

The role of government in agricultural innovation

Lessons from Bolivia¹

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Many governments in developing countries attempt to foster agricultural development and innovation by setting up funding facilities, extension programs, and research centers and by subsidizing private-sector and farm activities through fiscal measures. However, when trying to manage complex innovation processes involving many and different actors, governments sometimes find it difficult to design effective interventions and therefore end up supporting and managing only the public research and extension organizations that directly depend upon them. With the aid of various donors, Bolivia introduced a scheme in 2001 – the Bolivian Agricultural Technology System (SIBTA) – by which government support to agricultural research and extension was partly delegated to regional semiautonomous foundations.

Introduction

Countries around the world have developed programs for agricultural research and extension in order to promote innovation and development in the agricultural sector. However, the efficiency of such programs has been increasingly called into question as it becomes apparent that other agents in development, including farmers and their organizations, commercial buyers and input sellers, consultants, NGOs, the development community, and others also significantly contribute to agricultural innovation. In order to understand the

roles of and relationships among the various agents that contribute to innovation processes, scholars increasingly use an innovation systems framework (see Box 1).

Decisionmakers in governments find it challenging to formulate policy measures that enhance the functioning and performance of such a complex agricultural innovation system. Traditional approaches to innovation policies have often focused narrowly on funding research in central research stations and diffusion and extension via technology-transfer agencies. Newer approaches suggest that governments become involved in strategic planning and priority setting for agricultural innovation and development; the provision of incentives for private agents such as farmers or technical assistance consultants; enhanced collaboration among farmers, researchers, and commercial agents; and strengthening of innovative capacities among farmers.

The main question for policymakers is how to effectively encourage and guide the various public and private actors on the national, regional, and local levels so they can contribute to the generation, diffusion, and application of innovations. One particular issue focuses on determining to what extent the government should be involved in formulating innovation policies and to what extent certain activities can be delegated to decentralized local institutions.

In 2001, the Bolivian government formed the Bolivian Agricultural Technology System, Sistema Boliviano de Tecnología Agropecuaria (SIBTA), a governing and funding mechanism to promote applied research and technology transfer for agricultural development. SIBTA is unique in its organizational structure; it is based on the principles of decentralization, demand orientation, a market-based demand for technology,

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and the privatization of research and extension services. It enables the identification of local demands and the funding of research and development projects at the level of autonomous regional foundations. However, SIBTA's experimental nature and the various levels of hierarchies and diversity of actors have posed many challenges, particularly with regard to its governance.

This article discusses the main factors related to the governance of SIBTA and discusses opportunities for the Bolivian government to better oversee and manage the system in the strategic areas of participation in priority setting, transparency and accountability, responsiveness, orientation toward impact, delegation, strengthening of linkages, and strategic vision.

Bolivia's past experience in agricultural research and extension

Bolivia faces significant challenges in promoting broad-based agricultural innovation. Despite some anecdotal successes in cash crops such as soybeans in the tropical lowlands, average yields and productivity in Bolivia remain among the lowest in Latin America. Compared with other South American countries, Bolivia has the largest rural population and the highest percentage of rural people living below the poverty line. In certain rural areas, poverty levels can be as high as 90 percent.

Governments and donors have long made substantial efforts to support agricultural research and extension, with mixed success. In the 1950s, the agricultural service agency Servicio Agrícola Interamericano (SAI) was mandated to carry out both research and extension activities with support from the United States and other donors; the results were ambiguous. Activities were revived in 1975 with the creation of both the Bolivian Institute of Agricultural Technology, Instituto Boliviano de Tecnología Agropecuaria (IBTA), which established 15 experimental research stations, and

Box 1: Introducing the innovation systems approach

Innovation: a new idea, practice, or object that is successfully introduced into economic or social processes. In agriculture, this can include new knowledge or technologies related to primary production, processing, and commercialization – all of which can positively affect the productivity, competitiveness, and livelihoods of farmers and others.

Innovator: the agent – farmer, processor, or some other private actor – who introduces and adopts the innovation. Researchers and extensionists are inventors, knowledge transformers, and communicators who assist the innovator in the introduction of the innovation, which in any case may also occur without their contributions. There is a distinction between those who innovate and those who promote innovation. The promoters include researchers and extension agents, NGOs, opinion leaders, leading producers, private knowledge consultants, and many others.

Innovation process: the process by which various forms of knowledge and technology are used in order to respond to social needs and market-articulated and technological demands and opportunities. Agents acquire technology and tacit and codified knowledge in complex processes of competence building, such as learning by doing, learning by using, and learning by interacting.

Innovation network: a specific socioeconomic and agroecological setting in which adopters and promoters of innovations interact in learning cycles to pursue an innovation opportunity. It is often related to a territory or an agricultural commodity but may well include producer-buyer relationships and knowledge exchange across country borders.

Innovation system: the whole set of actors and practices that constitute, perform, and participate in innovation processes, their interactions, and the structure and rules that guide their actions on a national or sector level, including spillovers from other innovation systems. An innovation system exists regardless of the level of government intervention.

the Tropical Agriculture Research Center, Centro de Investigación Agrícola Tropical (CIAT)³, which serviced the tropical lowland region around Santa Cruz in particular. Both organizations followed a technology-transfer model based on research carried out on experimental stations to identify new and more efficient varieties and crop and animal management practices,

³ In this document CIAT refers to the Bolivian agricultural research center for the lowlands, and not to the International Center for Tropical Agriculture (Centro Internacional de Agricultura Tropical) of the Consultative Group on International Agricultural Research (CGIAR) based in Cali, Colombia.

Box 2: Main actors involved in the Bolivian Agricultural Technology System (SIBTA)

The government. Government responsibility for SIBTA lies with the Technology and Food Safety Unit (UTS) under the Directory of Productive Development in the Ministry of Agriculture, today the Ministry of Rural and Agricultural Development and Environment. The UTS is responsible for strategic orientation, national-level priorities, and coordination of activities among the various actors. In addition to other activities, the UTS develops regulations for funding mechanisms, organizes evaluations and stakeholder consultations, and facilitates linkages to international research and development agencies.

Donors. Approximately 50 percent of SIBTA's funding comes from the Bolivian government via a loan from the Inter-American Development Bank (IDB). This is complemented by a basket-fund arrangement, the Fondo Común de Apoyo al SIBTA (FOCAS), from the governments of Switzerland, the Netherlands, the United Kingdom (DFID), and Denmark. Three other donors – the United States (USAID), Germany (GTZ), and Japan – provide geographically or thematically earmarked funding, and DFID also supported a program of institutional learning on SIBTA. SIBTA's budget for 2002–2007 was around US\$60 million.

The **Coordination Unit** for the Agricultural Services Program (UCPSA). This unit was established under the Ministry in compliance with IDB loan requirements; it assures that the funds are efficiently and correctly administered and attributed to projects.

The **Foundations for Agricultural Technology Development (FDTAs)**. These four regional foundations, which have private legal status and a public mandate, promote agricultural innovation in the main agroecological regions: the highlands, valleys, semiarid lowlands (Chaco), and humid tropic lowlands. They manage funds for SIBTA's main applied innovation projects. They also receive funds directly from international donors and occasionally from local governments. Each foundation consists of more than 100 public- and private-sector and civil-society organizations that meet at an annual general assembly. They have an advisory board and an autonomous administration headed by a managing director elected by the board. FDTAs don't execute research and extension; they set regional priorities, identify demands, channel funds to knowledge providers, and monitor their use.

Beneficiaries. They are organized farmer groups with legal status, such as producer associations, community-based organizations, or indigenous groups, that request SIBTA's services via applied innovation projects. Beneficiaries are eligible to receive funding if they provide 15 percent of the total funding requested, be it on their own or through third parties such as local municipalities.

(Knowledge and technology) service providers. They include research organizations, university centers, and specialized private consultancy companies. The foundations commission them to provide services to the beneficiaries. Public organizations and especially universities find it almost impossible to qualify due to administrative obstacles. Main research centers include CIAT, which is affiliated with the regional government in Santa Cruz; the semi-public Foundation for Research and Promotion of Andean Crops (PROINPA); and the Pairumani Centre for Phytoecogenetic Research, which since 1972 has been involved in genetic improvement of maize and pulses.

disseminating the results to farmers through the use of extension agents and providing technical assistance and, occasionally, subsidized farm inputs.

During the 1980s, IBTA's less-effective extension program was first significantly reduced and in the 1990s, after a World Bank loan that induced strategic reorientation toward research and entrepreneurship among farmers, closed down. After depletion of the loan, the government could not find sufficient funding sources to sustain IBTA's remaining research activities. Management problems, political intromission, and unmotivated staff led to IBTA's further deterioration and

finally, after it was incapable of proving impact among farmers, IBTA ceased functioning altogether in 1997.

SIBTA: Its actors, their interactions, and the rules

In 1998, the Bolivian government began negotiations with the Inter-American Development Bank (IDB) and several bilateral development agencies to re-institutionalize the agricultural research and extension system. In 1999, the government and donor organizations struck a deal that formalized a Sector Wide

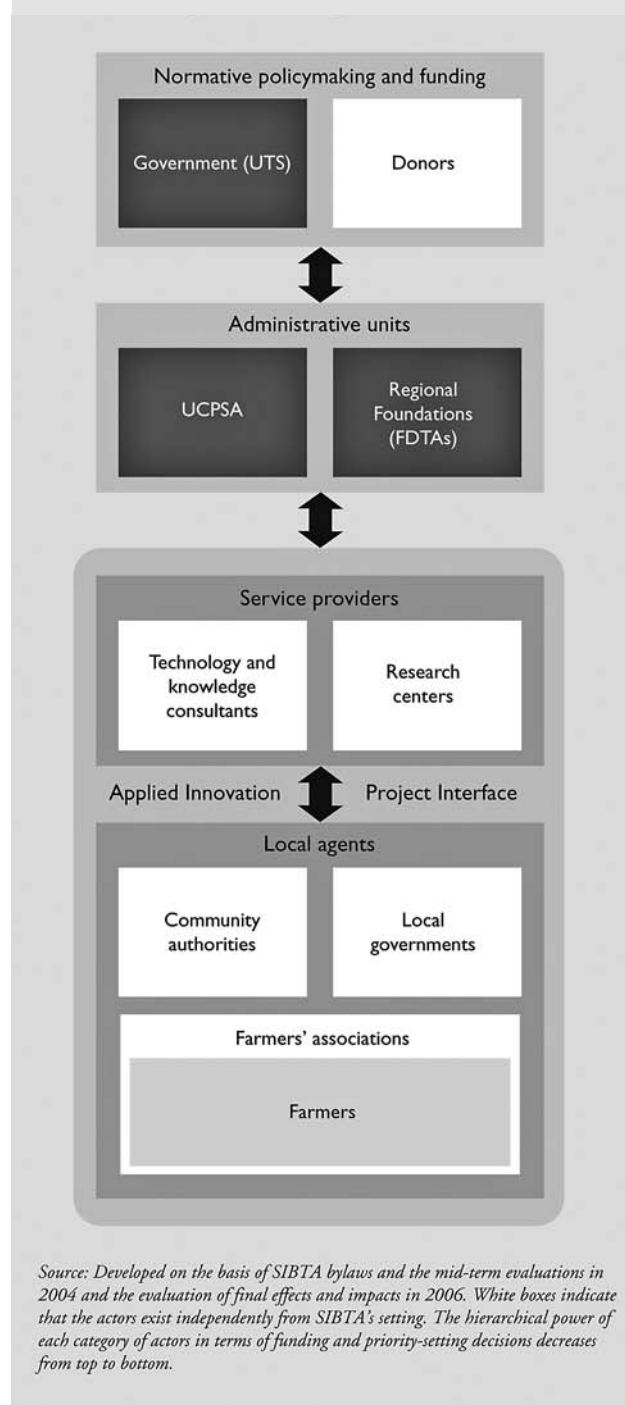
Approach (SWAP) in the field of agricultural research and technology. The resulting Bolivian Agricultural Technology System (SIBTA) brings into play a diversity of actors contributing to the generation, diffusion, and application of innovation (see Box 2).

SIBTA has developed three main mechanisms that enable interaction among agents to deliver services to beneficiaries:

- Applied Technological Innovation Projects (PITAs). The regional foundations solicit bids from producers who form an alliance with knowledge providers to submit joint proposals, and provide funding to the most promising proposals. Decisions are made by an anonymous committee on the basis of probability of impact and regional and national development priorities. In order to assure the receipt of worthy proposals, the regional foundations have often brokered contacts between beneficiaries and knowledge providers and assisted in organizational and proposal development.
- Under the National Strategic Innovation Projects (PIEN), the Ministry of Agriculture's technology unit approves funding for strategic research consortia. PIENs have been created in strategic research areas such as soil-fertility management, the peanut value chain, and others.
- The food and agriculture genetic resources program (SINARGEAA) is set up to conserve genetic material and carry out basic research. Under this mechanism, a number of research organizations and universities have been given the responsibility to manage and evaluate genetic resources in sectors such as roots and tubers, fruits, cereals and oilseeds, Andean grains, forestry, and camelids.

Further coordination and interaction activities are provided through the Accompanying Committee of SIBTA (CAS), which consists of government and donor representatives and determines funding procedures and revises implementation strategies for the three mechanisms mentioned above. Another useful coordination mechanism, especially with regard to the implementation of funding strategies, is the consultative committee, Comité Consultivo del SIBTA, which consists of representatives from the UTS, the four regional foundations, and several universities.

Box 3: Relationships between SIBTA agents according to the original design



The SIBTA bylaws outline the main rules for the operation of the system, and have been adjusted four times since 2002.

Some rules have also been determined by the IDB and other donors. The criteria for selecting project proposals is strict, and compliance is monitored by the UCPSA. Box 3 provides an organizational chart of SIBTA as it was originally intended to function.

SIBTA's performance and the Bolivian government

SIBTA is a novel institution and as such is accumulating information and experience to assure that it lives up to its potential. In the beginning, it had to establish working procedures among the different organizations involved. The regional foundations had to learn how to actively pursue opportunities for innovation among small farmers and have been particularly successful in maintaining financial integrity, accountability, and capable and motivated staff.

However, some stakeholders – including local civil-society organizations, development theorists and practitioners, and especially Bolivia's new government – have criticized SIBTA for not reaching enough of those in need. Various evaluation studies indicate that many farmers have not been able to participate in SIBTA's applied projects and have not profited from the new knowledge and technology promoted through SIBTA. Anecdotal evidence from the field suggests that many applied technology projects have led to significant increases in income and resource management, and though others have had only marginal impact, they have strengthened farmers' capacities in general. Satisfaction among the beneficiaries served by the service providers is often high, as some evaluation studies show.

A permanent question regarding SIBTA has been whether the government has been sufficiently active and enabling in order to assure its success. Whereas some stakeholders argue that SIBTA's institutional design – based on the principle of decentralization and

Box 4: Studying the role of governments in innovation systems

The governance of innovation systems has to do with how decisionmakers develop hierarchies and programs that foster and stimulate the generation and diffusion of knowledge and technologies in a given national or regional context in response to stakeholder needs. Good governance rules suggest taking into consideration complex structures and multiple agents, the uncertainty and multicausality of innovation, the limitations in controlling the innovation process, and the anticipation of risk. It can focus on central, regional, or local governments. Drawing from parameters of good governance as developed by the United Nations Development Programme (UNDP) and others, an analysis of the role of governments can take into account the following parameters:

- **Participation in priority setting:** To what extent do governments set the agenda for research and innovation and provide normative guidelines for the operations? To what extent do they participate in priority setting and decisions on funding? To what extent do governments let other stakeholders and beneficiaries participate?
- **Approach to transparency and accountability:** To what extent does the government foster the open exchange of information and render accounts?
- **Responsiveness:** In what way does the government respond to the various demands and needs of the potential beneficiaries of innovations?
- **Impact orientation:** In what way does the government make sure that operations aiming to generate and diffuse innovations are carried out in the most effective and efficient way and are oriented to areas where they may have the greatest impact?
- **Delegation:** To what extent does the government delegate responsibilities and pass decisionmaking power to local governments and other associated semipublic and private organizations?
- **Strengthening linkages:** In what way does the government foster collaboration and the exchange of knowledge among innovating agents through mechanisms such as development platforms, meetings and seminars, and financing of collaboration.
- **Strategic vision:** To what extent has the government developed a strategic vision of how the innovation system should develop, and in what way will it support this development?

private service provision – has systematically weakened the government’s position, others argue that SIBTA needed to be designed in a way that assures continuity despite political changes and inadequate governance by political decisionmakers and that it was effective in this regard. Many observers found that the former government demonstrated little interest in SIBTA, perhaps as the result of the government’s limited influence on the system.

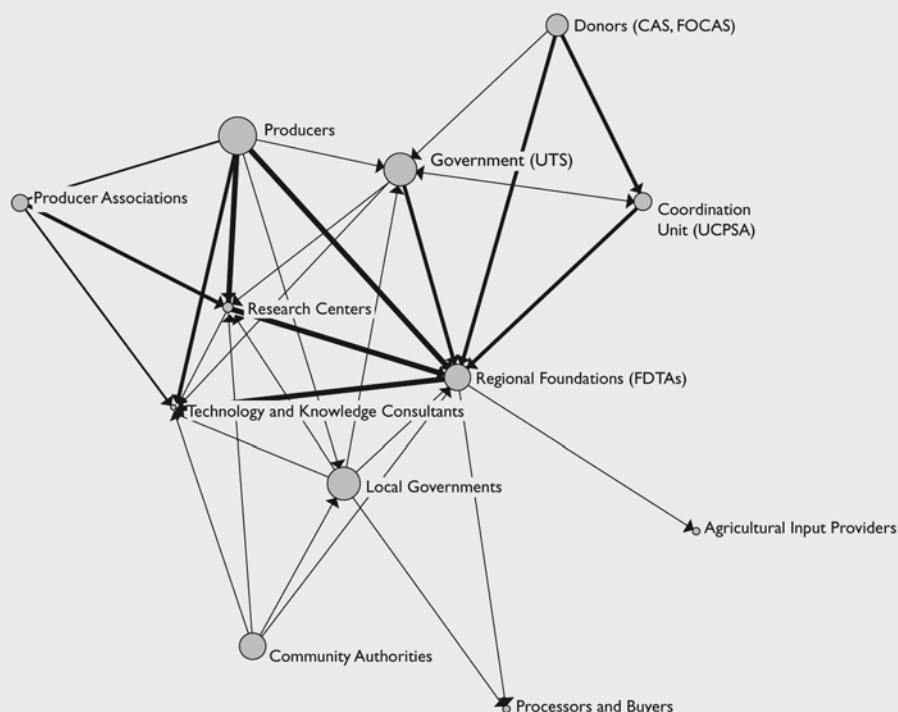
Studying the government’s role in SIBTA

In the context of the innovation systems approach, governments are facilitators of innovation processes, using a variety of options and styles in a given structural setting such as SIBTA, to steer and govern the actions and interactions of innovating agents. This can include providing research and technical assistance. The following section presents the results of a study

on the role of the Bolivian government in SIBTA’s operations. The study was carried out between June and November 2006 by IFPRI as part of a project on organizational learning in SIBTA, and was funded by DFID, drawing also from collaboration with the German Agency for Technical Cooperation (GTZ). Box 4 explains the methodological approach to the study.

Information for the study was gathered from surveys, interviews, a review of regulations and bylaws, and expert consultation. Overall, 54 key actors in organizations operating under SIBTA were questioned on the role of the government. In addition to this qualitative data, the analysis drew upon quantitative relational data – information on the interaction of actors with each other. The data was then visualized through relational graphs (see Box 5). The results of the analysis of the governance parameters suggest the following:

Box 5: Priority-setting relationships among SIBTA actors



Source: Study data.

The directions of the arrows show the nodes that impose and communicate priorities and the nodes that are affected by this. The size of the nodes is proportional to the out-degree centrality, in this case the number of ties a node uses to communicate directives on priorities to other types of actors. Nodes that have high out-degree centrality usually have more power and influence at their disposal and are able to communicate intensively and influence many others. Thicker arrows mean that there is stronger influence (on a scale where 1 is weak and 5 is strong).

Participation in priority setting: The central government – specifically, the Ministry of Agriculture – participated in SIBTA's initial design and oversaw its strategic orientation and general priority setting. However, it did not get involved in decisionmaking on the level of projects, regional commodity chains, subsector development, or research and development; these were left to the regional foundations and the service providers. At times, donor influence was condescending, partly due to weak government entities on the lower decisionmaking levels and disinterest on the higher levels. On the regional level, the semipublic regional foundations oversaw calls for proposals, support for project development, project funding, setting of regional priorities, and evaluation. Some producers' associations participated in decisionmaking by serving on the foundations' boards. However, a more prominent role for civil-society and farmers' organizations and local governments would have been in line with the public mandate of the foundations. In the national and regional decisionmaking processes, SIBTA's by-laws and donor directives have often played a more important role than has dialogue with beneficiaries.

Box 5 depicts the normative role of the government in setting priorities, the participation of other agents in the process, and the way those priorities are imposed on other SIBTA actors.

It is derived from mapping relational data collected from interviews with key actors regarding who communicates priorities to whom. Some nodes represent specific actors such as the UTS, UCPSA, or CAS, while others represent general actors such as the foundations, farmers' associations, or local governments.

Box 5 shows that the regional foundations – the FDTAs – are at the center of the priority-setting process and receive directives from all sides, most strongly from the producers. They communicate these priorities to knowledge providers such as research centers and private consultants as well as commercial agents such as private buyers and input providers, who are becoming involved in applied innovation projects. Commercial agents have no influence on SIBTA's priorities. Government organizations such as the UTS and UCPSA receive inputs with regard to priorities from producers and donors, then process them and pass them along to the regional foundations.

Approach to transparency and accountability: SIBTA has achieved a comfortable degree of transparency with regard to the use of funds; it is less transparent with its results and impacts, partly due to the absence of baseline data and to the limitations in the diffusion of evaluation results. Various and at times overlapping efforts were made to develop information databases, with mixed success. There are still too many procedures involved in collecting data that are not adequately used in the end. A more active role by the government in accountability issues would be useful.

Responsiveness: SIBTA has become so responsive to farmers' demands that it has begun to neglect the identification of strategic problems and opportunities through mechanisms other than calls for proposals through the foundations. However, the foundations, which are in direct contact with farmers' groups and other local actors, have been responsive by detecting genuine demand and facilitating the development of proposals as well as organizing regional priority-setting exercises. Higher government officials, who often see themselves as normative decisionmakers working at the behest of the government and the electorate, have not been as responsive.

Impact orientation: The evaluation procedures the government has requested from SIBTA actors, often as the result of donor directives, have substantial limitations. Evaluations commonly focus solely on adoption rates at the expense of a coherent interpretation of the development context and the identification of learning opportunities. Medium-term evaluations are common, but usually do not provide platforms for stakeholders and beneficiaries to discuss the reorientation of the project and opportunities to achieve higher impact. Furthermore, impact orientation has been less prominent among the smaller knowledge providers, who instead seek to minimize efforts and inputs and carry out activities according to plan. Another limitation is that the SIBTA bylaws do not provide much room for adjustment once funding is approved.

Delegation: Within SIBTA, the government successfully delegated demand identification, project planning, and monitoring functions to the regional foundations; this brought the planning and administration of research and extension closer to the farmers.

However, it was not as successful in delegating decisionmaking functions regarding the allocation of project funds and in including all the actors involved in local innovation processes; in fact, due to SIBTA's regulations, universities, NGOs, and commercial agents have been rather excluded from the process. Both government units – the UTS and the UCPSA – were not comfortable with delegating responsibilities to lower hierarchies or nongovernmental actors. For example, the UTS set priorities for research and innovation on a national level and was at times unwilling to accept that the foundations prioritized other sub-sectors or commodities on the regional level. UCPSA was reluctant to delegate financial responsibilities to the administrative departments of the foundations. As a consequence, the government became wrapped up in minutiae, impeding its involvement in setting policies of wider strategic importance.

Strengthening linkages: Linkages among innovation actors, particularly beneficiaries and knowledge service providers, were created as part of the rules of disbursement of funds and were often brokered by the regional foundations. In a few cases, the foundations have promoted linkages to buyers and input providers as well. The central government has been less effective in forging linkages; for example, few applied projects were connected with strategic research and few links to universities were established. It did try to foster connections with international research organizations, but encountered limits because there were no national programs with leaders that could follow up on specific linkages.

Strategic vision: The government's role has been limited due to its insufficient capacity and a lack of data to conduct more indepth policy analyses. Furthermore, much of the government's resources and time, particularly that of the technical unit in the Ministry of Agriculture, were devoted to maintaining national dialogues that did not always lead to concrete policies and decisions. The technical unit's strategic innovation projects (PIENs) only began to gain momentum in 2005, though there are already indications that the projects are too few and too small to provide the necessary strategic research results the country needs.

Conclusions

Governance in innovation systems is less about executing research and administering extension services, and has more to do with guiding diverse actors involved in complex innovation processes through the rules and incentives that foster the creation, application, and diffusion of knowledge and technologies. The role the government plays in fostering agricultural innovation depends on institutional regulations; the strength, weaknesses, and motivation of the actors who contribute to innovation; and the style of governance.

The findings of this study on governance in the Bolivian agricultural innovation system suggest that weak leadership and limited commitment – rather than the decentralized structural setting – have prevented the Bolivian government, particularly the Ministry of Agriculture, from taking a more active role in steering SIBTA. Further obstacles to a more prominent government role include limited policy-analysis and strategic-planning capacities and a tendency to focus on minute details at the project level.

In order to foster efficient agricultural innovation processes in a decentralized funding scheme such as SIBTA, the government needs to actively establish priorities, assure that others participate, guarantee transparency and accountability, maintain responsiveness to the demands of users, focus on impact, delegate administrative responsibilities to local agencies that are closer to the farmers, strengthen linkages among the various innovating agents, and provide a strategic vision. For a more effective governance of national agricultural innovation systems, governments should focus on general development issues and pursue opportunities via incentives given to a broad range of actors involved in innovation processes, including farmers, commercial agents, NGOs, government agencies, and producer organizations that promote new knowledge and technology.