.

In addition to Clusters programmes, there are several mechanisms in place for funding PPPs, including federal and provincial government programmes, formal agreements between public and private players (For example Memoranda of Understanding, MoU), and private sector donations and endowments (OECD, 2015d).

An example of agricultural PPP is the Global Institute for Food Security, launched in 2012, which is housed at the University of Saskatchewan working in partnership with the Potash Corporation of Saskatchewan Inc.

Canada's twelve **Value Chain Round Tables** (VCRTs) are mechanisms for cooperation across the supply chains at the national level. Launched in 2003, the VCRTs bring together key industry leaders from across the value chain – input suppliers, producers, processors, food service industries, retailers, traders and associations (geographical regions and sector diversity are also considered) – with federal and provincial government policy makers. VCRTs have become central vehicles for: Identifying sector strengths and weakness; Capitalising on domestic and international market opportunities; Sharing information and building trust across commodity sectors; Identifying research, policy, regulatory and technical requirements; Creating shared visions and cooperative long-term strategies; and Responding to crises.

Recent public-private strategies in various countries

In **Mexico**, the New Vision for AgriFood Development (VIDA) is a joint initiative between the public and private sector to reinvigorate and provide a new direction for the agriculture sector. It has been developed with the World Economic Forum and was launched in 2014. Institutional arrangements have been set along five working groups (oilseeds, grains, fruits and vegetables, coffee and cocoa, with fisheries currently on hold) with partners from public and private sector for each food group (Herrera and Merigo, 2014).

Each commodity working group is being led by strong national or multi-national corporations with an emphasis on common agendas even among wide and diverse groups of companies. Through work in fruits and vegetables, competitively gains are expected in production facilities and marketing. In coffee and cocoa, where the industry presence has been strong, greater investment is expected in a new measurement framework to identify evidence based practices for development, tracking and accountability. It is envisioned that new regulations should be established to reflect fund matching.

Japan recently developed a "Made WITH Japan" strategy promoting development of the global food value chain especially in developing countries, through PPPs. By establishing food value chains, value-added created by producers reflects better consumer demand. Through the Agricultural Cooperation Dialogues, the Japanese government works bilaterally with some partner countries to establish food value chains bringing in actors across the private sector from both sides. Through the Agricultural Cooperation Dialogue between Viet Nam and Japan, the Medium-long Term Vision for establishing food value chains in Viet Nam was created with various actors including private sector. Discussions in Myanmar have resulted in a confirmation for a collaboration and further exploration for the establishment of similar food value chains in Myanmar. The initiative provides incentives for food producers in Japan and partner countries to develop value added agriculture.[5]

5. "The strategy for the global food value chain: Promote "Made WITH Japan" through Public-Private Partnership", presentation by the Japanese government to the 6th meeting of the OECD Food Chain Analysis Network on PPPs for agricultural innovation, 13-14 October 2014, Paris. www.oecd.org/site/agrfcn/meetings/6th-oecd-food-chain-analysis-network-meeting-october-2014.htm.

As part of the new EU innovation strategy, **European Innovation Partnerships** were created in 2010 to act as a framework bringing together major EU activities and policies and covering the whole spectrum from research to market. They act across the whole research and innovation chain, bringing together all relevant actors at EU, national and regional levels in order to: (i) step up research and development efforts; (ii) coordinate investments in demonstration and pilots; (iii) anticipate and fast-track any necessary regulation and standards; and (iv) mobilise 'demand' in particular through better coordinated public procurement to ensure that any breakthroughs are quickly brought to market. They did not succeed in attracting value chain actors, which did not understand where they fitted (http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=eip).

The European Innovation Partnership for Agricultural productivity and Sustainability (EIP-AGRI) launched by the European Commission in 2012. EIP-AGRI aims to foster a competitive and sustainable agriculture and forestry sector that "achieves more from less" by bringing together innovation actors (farmers, advisors, researchers, businesses, NGOs, etc.) and connecting EIP Operational Groups and multi-actor projects, to facilitate the exchange of knowledge, expertise and good practices and to establish a dialogue between the farming and the research community.[6] Pillar 2 can be used to fund the setting up of "operational groups"; funding operational group projects (cooperation investment, knowledge transfer, advisory services); and establishing "innovation support services", e.g. to facilitate the formation of operational groups (OECD, 2015a).

Public research experience

In **Finland**, the Strategic Centres for Science, Technology and Innovation (SHOK) was an innovation policy initiative launched in 2006 by the Finnish Research and Innovation Council. These new PPPs are designed to speed up innovation processes. Their main goal is to thoroughly renew industry clusters and foster radical innovations. SHOKs are company-driven (operated) collaboration platforms adopted by Finland to share research strategies and create a new ecosystem of research with the goal to give rise to globally significant research leading to new products, services, business models and courses of action. These are in turn expected to renew Finland's business base while creating new export activities. SHOK research programmes are expected to foster long-term cooperation with time line for producing new products and services expected within 5-10 years. SHOK activities are expected to create competition where industry will be motivated to continue the development projects based on results (product development). The SHOKs have, in the last five years, become important instruments of Finnish innovation policy. Currently there are six SHOKs in operation: Cleen Ltd (in the area of environment and energy), FIMECC Ltd (in the metals industry), SalWe Oy (in health and well-being), TIVIT Oy (in the ICT and digital services sector), RYM Ltd (in the built environment sector) and Finnish Bioeconomy Cluster FIBIC. The financing model is based on an average of 60% of funding coming from Tekes and an average of 40% of the research conducted in the SHOKs being co-funded by the companies involved. While this SHOK platform is being used across six industrial branches in the bio economy, currently there is no agriculture project in the portfolio. Finland also recently instituted a bio economy strategy that focuses the agrifood research agenda for the coming years. To foster PPPs and commercialisation of its innovations, The Natural Resources Institute (LUKE, former MTT) has invested into a small resource base with business development professionals focused on commercialisation of innovation and IPR (Harkki, 2014).

As part of its strategy for coupling science and impact, the **French** agricultural research institute (INRA) uses a number of tools to foster collaboration, such as groups of scientific interest, joint technological units, networks, projects and common labs (Huyghe, 2014). Each instrument is used with different partners (Table 4.2) and at different stages in the research process (Table 4.3). At the national level, INRA programmes include vertical' partnerships along various chains coupling production and transformation, which involve technical institutes and companies (e.g. livestock and various crops);

6. For more information on the European Innovation Partnership for Agricultural productivity and Sustainability, see: http://ec.europa.eu/eip/agriculture/ .

'Horizontal' partnerships for transversal technologies (e.g. green biotechnologies, animal genomics, modelling); and Local partnerships based on competitiveness clusters and other regional transfer systems.

INRA partners with industrial and economic actors to raise the technological readiness level of research through:

- Public sectoral approaches for collaborative research: Three sectoral portals for renewable carbon, animal health, food products; and scientific intelligence on emerging issues.
- Public open technological platforms: INRA open platforms and two preindustrial demonstrators (metagenomics; white biotechnologies).
- Public-private programmes: Two institutes for the energy transition (biomaterials; agrochemistry) and one pilot programme for lignocellulosic bioethanol.

Table 4.2. INRA's partners by collaborative tool

Tools	Technical institutes	Farmers organisation	Cooperatives	SMEs	Large companies
Groups of Scientific Interest	■	■	■		
Carnot Institutes					
Joint Technological Units	■				
Joint Technological Networks	■	■			
Common Labs				■	■
PhD Cifre			■	■	■
Long term technological projects				■	■
Cross-participation in management boards	■	■			
Dissemination events	■	■	■		

Source: Huyghe (2014) www.oecd.org/site/agrfcn/meetings/6th-oecd-food-chain-analysis-network-meeting-october-2014.htm.

Table 4.3. INRA's use of collaborative tools, by level of technology readiness

Tools	TRL 1-2	TRL 3-4	TRL 5-6	TRL 7-9
Groups of Scientific Interest		■	■	
Carnot Institutes	■			
Joint Technological Units		■	■	
Joint Technological Networks			■	
Common Labs		■	■	
PhD Cifre	■	■		
Long term technological projects	■	■		
Cross-participation in management boards				
Dissemination events			■	■

TRL: Technology Readiness Level. See Figure 2.2.

Source: Huyghe (2014) www.oecd.org/site/agrfcn/meetings/6th-oecd-food-chain-analysis-network-meeting-october-2014.htm.

The **Brazilian** Agency for Agricultural Research (Embrapa) is developing a strategy to design a new research vision to orient its research for the next 20 years. This effort is coordinated through the **Agropensa**, an Embrapa initiative established in 2012 that operates through a networking approach. Agropensa is dedicated to interacting with relevant stake-holders, in Brazil and abroad, that aims to produce and disseminate strategic knowledge on future technological challenges and opportunities for agriculture. This network is expected to help identify opportunities for partnerships between public and private actors, at national and international levels.

Industry's experience: Selected examples

Large agri-food companies have developed strategies for engaging in PPPs to better address farmers' need, as well as to contribute to broader objectives, through technology transfer in smaller farms. Examples from Syngenta and FrieslandCampina were presented at the 2014 meeting of the OECD Food Chain Analysis on PPPs for agricultural innovation.

Syngenta is an agriculture input company that produces seeds and crop protection technology to address the specific needs of farmers (both small and large scale farmers) across all major crop types. The portfolio is broad and the company offers complimentary services through diagnostic tools, agronomic advice and establishment for partnerships and engagements. In its Good Growth Plan 2013 for productivity, sustainability and rural farming assistance, Syngenta actively engages with government, NGOs, R&D institutes, value-chain partners and with small farmers to combine expertise, both practical and R&D, while leveraging knowledge flows and networking capacity.

Current projects in Syngenta's portfolio include:

- a UN Soil Leadership Academy launched in 2013 in partnership with the World Business Council for Sustainable Development (WBCSD) that builds the capacity of policy makers through training in order to encourage them to design and implement policies for sustainable soil management.
- MasAgro where Syngenta provides advice for small farmers in Mexico on conservation agriculture, in partnerships with Mexico's Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) and the International Maize and Wheat Improvement Center (CIMMYT).
- A partnership with the International Rice Research Institute (IRRI) to develop more genetic marker for rice breeding, and best management practices.
- A partnership with the Maize Research Institute in Zambia to help broadening the portfolio of white seed corn, create a base to reach growers with extensive production areas and contract grower relationships and allows Syngenta to gain share and expand the market, including the introduction of integrated solutions (Vats, 2014).

FrieslandCampina, a Dutch based dairy cooperative, experienced successful PPPs in developing countries. As part of their corporate objectives for responsible entrepreneurship and sustainability in close partnership with NGOs, the cooperative has developed livelihood support, microcredit, knowledge and experience sharing partnerships with small dairy farmers in Asia and Africa to add value to the food chain (Van Ooijen, 2014).

Other collaborations include engagement about the UN development agenda topics, multiple international and multi-national partners, including:

- the Red Cross, where FrieslandCampina's expertise and resources were offered to combat global challenges of hunger, nutrient deficiency and food insecurity;

- Educational knowledge partnerships, e.g. Sino Dutch Dairy Development Centre between Dutch and Chinese agricultural universities, aim to equip famers for greater self-sufficiency through knowledge resource sharing;
- The Indonesia based Dairy Village Program, where limited access to arable land and limited investment opportunities impeded efforts to achieve national goals of fresh milk self-sufficiency, and FrieslandCampina committed to support development efforts with knowledge and advice sharing.

In other areas, cooperation agreements with NGOs (Agriterra) are conducted in countries where the company has no operations for rural development. PPP work with FrieslandCampina has been initiated by governments (e.g. Indonesia) and on their own initiative (e.g. the People's Republic of China).

Monsanto recently developed education partnerships with US universities. For the multinational biotechnology and agricultural company, university and industry partnerships are seen as essential in meeting global agricultural and food security challenges through the training of future leaders. Strategic industry-university partnerships can create and enhance certain business opportunities and support the wealth of ideas ready to be researched and developed. Successful academic-industry partnerships require well defined outcomes and milestones, measurable results, long-term success, joint financial commitment, information sharing (Cheikh, 2014).

In 2008, researchers and professors from the University of Minnesota presented Monsanto with the current challenges at the University in attracting students to applied agricultural sciences noting that applications have fallen dramatically in the past decade. Monsanto realised that this would be reflected in industry's difficulty to attract talent for their workforce and overall leadership in the agricultural sciences space. A scholarship/fellowship program was established in 2010 with modest initial aims to fund and develop a new curriculum for a cohort of seven doctoral students in agronomy. Four additional students are funded every year.

In another partnership, Monsanto reached out to several universities to identify high potential students to be trained in the field of plant breeding and be provided fellowships. The collaboration is intended to develop and maintain long-term relationships with top plant breeding academics to contribute to the development of future science leaders in the field of plant breeding. In 2014, the programme was in place in nine universities and funded 85 graduate students. Monsanto's broader contribution to academic collaboration covers: education and training; grants and gifts; scholarships; technology licensing; research services; meeting and workshops; recruiting events and memberships in organisations that foster university-industry relationships. In 2013, funding covered 166 universities in the United States. Monsanto objectives were not linked specifically to bringing these students to industry, but to simply train future leaders in agricultural sciences. The initiative is not specifically aimed to attracting students to agriculture who are not interested, but better training leaders to the sector.

PPPs in agricultural development strategies

The experience from PPPs for agricultural development shows the importance of partnerships projects to provide an enabling environment for investment in agricultural innovation along the food chain, in addition to PPPs for knowledge and technology transfer. However, PPPs alone should not be expected to achieve broad-based development impacts.

The **Australian** national research organisation (CSIRO) partners with developing countries, but also with private sector. A recent example of partnership for agricultural development is the **Food Systems Project**. The context of this project lies in a new aid policy with strong focus on private sector engagement including win-win opportunities for Australia and partners in Asia Pacific New aid policy and the linking of agencies for development aid to promote learning and innovation in food security programming in Australian Overseas Development Aid (ODA) with better interface between development and business. A focus on brokering linkages and creating partnerships lies at the core of

the strategy along with better understanding of innovation research and analysis. In the brokering of linkages, a better understanding on mapping the landscape among actors has been key to develop capacity and creating learning alliances. Bringing people together has been found to be hugely difficult and these linkages must be intentionally sought, fostered and developed for any chance of success (Hall, 2014).

In the **United States**, implementation of PPPs has been a key to promoting international relationship and development assistance. In 2010, **Feed the Future** was launched with a mandate for partnership with private industry and civil society with the coordination of three US agencies (USDA, USAID and the State Department). At the USDA Agriculture Research Service, two key programmes – Agriculture Research Partnership (ARP) Network and Tailored Partnership Agreements – have done model work on technology transfer agreements and other agreements including many stakeholders, arrangements and linkages. In providing guidelines for PPPs, USAID changed the way they worked in the Global Development Alliance by simplifying their requirements. Today, there are only five basic requirements: focus on development impact; based on complementary interests and objectives; market-based approaches and solutions; co-creation and shared responsibility; and significant private sector contributions for increased impact. As an example of successful PPPs at the Global Development Alliance, the USDA signed a three year agreement with Technoserve to provide support to small-scale cashew farmers in Mozambique to achieve global standards and traceability. Following this initiative, two major wholesale cashew buyers have begun to purchase cashews from these farmers. In a West African Partnership with national Cotton Council, through a five-year programme, a technical scholarship was established, which helps the United States to fulfil WTO obligations to assist cotton programmes. Both US government and industry are providing educational support, but outcomes for students remain to be seen as to where these students will continue for training and career development (McGuire, 2014).

5. Policy considerations for Public-Private Partnerships for agricultural innovation

Agricultural innovation systems need to respond to a very diverse demand given the high dependency of applied research to local conditions, and the structural characteristics of the food and agricultural sector, with a large number of agricultural producers, a diversity of products and production systems, and a wide range of consumers with different preferences. In addition, the production of food requires a wide range of technologies with close links with other fields of research such as resource management, health, machineries, construction, ICT or genetics. As a result, the need to cooperate across sectors is particularly acute and is frequently mentioned by agricultural innovation experts.

Agricultural innovation covers many different activities from basic research to development and transfer of technology, all along the supply chain and addressing more or less complex issues of various scopes. Some issues may require a large range of partners with different financial size, capacity and cultural behaviour, from multinationals to small farmers, from government research agencies in developed countries to local authorities in developing countries, local NGOs to international ones. Increasingly, complex issues, including global ones, require multiple fields of research and development. In some cases, different levels of government and institutions under the umbrella of different ministries also need to cooperate. For global challenges, cooperation between countries is required.

The range and type of private partners with the capacity and interest in engaging in partnerships with public institutions vary by country and sector. This may explain the wide diversity of partnerships for agricultural innovation, in terms of type, number of actors, innovation stage, scope, geographical coverage and context.

Given the growing importance of collaborative efforts in agricultural innovation, PPPs are becoming an attractive mechanism to pull financial and intellectual resources from different stakeholders. This is not specific to agriculture, hence many recommendations made for general innovation PPPs apply to agricultural activities. Some aspects and related recommendations may,

however, be more prominent in agriculture. For example, the links between innovation actors along the supply chain, and the importance of consumers' acceptance of innovation is particularly important in agriculture, and makes those actors relevant partners.

The situation of farmers in agricultural innovation systems is unique. Farmers are central stakeholders, as users, funders through levies, and creators of innovation. They need to respond to challenging objectives such as improving both productivity and sustainability, which require innovative solutions. But their fragmentation represents a specific challenge for agricultural innovation partnerships. Farmer organisations help in this regard, but extension and capacity building become all the more important. There are examples where farmers are direct partners in PPPs, but in general they are represented by producer groups, community representatives, or extension services. These have an important role in facilitating farmers' representation or participation in innovation projects, but they also need to strengthen their own capacity in this regard.

In the literature, agricultural-specific issues on PPPs for innovation are mainly discussed in the context of developing economies. Most are relevant for OECD country partners engaging with these countries, but it could also be interesting to look more specifically at partnerships for agricultural innovation within and between more developed countries.

The following recommendations draw on discussion with experts from agricultural innovation systems at the meeting of the OECD Food Chain Analysis Network dedicated to PPPs for agricultural innovation. They cover a wide range of considerations ranging from the choice of a PPP approach to policy incentives and evaluation requirements. Experts generally agreed that OECD guidelines for PPPs in the STI area apply to PPPs for agricultural innovation. They also outlined the following recommendations regarding conditions to enter in a PPP, governance of PPPs and needs for capacity building.

Conditions

- PPPs for agricultural innovation do not fit models, there is no one size fits all.
- Governments should not be prescriptive about PPPs, but provide policy incentives that enable them when they are a cost-efficient way to address shared objectives, i.e. in case there is a market or a policy failure and transaction costs are lower than marginal benefits.
- Governments play an important role in enabling PPPs for agricultural innovation, for example by providing a stable business environment, developing an appropriate legal framework, for example for IP rules and contract enforcement, and facilitating the sharing of experience and knowledge.
- A range of policies, mechanisms and arrangements, to be used flexibly, are needed to respond to the diversity of possible partnerships.
- The first step is to develop shared objectives, with early involvement of all actors concerned, including producer organisations. Prior networks, discussion groups and organisations facilitate this process, and should thus be encouraged.

Governance

- Governance ensuring good use of public funds remains in the public sector, but management can be shared. Consultative groups including all stakeholders can provide useful feed-back at different stages of implementation.
- Projects should include clear definition of targets, governance rules, and arrangements for sharing costs, risks and results.

- Co-financing arrangements need to be in place for public actors, private companies and producers (e.g. project funding, producer levies).
- Governments need to provide incentives, where needed, to promote investment in R&D for non-private goods, social return and long-term objectives. Government's contribution should be commensurate with public benefits.
- More monitoring needs to be done to track progress and failures and identify when interventions may be needed. Evaluation is needed as well to improve incentives and arrangements. Sharing experience and results is crucial for better learning. More data is needed to support endeavours in tracking, evaluation, learning and sharing.
- Evaluation procedures should be linked to funding arrangements. They allow for adaptation of governance structure and other changes when needed. Evaluation often takes place where successful programmes receive renewed funding, but planned formal evaluations may provide better sharing of what works and what does not.

Capacity building

- Training for leaders in public sector, academic research, producer organisations for soft skills in communication, negotiation and business management is key to success. Private sector partnerships with universities provide funding, new curriculums and exposure to industry that broaden the skills set of future agriculture researchers.
- Particularly for agriculture technology projects, business skills are needed among non-industry actors where IPR, marketing and commercialisation are involved.
- Partnerships can also be developed for education and knowledge (university agriculture science students, small farmers).

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Annex A1

Overview of main work on Public-Private Partnerships in the OECD and other international bodies

Selected reviews of PPPs

This annex briefly describes the purpose and content of selected studies considering PPPs in various areas, from general to more specific purpose. It covers PPPs for the delivery of public services, and for innovation in general, and then focuses on agricultural and related PPPs.

OECD Principles for public governance of Public-Private Partnerships

OECD work on the governance of PPPs focuses on partnerships for the delivery of public services, both with regards to infrastructure assets (such as bridges, roads) and social assets (such as hospitals, utilities, and prisons).

Recent outputs include a report on *PPPs In Pursuit of Risk Sharing and Value for Money* (OECD, 2008), which compares the performance of PPPs and traditional infrastructure public procurement; a *Survey of institutional and Governance Structures for PPPs* (OECD, 2010c), and *Council Recommendation on Principles for Public Governance of PPPs* (OECD, 2012).

OECD Principles for Public Governance of PPPs (OECD, 2012) aim to enable both members and non-members to use PPPs without jeopardising fiscal sustainability, affordability or value for money.[1] They complement the recommendation on private sector participation in infrastructure [C(2007)23/FINAL] based on the Policy Framework for Investment [C(2006)68] and build on various Council recommendations on government regulations, governance and public procurement.

Recommendations for the public governance of PPPs cover the institutional framework (regulations and responsibilities which should be clear, transparent and enforced), the selection of PPPs, based on value for money, and the budgetary process, which should be transparent (Box A4.1).

OECD work on Public-Private Partnerships for innovation

A large OECD study on PPPs for innovation (OECD, 2004) fed into the OECD innovation strategy (OECD, 2010a, 2010b). Findings draw on peer reviews of national experience with PPPs in Austria, Australia, France, the Netherlands and Spain, which focus on specific flagship programmes.

This study offers a definition of PPPs for innovation and develops a typology. It discusses the rationale for engaging in PPPs and describes recent trends. It also draws lessons for the development of more efficient PPPs for innovation and identifies good practices in the design and management of PPPs for innovation, which focus on four steering mechanisms that are key to choose the appropriate fields of collaborative research: 1) competitive selection of projects and participants; 2) optimal financing; 3) efficient organisation and management; and 4) rigorous evaluation (Box 3.1).

1. "Value for money" (VFM) is a term used to assess whether or not an organisation has obtained the maximum benefit from the goods and services it both acquires and provides, within the resources available to it.

More recently, OECD has investigated Strategic PPPs in Science, Technology and Industry (STI) (OECD, 2014). This work aimed to identify new trends and good practices for Strategic PPPs in order to propose a common framework for the design and evaluation of these strategic PPPs in STI and with a view to enhancing international cooperation. The study investigates further the following aspects:

- Programme design and implementation;
- Multi-level governance structures for strategic PPPs;
- Financing modes;
- Strategic PPPs and the policy mix for innovation;
- Internationalisation;
- Evaluation of PPPs; and
- Measurement of outcomes.

The methodological approach is based on case studies, drawing on countries' response to a questionnaire, and desk research. A summary is published in a Chapter of the *OECD Science Technology and Industry Outlook 2014* OECD (2014).

UNECE Guidebook on promoting Good Governance in Public-Private Partnerships

The UNECE Guidebook (UNECE, 2008) aims to demonstrate how governments and the private sector can improve governance in PPPs; and to create a basis for the elaboration of training modules for PPPs. It identifies some key principles and the main areas where PPPs are found. Good governance is considered a crucial factor for expanding the use of PPPs. Different chapters of the report discuss governance in specific areas, looking at the main challenges and the ways of addressing them, and concluding with some specific action points (Box A4.2).

World Bank Investment Sourcebook on Agricultural Innovation Systems

The World Bank SourceBook on Agricultural Innovation Systems (World Bank, 2012) includes a module (Module 5) on Incentives and Resources for Innovation Partnerships and Business Development, with a thematic note on Foundations for Public-Private Partnerships. This note discusses the opportunities and constraints of PPPs, including institutional settings, the capacities and skills on both sides, partnership arrangements (especially the need for contracts that clearly define outcomes and ensure accountability), and the need for independent supervision and monitoring of PPPs. It identifies guiding principles for adopting a partnership approach and provides advice for the implementation of successful PPPs (Box 3.3).

IFPRI project on Public-Private Partnerships for agricultural innovation in Latin America

As part of the IFPRI project to promote the use of PPPs to generate innovation in Latin America's agricultural and agro-industrial sectors, Hartwich et al. (2005) analyse a survey of 124 PPPs in agriculture innovation in nine countries of Latin America. They find a wide diversity of partnerships, and try to develop a typology. They discuss costs-and benefits of partnerships (Table 2.1) and suggest conditions for their success (Box 3.4).

A technical guide was then developed. It provides information and recommendations on every step of the design and implementation of PPPs for agricultural innovation (Hartwich et al., 2007). These steps include: the formation of a partnership, the negotiation of a common interest, the financing of the partnership, legal implications, organisational design, and the operation, termination and evaluation of the partnership. They are illustrated by a concrete PPP example. A format is proposed for a draft contact to establish a PPP for innovation development by means of collaborative research.

Public-Private Partnerships in an agricultural system of innovation

Hall (2006) discusses concepts and challenges for PPPs with the development of agricultural innovation systems. In this context, agricultural innovation PPPs can include a wider variety of actors. They include the creation and sharing of research, but also other types of knowledge. The author argues that PPPs should build on the agricultural system of innovation, and rely on the existing network of AIS actors. He distinguishes North-South partnerships between global life science companies and national and international research centres, from other types of PPP where local companies need the support of public research organisations to help them overcome problems, access new markets and compete domestically and internationally. He lists problems that occurred in PPPs, as well as conditions that allowed more successful PPPs. He concludes that to improve the functioning of PPP for agricultural innovation, efforts need to focus on human and social capital.

Public-Private Partnerships to enhance Sanitary and PhytoSanitary (SPS) capacity

A joint document of the Standard and Trade Development Facility (STDF) and the Inter-American Development Bank analyses the operation, performance of selected SPS-related partnerships between government agencies responsible for food safety, animal and plant health and trade, and the private sector (STDF, 2012). Private sector partners usually include local, national and multinational companies, as well as associations representing particular agri-food industries, producers and/or exporters. Authors consider costs and benefits of PPPs, identify pre-conditions for successful PPPs, analyse the implementation cycle, and suggest recommendations to facilitate the development of SPS-related PPPs (Boxes A4.3 and A4.4).

This document draws on material from a workshop, and focuses on experience in Latin America, but also includes examples for Africa, Asia and other regions. A broad diversity of PPPs is examined. Main functions are:

- SPS dialogue, networking, coordination.
- SPS infrastructure, e.g. roads, ports, irrigation, diagnostic laboratories or infrastructure for cold storage and food processing.
- Value chain development.
- Trade facilitation, e.g. SPS documentation and transparency in the operations of regulatory agencies and customs, such as electronic certification or traceability.
- Joint public-private companies for SPS implementation.
- Co-regulation.

FAO agribusiness Public-Private Partnerships country case studies

The **FAO** reviewed seventy case studies from 15 countries across Latin America, Asia and Africa, which include four main types of PPP projects: value chain development; innovation and technology transfer; business development services; and market infrastructure. Partners in these case studies were found to be quite diverse reflecting the extent of state involvement in the agriculture sector and the level of public sector decentralisation, as well as the level of domestic private sector development and overall openness of the sector to private investment. The case studies discuss benefits for the various partners and identify success factors. A synthesis report will be published early 2016 (FAO, 2015).

Annex A2

Public-Private Partnerships definitions and types

Various definitions of Public-Private Partnerships

Overview

The literature offers a wide range of definitions, reflecting the diversity of partnerships arrangements and purpose, but also how broad or narrow authors chose the focus to be. Some cover a large range of partnerships while others are more restrictive. **The main common feature is that PPPs are arrangements between public and private partners with a common purpose and the sharing of risks.** Additional characteristics help specify the purpose or narrow the definition.

Because of the nature of the PPPs concerned, the definition in the **OECD principles for the governance of PPP**s is very specific in the sense that the private sector pays for the delivery of the public service, although the type of service is not specified. In addition to the sharing of risk, most other definitions imply the sharing of costs and resources, as well as mutual benefits. The UNECE definition adds a long-term dimension to the arrangement.

In addition to indicating the purpose "science, technology or innovation", **the OECD definition of PPPs for innovation** is more precise as it provides a number of characteristics: the arrangement is formal but not necessarily institutionalised; the duration and the scale can vary; the decision-making process is interactive; partners join resources, including money, personnel, facilities and information; all partners contribute to the work and the financing.

Agricultural definitions point to the full sharing of risks, resources, responsibilities, and mutual benefits. They also recognise the different degree of formality, and the different degree of involvement of partners. The importance of partners having complementary skills is also noted. Compared to PPPs for innovation in other sectors, PPPs for agricultural innovation can include a wide range of actors: government agencies, education institutions, upstream and downstream industries, non-governmental organisations (NGOs), consultants and farmers' organisations, which bring different skills, but also have very different capacity.

General definitions

OECD defines **PPPs for the delivery of public services** as "long term agreements between the government and a private partner whereby the latter delivers and funds public services using a capital asset, sharing the associated risks" (OECD, 2012). PPPs may deliver public services both with regards to infrastructure assets (such as bridges, roads) and social assets (such as hospitals, utilities, prisons). OECD (2008) provides a more detailed definition, and presents definitions used in other organisations (Box A2.1).

Box A2.1. Definitions of Public Private Partnerships for the delivery of public services

The **OECD** defines a Public-Private Partnership as an agreement between the government and one or more private partners (which may include the operators and the financers) according to which the private partners deliver the service in such a manner that the service delivery objectives of the government are aligned with the profit objectives of the private partners and where the effectiveness of the alignment depends on a sufficient transfer of risk to the private partners (OECD, 2008).

According to the **International Monetary Fund** (IMF, 2006:1 and 2004:4), PPPs refer to arrangements where the private sector supplies infrastructure assets and services that traditionally have been provided by the government. In addition to private execution and financing of public investment, PPPs have two other important characteristics: there is an emphasis on service provision, as well as investment, by the private sector; and significant risk is transferred from the government to the private sector. PPPs are involved in a wide range of social and economic infrastructure projects, but they are mainly used to build and operate hospitals, schools, prisons, roads, bridges and tunnels, light rail networks, air traffic control systems, and water and sanitation plants.

For the **European Commission** (EC, 2004), the term "Public-Private Partnership" is not defined at Community level. In general, the term refers to forms of cooperation between public authorities and the world of business which aim to ensure the funding, construction, renovation, management and maintenance of an infrastructure of the provision of a service.

Standard and Poor's definition of a PPP is any medium- to long-term relationship between the public and private sectors, involving the sharing of risks and rewards of multi-sector skills, expertise and finance to deliver desired policy outcomes (Standard and Poor's, 2005).

For the **European Investment Bank** (EIB, 2004:2), "Public-Private Partnership" is a generic term for the relationships formed between the private sector and public bodies often with the aim of introducing private sector resources and/or expertise in order to help provide and deliver public sector assets and services. The term PPP is thus used to describe a wide variety of working arrangements from loose, informal and strategic partnerships, to design-build-finance-and-operate (DBFO) type service contracts and formal joint venture companies.

The **UNECE** Guidebook on promoting Good Governance in Public-Private Partnerships (UNECE, 2008) describes PPPs as arrangements aiming at financing, designing, implementing and operating public sector facilities and services. Their key characteristics include: 1) Long-term (sometimes up to 30 years) service provisions; 2) The transfer of risk to the private sector; and 3) Different forms of long-term contracts drawn up between legal entities and public authorities. There are two broad categories of PPPs: the institutionalized PPPs that refers to all forms of joint ventures between public and private stakeholders; and contractual PPPs. The guidebook also distinguishes various categories of PPP models depending on the degree of private sector risk, and the degree of private sector involvement (BOO, etc.).

The **STDF** report on Public-Private Partnerships to enhance SPS capacity (STDF, 2012) contains a number of definitions found in the literature. PPPs have been defined as a "collaborative venture between the public and private sectors built on the expertise of each partner that best meets clearly defined goals through the appropriate allocation of resources, risks and rewards" (Bettignies and Ross, 2004 in Hartwich et al., 2007). These arrangements generally entail "reciprocal obligations and mutual accountability, voluntary or contractual relationships, the sharing of investment and reputational risks, and joint responsibility for design and execution" (World Economic Forum, 2005 cited in FAO, 2009). Partnerships can range from very informal, flexible arrangements to highly defined relationships based on full sharing of risks, resources and responsibilities.

Source: OECD (2008); UNECE (2008); STDF (2012).

OECD definition of Public-Private Partnerships for innovation

The definition of **PPPs for innovation** used in OECD work on science, technology and innovation is included in Box 1.1.

Recent OECD work also proposes a working definition of **Strategic PPPs for Science, Technology and Innovation** as "a large-scale, challenge driven PPPs that takes a value chain and systemic approach to technological and innovation development". PPPs in this context are more directed towards global challenges and/or industrial policy and technological competitiveness goals and involve multiple partners on the supply as well as the demand-side (OECD, 2014).

Definitions of Public-Private Partnerships for agricultural innovation

In the glossary of Hartwich et al. (2007), **PPPs in agricultural research and innovation** are defined as "Collaborative mechanisms in which actors in research fields and in the private sector share resources and risks and generate innovation for the development of the agricultural sector, including the

livestock, forestry, and fisheries sectors. Possible partners include research institutes, universities, and extension agencies in the public sector, and producers' associations, businesses, and individual producers in the private sector. Often, in less-developed countries, these partnerships are supported by governments and international cooperation agencies."

Hartwich et al. (2005) outline that in the literature, it is commonly accepted that PPPs require common objectives, active partners, interdependent and complementary contributions from the partners, and a commitment to open relationships under the criteria of equity and clear, mutually agreed, rules.

Van der Meer (2002) (cited by Hall, 2006) defines **PPPs for agricultural research** as the pooling of public and private resources with the aim of providing value added to both parties, the private sector including local and multinational companies as well as farmers and their associations. He makes the following points:

- "Both parties must bring some resources to the partnership, which are valuable for the other party and for the common interest. These may be information, specialized human capital, germplasm, funds or research facilities.
- Both parties must have an interest that overlaps. This does not mean that goals or outputs need to be the same for each sector – the private sector may seek increased market share while the public sector may want progress in sustainable rural development.
- Both parties must expect some net gain – something that they cannot achieve as cheaply, as rapidly or as effectively when they operate on their own."

In the World Bank SourceBook on Agricultural Innovation Systems (World Bank, 2012), PPPs are defined as arrangements bringing the complementary skills of the public and private sectors to a programme or project in which each partner has a different level of involvement and responsibility, with the objective of providing public goods or services.

Categories and typologies

Given the wide range of partnerships, **typologies** are often proposed. They help understand the variety of PPPs, but the extent to which they help analysing the functioning of PPPs and drawing lessons on conditions for success is not always clear. Many criteria are used, most obvious being based on purpose, but also degree of formality, institutional arrangements or type of actors. For example, the typology of agricultural innovation PPPs proposed in Hartwig et al. (2005) is based on three criteria: the nature of the research (basic, strategic or adaptative), the part of the food chain (inputs, primary production, post-harvest) and the degree of participation of the private sector. The World Bank (2012) distinguishes PPPs based on their scope: PPPs implemented through individual development projects, with a relatively clear and specific expected outcome or service for which the private partner provides know-how and technical solutions; PPPs used to generate ideas and innovations, in which the public sector defines more or less specific fields and objectives (e.g. agricultural growth), and strategic alliances usually involving long-term cooperation (ten or more years), multinational companies, or groups of companies (e.g. the introduction of minimum social and environmental standards for agricultural or forestry products).

The OECD distinguishes four types of PPPs for innovation based on the purpose and corresponding to main innovation policy measures:

- **mission-oriented** PPPs corresponding to public procurement;
- **market-oriented** PPPs corresponding to subsidisation of business R&D;
- **industry-science-relation-oriented** PPPs corresponding to public execution of R&D; and

- **cluster/network-oriented** PPPs corresponding to infrastructural support to business R&D (OECD, 2004).

These four types of PPPs cover the wide range of agricultural innovation PPPs: PPPs to develop technologies can be considered as mission-oriented; PPPs to develop the value-chain are market-oriented. PPPs for agricultural R&D are industry-science-relation-oriented; and PPPs to develop networks in the cluster/network-oriented category.

Both the OECD definition of PPPs for innovation and the typology proposed suit the purpose of studying PPPs for agricultural innovation. Regarding the definition, one issue, which is not specific to PPPs, is to define the boundaries of agricultural innovation, given the linkages with other fields of research such as Information and Communication Technology (ICT, biotechnology, nanotechnology, ecology, climatology, etc.).

Annex A3

Benefits and challenges for Public-Private Partnerships in the Sanitary and PhytoSanitary area

Based on interviews and surveys, authors of the Joint document of the Standard and Trade Development Facility (STDF) and the Inter-American Development Bank (IDB) (STDF, 2012) identify potential benefits of a PPP approach to enhance Sanitary and PhytoSanitary (SPS) capacity, as well as main challenges in implementing successful PPPs (Table A3.1).

Table A3.1. Benefits and Challenges for PPPs in the SPS agricultural sector

Benefits	Challenges
Economic	**Economic**
Risk mitigation and sharing	Unbalanced contribution of partners
Opportunity to obtain additional funds	Limited funding
Maximization of earnings and economic profitability	Weak transparency and monitoring of the use of the funds
Efficiency and competitiveness	**Vision**
Improve the quality and relevance of the activities due to synergies among the partners	Difficulties to define a common interest
Allow small farmers to have access to better knowledge and technologies	Lack of clarity around the PPP objectives and stakeholders specific roles leading to weak commitment from the partners
Complementary abilities, skills and resources	Political considerations may affect the original objectives
Enhance results proposed since it tends to ensure greater adoption by user groups	PPP seen as an extra-work leading to the decrease of members participation over time
Stimulates discussion and supports synergies	Corruption and conflict of interests
Trade impact	**Implementation**
Enhanced market positioning through improved competencies	Complex and bureaucratic PPP functioning mechanisms
Faster and more efficient means to comply with international SPS standards and other import requirements	Delays in the decision-making process
Enhanced competitiveness	Differing expectations and unwillingness to compromise
Better consumer confidence in the product	Weak communication among partners

Source: STDF (2012).

Annex A4

Review of recommendations in the governance and design of Public-Private Partnerships

OECD Principles for public governance of Public-Private Partnerships

In May 2012, the OECD council adopted Principles for public governance of PPPs, which are set out in Box A4.1, and recommended member states take due account of them.

Box A4.1. OECD Principles for public governance of Public-Private Partnerships

A. Establish a clear, predictable and legitimate institutional framework supported by competent and well-resourced authorities

1. The political leadership should ensure public awareness of the relative costs, benefits and risks of Public-Private Partnerships and conventional procurement. Popular understanding of Public-Private Partnerships requires active consultation and engagement with stakeholders as well as involving end-users in defining the project and subsequently in monitoring service quality.
2. Key institutional roles and responsibilities should be maintained. This requires that procuring authorities, Public-Private Partnerships Units, the Central Budget Authority, the Supreme Audit Institution and sector regulators are entrusted with clear mandates and sufficient resources to ensure a prudent procurement process and clear lines of accountability.
3. Ensure that all significant regulation affecting the operation of Public-Private Partnerships is clear, transparent and enforced. Red tape should be minimised and new and existing regulations should be carefully evaluated.

B. Ground the selection of Public-Private Partnerships in Value for Money

4. All investment projects should be prioritised at senior political level. As there are many competing investment priorities, it is the responsibility of government to define and pursue strategic goals. The decision to invest should be based on a whole of government perspective and be separate from how to procure and finance the project. There should be no institutional, procedural or accounting bias either in favour of or against Public-Private Partnerships.
5. Carefully investigate which investment method is likely to yield most value for money. Key risk factors and characteristics of specific projects should be evaluated by conducting a procurement option pre-test. A procurement option pre-test should enable the government to decide on whether it is prudent to investigate a Public-Private Partnerships option further.
6. Transfer the risks to those that manage them best. Risk should be defined, identified and measured and carried by the party for whom it costs the least to prevent the risk from realizing, or for whom realised risk costs the least.
7. The procuring authorities should be prepared for the operational phase of the Public-Private Partnerships. Securing value for money requires vigilance and effort of the same intensity as that necessary during the pre-operational phase. Particular care should be taken when switching to the operational phase of the Public-Private Partnerships, as the actors on the public side are liable to change.
8. Value for money should be maintained when renegotiating. Only if conditions change due to discretionary public policy actions should the government consider compensating the private sector. Any re-negotiation should be made transparently and subject to the ordinary procedures of Public-Private Partnership approval. Clear, predictable and transparent rules for dispute resolution should be in place.
9. Government should ensure there is sufficient competition in the market by a competitive tender process and by possibly structuring the Public-Private Partnerships program so that there is an ongoing functional market. Where market operators are few, governments should ensure a level playing field in the tendering process so that non-incumbent operators can enter the market.

C. Use the budgetary process transparently to minimise fiscal risks and ensure the integrity of the procurement process

10. In line with the government's fiscal policy, the Central Budget Authority should ensure that the project is affordable and the overall investment envelope is sustainable.
11. The project should be treated transparently in the budget process. The budget documentation should disclose all costs and contingent liabilities. Special care should be taken to ensure that budget transparency of Public-Private Partnerships covers the whole public sector.
12. Government should guard against waste and corruption by ensuring the integrity of the procurement process. The necessary procurement skills and powers should be made available to the relevant authorities.

Source: OECD (2012) www.oecd.org/gov/budgeting/PPPnoSG.pdf.

UNECE Guidebook on promoting good governance in Public-Private Partnerships

As OECD Principles, the UNECE guidebook considers value for money as a basic principle for adopting a PPP approach (Box A4.2). While the OECD outlines the importance of the institutional framework and provides guidance in many institutional aspects, the UNECE focuses on the selection process, which should be fair and transparent.

Box A4.2. UNECE principles for the good governance in Public-Private Partnerships

Good governance in PPPs encompasses:

- A fair and transparent selection process by which governments develop partnerships.
- Assurance that value for money (i.e. higher quality for the same money or the same quality for less money) has been obtained.
- An improvement of essential public services, and adequate training for those to be involved in the new partnerships.
- Fair incentives to all parties and fair returns for risk takers.
- Sensible negotiation of disputes that assures continuation of services and prevents the collapse of projects and consequent public waste.
- Enhanced security in the face of the new threats and for a general improvement in the safety of services provided under PPP arrangements.

Source: UNECE (2008), *Guidebook on promoting Good Governance in Public-Private Partnerships*, cited in STDF (2012) www.standardsfacility.org/sites/default/files/STDF_PublicPrivatePartnerships_EN_0.pdf..

Public-Private Partnerships to enhance Sanitary and PhytoSanitary (SPS) capacity

In conclusion, STDF (2012) identifies pre-conditions for successful PPPs (Box A4.3) and outlines the need for sufficient capacity in the public sector. It then discusses the potential role of donors and development partners in facilitating PPPs, for example in providing advice on selection of PPPs and training on the skills needed to identify and launch projects, while recognising that PPPs should be based on local demand, and managed by relevant national stakeholders. Finally, a number of recommendations to facilitate the development of SPS-related SPS are made (Box A4.4).

Box A4.3. Preconditions for successful Public-Private Partnerships to enhance SPS capacity

- Ownership, commitment and trust of the key stakeholders involved.
- Identification of a common interest, agreement on clear objectives and alignment of expectations.
- Clarity on how the PPP will be implemented and managed, including the roles, responsibilities and obligations of the stakeholders involved.
- Good governance and transparency.
- High-level support, leadership and capable partners.
- Clarity on the financial costs and contributions required.

Source: STDF (2012) www.standardsfacility.org/sites/default/files/STDF_PublicPrivatePartnerships_EN_0.pdf..

Box A4.4. Recommendations for successful Public-Private Partnerships to enhance SPS capacity

- **Create a favourable, enabling environment**, characterized by stability, transparency, good governance, integrity and trust, and requiring coherent policies and clear laws and regulations (Box 4.2).
- **Consider the complexity, selection and scope of PPPs:** start simple, with project with realistic expectations of results; carry-out feasibility studies.
- **Identify a common interest and existence of a win-win situation**: set-up phase is important, ideally involving all stakeholders.
- **Establish clear institutional management arrangements:** formal agreements, such as Terms of Reference or Memorandum of Understanding to define purpose, scope and expected outcomes, implementation modality, budget and operational rules, including the respective roles, responsibilities and obligations of partners. Legal agreement advisable when financial resources are involved, or trust is limited.
- **Agree on and identify the resources needed:** compare costs and benefits of PPPs with alternative approaches to identify 'value for money'; at an early stage, identify and agree on the resources required; set-up transparent rules and procedures for budgeting, accounting, and financial reporting to avoid corruption and rent-seeking, and maintain confidence in the partnerships.
- **Ensure transparency and effective communications:** to facilitate the implementation of the PPP, but also to exchange experience and enhance the creation of future PPPs.
- **Monitor and evaluate performance results:** to enable individual PPPs to adapt and improve, and to provide evidence needed improve the design, operation and management of future PPPs.

Source: STDF (2012) www.standardsfacility.org/sites/default/files/STDF_PublicPrivatePartnerships_EN_0.pdf..

Annex A5

Public-Private Partnerships for agricultural innovation and productivity: Views from the private sector[1]

The Business and Industry Advisory Committee to the OECD (BIAC) developed an issue paper raising views from the private sector perspective that we encourage the OECD and its member governments to consider in the context of the Organisation's ongoing work on partnerships for agricultural innovation and productivity. Specifically, we call attention to the following four recommendations:

- Be clear on the different definitions of partnerships.
- Build an enabling environment conducive to partnerships.
- Ensure coordination along the entire food chain.
- Promote good practices for partnerships and share lessons learned.

1. Productivity and innovation for food security: The need for partnerships

There are few parts of our economies that face such intense and uncertain pressures as the global food and agricultural sector. It stands on the frontline against myriad natural and manmade challenges, ranging from extreme weather conditions, climate change, floods and droughts, to competing demand for resources, barriers to global value chains, sudden shifts in policy, and intense price volatility. At the same time, the sector is challenged to serve the most basic human needs by providing food that is sufficient and sustainable, both in quantity and quality, for an ever-growing world population.

Faced with such conditions, the only sustainable approach for global food security lies in increasing productivity. Crucially, this depends upon the ability of the food and agricultural sector to *innovate*: different actors along the food chain need new tools and practices that improve productivity more than ever before, as well as the knowledge and skills to use them responsibly.

But to harness the full power of innovation, there is a need for substantial investment, cooperation and knowledge-sharing. One way to make this possible is through the partnership of public and private sectors, working together for mutual growth and benefit. Such collaborations allow for goals, resources, expertise and risk to be shared, thereby ensuring scientific innovations and good practices to become valuable tools for farmers and other actors along the food chain.

Successful Public-Private Partnerships (PPPs) can, for example, improve the efficiency of developing locally-adapted innovation, enable distribution of technology, make the most of sustainable agricultural practices, promote the responsible application of new technologies, and provide social and economic value to farmers and communities.

1. Business and Industry Advisory Committee to the OECD (BIAC) Issues Paper, 10 October 2014. http://www.oecd.org/site/agrfcn/meetings/6th-oecd-food-chain-analysis-network-meeting-october-2014.htm

2. Private sector views on partnerships for agricultural innovation

In order to harness the full potential of PPPs, the following business recommendations should be taken into account.

a) Clarify the definition of partnerships

The term Public-Private Partnership is increasingly employed to cover a wide range of different kinds of partnership. It is therefore important to clarify these different interpretations, as different partnerships entail different working arrangements and policy approaches.

For instance, a partnership can refer to a contractual relationship, a joint venture company, an informal relationship, cooperation based on corporate philanthropy, or a strategic alliance, among others (BIAC, 2014). Clarity in the definition is crucial for understanding the roles of different parties in any given partnership. Non-contractual partnerships should be examined more closely, as there tends to be less advice available on creating and managing such partnerships.

b) Build an enabling environment

Improving the domestic policy, legal, regulatory, institutional, and macroeconomic environment is not only good for sustainable economic growth, but also for agricultural partnerships. Rule of law and effective institutions are the bedrock of our economies and societies, without which sustainable development – including food security – would be impossible. Additionally, partnerships depend on policy consistency and overall macroeconomic stability, which are key conditions for market confidence to trade and invest.

Putting oneself into the mind-set of an actor in the food chain, such as a farmer or food retailer, one quickly recognizes the importance of these conditions. Burdensome regulatory barriers, regulatory instability, lack of rule of law, corruption, weak intellectual property rights, and extreme macroeconomic volatility are just some of the factors that can easily cripple agricultural partnerships and the benefits that they deliver to economies and societies.

c) Ensure coordination along the entire food chain

Public and private sectors engaging a new partnership for agricultural innovation need to be able to understand how their specific partnership can complement the many other partnerships that exist. A coordinated strategy with effective communication among all relevant actors is needed in order to make most efficient and effective use of resources. This requires looking at the entire food chain and examining how the objectives of partnerships in one part of the chain could impact upon, and possibly enhance, partnerships in other parts of the chain. Multi-stakeholder partnerships also call for a spirit of understanding, mutual learning and compromise, with all partners' interest at heart.

d) Promoting good practices for partnerships and sharing lessons learned

The OECD, in carrying out its work on agricultural innovation and productivity, is uniquely well-placed to promote good practices for effective partnerships and to share lessons learned from country experiences. This helps public and private sectors alike to continuously make improvements to partnerships and maximize their impacts. The OECD Food Chain Network meeting on 13-14 October 2014 is one occasion by which to exchange good practices, and further opportunities should be sought as the OECD work continues. While there is no one-size-fits-all approach to a successful partnership, BIAC highlights the following good practices in particular:

- *Ensure there are mutual benefits*

The public and private sectors participating in a partnership should each do so on a voluntary basis for mutual benefit. Each collaborative effort is a unique partnership with its own set of mutually agreeable terms and objectives, roles and responsibilities, and shared capacity-building and resources.

- *Develop clear contracts*

In cases of a contract-based PPP, partners must recognize, acknowledge and accept what each sector can offer – from resources, talent, relationships or knowledge. Contracts should unambiguously determine the division of tasks, and the distribution and use of any commercial rights emerging in connection with a partnership project. Topics such as liability and intellectual property require special attention.

- *Identify obstacles*

Partners should discuss potential obstacles as early as possible, such as exclusivity, commercial exploitation, timelines, and confidentiality. A formal signed Memorandum of Understanding between the parties can be helpful in setting the framework for negotiations.

- *Build an appropriate level of transparency*

Partnerships rely on a spirit of openness and transparency, including clear lines of communication and respecting and being receptive to different solutions and ideas. But partners need to understand and respect each other's communication requirements – whether for privacy and institutional competitiveness, or for scientific information-sharing and public awareness-raising. For example, the private sector often maintains a culture of privacy in R&D and seeks respect for intellectual property, given the expense involved in generating innovation. Ensuring full transparency and yet enabling collaborators to keep some competitive advantage is a recurring challenge, and thus commercialization rights should be agreed and defined explicitly at the start of a partnership.