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Politization, participation, and innovation: Socializing agricultural research in Bolivia

Diana Córdoba
State University of New York, United States
dianamarcela.cordoba@gmail.com

Abstract. Using the case of agricultural research in Bolivia during the neoliberal period, this paper argues that there is a need to bring politics into science, but differentiates between two levels: politics as a mode of governance or a political project that shapes the scientific process (macro-politics), and politics as an eternal process of contestation in society (micro-politics). To support this argument, we focus on the Foundation for the Promotion and Research of Andean Products (PROINPA) to demonstrate how the "macro-political" project of neoliberalism decentralized and privatized agricultural research services, redefining research agendas, and the relationship between researchers and end-users of technology; and, in turn, how researchers responded to this project, adapting and contesting neoliberalism in their everyday activities (micro-politics).

Keywords: Agricultural research; participation; innovation; politization; politics; Bolivia.

Acronyms and abbreviations

CGIAR	Consultative Group Center for International Agricultural Research
CIAL	Local agricultural research committees (comités de investigación agrícola local)
CIAT-SCZ	Centre for Tropical Agricultural Research (Centro de Investigación Agrícola Tropical, Santa Cruz)
CIAT	Centre for Tropical Agricultural Research (Centro de Investigación Agrícola Tropical)
CIFP	Pairumani Center for Phytoecogenetic Research (Centro de Investigación Fitoecogenética de Paiurumani)
COSUDE	Swiss Agency for Development and Cooperation

DGSAR	General Office for Agricultural and Rural Services (Dirección General de Servicios Agropecuarios y Rurales)
ECA	Rural schools (Escuelas de campo)
FAO	Food and Agricultural Organization of the United Nations
IBTA	Bolivian Institute for Agricultural Technology (Instituto Boliviano de Tecnología Agropecuaria)
ICP	International Potato Center
IDB	Inter-American Development Bank
IICA	Inter-American Institute for Cooperation on Agriculture
IMF	International Monetary Fund
INIA	National Institute for Agricultural Research (Instituto Nacional de Investigación Agrícola)
INIAF	National Institute for Agricultural and Forest Research (Instituto Nacional de Innovación Agropecuaria y Forestal)
ISNAR	International Service for National Agricultural Research
MACA	Ministry of Peasant and Agricultural Affairs
MAS	Movement for Socialism (Movimiento al Socialismo)
NGO	Non-governmental organization
PIEN	National Programs for Strategic Innovation Project (Proyecto de Innovación Estratégica Nacional)
PITA	Innovative Applied Technology Project (Proyecto de Innovación Tecnológica Aplicada)
PMCA	Participatory Market Chain Approach (Enfoque participativo de cadena productiva, EPCP)
PROINPA	Foundation for the Promotion and Research of Andean Products (Fundación para la Promoción e Investigación de Productos Andinos)
PPB	Participatory plant breeding (Fitomejoramiento participativo, FMP)
SAI	Inter-American Agricultural Service (Servicio Agrícola Interamericano)
SIBTA	Bolivian Agricultural Technology System (Sistema Boliviano de Tecnología Agropecuaria)
SINARGEAA	National System for the Management, Conservation, Utilization, and Evaluation of Genetic Resources for Agriculture and Food (Sistema Nacional de Manejo, Conservación, Utilización y Evaluación de Recursos Genéticos para la Agricultura y Alimentación)
UMSS	Universidad Mayor de San Simón
USAID	United States Agency for International Development

1. Introduction

Since 1970, studies in the fields of science, technology, and society have questioned the idea that the science is only a "cognitive nucleus," separated from the social world. These studies highlight the social and political context of science, helping to deconstruct the dichotomy between science and technology, on the one hand, and society, on the other. The concept of co-production is used as a term to indicate that nature, science, and social dynamics give form to the result of the interaction between science and society (Jasanoff, 2005). For Latour (1999), the idea of science as isolated from the rest of society is "as meaningless as the idea of a system of arteries disconnected from the system of veins." On the other hand, Collins and Evans (2002) argue that this co-productionist vision, or the second wave in the sociology of scientific knowledge, minimizes the role of knowledge in the process of decision-making; in contrast, they propose a "third wave" to separate the technical phase from the political phase given that, in their view, the speed of politics is quicker than the speed of technical processes. With regard to this third wave, Jasanoff (2003) and Wynne (2003) defend the need to protect the "public" from technical expertise and propose both a change to more participative institutions and a greater emphasis on the knowledge of citizens and interest groups in scientific analyses. Accordingly, good expertise and good participation through "public engagement" are both needed to enable more deliberative and democratic societies (Jasanoff, 2003).

This article enters this debate and questions the co-productionist vision of politics as always central to science. I argue that this focus reduces the opportunities to distinguish between two levels of politization: the first level, in which science is molded by politics understood as a mode of governance or "macropolitics," which affects its operation, its priorities, and the institutions that govern it; and the second level, related to the first, in which politics, following Mouffe, "cannot be restricted to a certain type of institution, or envisaged as constituting a specific sphere or level of society" (2005, p. 3). This level of politics – referred to here as "micropolitics" – is marked by the permanent struggles and incessant contestations that are inherent in all human societies due to the differences between individuals or among collectives, and the affirmation of these differences (Mouffe, 2005).

To support this argument, I use the case of Bolivia as an example, examining how the neoliberal macropolitical model – viewed as a governance strategy – molded agricultural research, thereby generating the micropolitics that challenged it. Since 1985, as a result of the adoption of the neoliberal model, the participation of the state in agricultural research in Bolivia has decreased. The Bolivian Institute for Agricultural Technology (Instituto

Boliviano de Tecnología Agropecuaria, IBTA), created in the 1960s, entered into a crisis that led not only to its closure, but also to the dismantling of both public experiment stations and the basic and adaptive research that these carried out. Neoliberalism decentralized and privatized agricultural research services, redefining research agendas and the relationship between researchers and the final users of the technology. These changes were part of broader changes in society that championed a diminished role of the state through the mechanisms of a market economy and the decentralization of decision-making processes. Neoliberalism eliminated the protagonism of the state and public research and placed most of the responsibility for technological development in the hands of private actors, including non-governmental organizations (NGOs) and small producers. Using the case of the Foundation for the Promotion and Research of Andean Products (Fundación para la Promoción e Investigación de Productos Andinos, PROINPA) in the Bolivian Altiplano, I explore the micropolitics or processes of contestation and struggle that the researchers generated. I demonstrate how PROINPA, through the initiative of its lead researchers, was transformed from the National Potato Research Program into a foundation whose goal was to continue the latter's research processes, adapting itself and challenging the neoliberal project.

The fieldwork for this study was carried out during two visits to Bolivia, the first between August and October 2010 and the second, between August and December 2011. The first methodological step consisted of semi-structured interviews with different actors in the Bolivian agricultural innovation system in the cities of La Paz, Santa Cruz, Cochabamba, and Sucre. This step made it possible to obtain a general insight into the current state of agricultural research in Bolivia. The second step was to select PROINPA and its research and development activities in the municipality of Morochata, department of Cochabamba, as a case study. In Morochata, I took part in the routine activities of PROINPA for five weeks, talked informally with producers, and participated in different scheduled activities such as workshops, meetings, evaluations, and training activities. In addition, I interviewed public officials, technicians, researchers, and producers. In total, 44 interviews were analyzed. In addition, this article is also based on secondary information such as documents and reports from projects, evaluations, and monitoring, among others.

This paper is organized as follows: The second and third sections discuss the macropolitics of agricultural research in Bolivia, from the beginnings of public research to the neoliberal project of state withdrawal, the crisis of the experiment stations, and the redefinition of research strategies and agendas.

The fourth section explores the micropolitics that developed as a result of the institutional changes brought about by the neoliberal project through an analysis of the case of the PROINPA Foundation and researchers' process of adaptation and contestation related to different institutional changes. Finally, the sixth section presents some general reflections.

2. La macropolitics of agricultural research in Bolivia

The policies that helped to construct the Bolivian nation and international ideas about what research and development in rural areas should be like have conditioned the transformation of the agricultural research system in the country. A brief history of these changes, starting in 1950, is presented below.

2.1 "The first years" of public research in Bolivia

Before the 1950s, there was practically no agricultural research carried out in Bolivia. The Bohan Mission, sent by the government of the United States in order to study the economic problems of Bolivia and prepare a plan for development, reported that:

> Relative to the need very little agricultural work of a scientific nature has been done in Bolivia [...] With the exception of localized work undertaken in connection with recent studies of irrigation possibilities, no systematic soil survey has been made in the country [...] Even climatic data is paltry and most is collected by private individuals. The fields of breeding, pathology, entomology and others related to agricultural production have hardly been touched"... (Ibid.: 45).

One of the recommendations of this mission was to modernize agriculture in order to remedy the country's economic dependence on the exploitation of non-renewable natural resources.

By the beginning of the 1950s, with the end of WWII and the National Revolution of 1952, which was rural and peasant in character, the importance of research to modernizing Bolivian agriculture had come to be recognized (Ormachea, 2008). The agricultural research model during this decade was very similar to that of the rest of the Latin American countries: its role was to contribute to the transition from pre-capitalist to capitalist agriculture. According to Trigo (1989), this was basically due to the considerable foreign participation in these activities, especially that of the United States, which was interested in stopping the spread of communism in Latin America after WWII. In this model, the experiment stations were to import technologies from the most advanced countries and make them available – after rapid testing – to be adopted in different local agroecosystems. More-

over, modernization was seen as the solution to problems of rural poverty in Bolivia (Godoy *et al*., 1993). To this end, peasants had to be persuaded of the inefficiency of their production techniques and encouraged to adopt those suggested by the experiment stations. In this context, state intervention was justified by the need to invest resources in technological conversion without any guarantee of adoption and dissemination among producers, nor any commercial mechanisms that would allow for the recovery of the expenditures made (Kaimowitz, 1993; Trigo & Kaimowitz, 1994).

In 1948, the Inter-American Agricultural Service (IAS) was created, which, through U.S. financing, contributed to the creation of experiment stations in the different agroecosystems of Bolivia (Gandarillas, 2001). During the first years, with strong external and state support, various advances were reported by different authors. These included increased productivity of traditional crops, the wide acceptance of new varieties, and the introduction of livestock raising in the Altiplano (Gandarillas, Blajos, Aguirre & Devaux, 2007; Gandarillas, 2001; Godoy *et al.*, 1993; Quispe, 2005).

At the beginning of the 1960s, a consensus was reached that developing countries could achieve food security and economic growth at the same time through promotion of the agricultural sector (Schultz, 1964). During this period, to increase food provision, the Bolivian government concentrated most of its services on developing the agroindustrial sector in the lowlands, since this area provided the best prospects for the development of intensive agriculture. Consequently, agricultural research in the Altiplano took second place in research budgeting (Godoy *et al*., 1993). Also during this decade, U.S. financing was reoriented to the generation of rural development projects within the framework of the Alliance for Progress (Trigo, 1989). The SAI disappeared and the administration of the experiment stations and research activities was moved to the Ministry of Agriculture, which in 1975 decided to create the IBTA.

IBTA adopted the organizational model of other national agriculture research institutes (INIA) on the continent, based on the principles of the Green Revolution, which was proposed as a global paradigm. The goal was for research and experimentation programs to find a technology that would serve to improve agricultural productivity in the Altiplano, which was considered key to reducing rural poverty.

During the first years after it was established, IBTA became a relatively solid institution. Various studies demonstrate the interest of the public sector in training research personnel, under the assumption that the primary limiting factor on agricultural productivity was the lack of technology and

know-how (Gandarillas *et al.*, 2007; Gandarillas, 2001). IBTA documents from the period demonstrate that some of its researchers received specialized training, primarily through an agreement with the University of Utah in the United States, which became the school of choice for future Bolivian agronomic engineers (Gandarillas, 2001).

Although IBTA started out under the administration of the government through the Ministry of Peasant and Agricultural Affairs (Ministerio de Asuntos Campesinos y Agropecuarios, MACA), its activities were marked by the support of international cooperation. Projects financed by the Food and Agriculture Organization of the UN (FAO), the Inter-American Institute for Cooperation on Agriculture (IICA), the Inter-American Development Bank (IDB), the World Bank, the Swiss Agency for Development and Cooperation (COSUDE), and the US Agency for International Development (USAID), among others, provided laboratories and basic equipment for the experimental stations and financed the establishment of gene banks, especially for potatoes, quinoa, fodder, cereals, and Andean grains (Coca, 2010; Gandarillas, 2001). This support sought to maintain and strengthen an autonomous research system that was capable of weathering various institutional crises, especially the periods of dictatorship in the 1970s and the process of state illegitimacy.

2.2 Period of transition to neoliberalism

In 1982 and after 18 years of dictatorships (1964-1982), the country returned to democracy, and with it a period of political instability and profound economic crisis, leading to the application of a series of structural adjustment measures, following International Monetary (IMF) guidelines (Postero, 2007). These measures, promoted by neoliberal governments starting in 1985, led to a wave of privatizations of public enterprises and reduced the participation of the state in the financing of agricultural research (Córdoba, Jansen, & González, 2014). In 1989, IBTA was evaluated by the International Service for Agricultural Research (ISNAR) and IICA, which recommended that the institution be restructured to adapt to the new political and economic situation in the country. This meant a dramatic reduction in funds for research, which shrunk from 4% in the years of firm government support to an average of only 0.002% of the national budget in the 1990s (Godoy *et al.*, 1993; Zapata, 2004).

In order to adapt IBTA to existing circumstances, it was restructured several times through a loan of $20 million from the World Bank (Quijandría-Salmón, 1989). In general terms, the proposed reforms required that IBTA reduce the thematic and geographical coverage of its research to align with the available funds. In the proposals that document this new restruc-

turing, it is emphatically noted that: "[…] there is only external financing [international cooperation] for potatoes and quinoa,"[1] crops for which Bolivia is the center of origin with a biodiversity of global importance, and which are fundamental for the subsistence of much of the rural population in the Altiplano (Quijandría-Salmón, 1989). The other research programs were to be reformed with state support or, in its absence, to disappear.

As a result of the restructuring of IBTA, basic research was eliminated and only adaptive research was to be considered, reducing the number of national programs to five: potatoes, quinoa, cereals (wheat and barley), legumes (lima beans and green beans), and camelids (llamas and alpacas). Meanwhile, crops of national importance such as rice, corn, and soybeans were delegated to the Center of Tropical Agricultural Research in the department of Santa Cruz (CIAT-SCZ)[2] and the Paiurumani Center for Phytoecogenetic Research (Centro de Investigación Fitoecogenética de Paiurumani, CIFP), in the department of Cochabamba, which were financed by private funds. IBTA only took charge of three of the 11 experiment stations that, according to those who made the decision, represented "sufficient" agroecological coverage, while the rest of the stations were given in concession to universities or regional governments. The stations chosen by IBTA were: Patacamaya (quinoa), San Benito (cereals, pulses, and the fruit transfer program), and Toralapa (potatoes) (Coca, 2010).

The restructuring of IBTA also created the need to establish and strengthen channels of dialogue with agriculturalists and peasants, the end users of the technology; as well as with NGOs and corporations, the intermediary users of the institution.

The NGOs had been established at the end of the 1980s as an important actor in rural areas, since they went into places that had been abandoned by the state during this period when public support for the rural sector was reduced (Córdoba, & Jansen, 2015). IBTA was structured according to a traditional model – called Agricultural Extension Service – which followed a linear model of technology transfer and went from experiment stations to regional extension offices. Later, IBTA's extension work was eliminated and consequently its regional offices were closed. The concept of pre-assistance – in which, in theory, the NGOs established a relationship with IBTA to train

1 Translation by *Apuntes*.

2 Hereafter the acronym CIAT-SCZ will be used for the Centre of Tropical Agricultural Research in the department of Santa Cruz, and CIAT for the International Center for Tropical Agriculture-Consultative Group Center for the International Agricultural Research (Centro Internacional de Agricultura Tropical-Centro Grupo Consultivo para la Investigación Agrícola Internacional, CGIAR).

the trainers – was established, leading to the privatization of agricultural extension services. Nevertheless, as a researcher who was with IBTA during this period recalls, rarely was there real coordination with the NGOs since they worked within specific projects, which often did not coincide with the technology available from IBTA.

> At this time, it was said that IBTA should train the trainers. The trainers were the extension workers from the NGOs, […], but I would say that it worked partially because the objectives of the NGOs and IBTA's objectives of transfer did not always coincide. Different approaches appeared, each from the dimension of the NGO, so doing what we wanted to do from the point of view of research was not possible. For example, IBTA wanted to promote its varieties and the NGO established in our area of influence did not necessarily take into account this activity, its activity was to complete, what can I say, a micro-environmental project, I don't know […][3] (Interview, December 6, 2011).

After implementation of the Law of Popular Participation of 1994, which promoted a process of decentralization, municipal governments became key actors in rural development (Arellano-Lopez, & Petras, 1994). The NGOs then used their experience to support the municipal governments, especially in participative planning processes and local development (Agencia de Cooperación Internacional de Japón, JICA, 2004). This was partially due to their exponential growth during the neoliberal period and, on the other hand, the multiple spaces left by the state when it retracted during this period. According to interviews with various IBTA researchers, although this institution never had strong support from the national government, during the 1990s it lost its autonomy from the governments in power. Labor instability, low salaries, and growing political interference in the selection of administrative personnel were characteristic of this period. IBTA reduced its workforce by 40% and jobs became spoils to reward political sympathizers, while, according to various interviews, researchers' scientific and technical training lost its relevance. One researcher interviewed at the Patacamaya station, 100 km from La Paz, illustrates how political interference affected the staff selection process at IBTA:

> Until 1990, until then, IBTA was a technical institution, with its autonomy, more or less, you could have a career. That is, the technicians were promoted according to their merits. But after-

3 Translation by *Apuntes*.

> wards there was political interference from the governments. This is what ruined IBTA. These were neoliberal governments, even with a populist orientation, but just the same they placed their people and practically ruined it. There were alliances of some [political] party with the Ministry of Agriculture, and, for example, it turned out that the person who was my boss, the head of the station in Patacamaya, was my undergraduate student at the university.[4] (interview, December 6, 2011).

Apart from IBTA, agricultural research was limited to the universities, the CIAT-SCZ, and the CIFP. Despite the limited spectrum of opportunities for agricultural research in Bolivia, the best educated professionals looked for better and more stable job opportunities in the universities or in new NGOs.

The progressive abandonment of experiment stations – those that were managed by IBTA or had been given in concession to other institutions, such as universities or departmental governments – became significant. Once the loan offered by the World Bank in 1997 was finalized and after the government determined that the institution had been unable to have a sufficient impact on the producers, IBTA was closed in 1997.

2.3 The birth of a new model based on demands

In 2001, after a four-year institutional absence in agricultural research, the Bolivian Agricultural Technology System (Sistema Boliviano de Tecnología Agropecuaria, SIBTA) was created to bring together the Ministry of Economic Development, the MACA, and the Ministry of Foreign Trade and Investment (Harwich, Alexaki, & Baptista, 2007). The SIBTA was presented as a novel system in which state support was partially delegated to semiautonomous regional foundations in the four ecoregions of Bolivia: Altiplano, Valles, Trópico, and Chaco. The SIBTA was based on principles of decentralization, demand-orientation, development of a technology market, and privatization of research and extension services. This new proposal considered that the conventional model of agricultural research applied in the country since the 1950s had failed, not because of the lack of a long term agricultural research policy but because of the verticality of the investigation process, from research centers to the final users of the technology. In addition, it was argued that there was a rift between the researchers and the producers, and that research results could not be adapted to producers' demands nor to the dynamics of market demand. In addition, the leadership

4 Translation by *Apuntes*.

of the public sector was criticized for generating technological innovation through financing institutions, extension programs, and research centers, which was considered to impede the participation of multiple actors in producing technology. This impeded competitiveness in agriculture and curbed initiatives that could have been developed in the private sector.

In order to overcome these obstacles, SIBTA adopted a systems innovation approach (Hartwich *et al.*, 2007). This approach is based on a recognition of the need to respond to changing conditions and demands in order to facilitate interaction between multiple actors and sources of information – both on the level of the smallholding and beyond, including the market chain – as providers of technology and knowledge. Developed countries often use this approach to formulate national innovation policies (Lundvall, 2007), which seek to improve interaction between scientists, agriculturalists, and other actors during production and consumption, as well as by providing alternatives in terms of knowledge and technology that enable interaction and innovation. In the case of Bolivia, however, experiment stations were dispensed with as providers of basic and applied information, which was left in the hands of the almost-nonexistent research centers or public universities, enterprises, producers' organizations, and NGOs.

SIBTA created three main mechanisms to facilitate interaction between the different actors in the innovation system: a) the PITA (innovative applied technology projects), a mechanism through which four foundations solicited offers from producers' organizations and granted funds to those with the best prospects. The selection process for innovative technology proposals was based primarily on producers' possibilities of market entry and on the technical viability of the project[5]; b) National Programs for Strategic Innovation Project (Proyecto de Innovación Estratégica Nacional PIEN)[6]; and c) the National System for the Management, Conservation, Utilization, and Evaluation of Genetic Resources for Agriculture and Food (Sistema Nacional de Manejo, Conservación, Utilización y Evaluación de Recursos Genéticos para la Agricultura y Alimentación, SINARGEAA), which was established to conserve genetic material *ex situ*; this system offered custody of crop gene banks to private institutions and universities[7]

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5 Between 2002 and 2007, SIBTA supported 264 PITA in the four regions of the country (Estado Plurinacional de Bolivia, 2009).

6 The PIEN were defined as a process made up of a set of technology generation, transfer, and adoption activities with sectoral and territorial transversal characteristics, which did not respond exclusively to the needs of the regional beneficiaries of SIBTA. These were administrated and executed as service contracts by the General Offices for Agricultural and Rural Services (Dirección General de Servicios Agropecuarios y Rurales, DGSAR) (Estado Plurinacional de Bolivia, 2009).

7 SINARGEAA was made up of six gene banks: high-altitude grains, roots, and tubers (in the

(Estado Plurinacional de Bolivia, 2009). Throughout this whole process, the Bolivia government played a normative role through its participation in the boards of the foundations.

At the same time, the mandate of SIBTA was to increase competitiveness through the creation of so-called "value chains" or "production chains," intended to position and consolidate agricultural products or agro-industries on markets, especially for export. The projects were primarily prepared by support institutions in 30 production chains, selected based on their market potential and their importance for food security. However, products such as potatoes and maize were not researched by the PITAs and, apart from the production chain of quinoa and camelids, the viability of the Altiplano production systems were dismissed (Lema, Meneses, Crespo & Muñoz, 2006; Ranaboldo, 2002).

The four foundations were charged with managing the funds to which the agricultural service-providers (extension or research) and the producers' organizations had access. The NGOs became important intermediaries for producer demands and the execution of services. While producers had to be organized into associations and to contribute at least 15% of the cost of the project, a central coordination unit (located in the Ministry of Agriculture) facilitated links between the grassroots groups and, in theory, contributed to the strategic planning of research on the national level. Although the Ministry of Agriculture supported the process of creating SIBTA, it did not actively participate in the selection of projects and research priorities (Ranaboldo, 2002). This responsibility fell to those who offered the services – that is, the NGOs.

It was expected that private-sector participation would be decisive for the success of the projects. However, this did not happen. The later evaluations of SIBTA demonstrated that the vast majority of the producers in the Altiplano and Valles regions, especially, were unable to meet 15% of the cost of the PITA and thus to co-finance the research. In some regions, the NGOs supported groups of producers in the administration of the PITA, helping them contribute the 15% (Lema *et al.*, 2006). Nevertheless, the system excluded "unviable" producers and those that did not fit the 30 chains selected by SIBTA.

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custody of the PROINPA Foundation); cereals and legumes (in the custody of the Fundación Patiño); valley fruits (in the custody of the Tarija Prefecture); camelids (in the custody of the Universidad Técnica de Oruro); and forestry (in the custody of the Universidad Mayor de San Simón, UMSS) in Cochabamba (Organización de las Naciones Unidas para la Alimentación y la Agricultura, FAO, 2009).

3. The years of collapse: the dismantlement of the experiment stations

Between 1997 and 2004, the public research model represented by the experiment stations in the Altiplano collapsed. The crisis of IBTA during the 1990s also created a conflictive relationship with social movements, especially agricultural unions in the areas of influence of the agricultural stations. The communities' criticisms of IBTA were based on their social isolation, their lack of coverage, and the inefficiency of the institution in fulfilling local demands. This discontent spilled over into a series of violent actions by peasants against some agricultural stations in the Altiplano: in Patacamaya in August 2002; Kallutaca and Huayrocondo in September and October 2003, respectively; and in Belén in 2004 (Coca, 2010; Quispe, 2005). During these acts of social "effervescence," peasants found and destroyed gene banks of crops such as quinoa, tubers, Andean roots, minor cereals, forage, camelids, sheep, and fruit species, as well as documentation systems including passport data. Afterwards, the experiment stations were dismantled because the peasant actions included attacks on their infrastructure: machines and equipment were destroyed, making it impossible to continue any kind of research activity there.

According to the interviewees, the peasants' actions only precipitated the demise of the already moribund experiment stations, whose activities had been minimal due to institutional apathy in the 1990s. The peasants observed the corruption that had taken hold in these centers with their own eyes; the experiment stations that had been created to support the development of their production systems with new technologies had been turned into sources of personal income for their employees. In this vein, a researcher who was present during the attack on the Patacamaya station stated:

> The motives [for the attack on the experiment stations] was bad management […]. Just one example, the quinoa gene bank was harvested in March and April; between April, May, and June everything should have been threshed and stored. The politicians who had taken charge of the station in September still had the quinoa stowed to be threshed and the rats were eating the bank, the animals ate and the technician-politicians were partying. (Interview, December 6, 2011).

Starting in 1998, these researchers – who witnessed the considerable politization of IBTA and understood the risk that this could pose to the conservation of genetic material – made a backup copy (Rojas, Soto, Pinto, Jäger, & Padulosi, 2010). Thus, the original quinoa gene bank was lost during

peasant encroachments on the Patacamaya experiment station in 2002, but researchers managed to save its back-up copy, which was kept elsewhere.

In the next section, the case study of PROINPA is discussed in order to explore the everyday micropolitics through which agricultural researchers and other actors challenged the neoliberal project.

4. The micropolitics of agricultural research on potatoes and Andean grains: the exceptional case of PROINPA

PROINPA started out as the Potato Research Program (Programa de Investigación de la Papa), a product of the restructuring of IBTA through an agreement between the Bolivian government, the Swiss government, and the International Potato Center (IPC). During the 1990s, PROINPA was organized into departments (i.e., nematology, physiology, phytopathology, etc.), and included one devoted to the social sciences, which contributed to identifying the principal limitations of potato growing among the possible users of the technology (Gandarillas, & Devaux, 1992). In addition, during this period, PROINPA worked on the restructuring of the National Potato Gene Bank (Banco Nacional de Germoplasma de Papa) at its experiment station in Toralapa in Cochabamba as a source of genes for its improvement program (Gabriel, Torrez, & Thiele, 2000; Gabriel, Vallejos, & Coca, 2006).

Once IBTA was closed, research and technology transfer in potato cultivation, which was the most important focus for the Altiplano's small producers, was in danger of disappearing. With the objective of avoiding this and retaining trained human resources, the external mission that evaluated this program in January 1998 recommended transforming PROINPA into a non-profit private foundation, which would have access to contributions received from the government and donors, as well as the funds generated by the institution itself (Gandarillas *et al.*, 2007). In 1998, PROINPA kept its acronym but changed its name to the PROINPA Foundation, expanding its research areas to other Altiplano crops, such as quinoa and other Andean grains. One PROINPA researcher describes this transition process:

> When IBTA ended, all the technicians looked for other jobs and there were no other entities that carried out research at the same level as IBTA did, with the intensity that IBTA carried it out. Some NGOs existed but not with the fundamental goal of doing research, but more on social issues. At this time when it disappeared, PROINPA had to take a decision, and this decision was that it should remain in the sphere of Bolivian innovation, but also change its legal status […], thus the idea of becoming a foundation came up, a non-profit private founda-

> tion which would carry out public activities, that is, do research and generate public resources. (Interview, December 7, 2011)

The periods of transition from a research model based on experiment stations aligned with long or short term research programs to another based on competitive short-term projects (PITA) also meant that PROINPA would adopt different research and technology transfer approaches.

During the restructuring period in the 1990s, the participative research approach prevailed, which was due especially to the strong relationship between CIAT and the IPC in the development of research projects, and their influence on these. Also during this time, participation and the agency of producers in research processes was a decisive element in generating rapid agricultural technology adoption and diffusion processes. Additionally, most of the research processes were oriented to solving demands on the level of smallholdings and specific crops, such as the integrated management of plagues and diseases, participative improvement related to diseases, selection and adoption of new varieties, etc. Later, with SIBTA, the change was oriented to articulating small producers to the market economy and new participative methodologies; in addition, the results of research oriented to responding to these demands and improving the competitiveness of small producers were applied in different communities throughout the Bolivian Altiplano. To this end, PROINPA researchers had to train themselves to engage in new types of activities in what was called "research for development." Entomologists, nematologists, and phytopathologists had to "open up" their perspectives to other research areas, which allowed them to be more "sensitive" to demands and introduce a market-oriented vision. Using the case of PROINPA, the next section analyzes the principal changes in agricultural research in Bolivia during the neoliberal period, and how researchers adapted to or challenged these changes in their everyday activities (micropolitics).

4.1 From a focus based on technology to one centered on individuals: narratives on participation

From the end of the 1980s, criticism emerged of the meager impacts of the Green Revolution and technology transfer model, proposed in the 1960s. On the one hand, it was argued that capital intensive technologies worked well in relatively uniform agroecological conditions, in irrigated areas, and wherever provision, extension, commercialization, and transport services existed and were efficient. However, such conditions did not exist in most of the mountainous and marginal systems in Latin America (Pichón, & Uquillas, 1998). On the other hand, it was argued that the model of technology

transfer through experiment stations was too abstract, and that many of the recommendations failed because producers found them to be poorly suited to their needs. To answer these criticisms, during the 1980s, the focus of research and "technology transfer" underwent a series of adaptations to satisfy the needs of agriculturalists. To this end, researchers had to go out from the experiment stations and start research processes alongside innovative agriculturalists; at the same time, this generated peasant-to-peasant adaptations and horizontal exchanges of knowledge and resources (Ashby, 1990; Bentley, 1994; Richards, 1985). Participative methodologies were needed to facilitate interaction between researchers and agriculturalists, given the informality of the experimentation process among producers and in order to create spaces of encounter and knowledge-exchange between these two groups of actors. The most important of these new ideas was the emphasis on the importance of "local knowledge" as a medium for generating new technologies, and through this process, increasing the impact of agricultural research. Thus, agriculturalists were increasingly recognized as innovators and experimenters who behaved very rationally, based on their experience and knowledge (Chambers, Pacey, & Thrupp, 1989).

During this period, PROINPA, with the support of CIAT and the Kellogg Foundation, worked on the platform of local agricultural research committees (comités de investigación agrícola local, CIAL) and in the rural schools (ECA), at first adapting them to Bolivian conditions and later incorporating them into PROINPA's participative research strategy (Almanza, Salazar, & Gandarillas, 2003; Thiele, Gardner, Torrez & Gabriel, 1997). The CIAL are an alternative methodology whose purpose is to create sustainable agricultural research capacity within rural communities. At the same time, they are intended to help with the process of generating and adopting technologies based on greater interaction and feedback with the agriculturalists. It was expected that these committees would play an important role within peasant communities, since the research work that they carry out is based on agricultural problems prioritized by the communities themselves. The CIAL are made up of agriculturalists elected by their local organization (in Bolivia, usually agricultural unions), to whom the communities delegate research activities on the problem that is most important to them, for the CIAL to recommend how the problems can be solved. Meanwhile, the ECA were selected as the most effective extension methodology to disseminate the agriculturalists' knowledge.[8] The ECA focus constituted a paradigm

8 The first ECAs were introduced in East Asia as a mechanism to disseminate knowledge-intensive integrated management practices for plagues in rice. Since then, the ECAs have been adapted for

change in agricultural extension, in which participative methods are used to "develop their analytic abilities, critical thinking, and creativity so that they would learn to make better decisions" (Kenmore, 2002). In 1999, PROINPA personnel participated in a three month FAO-funded training program in Ecuador, and later carried out a validation of the platform in the Bolivian context so it could be used in various projects implemented by PROINPA.

In the cultivation of potatoes, agriculturalists primarily sought alternatives to avoid problems such as potato blight (*Phytophtora infestans*), seed multiplication, control of Andean potato weevils (*Prennotrypes*) and the South American tuber moth (*Symmetrischema tangolias*), and also nematodes and rizoctoniasis. The purpose of the work of the CIAL and ECAs was to have agriculturalists in different communities in the country adopt specific technologies for production such as the use of resistant varieties, the management of integrated control strategies for plagues and diseases, or the use of high quality seeds (Thiele *et al.*, 1997; Torrez, Tenorio, Valencia, Orrego, Ortiz, Nelson, & Thiele, 1997). The number of agriculturalists participating in the ECAs generally ranged between 15 and 20, while in the CIAL the number was even smaller – between six and eight – and included only those agriculturalists who had the greatest interest in participative work. PROINPA carried out different evaluations of the results of participative methodologies, which demonstrated that those producers who participated had more knowledge about the practices of integrated management of plagues, for example, than those who did not. Nevertheless, it was difficult to prove that this improved knowledge was related to a reduction in poverty in the places where these methodologies were applied (Bentley, 1994).

Applying this same logic and utilizing previous experiences with the CIALs and ECAs, other participative methodologies started to be used, such as participatory plant breeding (PPB). In the application of this methodology, the local knowledge of agriculturalists is combined with the knowledge of breeders, thus creating cultivars that are better adapted to their environments. In this methodology, both the agriculturalists and the scientists converge in a "dialogue of knowledge" to evaluate and select genotypes that fit the needs of the agriculturalists, as well as the available resources and the market demands (Almekinders, Thiele, & Danial, 2007; Gabriel, Herbas, Salazar, Ruiz, López, Villarroel & Cossio, 2004; Gabriel *et al.*, 2006).

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work on different crops and diseases and have expanded rapidly in the rest of Asia, and to Africa and Latin America (Nelson, Orrego, Ortiz, Tenorio, Mundt, Fredrix, & Vien, 2001).

One of the most successful PPB experiences facilitated by PROINPA was the improvement of blight-resistant potato varieties in the municipality of Morochata (Piusilla, San Isidro, and Compañía Pampa communities).[9] This experience started in 1998 with crosses between the blight-resistant Waych'a cultivar (*Solanum tuberosum ssp. Andigena*) and the Robusta, India, and Runa Toralapa cultivars. After nine years of participative research, six varieties were generated, of which four received precertification.

However, although these varieties responded to the needs of the producers, this was not enough to achieve their dissemination. The participating producers lost the seeds generated during this process, and PROINPA had to recover these varieties. In the interviews conducted, the researchers noted that while they agreed that working with agriculturalists was a good idea in principle, in practice it was easier said than done. Training and interaction meetings with agriculturalists took up time which very few researchers were willing to invest. Additionally, institutional limitations, such as the short time that projects lasted, affected the continuity of the research and experimentation processes with agriculturalists, and the dissemination of technologies on a wider scale.

Methodologies such as the CIAL, ECAs, and PPB did provide an opportunity to improve scientists' understanding and to define research priorities, but they were not sustainable over time. The participative research methodologies were important in democratizing knowledge about crop improvement and plague management. For example, a PROINPA researcher noted that his objective as a researcher was to increase producers' "hidden" knowledge about plant genetics, and though the producers were already crossing and improving their animals, they still did not know about the possibilities of doing the same with plants.

At the same time, in their narratives about participative methodologies, PROINPA researchers see these as an opportunity to create social justice by providing producers with the knowledge and techniques to help solve the agricultural problems that they face on a daily basis. In addition, they noted that this allowed the producers to be less dependent on external inputs, which lowered their costs of production. However, this vision of social justice is problematic in at least two ways. First, it seeks to generate solutions only on the level of the productive unit, without linking the uncertainties and concerns of agricultural production with the social inequalities generated on the structural level. This leads to a certain depolitization of rural

9 In Bolivia, potato blight is the main disease affecting potatoes in humid areas.

poverty. For example, demographic growth and the limited availability of lands in Morochata have meant that current and future generations do not have sufficient land to satisfy their needs and to set up their own families. During the interviews with some of the leaders of the participative processes supported by PROINPA, it was found that the lack of land for cultivation forced them to work in the public sector (municipality) or in other activities in town. Second, these methodologies are limited to agriculture and ignore the prevailing rural dynamics in the Bolivian Altiplano, already mentioned in various studies as the "new rurality" (Bebbington, 2010; Kay, 2006). These dynamics are marked by processes of migration between rural areas and the cities as well as abroad, and by an ever more fluid interchange between the rural and the urban. When the producers from the community of San Isidro in Morochata were asked about their economic activities in the communities, they responded: "Here there is no way to make a living, there is not enough land to make a living, for this reason people have gone to other places such as Chapare or Quilacollo to make a living"[10] (interview, November 10, 2011). Others decide to migrate to obtain access to better services, such as a better education for their children, and maintain a seasonal relationship with their communities.

4.2 The market as an alternative for agricultural research

Since it was founded, PROINPA has not had stable financing from the government nor from international cooperation. Consequently, it has had to compete for different short-term projects in order to sustain basic research, as well as its genetic improvement and applied research programs and extension activities in their areas of intervention. In 2001, when SIBTA began, PROINPA competed for various PITA projects, its accumulated experience and availability of technologies and services putting it well ahead of inexperienced and recently created NGOs. In addition, as part of SINARGEAA, PROINPA received, in concession from the government, the potato and Andean cereals banks, which were kept at the Toralapa experiment station (Gandarillas *et al.*, 2007).

The narratives about this transition period refer to a paradigm shift among the researchers that allowed them to survive the progression from a research model based on government support – which was referred to as "vertical" and "disciplinary" – to a transdisciplinary research model open to the demands of producers and the perspectives and demands of donors and the market. During the SIBTA period, the success of PROINPA did

10 Translation by *Apuntes*.

not depend on the quality of its research nor its contribution to national research priorities but rather on its capacity to adapt or "refine" its research proposals for the different competitions for projects offered by international cooperation.

On the national level, SIBTA's competitive projects also became a source of resources, which made it possible not only to finance applied research but also to continue extension activities, as a PROINPA researcher pointed out:

> When we began as a foundation, we must have had about 60, 70 people during the first two years, and when SIBTA began, we started to get projects [PITA], PROINPA started to grow in terms of coverage and in terms of subjects as well. Before, we only worked on potatoes, until IBTA; after IBTA spaces began to open up which responded to demands. So it was not only potatoes, we went into the field and you couldn't say "I only know about potatoes," you had to open yourself up to the system […]. Then we began to introduce subjects such as quinoa for example. When SIBTA finished, there were about 180 persons in PROINPA working 60% on research and the rest on the diffusion of technology.[11] (Interview, December 9, 2011).

As can be seen from this interview, because of the demand for innovations to allow for the solution of urgent rural problems, PROINPA grew and expanded its research agenda to different types of Andean crops. In addition, during the SIBTA period, PROINPA was able to retain its research team, promote staff training and specialization, and continue with some applied research projects at the agricultural stations (Toralapa, given in concession to PROINPA by the Bolivian government, El Puente in Cochabamba, and the Quipaquipani Facilities Center for Research and Training in the department of La Paz). These applied research processes sought to provide continuity, especially to conservation and use of phytogenetic resources programs previously carried out by IBTA. During the 11th Andean Cultivars Congress (XI Congreso Internacional de Cultivos Andinos) PROINPA head Antonio Gandarillas did highlight SIBTA'S intention to reach more producers through specific demands, but also appealed for "the creation of long-term research projects, especially on Andean crops"[12] as something that had been neglected because of the new agricultural research system.

At the same time, PROINPA researchers considered that identifying producers' demands was not as simple as SIBTA maintained. First, SIBTA

11 Translation by *Apuntes*.
12 Translation by *Apuntes*.

assumed the existence of producers' organizations united in associations and oriented toward production for the market. This is not what the PROINPA researchers found. The vast majority of producers were organized into agricultural unions, which had a more political orientation, centered more on demanding community rights than productive rights. Second, PROINPA had a pool of technologies it had developed in previous years, to which it had assigned capital and human resources, which were also the product of demands identified previously by the scientists in their interactions with communities of agriculturalists.

Generating new technologies was outside the time limitations and the budget proposed by SIBTA. Consequently, PROINPA decided to work on the basis of the technology that was already available. To do so, PROINPA introduced the concepts of implicit and explicit demand, under the assumption that demand must exist for an available technology that producers did not make explicit (Bentley, Thiele, Oros, & Velasco, 2004). The implicit demand was defined as "a need for research that people have not requested, but that they recognize if explained or shown in an appropriate form" (Bentley *et al.*, 2004). Thus, implicit demand is not simply something of interest to the researcher, but has been identified by that researcher on the basis of local problems. As a result, implicit demands should be reconfirmed by the community or agriculturalists in collaboration with researchers. In order to discover these implicit demands, researchers organized workshops, fairs, and other activities with communities and producers' organizations in order to describe available technologies and determine if these were of interest to those in attendance. The technologies available were metaphorically referred to as "the slipper of the prince in search of a Cinderella whose foot it would fit."

In parallel with the focus on demand, the other element that became a component of SIBTA was the application of the concept of the production chain. To this end, newly created associations of small producers were supported and different organizational strengthening activities were carried out as a way of empowering the producers to negotiate and to equalize power relationships with other actors along the chain (Lundy, Ostertag, Gottret, Best & Ferris, 2005). With the support of IPC and CIAT, methodologies were adapted and applied, including a participatory market chain approach (PMCA) and participatory market surveys, with the objective of working with producers' associations as well as actors in the production chain (intermediaries, supermarkets, etc.) and with the providers of services (Devaux, Horton, Velasco, Thiele, López, Bernet, Reinoso & Ordinola,

2009). In EPCP, the actors in the chain met to create group innovations, with PROINPA serving as a facilitator. These innovations included, for example, the generation of value added for the sale of native potatoes to industries and supermarkets in Cochabamba, the export of organic onions, and transformation and export of peanuts and peppers, among others. Meanwhile, participatory surveys of markets allowed associations to visit regional markets to ask buyers about the main product characteristics they desired (quantity, quality, frequency of sales, presentation, etc.). Nevertheless, the rigid budgets established by SIBTA to finance these projects coupled with the lack of interest on the part of producers and other actors discouraged the processes facilitated by PROINPA (Oros, 2010).

In summary, at the time of SIBTA, research focused on demand and the market was seen as a trigger mechanism for technological development (macropolitics). PROINPA researchers had to adapt to these changes through the use of new concepts, approaches, and discourses, such as the production chain, market development, and participatory processes. However, they were not passive recipients of these concepts and approaches, and through their everyday activities (micropolitics) they transformed them to continue their research processes. In addition, through their relationships with new national and international actors, they generated alternatives to continue a medium- and long-term vision of research on potatoes and Andean cereals.

In June 2008, the Movement for Socialism (Movimiento al Socialismo, MAS) administration, following a model referred to as "post-neoliberal" (Córdoba, & Jansen, 2015), decreed the creation of the National Institute for Agricultural and Forest Research (Instituto Nacional de Innovación Agropecuaria y Forestal, INIAF) under the tutelage of the Ministry of Rural and Agricultural Development and the Environment. This was the first step by this government to have the state resume leadership of agricultural research. This change was presented as a return of the state to agricultural production and the retrieval of agricultural research from private hands in order to place it in the realm of public interest.

5. Conclusions

The debate in studies of science, technology, and society is concentrated in these two positions: on the one hand, the belief that it is necessary to separate the technical and political phases in order to recognize the cognitive aspect of science; and on the other, the position that defends greater participation of society in order to defend the public from technocracy and the excessive power of experts in western science. This paper argues, following Collins and Evans (2002), for the need to recognize politics in science, but differs from

their approach on two levels: politics as a form of governance or a political project that molds the scientific process (macropolitics), and politics as an eternal process of contestation and antagonisms in society (micropolitics).

The trajectory of agricultural research in Bolivia is useful for obtaining an on-the-ground understanding of these two levels of politization, and their influence on defining the meaning of agricultural research and knowledge in general for society. Both processes of politization have played an important role in shaping agricultural research in Bolivia. As we saw in the case of PROINPA, the changes in this institution over the last 30 years, from the public to the private sector, were the result of the neoliberal macroproject, which limited the institution's activities in many ways. The researchers then exchanged laboratories for the fields of agriculturalists, focusing on short-term projects based on their demands. By adopting the participatory research approach and strengthening the capacities of users of agricultural technologies, PROINPA was transformed to become part of the government objective of channeling the neoliberal macropolitical project and creating agriculturalists who were responsible for their own needs and technological demands.

Nevertheless, the trajectory of PROINPA was also the result of micropolitics with the greater – macropolitical – project of neoliberalism (Jessop, 2006). This provided the framework not only for the trajectories and sentiments of the researchers that led the research processes of PROINPA, but also their everyday contestations and those of the people with whom they worked. The majority of PROINPA researchers are agricultural engineers, with graduate degrees from European and U.S. universities, who have adopted ideas about innovation, participation, and technology while working for projects that established similar frameworks. It is evident that the trajectories that facilitated these micropolitics were influenced by the ideas of CIAT and the ICP and the various international donors (Swiss, Dutch, and German, for the most part). The relationships with these actors provided new possibilities for PROINPA to carry out applied and adaptive research when the state withdrew its support. But its work was not only determined by these external influences. Many PROINPA researchers had previously been with IBTA and remembered the days when agricultural research was run by the state and researchers were chosen according to the vicissitudes of political convenience. They also contested, on the micropolitical level, the changes that took place under neoliberalism, creating a replica of the quinoa gene bank, safeguarding it from external threats, and adapting their research proposals to continue their long-term strategies.

There is an enormous difference between the role of science in highly industrialized countries and its role in developing countries, where national research centers and public research is limited and science has not been highly valued by the state (De Janvry, Sadoulet, & Fafchamps, 1991). Therefore, it is critical to unpack how macropolitics influences science and technology in order to defend power agendas in different contexts and thereby avoid their subsumption in micropolitics, a space in which societies and their different interest groups define the role of science in society.

References

Agencia de Cooperación Internacional del Japón, JICA. (March, 2004). *Boletín Amanecer*, (33).

Almanza, J., Salazar, M., & Gandarillas, E. (2003). Empoderamiento de la investigación y extensión participativa por agricultores locales. *Leisa. Revista de Agroecología, 19*(1), 37-39.

Almekinders, C., Thiele, G., & Danial, D. (2007). Can cultivars from participatory plant breeding improve seed provision to small-scale farmers? *Euphytica, 153*(3), 363- 372.

Arellano-Lopez, S., & Petras, J. (1994). Non-governmental organizations and poverty alleviation in Bolivia. *Development and Change*, *25*(3), 555-568.

Ashby, J. (1990). Small farmers' participation in the design of technologies. In Altieri, M., & Hecht, S. (Eds.), *Agroecology and small farm development* (pp. 245-253). Los Angeles: CRC Press.

Bebbington, A. (2010). Reencountering development: Livelihood transitions and place transformations in the Andes. *Annals of the Association of American Geographers, 90*(3), 495-520.

Bebbington, A., Hickey, S., & Mitlin, D. (2008). Can NGOs make a difference? The challenge of development alternatives. London: Zed Books.

Bentley, J. (1994). Facts, fantasies, and failures of farmer participatory research. *Agriculture and Human Values, 11*(2), 140-150.

Bentley, J., Thiele, G., Oros, R., & Velasco, C. (2004). *Cinderella's slipper: sondeo surveys and technology fairs for gauging demand*. London: ODI AgREN.

Chambers, R. (1997). *Whose reality counts? Putting the first last*. Bradford: ITP.

Chambers, R., Pacey, A., & Thrupp, L. (Eds.). (1989). *Farmer first: Farmer innovation and agricultural research.* London: ITP.

Coca, M. (2010). *Universidad e investigación agropecuaria: breve historia de las estaciones experimentales y deterioro de la seguridad alimentaria*. Cochabamba: Universidad Mayor de San Simón.

Collins, H. M., & Evans, R. (2002). The third wave of science studies: Studies of expertise and experience. *Social Studies of Science, 32*(2), 235-296.

Córdoba, D., & Jansen, K. (2015). Realigning the political and the technical: NGOs and the politicization of agrarian development in Bolivia. *European Journal of Development Research, 28*(3), 447-464.

Córdoba, D., Jansen, K., & González, C. (2014). The malleability of participation: The politics of agricultural research under neoliberalism in Bolivia. *Development and Change, 45*(6), 1284-1309.

De Janvry, A., Sadoulet, E., & Fafchamps, M. (1991). Agrarian structure, technological innovations, and the state. *The Economic Theory of Agrarian Institutions, 1*(9), 356-408.

Devaux, A., Horton, D., Velasco, C., Thiele, G., López, G., Bernet, T., Reinoso, I., & Ordinola, M. (2009). Collective action for market chain innovation in the Andes. *Food Policy, 34*(1), 31-38.

Edquist, C., & Hommen, L. (1999). Systems of innovation: theory and policy for the demand side. *Technology in Society, 21*(1), 63-79.

Estado Plurinacional de Bolivia. (2009). Plan Sectorial de Ciencia y Tecnología. In Ministerio de Planificación del Desarrollo (Ed.), *Plan de desarrollo económico y social para el vivir bien.* La Paz: Ministerio de Planificación del Desarrollo.

Gabriel, J., Herbas, J., Salazar, M., Ruiz, J., López, J., Villarroel, J., & Cossio, D. (2004). *Participatory plant breeding: A new challenge in the generation and appropriation of potato varieties by farmers in Bolivia*. Working document. Cali: PRGA.

Gabriel, J., Torrez, R., & Thiele, G. (2000). Participatory approaches in potato improvement: experiences of Proinpa in Bolivia. In Almekinders, C. J. M., & De Boef,W. S. (Eds.), *Selection methods (pp. 194-199).* London: Intermediate Technology Publications.

Gabriel, J., Vallejos J., & Coca, C. (2006). *Fitomejoramiento participativo: una iniciativa para la seguridad alimentaria y la sostenibilidad del sistema de papa y otros cultivos en comunidades campesinas de Bolivia*. Cochabamba: Proinpa.

Gandarillas, A., Blajos, J., Aguirre, G., & Devaux, A. (2007). Changing paradigms for organising R&D: Agricultural research and the creation of the Proinpa Foundation in Bolivia. *International Journal of Agricultural Resources. Governance and Ecology, 6(*2), 256-276.

Gandarillas, A., & Devaux, A. (1992). Proinpa's collaborative development strategy. *CIP Circular, 19*(2), 2-5.

Gandarillas, H. (2001). *Historia de la investigación para el desarrollo agropecuario en Bolivia. Memorias de un investigador*. Cochabamba: Editora J. V.

Godoy, R., De Franco, M., & Echeverria, R. G. (1993). A brief history of agricultural research in Bolivia: Potatoes, maize, soybeans, and wheat compared. *Harvard Institute for International Development*, (460), 1-18.

Hartwich, F., Alexaki, A., & Baptista, R. (2007). *Innovation systems governance in Bolivia: Lessons for agricultural innovation policies*. Washington: International Food Policy Research Institute.

Hartwich, F., & Jansen, H. G. (2007). *El rol gubernamental en el proceso de innovación agropecuaria: la experiencia de Bolivia*. Washington: IFPRI.

Jasanoff, S. (2003). Technologies of humility: Citizen participation in governing science. *Minerva, 41*(3), 223-244.

Jasanoff, S. (2005). *Designs on nature: Science and democracy in Europe and the United States*. Princeton University Press.

Jessop, B. (2006). From micro-powers to governmentality: Foucault's work on statehood, state formation, statecraft and state power. *Political Geography, 26*(1), 34-40.

Kaimowitz, D. (1993). The role of nongovernmental organizations in agricultural research and technology transfer in Latin America. *World Development, 21*(7), 1139-1150.

Kay, C. (2006). Rural poverty and development strategies in Latin America. *Journal of Agrarian Change, 6*(4), 455-508.

Kenmore, P. (2002). Integrated pest management. *International Journal of Occupational & Environmental Health, 8*(3), 173-174.

Latour, B. (1999). *Pandora's hope: essays on the reality of science studies.* Cambridge: Harvard University Press.

Lema, R., Meneses, O., Crespo, A., & Muñoz, R. (2006). *Evaluación de efectos e empactos del Sibta: informe final*. La Paz: Ministerio de Desarrollo Rural, Agropecuario y Medio Ambiente.

Lundvall, B. (2007). National innovation systems. Analytical concept and development tool. *Industry and Innovation, 14*(1), 95-119.

Lundy, M., Ostertag, C., Gottret, M. V., Best, R., & Ferris, S. (2005). *Strategy paper: Territorial approach to rural agro-enterprise development. Rural agro-enterprise development project of CIAT*. Cali: CIAT.

Mouffe, C. (2005). *The return of the political*. London: Verso.

Nelson, R., Orrego, R., Ortiz, R., Tenorio, J., Mundt, C., Fredrix, M., & Vien, N. V. (2001). Working with resource-poor farmers to manage plant diseases. *Plant Disease, 85*(7), 684-695.

Organización de las Naciones Unidas para la Alimentación y la Agricultura, FAO. (2009). *Estado de los recursos fitogenéticos para la agricultura y la alimentación (RFAA) en Bolivia*. Rome: FAO.

Ormachea, E. (2008). ¿Revolución *agraria o consolidación de la vía terrateniente? El gobierno del MAS y las políticas de tierras*. La Paz: Cedla.

Oros, R. (2010). *Institutional arrangements for market access and poverty alleviation: An investigation of participative market chain approaches in Bolivia*. London: Imperial College.

Pichón, F., & Uquillas, J. (1998). Sustainable agriculture through farmer participation: Agricultural research and technology development in Latin America's risk-prone areas. In Blauert, J., & Zadek, S. (Eds.), *Mediating sustainability: Growing policy from the grassroots* (pp. 26-47). West Hartford: Kumarian Press.

Postero, N. (2007). *Now we are citizens: Indigenous politics in postmulticultural Bolivia*. Palo Alto: Stanford University Press.

Quijandría-Salmón, B. (1989). *Marco orientador institucional para el Instituto Boliviano de Tecnología Agropecuaria, IBTA*. La Paz: IICA.

Quispe, W. (2005). *Pampa Belén: comunarios, maestros y residentes defienden su tierra*. La Paz: Fundación Tierra.

Ranaboldo, C. (2002). *Asistencia técnica y sector agropecuario campesino: ¿y si dejáramos de pensar en «un sistema»? Condiciones y posibilidades productivas del campesino andino en el libre comercio*. La Paz: Unitas.

Richards, P. (1985). *Indigenous agricultural revolution: ecology and food production in West Africa*. London: Hutchinson.

Richards, P. (2007). How does participation work? Deliberation and performance in African food security. *IDS Bulletin*, *38*(5), 21-35.

Rojas, W., Soto, J. L., Pinto, M., Jäger, M., & Padulosi, S. (2010). *Granos andinos: avances, logros y experiencias desarrolladas en quinua, cañahua y amaranto en Bolivia*. Cochabamba: Proinpa.

Schultz, W. (1964). *Transforming traditional agriculture*. New Haven: Yale University Press.

Thiele, G., Gardner, G., Torrez, R., & Gabriel, J. (1997). Farmer involvement in selecting new varieties: Potatoes in Bolivia. *Experimental Agriculture*, *33*(3), 275-290.

Torrez, R., Tenorio, J., Valencia, C., Orrego, R., Ortiz, O., Nelson, R., & Thiele, G. (1997). *Implementing IPM for late blight in the Andes*. Lima: CIP.

Trigo, E. (1989). *La participación del sector privado en la investigación agropecuaria: notas y comentarios*. Costa Rica: IICA.

Trigo, E., & Kaimowitz, D. (1994). Investigación agrícola y transferencia de tecnología en América Latina en los años noventa. *Cuadernos de Ciencia y Tecnología, 11*(1), 99-126.

Wynne, B. (2003). Seasick on the third wave? Subverting the hegemony of propositionalism: Response to Collins, & Evans (2002). *Social Studies of Science*, *33*(3), 401-417.

Zapata, G. (2004). *Importancia y situación de la investigación científica y tecnológica en Bolivia: desde una sobreabundancia normativa hacia una pobreza productiva*. Centro de Planificación y Gestión. Cochabamba: Universidad Mayor de San Simón.