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On the road to change: writing the history of technologies in Bolivia

GENERAL SECTION

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Introduction

From 2002 to 2006, the authors were part of a project in Bolivia implemented by a consortium of research organisations called Innova. The goal of Innova was to test methods for linking supply and demand for technology. Innova took several technologies that consortium members had worked on previously, and which researchers felt were nearly ready to release. It tested whether they corresponded to what farmers really wanted, and fine tuned those technologies that passed this test, ready for extension to farmers.[1]

The project adapted many participatory methods while trying out promising technologies with farmers (see references at the end of this article). Innova's grassroots technical people were the key to this process since they are in the field most of the time and in close contact with farmers. This article focuses on an innovative type of workshop developed by the project, similar to a method developed independently by Douthwaite and Ashby, J. (2005), in which grassroots agronomists were given the opportunity to map the history of the technologies introduced (the road to change). We heard how the technologies actually changed, some quite a lot, and how some were even dropped, and we were able to understand local reactions to the innovations. We found this type of workshop to be a useful evaluation tool in showing how technologies were adapted and adopted, which were not adopted, and the role of the Innova project in this process.

Background

Background to Bolivia

Bolivia is one of the poorest countries in the Americas, with a *per capita* Gross Domestic Product (GDP) of US$1000. Income distribution is extremely unequal and there is a big economic divide between people of European (mainly Spanish) extraction and indigenous people, most of whom are Quechua or Aymara speakers. Indigenous people mostly depend on agriculture for a living. Land reforms stemming from the 1952 revolution placed much of the land in the hands of indigenous farmers, giving many rural households two to four hectares of land to farm. However, agriculture contributes only 12.8% of national income. New technologies could help make the land much more productive, and contribute to reducing poverty.

[1] The UK Department for International Development (DfID) supported research with consortium members on these technologies and continued this support through INNOVA (Strengthening Technical Innovation Systems for Potato-Based Agriculture in Bolivia) between 2002 and 2006.

Figure 1: Map of Bolivia showing project sites

Map courtesy of: www.appliedlanguage.com/maps_of_the_world/map_of_bolivia.shtml

About Innova

Innova is a consortium of three partner organisations (see Table 1) who worked together from 2002 to 2006. The project was managed by Papa Andina, the regional partnership programme of the International Potato Centre (CIP).

Innova worked at three pilot sites, one each in the following locations (see Figure 1):

Table 1: Innova partner organisations

Institution	Brief description
CIAT/Santa Cruz	The Centre for Tropical Agricultural Research, Santa Cruz, a public agricultural research and development institution affiliated with the prefecture of Santa Cruz Department.
UMSS	The Public University of San Simón, Cochabamba, which includes an agricultural college.
PROINPA Foundation	*Promoción e Investigación de Productos Andinos*, a private, non-profit institution for research on Andean crops, which evolved out of the IBTA (Bolivian Institute for Agriculture and Livestock Technology) potato programme, with support from the Swiss Agency for Development and Cooperation (SDC).

Table 2: Examples of the supply of technology at the start of Innova

Technology proposed, 2001	Brief description
Improved fallow	Mixtures of purple clover (*Trifolium pratense*) with grasses (*Lolium perenne, Festuca arundinaceae, Dactylis glomerata*). These are planted after harvesting oats or barley, as the field enters fallow, to produce fodder and manage weeds.
Grains-plus-legumes	Mixes of legumes (vetch, purple clover) with grains (oats, barley) for fodder, to conserve soil and water, control pests, diseases and weeds, and stabilise yields.
New fodders	Some 14 varieties of several species of legumes and grasses, planted in small demonstration plots called 'pasture gardens'.
Phalaris grass	Live barriers of phalaris grass (*Phalaris tuberoarundinacea*) planted in rows for soil conservation. The live barriers form a wall that traps soil runoff, slowly forming a terrace. The grass is good fodder.
Chicken manure for nematodes	Integrated management of the nematode *Nacobbus aberrans* (a major pest of potato in Bolivia which causes heavy losses to some farmers) by applying chicken manure to the soil.
Potato Integrated Pest Management (IPM)[2]	IPM of potato pests and diseases in the low valleys (Santa Cruz), including: using insecticides and plant extracts to kill insect vectors of disease (aphids, whiteflies etc.); control of tuber moth in the field; and fungicides for Rhizoctonia.
Herbicide for purple nut sedge	Trials of the herbicide glyphosate to manage the weed *Cyperus rotundus*.
Improved tillage	Several ploughs had been designed, and a few trials were needed to learn the best ploughing dates.
Adoption of implements	Promote adoption of animal-drawn implements.
Home remedies for cows	Better nutrition for livestock; remedies made from local plants to kill cattle parasites.

[2] Integrated Pest Management (IPM) is a pest control strategy that uses an array of complementary methods: natural predators and parasites, pest-resistant varieties, cultural practices, biological controls, various physical techniques, and pesticides as a last resort. It is an ecological approach that can significantly reduce or eliminate the use of pesticides. Source: www.en.wikipedia.org

Taking two-minute questionnaires at the technology fair in the high valleys, 2006.

Photo: Jeffery Bentley

• the Altiplano at about 4000 metres above sea level;
• the high Andean valleys at about 3000 metres; and
• the low valleys of Santa Cruz, at about 2000 metres.

The three sites were in different language areas: Aymara on the Altiplano; Quechua in the high valleys; and Spanish in the low valleys. The climate becomes warmer and more humid as altitude decreases, so the crops are different:

• native tubers, quinoa and cereals on the Altiplano;
• potatoes, broad beans and cereals in the high valleys; and
• temperate crops in the low valleys.

The Innova project started with ten main technologies (see Table 2), which were to be validated on-farm.

Participatory methods used

For the first two years, Innova used *sondeos* (Hildebrand, 1981) or rapid reconnaissance surveys, to see what technologies farmers demanded and decide if these fitted with what researchers had been developing. *Sondeos* are similar to PRAs but rely more on individual, semi-structured interviews on farmsteads, and have fewer meetings and visual methods. Innova added a results session to the *sondeo* format during which the *sondeo* team reported the findings back to the community in an open meeting, and local people corrected and confirmed the conclusions (Bentley *et al*., 2004).

Innova staff also helped farmers set up local agricultural research committees or CIALs (Ashby et al., 2000) to test possible innovations and report back on them to their neighbours. In Innova, these were called GETS (*Grupo Evaluador de Tecnología* or Technology Evaluator Group)

Innova added a community feedback session, during which committee members gave their opinions about the technologies in front of other community members.

Another method, the technology fair, was like a field day. Farmers presented their field trials to up to 200 people from neighbouring communities (in groups of 30 each). But, unlike a field day, the technology fair included very short (two minute) questionnaires to gather people's impressions of the technologies they had seen. This was done every year. (See Bentley *et al*,. 2004 for more detail).

These and other participatory methods gave Innova an idea of which technologies were being adopted, but something was missing. It was still not clear why certain technologies had changed more than others. Of course the staff wrote reports, but they were formal and quantitative, with the human side written out of the picture. So, near the end

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Javier Aguilera, Rubén Botello and Remy Crespo (left to right, below) design a time line for the multiple mountain plough (opposite page), 17 May 2005.

Photo: Jeffery Bentley

of the project, in May 2005, Innova held a two-day workshop with project staff to write the history of the main technologies, with an emphasis on what actually happened rather than what was supposed to have happened.

Writing a historical timeline: Roads to Change

We called the workshop Roads to Change (*Caminos al Cambio*). This was to emphasise how change happened. We started with a few examples we had written earlier, showing the history of changes. We divided into three groups according to where staff were located (Altiplano, high valleys or low valleys). The people all knew one another, and were comfortable working together. Each group had:

- Three or four grassroots technical people who knew the technologies and the farming communities well.
- A facilitator to stimulate discussions who was an agronomist and a project member and so familiar with the work, but slightly removed from day-to-day field activities.
- A scribe to take notes (a role the authors undertook, with another colleague). In practice, the scribes did more than take notes, also helping the facilitators ask questions about the work.

Each group picked a few interesting technologies, and then talked them through in the following format:

- What is the technology like now (in 2005)?
- What was it like at the start of the project (in 2002)?
- How has it changed?
- What were the critical turning points on the road to change? (What changed? When? Where? Who was involved? How did you know change was needed? Who suggested the change? What were the benefits? Which Innova events influenced the change?)

The next step was to create a table of the results as a timeline (see Table 3).

We organised the steps this way because by this time, each of our participatory methods (CIALs, *sondeos* etc.) was associated with certain project staff. Looking at technical change from the technology's perspective helped us forget a bit about the methods and avoid defensive reactions. Nobody was forced to say, 'What do you mean, my method was not helpful?'

After presenting the results at the end of the meeting to the whole project staff, the three scribes pooled their notes. Jeffery Bentley edited the results and emailed a draft to all

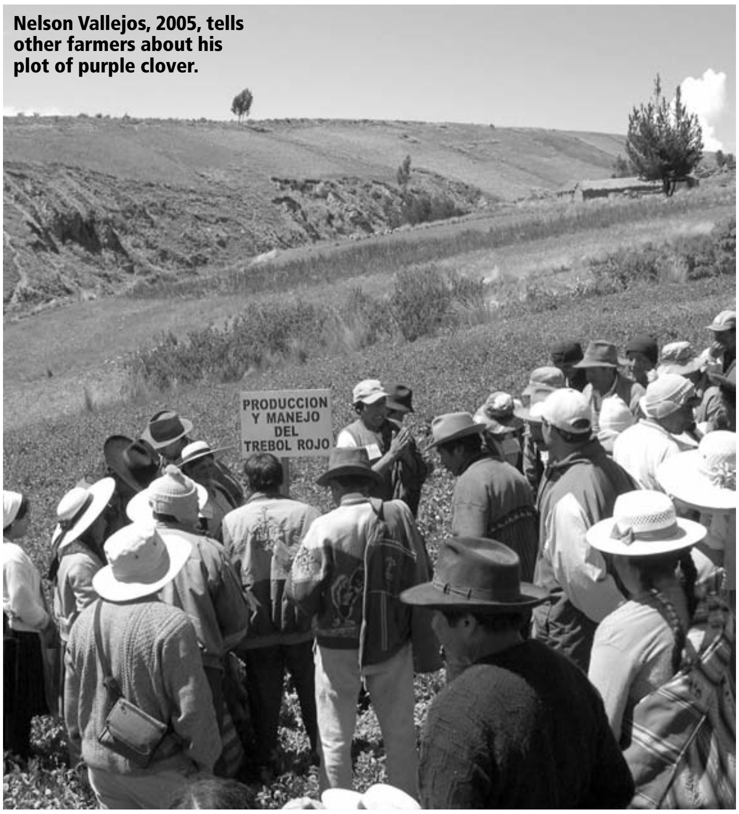
Table 3: Example of an innovation history

Multiple mountain plough							
	1979–1996	**1996**	**1997–2001**	**2000**	**2002–2003**	**2003–2004**	**2004–2005**
Key events	CIFEMA (a university project) in Cochabamba	PRA by PROMETA (a follow-on university project) in Cochabamba	PROMETA in Cochabamba	Municipal government of Umala holds an inter-institutional workshop	PROMETA works on the Altiplano for the first time	Tests with GETs	Ploughs promoted with the PITA: *Proyectos de Innovación Tecnológica Aplicada* (Applied Technological Innovation Projects) in Umala
Changes in the technology	Develops ploughs and other equipment	Implements for soil conservation	Tools to be pulled by horses, donkeys and oxen	Municipality demands tillage technology	INNOVA tests 6 ploughs with GETs	Multiple mountain plough	Sale of ploughs in a store in Patacamaya

Box 1: From improved fallow to purple clover

Purple clover (*Trifolium pratense*) has been in Bolivia since the 1970s. DfID projects in the 1990s conducted on-farm trials of 'improved fallow' (mixes of grasses and legumes) for several years in the high valleys. During the first *sondeo* in November 2002 in the high valleys, people said they were tired of doing little field trials with clover. 'We want to try big fields,' they said.

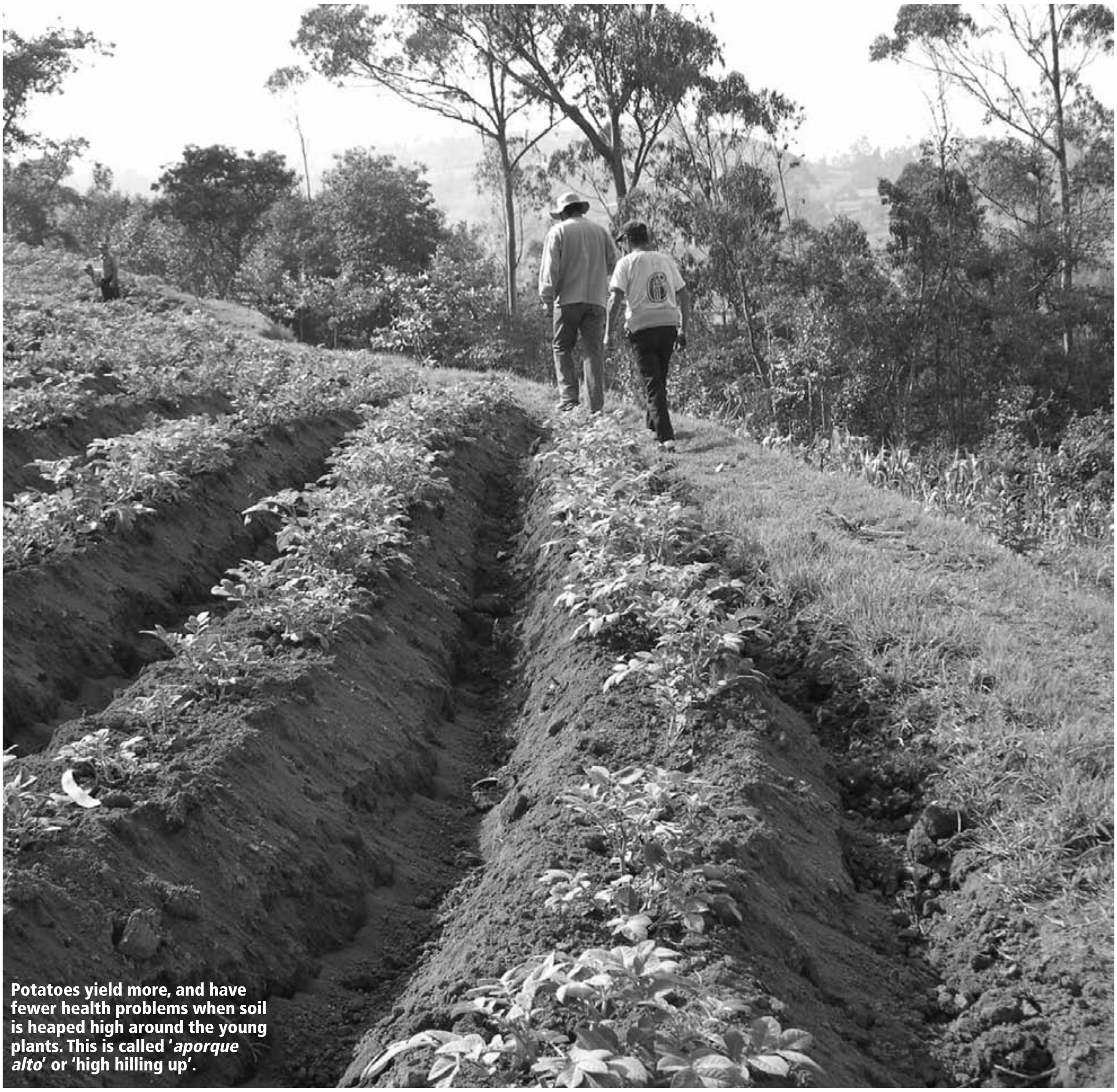
Innova kept studying 'improved fallow' and in the first technology fair presented a trial, in a farmer's field, with three treatments of different mixes. But at the same technology fair, another farmer, Nelson Vallejos, showed a plot he had planted on his own. Innova's technology was based on the idea of planting clover and grass seed in dry fields, after harvest (in the dry season), so that during the several years of fallow, the plot would grow nutritous fodder, and less weedy herbs. The problem was that the clover and grass failed to thrive in the dry, rocky fields. As soon as Vallejos and other farmers started planting purple clover on their own, they changed it radically. Instead of planting it at harvest time, they planted it at the regular planting time, and they sowed it with oats, instead of pasture grasses, since they knew oats better, and had the seed. They planted purple clover in good soil, not in hillside fields. Innova agronomists Salomón Pérez and Freddy Almendras recommended another change, irrigation. Farmers and agronomists realised that they should plough carefully before planting, instead of simply broadcasting the seed. Later farmers began manuring the clover, and they soon had a thriving field of it. They could cut fodder every day for their cows, even though the clover was growing in a well-tended, permanent pasture, and not on a fallow hillside.



Nelson Vallejos, 2005, tells other farmers about his plot of purple clover.

Photo: Jeffery Bentley

Box 2. High hilling up



Potatoes yield more, and have fewer health problems when soil is heaped high around the young plants. This is called '*aporque alto*' or 'high hilling up'.

Photo: Jeffery Bentley

In April 2001 an earlier project found the flea beetle *Epitrix* damaging seed potato in one of the CIALs in the low valleys. Innova agronomists Ernesto Montellano, Pablo Franco and colleagues began to manage it with a technique they learnt from CIP (International Potato Centre): higher *aporque* (hilling up, i.e. putting more soil around the plants while weeding). But it was hard to do with a wooden plough.

By 2002 people in the CIALs were using higher hilling, which damaged the potato plants less and gave room in the soil for the tubers to grow better. Innova planted tillage trials in all three pilot areas. In 2003, Innova agronomists designed a metal plough pulled by oxen, which made hilling up easier. In the technology fair on the Altiplano in 2005, farmer-experimenter Rogelio Cachaca López showed that he had doubled his potato harvest, among other things, by using high hilling up.

of the participants, who responded with comments within a week. Most of the comments were minor, but one of the participants objected strongly to the editor's summary. We (Bentley and Thiele) liked the case of purple clover (Box 1), because the technology changed so much. We thought it showed how sensitive the technical people were to farmers, thoughtfully incorporating farmer suggestions into the technology. But one of the agronomists said it made the staff look bad, that they had relied too much on farmers. He insisted that some of the changes had come from the agronomists, not the farmers. We incorporated this colleague's suggestions into the history of the technology, and we realised that he had a point. In our haste to show that the farmers had 'participated' in adapting the technologies, we had under-represented the creativity of the agronomists. Without their ideas and encouragement the farmers would never have thought of the purple clover innovations.

In other cases, the technology changed just a little, so the technical people had got it mostly right the first time (e.g. Box 2).

If there was a limitation with the 'road to change' method, it was that the agronomists tended to mention only those technologies they thought were successful. They were much less likely to discuss technologies that were abandoned. For example, Innova taught farmers to make home remedies for cows, from local plants, but the home-brews were abandoned when farmers failed to adopt them because the medicine was tedious to make, and farmers preferred store-bought medicines. Even though this shows clearly that the agronomists were listening to farmers' views, they omitted this case at our workshop. It is perhaps understandable that people want to remember their successes and forget the failures, but this means that some of the lessons learnt are soon forgotten.

Ways forward

We are currently beginning a new project in the Andes called the *Alianza Cambio Andino* (Alliance for Change in the Andes), building on the Innova project and also funded by DfID. We anticipate that some 20 to 30 organisations, 150 plus agronomists, and several thousand farmers will be involved in the four countries (Colombia, Ecuador, Peru and Bolivia). *Alianza* will promote the broader use of the best participatory methods developed by Innova.

We hope to use Roads to Change in a more systematic way to document the outcomes and impacts of using participatory methods in agricultural research and development organisations and projects. This information will be used to understand the conditions under which a participatory method or combination of methods is appropriate. In addition, the Alianza will use evidence of the effectiveness of participatory approaches to promote policy change in national agricultural innovation systems to make them more inclusive and responsive to the needs of the poor. The histories that emerge from Roads to Change of how participatory approaches make a difference should help support this advocacy process.

"In our haste to show that the farmers had 'participated' in adapting the technologies, we had under-represented the creativity of the agronomists"

Conclusions

Technologies, methods and log frames all have to evolve. Admitting mistakes is an important part of successful adaptations. Roads to Change examined the way a technology changed rather than what the project did or achieved. It provided a novel and more objective window into how the projects' activities influenced the twists and turns on the road to innovation.

Sondeos gave us a picture of demand, but knowing about demand is not always enough. Just because a technology addresses demand (and most of Innova's did), doesn't mean it does so in the best way. For example, the improved fallow described in Box 1 addressed the key shortage of fodder, but it wasn't functional until farmers and agronomists reworked it in the field.

Of all the methods we tried, the CIAL (or the version which Innova called GET) was the most useful for completing a part-developed technology. The other methods all fit inside it, like tools on a Swiss army knife. It would have been impossible to hold technology fairs or *sondeos* without the collaboration of the farmers in the CIAL. The 'community feedback' method was useful for developing the mountain plough and for changing 'improved fallow' to a meadow of clover. The technology fair was perhaps best for giving some researchers the courage to quietly set a technology aside and go on to a more promising topic. We would not have learnt insights like these if our discussions had kept stressing the virtues of everyone's favourite method. To really judge the methods, we needed to look at change from the technologies' perspective.

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NOTE
The full text of the Road to Change paper is available (in Spanish) online: www.jefferybentley.com/caminosalcambiomemorias14.pdf

REFERENCES
Ashby, J., Braun, A.R., García, T., Guerrero, M.P., Hernández, L.A., Quirós, C.A. and Roa, J.I. (2000) *Investing in farmers as researchers: experience with local Agricultural committees in Latin America*. Cali, Colombia: CIAT

Bentley, J.W., Thiele, G., Oros, R. and Velasco, C. (2004) Cinderella's slipper: sondeo surveys and technology fairs for gauging demand London: ODI *Agricultural Research & Extension Network* (*AgREN*), Network Paper No. 138

Bentley, J.W., Velasco, C., Rodríguez, F., Oros, R., Botello, R., Webb, M., Devaux, A., and Thiele, G. (in press) 'Unspoken demands for farm technology.' Submitted to *International Journal of Agricultural Sustainability*

Douthwaite, B. and Ashby, J. (2005) 'Innovation Histories: A Method for Learning from Experience.' *ILAC Brief* 5:1-4

Hildebrand, P.E. (1981) Combining disciplines in rapid appraisal: the sondeo approach *Agricultural Administration* 8, 423-32

Van Mele, P. and Braun, A. (2005) 'Methodological diversity and creativity in agricultural innovation systems.' In: *Participatory Learning and Action* 53

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